Devaluation, Oil Price Shock and Consumer Price Inflation: Evidence from Markov Autoregressive Regime Switching Model

David Umoru[1]
Salisu Shehu Umar[2]
Beauty Igbinovia[3]

Abstract
Decreasing trends in the external worth of most currencies and an oil price surge have been accompanied by a persistent increase in food prices and transportation costs. In 2023, Sub-Saharan Africa (SSA) had a growth rate of 3.3 percent (IMF, 2023), yet the region experiences long-lasting external shocks in addition to domestic shocks. The goal of this study is to clarify the dynamic effects of devaluation of exchange rates and oil price shocks on the prices of food and fuel consumption in eleven SSA emerging nations while also examining the causality's direction. The study also seeks to ascertain whether there is a threshold for oil prices based on the relationship between oil prices, currency rates, and food consumption. We estimated the Markov Autoregressive Regime Switching Model (MARSM) with monthly data from 2000Q1 to 2024Q2. The research findings provide an informed basis for re-assessing the monetary policy rate in order to control inflation in Nigeria. In particular, the study establishes that the conventional theoretic view of monetary policy transmission, whereby higher interest rates translate to reductions in inflation, is misleading for SSA. The study established the presence of a domino effect, which embraces excessive depreciation of local currencies, causing high consumer price inflation that leads to rising costs of living in the midst of a foreign exchange shortage. For a sensitivity analysis, we disaggregated the consumer price inflation rate into food inflation and fuel consumption price to have food CPI and fuel CPI and estimated the panel GMM model for our panel of ten nations. The importance of transition probabilities in comprehending food price inflation validates the model's validity. The results validate the presence of a significant causation effect of currency depreciation, oil price surges, and interest rate differentials on the price of food and fuel in SSA. It is advisable to take into consideration the established fact that the amount of surplus reserves in emerging nations serves as the primary anchor for their currency rates. Therefore, exchange rate stability might be attained even in the face of declining oil revenue by making a deliberate effort to diversify the economy's export base and expand infrastructure.

Keywords: Inflation, devaluation shock, oil prices, food CPI, fuel CPI, Markov autoregressive regime switching regression (MARSM)

JEL Classification: B23, C30, D12

DOI: 10.24818/REJ/2025/90/05

[1] Department of Economics, Edo State University Uzairue, Iyamho, Nigeria, david.umoru@yahoo.com/david.umoru@edouniversity.edu.ng
[2] Department of Statistics, Auchi Polytechnic Auchi, Nigeria
[3] Department of Economics, Edo State University Uzairue, Iyamho, Nigeria, beauty.igbinovia@edouniversity.edu.ng

1. Introduction

Over time, household consumption in emerging nations has persistently responded positively and significantly to changes in exchange rates and external oil price movements. In emerging nations, there is frequently a strong correlation between food inflation, fuel consumption, and exchange rates (Mahmoudinia, 2021). In 2023, Sub-Saharan Africa (SSA) had a growth rate of 3.3 percent (World Bank, 2024a; 2024b), yet the region experiences long-lasting external shocks in addition to domestic shocks. According to the IMF (2024), the food inflation rate in SSA countries accounts for about 40% of the basket of goods consumed in the region. In particular, the IMF reported that food inflation rose on average consecutively for three years, namely 2019, 2020, and 2021, in the region's 20 countries where monthly food price statisticswere obtainable were made available. This is closely substantiated by the World Bank (2023) update, which reported that domestic food price inflation remains high in low-income countries. It noted that food inflation exceeded 5% in 71% of the low-income African countries. Relatively, in March 2023, the petrol CPI in SSA stood at 192.5 points, representing an increase of 28.3 points from 2020. This means that African countries suffered the most from high spikes in food and fuel price inflation in real terms.

Lamentably, the problem of high inflation and rising food and fuel consumption costs has caused a major hardship in emerging nations, especially those in Africa (Montes-Rojas & Toledo, 2021). The reason is not far-fetched. Emerging countries rely on imports of products for manufacturing since their economies are still emerging in their early stages. These nations are thought to be too far behind the technological frontier to be able to fulfill all of their own agricultural production demands. In sub-Saharan Africa (SSA), inflation edged up significantly to 29% in 2024. Food prices are the fundamental factor fuelling the inflationary trend in the SSA. Approximately 40% of the region's consumer price inflation (CPI) is attributable to food inflation. Food inflation was 11.1% in 2024 (World Bank, 2024). In SSA, the food CPI is rising fast, and it has become a contributing factor in the rising trend of the overall CPI. The CPI for fuel prices comes next, increasing to almost 9% in April 2024. According to the AfDB (2024), food inflation in SSA was 9.46% in 2022, a 5.2% increase from 2021; 4.26% in 2021, a 0.42% increase from 2020; 3.84% in 2020, a 1.04% increase from 2019; and 2.80% in 2019, a 1.29% decline from 2018. In December 2019, food inflation in Angola was 30 percent (AfDB, 2024). The average increase in food inflation in the twenty SSA nations where monthly food price data are available was observed in 2019.

According to the World Bank (2024), in 2020, 20% of the aggregate number of undernourished people, encompassing 264 million people, will live in the SSA.

Thus, increased food inflation is contributing to hunger and insecurity throughout Africa, particularly affecting low-income households. A food crisis or poorer circumstances amid a feeble growth rate in SSA, which was 3 percent in 2023, will affect 135 million people in the region in the second quarter of 2024 (FSIN and GNAFC 2024). During the same quarter of 2024, activities of the private sector in the region strengthened (IMF, 2024). Sadly, many of the region's economies struggled with weak government budgets, which were largely caused by high debt repayment costs and poor revenue from taxation. Yet, the majority of the SSA's member nations had to contend with the negative consequences of currency depreciations.

Besides, these SSA regions are particularly vulnerable to long-term macroeconomic shocks, including oil price shocks that weaken their resistance to fluctuations in currency rates. It has also been reported that higher oil prices resulted in a US$19 billion import bill for SSA, worsening trade imbalances and escalating domestic prices of transport and consumables. In addition, most oil-importing fragile states have been hit with fiscal imbalances, which deteriorated by 0.8 percent of GDP in 2022 (Selassie and Kovacs, 2022). In emerging nations, currency crises and high rates of inflation are common (Agarwal & Vandana, 2021). Food prices can affect a nation's macroeconomic indicators as well as poverty (Pocol, Marinescu, Dabija, & Amuza, 2021). For many years, Latin American nations have struggled with persistent inflation. These are less developed and yet developing nations. Furthermore, it is held that food costs might reduce buying power and lead to growing inflation as a result of economic integration into industrialized economies (Ginn&Pourroy, 2020). Food prices and oil prices are significantly correlated (Olayungbo& Hassan, 2016; Pal &Mitra, 2017). According to Köse&Ünal (2021), the price of oil can influence inflation. Chowdhury, Meo, Uddin, &Haque (2021) reported that a rise in global energy costs has a significant and enduring impact on global food prices. Therefore, it is anticipated that rising oil prices would have an effect on the inflation of food in emerging nations. On the other side, rising food costs may also have a detrimental effect on the economy and the exchange rate, especially in countries where the majority of the country's imports come from food (Alom, Ward, & Hu, 2013).

Public involvement in food markets has become more popular recently. Policymakers in developing nations are particularly concerned about the volatility of food and fuel prices. This study looks at how several factors, including shocks to the oil price and devaluation, affect the prices of food and fuel domestically. The influence of global price volatility is particularly concerning since it has been quite volatile in recent years and has the potential to interrupt the stability of domestic pricing. In the first quarter of January 2024, oil prices rose by 12.9%.

This follows the volatility caused by concerns that global geopolitical tensions will result in oil supply disruptions. Accordingly, the Brent crude benchmark price, which traded at US$76.86 per barrel, increased by 4.6% to $80.42 per barrel and by 1.65% to $81.75 per barrel in January and February 2024, respectively. In the month of March 2024, the Bent crude price increased to $86.79 per barrel, compared to the February price, such that the percentage price jump stood at 6.16% (IEA, 2024). Therefore, reducing the volatility spillover from global commodities markets would be one of the policy difficulties. The goal of this research is to evaluate the regime effect of the depreciation of local currencies and the global oil price hike on food and fuel prices in emerging countries in sub-Saharan Africa. These countries are Nigeria, Ghana, South Africa, Sudan, Sierra Leone, Morocco, Zimbabwe, Kenya, the Congo Democratic Republic, The Gambia, and Egypt. Specifically, we calculated the magnitude of the shocks of devaluation and oil prices on food prices and fuel price inflation in emerging nations. We also conducted a sensitivity analysis by subjecting the data to different model specifications as a panel of countries and also as individual nations for all the countries in our sample. The results are consistent with studies that combine theoretical and empirical components. The following are the primary findings: First, a key element highlighting the persistence of price volatility is the volatility of the preceding period. Second, domestic prices become unstable due to production shortages and stock stabilization. Third, the volatility of domestic prices is significantly influenced by the differentials between local and foreign interest rates. Then, food and fuel price volatility is influenced by international transaction costs. The research findings are useful to policymakers in emerging nations. The research will expand the boundaries of knowledge in this field and add to the body of material already available on food production. Theoretical literature, earlier studies that examined food inflation while accounting for the chosen factors, and the novelty of the current work are introduced in Sect. 2. Section 3 covered the technique. Section 4 looks at the analysis's findings. Section 5 concludes the paper.

2. Literature Revew

2.1 Theoretical review

The theoretical literature centers on the portfolio balance theory as advanced by McKinnon (1969), which emphasizes the significance of asset market fluctuations in influencing exchange rates. It explains how variations in exchange rates reflect the supply and demand for a variety of different assets denominated in several currencies. People are supposed to allocate their money among cash, domestic and international bonds, and other assets in a unified portfolio balancing framework. Only government-backed and non-resident loans are considered perfect replacements. Because of the risk (such as political risk), risk-averse stakeholders no longer find it useful to have a mix of domestic and international enterprises in their portfolio. This means that, in addition to monetary issues, the study's focus is now on fiscal policy and the current account. The net financial equity, or equilibrium framework, for the portfolio consists of all non-interest-bearing assets, including local currency-expressed domestic and foreign bonds. Conversely, the foreign interest rate is influenced by the demand for foreign bonds in both positive and negative ways. The costs incurred overseas need to be fixed. There is a slight negative link between the demand for domestic bonds and foreign interest rates, and a large positive association between the two. It is believed that the short-term stock of assets with values in both local and foreign currencies is fixed. According to Frankel's (1983) PBT, the exchange rate is equivalent to the prices of goods and services set by market forces. This suggests that robust or underperforming stock markets, based on the returns they generate, draw in or deter foreign investors, resulting in a rise in or decrease in capital inflows and outflows based on the increased or decreased demand for local currency, which in turn strengthens or weakens the local currency.

Oil prices appear to have a multifaceted impact on industrial production. It first increases manufacturing overhead, which drives up production costs overall. Commodity prices rise as a result of the increasing production costs, which are subsequently passed on to consumers. Increased production costs would, on the supply side, result in lower buying power for businesses, which would limit total output for local sales and, if applicable, exports. However, monetary policy adjustments and labor market flexibility, according to Blanchard & Gali (2007), have reduced the effect of shocks from oil price variations on production in industries and the economy as a whole. A decrease in output would suggest a weakening of overall productivity, which would discourage investment and result in scarcity, which would raise prices. Shocks from fluctuations in oil prices cause different dynamics in nations that produce and export oil than in those that import it. Imports and exports provide a platform for the transfer of wealth. Oil-importing nations need greater resources to get oil as prices climb. It results in a decline in the total demand for these imports. On the other hand, when oil prices are lower, oil-exporting nations earn more money for the same amount of oil sold. Oil-exporting nations typically lose out when oil prices decline because they don't get paid enough for the oil they send. However, how the price of oil interacts with the anticipated impact on output has been diminishing. Using an asymmetric causality in quantiles technique, Mokni& Ben-Salha (2020) found that the price of oil had an effect on both food and non-food costs, with the influence on non-food prices being noticeably larger.

2.2 Review of literature on inflation effect of exchange rate changes

The results obtained by Kallon and Barrie (2023) that exchange rate depreciation causes considerable currency substitution, which has influenced inflation in Sierra Leone recently between 2020 and 2023. Rauff (2022) equally found a significant positive inflation-real exchange rate nexus for the Nigerian economy. In contrast, devaluation has an adverse effect on production growth at the price of Pakistan's high energy consumption, according to studies by Shah et al. (2022). According to Olamide et al. (2022), local output in oil-exporting African nations was positively impacted by currency exchange rate depreciation, which expanded the actual economic sector. Dynamic panel data models were used by Agyei *et al.* (2021) to investigate the impact of COVID-19 on food prices in sub-Saharan Africa between March and September of 2020. Food costs were predicted to rise as a result of COVID-19. Moreover, food costs were significantly impacted by inflation, oil prices, and exchange rates. Sani *et al.* (2020) noted that core inflation responds more strongly to oil price increases than food inflation. He also established empirically that a negative oil price shock induced higher inflation in Nigeria. Yunusa (2020) noted beneficial effects of exchange rate volatility on inflation. Akanni (2020) investigated the link between the cost of food and the exchange rate in Nigeria using a VAR model and discovered evidence of a directional dependence between food prices and currency rates. Wong & Shamsudin (2017) conducted research on how changes in the real GDP, oil price, and exchange rate affect Malaysian food prices. A NARDL model without limitations was applied to quarterly data from 2000/Q1 to 2016/Q2. This study found a long-term asymmetric link between real GDP, exchange rates, and changes in food prices. While the oil price had little effect, these two factors significantly 'affected the movement of food prices in the near term. It was recommended that the exchange rate be taken into account by policymakers rather than the price of oil. In all BRICS nations, Ekanayake&Amila (2022) demonstrated the long-term negative export effect of exchange rate volatility. Regardless of the volatility measure employed, the same authors obtained inconsistent short-term results on the impact of exchange rate volatility on exports. Previous research by Sharma & Pal (2020) revealed a substantial negative long-run export impact of exchange rate fluctuation. Bahmani-Oskooee & Karamelikli (2022a) claim that while full exports decreased for some Chinese sectors, exchange rate volatility was reduced overall for the UK. Significantly unequal impacts of exchange rate fluctuations on cross-border commerce were documented by Chi (2020). Liming *et al.* (2020) discovered an asymmetric correlation between China's policy uncertainty and currency rate volatility based on quintile regression analysis. According to Bahmani-Oskooee & Kanitpong (2019), currency exchange rate volatility asymmetrically affects 50% of industrial production. According to Hurley & Papanikolaou's (2021) analysis, there was a considerable and unfavourable response in the US-China bilateral trade of products to changes in real exchange rates. Adjei (2019) asserts that exchange rate fluctuation exhibits risk that inhibits international commerce, which has a substantial negative impact on Ghana's growth rate. According to Yusuf et al. (2019), currency rate volatility significantly hinders Nigeria's economic growth. Rabee & Pedram (2014) examine oil price shocks and optimal monetary policy in Iran. They found that a well-executed monetary policy can help mitigate the harmful effects of allocations that fall short of ideal levels. Marco & Alessandro (2009) examined how a selected group of countries might be affected by shocks to the price of food and oil shortly by employing the Global VAR (2009). Although emerging economies feel the consequences of oil price shocks, the study shows that industrialized countries feel the effects of inflation more acutely. And, in particular, for developing countries, an increase in food prices had an extremely noticeable direct inflationary effect.

2.3 Review of literature on inflation effect of oil price changes

Using a panel VAR model, Taghizadeh-Hesary, Rasoulinezhad, & Yoshino (2019) examined the relationships between energy and food prices in a number of Asian nations over the years 2000 - 2016. The findings showed that food costs were highly impacted by the price of oil. Ahmadi, Behmiri, & Manera (2016) examined commodity volatility in terms of changes in the price of oil between April 1983 and May 2014 using a stochastic vector (SVAR) model. The findings demonstrated that the response of commodities to shocks in the price of oil varied considerably depending on the time periods included. Variance decomposition revealed that, following the 2008 financial crisis, oil shocks had greater explanatory power. Tolepbergen (2022) investigated the persistent features of monthly inflation and its constituents. A technique that was fractionally integrated was used. It was discovered that an inflation-targeting monetary policy changed the course of inflation. It was discovered that the decline in the nominal exchange rate and inflation were unrelated to food co-integration. Using the ARDL dynamic panel framework, Bala & Chin (2018) found that over time, both positive and negative oil price shocks had a favourable impact on inflation in these nations; however, the impact was more noticeable during periods of reductions in oil prices.

According to Zivkov, Duraskovic, & Manic (2019), following a 100% increase in oil prices, inflation increased by 1-6 percentage points. In the research, the two nations with the greatest oil import/GDP ratios namely, Bulgaria and Slovakiaalso tended to have the strongest and most reliable pass-through effects. In a similar vein, Odionye, Ukeje, and Odo (2019) demonstrated that inflation first responded negatively to shocks to oil prices before flipping positively after two periods. The currency rate did, however, react negatively and persistently to shocks to the price of oil. Omotosho (2019) found that while headline inflation was affected by oil price shocks, the contribution was small because domestic fuel prices do not fully reflect international oil prices. According to the study, a negative shock to oil prices resulted in reduced marginal costs and a decline in domestic inflation. Nevertheless, a decline in oil prices led to a devaluation of the home currency, which increased import costs and raised both the headline and core measures of inflation.

Iyke (2019) asserts that an increase in the price of oil throughout the world causes productivity to decrease. Yildirim & Arifli (2021) endorsed Zulfigarov&Neuenkirch's (2020) findings regarding the Azerbaijani economy, which stated that a negative shock to oil prices worsens the trade balance and important economic activity. Zulfigarov&Neuenkirch (2020) concluded that variations in the price of oil throughout the world drive up domestic inflation in the Azerbaijani economy. The findings obtained by Syzdykova et al. (2022) for China and Brazil revealed absence of asymmetry in the causal link between inflationary spikes and shocks to oil prices. Although there is a causal link between rising inflation shocks and low oil price shocks in Russia, the opposite was true for high oil price shocks. The findings of the causality test for India show that rising prices shocks are causally related to high oil shocks. Crude oil price volatility drives up manufacturing costs and lowers enterprises' production activity, leading to a decline in output (Choi *et al.*, 2017). Tams-Alasia *et al.* (2018) discovered a favourable impact on industrial production over the long term in Nigeria after altering the oil. It supported Gummi *et al.*'s (2020) findings that Nigeria's manufacturing production was positively impacted by changes in oil prices. Gummi *et al.* (2021) reported an identical finding about the price level of the asymmetry and partly structural shifts analysis of the Nigerian food and oil markets. Ahmad *et al.* (2022) found that the impulse response function explained a significant amount of the variation in gross domestic output following shocks to the price of crude oil. This finding raises questions about the impact of oil price volatility on the behaviour of important macroeconomic indicators. Variations in oil prices have a major impact on the effective execution of economic policies that boost production growth, according to Saddiqui et al. (2018).

Using a quantile regression analysis, Samal&Goyari (2022) looked at how monetary policy shocks affected food inflation in India for each month from January 2009 to December 2019. It was noted that food inflation was stabilized throughout the quantiles by contractionary monetary policy. It was also suggested that transportation and exchange rates are major factors in the rise in food prices.

Using a panel VAR analysis, Bhattacharya and Jain (2020) examined the efficacy of monetary policy in controlling food inflation for the years 2006/Q1 to 2016/Q2 in both developed and developing nations. It was discovered that food inflation is positively and significantly impacted by any unanticipated monetary tightening. While Lin & Su (2020) discovered a non-linear influence of changes in oil prices on the exchange rates of BRICS, Lin et al. (2018) revealed significant negative industrial trade impacts of exchange rate volatility, which varied greatly across industries. A panel VAR model was used by Mukherjee and Ouattara (2021) to calculate the impact of temperature shocks on inflation in developed and developing nations from 1961 to 2014. The findings demonstrated that inflationary pressures were a result of temperature shocks. After the initial shock, the impacts lingered for several years, especially in developing nations. Using an SVAR model, Dalheimer, Herwartz, & Lange (2021) examined the connection between sub-Saharan African food prices and the volatility surrounding the world oil market during the months of January through June 2019. It was discovered that African corn markets were less vulnerable to the impacts of demand shocks related to oil than were US and international corn markets. Still, constraints in the availability of gasoline can be the cause of increased food costs.

According to Yunusa (2020), the export of crude oil commodities from Nigeria to overseas markets benefits from currency rate volatility. Senadza & Diaba (2018) upheld that the actions of African nations are positively influenced by exchange rate volatility. According to Smallwood (2019), currency rate uncertainty has little impact on US commerce. According to Oseni et al. (2019), Nigeria's industrial productivity was positively impacted by actual exchange rate fluctuations. Research by Mo et al. (2019), Turan & Ozer (2018) and Okafor *et al.* (2018) also revealed a substantial inverse relationship between industrial production and the exchange rate. The unpredictability of oil prices was proven to have beneficial impacts on output in later research (Mukhtarov et al.2021). Variations in oil prices have been demonstrated to have both short- and long-term beneficial effects on the Nigerian economy by Ighosewe *et al.* (2021).

According to Tatjana & Garima (2014), US monetary policy normalization is expected to have a minimal economic impact as a proportion of GDP on capital flows to emerging market economies. Rudi *et al.* (2004) observed that financial shocks increase the number of non-performing loans. In 32 established and emerging economies between 1990 and 2013, Furceri *et al.* (2016) present fresh evidence about the influence of monetary policy shocks on income inequality. According to the study, monetary policies that restrict or raise credit expansion also enhance or reduce income disparities. With an eight-variable SVAR model, Kutu & Ngalawa (2016) investigate the effects of monetary policy shifts on South

Africa's manufacturing sector's output. The money supply shock, however, had a substantial positive effect on industrial production growth, contrary to the effects of shocks arising from exchange rate and interest rate changes, as shown by their research. Nakibullah (2016) found this to be the case when he studied the impact of both external and internal structural shocks on consumer prices in the GCC. According to Senadheera's (2016) research on monetary policy and external shocks in the Sri Lankan economy, domestic shocks are the primary contributors to macroeconomic variations in the country. A sizable amount of the volatility in both production growth and local inflation can be attributed to foreign shocks. The FAVAR model's findings are more theoretically sound and superior to those of the VAR model, which, unlike the FAVAR approach, managed to shed light on the existence of pricing and liquidity issues. Compared to realistic scenarios of the three external shocks, Kar & Bhattacharaya (2011) observed that fiscal profligacy shocks had a considerable growth-retarding effect. This is what they found after analyzing the effects of shocks on India's economic growth. Tweneboah & Adam (2008) developed a VECM to examine the long- and short-term connections between the market price of crude oil and economic activity in Ghana. Both unexpectedly high oil prices and production losses in Ghana lead to cost increases, as seen by the data.

3. Methodology and Data Measurement

The methodology for this study is rooted in the framework of monopolistic competition, which is applicable for analyzing nominal pricing rigidities. It is based on the New Keynesian model first proposed by Calvo (1983). The impacts of oil prices on production and inflation were taken into account by Blanchard & Gali (2007) and Rondina (2017) in their analyses of the New Keynesian Phillips Curve (NKPC). The real marginal cost of production is a function of inflation, firm expectations for future inflation, and inflation, as explained by the NKPC. It suggests that inflation would tend to increase as a result of rising real marginal costs as businesses pass on increased costs to their product prices and because businesses raise prices now in anticipation of higher inflation in the future. This NKPC paradigm is based on the assumption that a profit-maximizing monopoly produces the good whose price has to be set. When a monopolist has the ability to continually modify his nominal pricing, he will do so in order to maintain a markup over marginal cost and to equal contemporaneous marginal revenue and marginal cost. In completely competitive marketplaces, when price and marginal cost are equal, compare this to flexible pricing. The monopolist will select the current nominal price such that he equalizes the projected present value of marginal revenue and marginal cost throughout the period that the price remains set if nominal prices cannot be continually readjusted. Woodford (2003) demonstrates that the sum of each firm's linearized optimal price adjustment rules produces an expression for both the present and anticipated future inflation as well as a measure of aggregate marginal cost mc using Calvo-type price adjustment as follows:

$$fpinfl_t = y_f E_t(fpinf_t) + \beta MC_t + \beta(y_t - y_t^*) + e_t \quad (1)$$

This is the structural NKPC, where *fpinfl* is food inflation rate; y_f stands for output and $(y_t - y_t^*)$ is output gap, is marginal cost and β is the coefficient of price adjustment. The present inflation is driven by the existing and predicted future marginal costs *(MC)*, as captured in the equation. Accordingly, food inflation tends to be more persistent than marginal cost. Hence, the inclusion of lagged inflation in equation (2):

$$fpinfl_t = y_s E_t(fpinf_t) + y_f E_t(fpinf_{t-1}) + \beta MC_t + \beta(y_t - y_t^*) + e_t \quad (2)$$

The relative size of the factors on past and future inflation, y_s and y_f, determines how costly it is to control inflation. The relative magnitudes of these coefficients determine how well monetary policy can manage food inflation in an *NKPC*. In the extreme scenario, when $\beta = 0$, inflation develops on its own without regard to monetary policy. If the coefficient for delayed inflation is high, then policy decisions may only have a long-term lag before having an impact on food inflation, which is mostly driven by the past. Therefore, we require estimates of these characteristics in order to assess the efficacy of monetary policy operations. In line with Bello &Sanusi (2019), our dynamics of food inflation are specified in the following model specification:

$$fpinfl_t = \phi_0 + \phi_1 fpinf_{t-1} + \phi_2 exrd_t + \phi_3 oilp_t + \phi_4 mssp_t + \phi_5 (r_t^d - r_t^f) + e_t \quad (3)$$

Where the food inflation lag one period is represented by $fpinf_{t-1}$, and we have chosen to replace the output gap with the domestic (r_t^d) and foreign (r_t^f) interest rate differentials. In addition to exchange rate devaluation and oil price variations, the moderating predictors are the growth rate of broad money supply and interest rate differentials. The choice of these two control variables is informed by the prevailing devaluation and instability in oil prices which are currently driving the hardship. The analysis incorporates two control variables, namely crude oil prices, and currency rates in place of money supply growth and output gap accordingly. Considering the presence of structural breakdowns or regime transitions that occur in a time series, a Markov autoregressive regime switching model (MARSM) that accurately depict the changes that occur was estimated. Using the MARSM model, we evaluated a nonlinear link between devaluation shock, oil price fluctuations, broad money supply, and local and foreign interest rates. The key component of this methodology is the endogenous modeling of the switching probabilities within two regimes, namely, regime 1 and regime 2 respectively. The high (low) volatility regime is represented by the standard deviations of the higher (lower) coefficients. Regime 1 has both strong growth and high volatility and Regime 2 has low growth and low volatility. Besides, the regime-switching model accounts for dynamics like heteroscedasticity and asymmetry. The MSAR model with two state-dependent AR terms in state "s" at time "t" is here specified as in equation (4):

$$\begin{aligned} fpinfl_t &= \phi_{0st} + \phi_1 excd_t + \phi_2 oilp_{st} + \phi_3 mssp_{st} + \phi_4 [r_t^d - r_t^f]_{st} + \\ &\gamma_{1,st}(fpinfl_{t-1} - \phi_{0st-1} - \phi_1 excd_{t-1} - \phi_{2,st-1} oilp_{st-1} - \phi_{3,st-1} mssp_{st-1} - \phi_{4,st-1}[r_t^d - r_t^f]_{st-1}) \\ &+ \gamma_{2,st}(fpinfl_{t-2} - \phi_{0st-2} - \phi_1 excd_{t-2} - \phi_{2,st-2} oilp_{st-2} - \phi_{3,st-2} mssp_{st-2} - \phi_{4,st-2}[r_t^d - r_t^f]_{st-2}) + e_t \end{aligned} \quad (4)$$

where ϕ_{0st} is the state-dependent intercept; the coefficient ϕ_1 is state invariant; coefficient $\phi_{2,st}$, is state-dependent; $\gamma_{1,st}$ is the first AR term in state s_t; $\gamma_{2,st}$ is the second AR term in state s_t. The probability of remaining in a given state "s" at time "t" is a function of s_{t-1}, and is given by:

$$Pr = (s_t = j \mid s_{t-1} = i) = p_{ij}$$

Hence, all possible transitions from one "state" is representable in the transition matrix given as:

$$Pr = \begin{bmatrix} p_{11} & p_{21} \\ & \\ p_{12} & p_{22} \end{bmatrix}$$

Where $p_{ij} = p_{11} p_{21}$, and $p_{12} p_{22}$ are the regime probabilities. The probability of staying in that state is o and 1, as well as the probability of changing from one to another. While state two has low volatility, state one has volatility. The key component of this methodology is the endogenous modeling of the switching probabilities within each regime. This study also estimated the system panel GMM model, whose specification becomes equation (5).

$$cpi_t = cpi\rho_1 + \cdots + cpi_{t-p}\rho_p + H_t\varphi_0 + \cdots + H\varphi_q + U_t, \quad t \in \mathbb{Z} \quad (5)$$

$$U_t = \partial + \lambda_t + \varepsilon_t \quad (6)$$

Where *cpi*$_t$ is the consumer price inflation; *cpi*$_{t-1}$ is the lag of *CPI* with p lags; H_t… H_{t-q} *are* vectors of exogenous variables; ∂i, the individual-specific effect, λ_t, is the time effect, and ε_t is the random variable. The specification introduces the index, *i* into equations (7) and (8) for purpose of indicating cross-sections as:

$$cpi_{it} = cpi_{i,t-1}\rho_1 + \cdots + cpi_{i,t-p}\rho_p + H'_{it}\varphi_0 + \cdots + H'_{i,t-q}\varphi_q + U_{it}, \quad \mathrm{i} = 1, \ldots, \mathrm{N};\ \mathrm{t} \in \mathbb{Z} \tag{7}$$

$$U_{it} = \partial_i + \lambda_t + \varepsilon_{it} \tag{8}$$

Replacing U_{it} in equation (7) with equation (8) results in equation (9):

$$cpi_{it} = cpi_{i,t-1}\rho_1 + \cdots + cpi_{i,t-p}\rho_p + H'_{it}\varphi_0 + \cdots + H'_{i,t-q}\varphi_q + A_i + \lambda_t + \varepsilon_{it} \tag{9}$$

Simplifying equation (9) by excluding time effects, λ_t, and using only one lag of the dependent variable and contemporaneous non-lagged explanatory variables, we have the specification in equation (10):

$$lncpi_{it} = lncpi_{i,t-1}\rho_1 + X'_{it}\varphi + \partial_i + \varepsilon_{it} \tag{10}$$

Accounting for the first differences as a transformation entailed in the estimation process, the Δ is introduced into the model specification and this nullifies the ∂i, the individual-specific effect. The resulting model specification is given in equation (11).

$$\Delta lncpi_{it} = \phi\Delta lncpi_{it-1} + \vartheta\Delta H'_{it} + \Delta\varepsilon_{it}) \tag{11}$$

Where

$$H' = \begin{bmatrix} \ln exrd \\ \ln oip \\ \ln mssp \\ (r^d - r^f) \end{bmatrix}',$$

where $lncpi_{it-1}$ is lagged log value of the consumer price level; ϕ is the coefficient of the lagged price level, Δ is the first differencing of variable, *H* is the vector of predetermined and endogenous covariates; ϑ is the k×1 vector of parameters; ε is the standard error of the model; η_i is panel effects. The rationale for estimation with the *GMM* estimator in this paper is that it improves the efficiency of regression estimates relative to estimation methods that focus on within-country variations in the explanatory variables. The *GMM* method yields efficient estimates by solving the endogeneity problem.

The two sources of data were the statistical websites of the World Bank and the International Monetary Fund. These databases provided data on exchange rates, Brent crude oil prices, broad money supply, and local and foreign interest rates. The foreign interest rate was calculated as the federal fund rate of the United

States of America. Consumer price inflation was disaggregated into two prices for a sensitivity analysis that was conducted using the system panel GMM model estimator. The two prices are the food CPI and the fuel CPI. The fuel CPI was calculated as the average change in the price of the transportation group of the CPI. The transportation index comprises public, private transportation, motor fuel, gasoline all types (premium, regular and Midgrade), automotive diesel fuel, Ethanol (E85/flex fuel and E15), natural gas, electricity, and biodiesel that is sold for use in consumer automobiles. Similarly, data on food inflation was calculated as the average consumer price changes of foodstuffs purchased from restaurants, stores, and market squares plus online shopping and services consumed by people on a daily basis. The eleven SSA countries covered in this study are Nigeria, Ghana, South Africa, Sudan, Sierra Leone, Morocco, Zimbabwe, Kenya, the Congo Democratic Republic, The Gambia, and Egypt. The World Bank database provided the data for these ten emerging countries. The years 2000Q1 to 2024Q2 are covered.

4. Results

According to Table 1, the average agricultural production was 20.79136 in 2000, and the average exchange rate was 550.4874 in 2022. Additionally, the average price of oil was 7.075203 in 2022, compared to 2000. The oil price, currency rate, and agricultural production all have Jarque-Bera probabilities that are less than 0.05, indicating that none of the variables is normally distributed.

Table 1. Summary statistics results

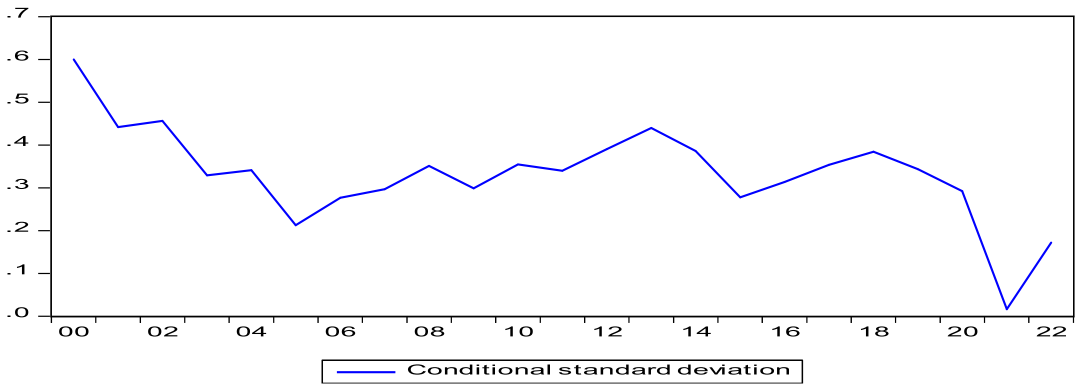
Nigeria	foinfl	excd	Boilp	mssp	(r^d-r^f)	fuinfl
Mean	320.79136	550.4874	1294.1357	150.3728	21.93863	132.2001
Skewness	19.09412	132.8880	6.847283	110.2470	20.3891	3.0238
Std. Dev	79.04236	9565.082	644.1999	134.4891	7.3819	1.09256
Kurtosis	3.48090	2.438095	3.458957	110.3872	0.9176	3.3892
Ghana	foinfl	excd	Boilp	mssp	(r^d-r^f)	fuinfl
Mean	143.41160	1302.926	1294.1357	1252.386	13.4801	1452.352
Skewness	5.125881	29.23612	6.847283	112.3832	0.1873	9.20481
Std. Dev	169.5063	15042.27	644.1999	120.3397	0.0387	16.3409
Kurtosis	2.38792	3.495791	3.458957	131.4932	0.86191	5.8093
South Africa	foinfl	excd	Boilp	mssp	(r^d-r^f)	fuinfl
Mean	943.236	252673.7	1294.1357	231.4874	10.03897	121.746
Skewness	2.5648	1.3579	6.847283	110.2387	0.0037	5.20273
Std. Dev	1.289	1.4891	644.1999	131.3899	0.0376	5.42293
Kurtosis	3.1872	3.3285	3.458957	126.3855	1.03265	0.35622
Sudan	foinfl	excd	Boilp	mssp	(r^d-r^f)	fuinfl
Mean	1836.8901	17892.397	1294.1357	156.398	9.20341	187.289
Skewness	4.2093	14.5896	6.847283	0.41038	1.15478	17.2394
Std. Dev	19.4368	5.32091	644.1999	101.6932	0.18931	13.4875

Kurtosis	19.3714	6.19402	3.458957	3.24790	1.03278	0.15834
Sierra Leone	foinfl	excd	Boilp	mssp	$(r^d - r^f)$	fuinfl
Mean	1421.4974	1332.1182	1294.1357	214.4137	14.3565	1245.3793
Skewness	3.2289	3.0578	6.847283	3.02894	4.0769	6.32719
Std. Dev	0.2160	0.0286	644.1999	10.0375	20.3542	4.33801
Kurtosis	3.4292	0.1673	3.458957	0.2479	2.4348	7.86631
Morocco	foinfl	excd	Boilp	mssp	$(r^d - r^f)$	fuinfl
Mean	1354.0001	1452.352	1294.1357	1231.2325	12.5540	1236.0346
Skewness	3.3562	4.60932	6.847283	2.34800	5.0013	1.35622
Std. Dev	2.34085	2.02372	644.1999	10.2309	13.0458	6.34083
Kurtosis	9.12346	9.85632	3.458957	4.6325	3.91255	4.58950
Zimbabwe	foinfl	excd	Boilp	mssp	$(r^d - r^f)$	fuinfl
Mean	1561.474	1332.1182	1294.1357	214.4137	20.1279	1908.2973
Skewness	2.2343	3.7485	6.847283	5.8768	31.0693	6.22145
Std. Dev	15.3209	10.0376	644.1999	1.5664	1.3432	2.30344
Kurtosis	6.1335	1.03265	3.458957	0.2479	2.4348	5.3028
Kenya	foinfl	excd	Boilp	mssp	$(r^d - r^f)$	fuinfl
Mean	1325.2001	1452.352	1294.1357	1231.2325	2.5540	1987.389
Skewness	3.4292	5.1673	6.847283	6.0346	6.3542	3.21256
Std. Dev	12.7289	20.0182	644.1999	10.2309	13.3458	5.30298
Kurtosis	9.12346	9.85632	3.458957	4.6325	3.1255	4.32084
Congo D.R.	foinfl	excd	Boilp	mssp	$(r^d - r^f)$	fuinfl
Mean	1982.1121	1352.122	1294.1357	1225.0125	1232.740	1355.3879
Skewness	3.4292	5.1673	6.847283	6.0346	6.3542	5.6850
Std. Dev	4.02589	10.0279	644.1999	4.15869	12.03489	3.04921
Kurtosis	3.1376	4.56896	3.458957	5.38793	5.67890	2.13384
The Gambia	foinfl	excd	Boilp	mssp	$(r^d - r^f)$	fuinfl
Mean	1342.0156	231.2982	1294.1357	2141.2789	17.54278	1090.3479
Skewness	1.8258	4.2026	6.847283	13.4292	0.1673	4.5987
Std. Dev	0.1473	6.3899	644.1999	223.7289	0.0182	10.2893
Kurtosis	0.2287	0.0037	3.458957	4.13216	0.01863	3.04589
Egypt	foinfl	excd	Boilp	mssp	$(r^d - r^f)$	fuinfl
Mean	1846.587	1451.3987	1294.1357	1467.399	11.438	1465.879
Skewness	5.4292	4.1673	6.847283	5.4870	3.4598	4.28094
Std. Dev	12.7289	20.0182	644.1999	10.2309	13.3458	6.34083
Kurtosis	9.12346	9.85632	3.458957	4.6325	6.87902	3.48975

Source: Authors' Eviews estimation results

The variation under condition of Bent crude oil price movement is shown in Figure 1. It may be inferred that there is a positive and rising trend in the Bent crude price until it nosedives in 2022. This suggests that the rising cost of living in developing SSA nations is owing to rising oil costs.

Figure 1. Conditional volatility



Source: Authors' Eviews estimation results

The stationarity of variables was verified using the IPS (Im, Pesaran, and Shin) and ADF (Augmented Dickey-Fuller) tests. The findings demonstrate that not every series is stationary at the same level. Rather, the results of the test show that the majority of variables have a probability larger than 0.05%, which permits us to accept the null hypothesis that co-integration is nonexistent. These results are not reported in order to control for brevity. Table 2 provides a summary of the MARSM estimations.

Table 3. Markov (AR) Regime Switching Regression results for Nigeria

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.0618***	127.1823	0.0000
$foinfl_{(t-2)}$	0.0165***	126.4571	0.0000
$excd_t$	1.0216***	15.0328	0.0000
$excd_{(t-1)}$	1.0075***	29.3386	0.0000
$excd_{(t-2)}$	0.0143***	125.4219	0.0000
$mssp_t$	0.0596	1.0283	0.8965
$mssp_{(t-1)}$	0.0237	0.2900	0.6822
$mssp_{(t-2)}$	1.0486	1.4362	0.9876
$oilp_t$	1.2652***	13.2100	0.0000
$oilp_{(t-1)}$	0.1896**	2.8608	0.0145
$oilp_{(t-2)}$	0.1156***	49.5178	0.0000
(r^d-r^f)	0.0175**	2.6810	0.0144
$(r^d-r^f)_{(t-1)}$	0.0198***	12.4053	0.0000
$(r^d-r^f)_{(t-1)}$	0.0553***	8.5678	0.0000
c	11.4201***	21.7592	0.0000
Diagnostics	S.E. of regression	0.0003	0.0001
	Durbin-Watson statistic	2.146	0.0010
Non-switching	AR(1)	0.1038*	0.006
	AR(2)	0.0420**	0.042

Variable	Coefficient	z-Statistic	Prob.
	AR(3)	0.0310**	0.050
	AR(4)	0.0158	0.134
	LOG(SIGMA)	-1.3066***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	0.0238***	4.8623	0.0000
$foinfl_{(t-2)}$	0.0115***	6.0998	0.0000
$excd_t$	1.0142***	34.0234	0.0000
$excd_{(t-1)}$	1.2355***	6.1225	0.0000
$excd_{(t-2)}$	0.0263***	36.0811	0.0000
$mssp_t$	0.0156	0.0773	0.9946
$mssp_{(t-1)}$	0.0977	0.5689	0.8762
$mssp_{(t-2)}$	1.0396	0.6842	0.5687
$oilp_t$	1.0052***	13.7800	0.0000
$oilp_{(t-1)}$	0.0896**	21.3560	0.0000
$oilp_{(t-2)}$	0.0156***	-40.5324	0.0000
(r^d-r^f)	0.0199**	29.7830	0.0000
$(r^d-r^f)_{(t-1)}$	0.0237***	79.4688	0.0000
$(r^d-r^f)_{(t-1)}$	0.0153***	13.5665	0.0000
Diagnostics	S.E. of regression	0.0007	0.0000
	Durbin-Watson stat	2.0987	0.110
Non-switching	AR(1)	0.0065***	0.000
	AR(2)	0.0175**	0.050
	AR(3)	0.0191**	0.050
	AR(4)	0.0370***	0.000
	LOG(SIGMA)	-2.7804***	0.000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.332370	0.667630***(0.0000)
Regimes	Expected durations	
1	Regime 1	Regime 2
2	43.214620	26.008698

Source: Authors' Eviews estimation results

Table 4. Markov (AR) Regime Switching Regression results for Ghana

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.0134***	221.8623	0.0000
$foinfl_{(t-2)}$	0.1076***	34.5875	0.0000
$excd_t$	1.0223***	20.0234	0.0000
$excd_{(t-1)}$	1.0289***	12.547	0.0000
$excd_{(t-2)}$	0.0018***	36.0231	0.0000
$mssp_t$	0.0137***	25.0773	0.0000
$mssp_{(t-1)}$	0.0123**	25.5689	0.0000
$mssp_{(t-2)}$	1.0142***	35.0012	0.0000

Variable	Coefficient	z-Statistic	Prob.
$oilp_t$	1.0231***	12.3738	0.0000
$oilp_{(t-1)}$	0.1076**	10.1420	0.0000
$oilp_{(t-2)}$	0.0198***	20.0324	0.0000
(r^d-r^f)	0.0160**	11.0030	0.0000
$(r^d-r^f)_{(t-1)}$	0.1567***	10.1388	0.0000
$(r^d-r^f)_{(t-1)}$	0.1075***	15.2265	0.0000
c	0.0145***	30.9923	0.0000
Diagnostics	S.E. of regression	0.0340	0.0000
	Durbin-Watson stat	2.0135	0.1000
Non-switching	AR(1)	0.0135***	0.000
	AR(2)	0.0114**	0.050
	AR(3)	0.0112**	0.050
	AR(4)	0.0250***	0.000
	LOG(SIGMA)	3.5470***	0.000
	Regime 2		
$foinfl_{(t-1)}$	0.0896**	21.3560	0.0000
$foinfl_{(t-2)}$	-0.0156***	-40.5324	0.0000
$excd_t$	0.0199***	29.7830	0.0000
$excd_{(t-1)}$	0.0237**	2.4688	0.0143
$excd_{(t-2)}$	0.0153**	2.5665	0.0156
$mssp_t$	0.0238***	13.8623	0.0000
$mssp_{(t-1)}$	0.0115	1.0998	0.7658
$mssp_{(t-2)}$	0.0002	1.0234	0.7796
$oilp_t$	1.2355***	117.1225	0.0000
$oilp_{(t-1)}$	0.0263***	106.0811	0.0000
$oilp_{(t-2)}$	0.0156***	22.0773	0.0000
(r^d-r^f)	0.0177**	27.5689	0.0000
$(r^d-r^f)_{(t-1)}$	0.0126***	55.6842	0.0000
$(r^d-r^f)_{(t-1)}$	0.0152***	13.7800	0.0000
Diagnostics	S.E. of regression	0.0014	0.0017
	Durbin-Watson stat	2.146	2.110
Non-switching	AR(1)	0.0115***	0.000
	AR(2)	0.0103**	0.050
	AR(3)	0.0273**	0.050
	AR(4)	0.0189***	0.000
	LOG(SIGMA)	-2.3596***	0.000

Transition parameters		
Regimes	Regime 1	Regime 2
1	0.789327***(0.0000)	0.5643239
2	0.15673250	0.13862***(0.0000)
	Expected durations	
Regimes	1	2
	57.098608	40.758436

Source: Authors' Eviews estimation results

Table 5. Markov (AR) Regime Switching Regression results for South Africa

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.0136**	20.1060	0.0000
$foinfl_{(t-2)}$	0.0146***	10.5014	0.0000
$excd_t$	1.1725**	29.7310	0.0000
$excd_{(t-1)}$	1.0348***	13.7951	0.0000
$excd_{(t-2)}$	1.0119***	14.0122	0.0000
$mssp_t$	0.2465	0.1323	0.7134
$mssp_{(t-1)}$	1.0015	0.0458	0.8135
$mssp_{(t-2)}$	1.0132	0.9120	0.5122
$oilp_t$	0.2105***	-23.0565	0.0000
$oilp_{(t-1)}$	0.0903***	-26.0821	0.0000
$oilp_{(t-2)}$	0.0012***	42.0453	0.0000
(r^d-r^f)	0.0417**	57.5109	0.0000
$(r^d-r^f)_{(t-1)}$	0.3026***	65.6102	0.0000
$(r^d-r^f)_{(t-1)}$	0.1208***	15.7300	0.0000
c	1.0897**	10.3200	0.0000
Diagnostics	S.E. of regression	0.1000	0.0001
	Durbin-Watson statistic	2.0022	0.013
Non-switching	AR(1)	0.0048*	0.006
	AR(2)	0.0009**	0.001
	AR(3)	0.0014**	0.050
	AR(4)	0.0124	0.005
	LOG(SIGMA)	-4.0066***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	0.0136**	10.0360	0.0000
$foinfl_{(t-2)}$	0.0146***	-11.0014	0.0000
$excd_t$	1.1241**	141.0310	0.0000
$excd_{(t-1)}$	0.4378***	163.100	0.0000
$excd_{(t-2)}$	0.0813***	150.6012	0.0000
$mssp_t$	0.1131	0.4891	0.6879
$mssp_{(t-1)}$	0.1026	0.4258	0.6867
$mssp_{(t-2)}$	1.0389	0.9135	0.5256
$oilp_t$	0.1131**	124.0875	0.0000
$oilp_{(t-1)}$	0.1102***	76.0139	0.0000
$oilp_{(t-2)}$	0.1017***	52.0315	0.0000
(r^d-r^f)	1.0109**	24.1009	0.0000
$(r^d-r^f)_{(t-1)}$	0.1379***	100.4562	0.0000
$(r^d-r^f)_{(t-1)}$	0.1089***	125.2300	0.0000
Diagnostics	S.E. of regression	0.0051	0.0011
	Durbin-Watson stat	2.1103	0.500
Non-switching	AR(1)	0.0013***	0.000
	AR(2)	0.0105**	0.050
	AR(3)	0.0102**	0.050
	AR(4)	0.0130***	0.000

Variable	Coefficient	z-Statistic	Prob.
	LOG(SIGMA)	-3.4800***	0.000
Transition parameters			
Regimes	Regime 1	Regime 2	
2	0.1938754	0.5675630***(0.0000)	
Regimes	Expected durations		
1	Regime 1	Regime 2	
2	29.228157	15.489499	

Source: Authors' Eviews estimation results

Table 6. Markov (AR) Regime Switching Regression results for Sudan

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.0122**	134.5879	0.0000
$foinfl_{(t-2)}$	1.0156***	100.3715	0.0000
$excd_t$	1.0145**	3.5486	0.0000
$excd_{(t-1)}$	0.0248***	14.5689	0.0000
$excd_{(t-2)}$	0.0016***	13.0000	0.0000
$mssp_t$	0.1392	1.15413	0.6855
$mssp_{(t-1)}$	1.0103	1.0389	0.5687
$mssp_{(t-2)}$	0.0156	1.3950	0.6754
$oilp_t$	0.7901***	23.0230	0.0000
$oilp_{(t-1)}$	0.0013***	23.0109	0.0000
$oilp_{(t-2)}$	0.0014***	12.0210	0.0000
(r^d-r^f)	0.0156**	17.0109	0.0000
$(r^d-r^f)_{(t-1)}$	0.1200***	35.4602	0.0000
$(r^d-r^f)_{(t-1)}$	0.1017***	19.4000	0.0000
c	3.4795***	20.4861	0.0000
Diagnostics	S.E. of regression	0.0022	0.0017
	Durbin-Watson statistic	2.146	2.110
Non-switching	AR(1)	0.0048***	0.0000
	AR(2)	0.0020**	0.042
	AR(3)	0.0014**	0.050
	AR(4)	0.0023**	0.034
	LOG(SIGMA)	-6.3066***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	0.0124**	104.287	0.0000
$foinfl_{(t-2)}$	1.0169***	101.354	0.0000
$excd_t$	1.0122**	35.236	0.0000
$excd_{(t-1)}$	0.0108***	13.4700	0.0000
$excd_{(t-2)}$	0.0026***	12.0343	0.0000
$mssp_t$	0.1402	1.5413	0.6879
$mssp_{(t-1)}$	0.0210	1.1989	0.4658
$mssp_{(t-2)}$	0.0161	0.2560	0.6789
$oilp_t$	1.0075***	63.0223	0.0000

Variable	Coefficient	z-Statistic	Prob.
$oilp_{(t-1)}$	0.0146***	73.0349	0.0000
$oilp_{(t-2)}$	0.0219***	32.2202	0.0000
(r^d-r^f)	0.0119**	27.0111	0.0000
$(r^d-r^f)_{(t-1)}$	0.0013***	25.2783	0.0000
$(r^d-r^f)_{(t-1)}$	0.1033***	49.3581	0.0000
Diagnostics	S.E. of regression	0.2300	0.0019
	Durbin-Watson stat	2.3980	0.5670
Non-switching	AR(1)	0.0012***	0.0000
	AR(2)	0.0013**	0.0500
	AR(3)	0.0100**	0.0500
	AR(4)	0.0125***	0.0000
	LOG(SIGMA)	4.0013***	0.0000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.112938	0.103870***(0.0000)
	Expected durations	
Regimes	Regime 1	Regime 2
	43.214620	26.008698

Source: Authors' Eviews estimation results

Table 7. Markov (AR) Regime Switching Regression results for Sierra Leone

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.0527**	25.6000	0.0000
$foinfl_{(t-2)}$	1.0486***	130.1145	0.0000
$excd_t$	2.0509**	39.1579	0.0000
$excd_{(t-1)}$	0.0238***	120.1190	0.0000
$excd_{(t-2)}$	0.0015***	132.0091	0.0000
$mssp_t$	0.0381	1.3856	0.4894
$mssp_{(t-1)}$	0.0171	0.4871	0.6079
$mssp_{(t-2)}$	0.0038	0.3190	0.6568
$oilp_t$	0.0211***	14.5807	0.0000
$oilp_{(t-1)}$	0.1009***	14.68091	0.0000
$oilp_{(t-2)}$	0.0186***	50.6888	0.0000
(r^d-r^f)	0.0134**	2.0010	0.0000
$(r^d-r^f)_{(t-1)}$	0.0179***	5.6891	0.0000
$(r^d-r^f)_{(t-1)}$	0.0143***	34.5796	0.0000
c	0.0156**	111.4097	0.0000
Diagnostics	S.E. of regression	1.0873	0.0017
	Durbin-Watson statistic	2.3592	0.5690
Non-switching	AR(1)	0.0011*	0.006
	AR(2)	0.0032**	0.022
	AR(3)	0.0115**	0.050
	AR(4)	0.0111***	0.0000
	LOG(SIGMA)	-1.3066***	0.0000

Variable	Coefficient	z-Statistic	Prob.
	Regime 2		
foinfl$_{(t-1)}$	0.0122**	133.1000	0.0000
foinfl$_{(t-2)}$	0.0119***	140.1436	0.0000
excd$_{t}$	1.0017**	390.1579	0.0000
excd$_{(t-1)}$	1.0013***	124.1790	0.0000
excd$_{(t-2)}$	0.0214***	133.0091	0.0000
mssp$_{t}$	0.0165	0.309	0.6115
mssp$_{(t-1)}$	0.0134	0.4210	0.5678
mssp$_{(t-2)}$	0.0015	1.0019	0.6199
oilp$_{t}$	0.0433***	250.1607	0.0000
oilp$_{(t-1)}$	0.0171***	34.5701	0.0000
oilp$_{(t-2)}$	0.0111***	210.018	0.0000
$(r^{d}-r^{f})$	0.0126**	2.4789	0.0000
$(r^{d}-r^{f})_{(t-1)}$	0.0146***	5.6891	0.0000
$(r^{d}-r^{f})_{(t-1)}$	0.0183***	34.5796	0.0000
Diagnostics	S.E. of regression	0.1092	0.0011
	Durbin-Watson stat	2.100	0.0510
Non-switching	AR(1)	0.0065***(0.000)	0.000
	AR(2)	0.0175***	0.000
	AR(3)	0.0191***	0.000
	AR(4)	0.0370***	0.000
	LOG(SIGMA)	-2.7804***	0.000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.2765510	0.124810***(0.0000)
	Expected durations	
Regimes	1	2
	30.092846	20.367481

Source: Authors' Eviews estimation results

Table 8. Markov (AR) Regime Switching Regression results for Morocco

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
foinfl$_{(t-1)}$	1.0012**	34.587	0.0000
foinfl$_{(t-2)}$	0.0139***	20.3418	0.0000
excd$_{t}$	3.0547***	33.4861	0.0000
excd$_{(t-1)}$	0.0142***	12.3894	0.0000
excd$_{(t-2)}$	0.0514***	109.4879	0.0000
mssp$_{t}$	0.022	0.0079	0.4578
mssp$_{(t-1)}$	0.0136	1.4231	0.6087
mssp$_{(t-2)}$	0.0014	0.5792	0.5231
oilp$_{t}$	0.0123***	16.2879	0.0000
oilp$_{(t-1)}$	0.0961***	20.3970	0.0000
oilp$_{(t-2)}$	0.0281***	50.3487	0.0000

Variable	Coefficient	z-Statistic	Prob.
(r^d-r^f)	0.0135**	24.0109	0.0000
$(r^d-r^f)_{(t-1)}$	0.0146***	90.3027	0.0000
$(r^d-r^f)_{(t-1)}$	0.0172***	13.4790	0.0000
c	0.0141**	123.1790	0.0000
Diagnostics	S.E. of regression	0.0025	0.0007
	Durbin-Watson statistic	2.004	0.0510
Non-switching	AR(1)	0.0014***	0.0000
	AR(2)	0.0130**	0.0520
	AR(3)	0.0019**	0.0500
	AR(4)	0.0523***	0.000
	LOG(SIGMA)	-3.4126***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	1.0239***	14.1865	0.0000
$foinfl_{(t-2)}$	1.0513***	15.6897	0.0000
$excd_t$	1.0231***	297.4832	0.0000
$excd_{(t-1)}$	0.0172***	224.579	0.0000
$excd_{(t-2)}$	0.0003***	136.3407	0.0000
$mssp_t$	0.0847	1.3861	0.5689
$mssp_{(t-1)}$	0.1355	1.4790	0.3597
$mssp_{(t-2)}$	0.0025	1.1235	0.2256
$oilp_t$	0.0409***	193.4791	0.0000
$oilp_{(t-1)}$	0.0018***	167.2209	0.0000
$oilp_{(t-2)}$	0.0561***	268.4890	0.0000
(r^d-r^f)	0.0164**	139.2687	0.0000
$(r^d-r^f)_{(t-1)}$	0.0109***	188.3594	0.0000
$(r^d-r^f)_{(t-1)}$	0.0237***	400.2870	0.0000
Diagnostics	S.E. of regression	0.0004	0.0006
	Durbin-Watson stat	2.3572	0.0589
Non-switching	AR(1)	0.0131***	0.000
	AR(2)	0.0190**	0.050
	AR(3)	0.0123**	0.050
	AR(4)	0.0001***	0.000
	LOG(SIGMA)	-5.0314***	0.000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.148321	0.4576930***(0.0000)
	Expected durations	
Regimes	1	2
	64.289350	56.28793

Source: Authors' Eviews estimation results

Table 9. Markov (AR) Regime Switching Regression results for Zimbabwe

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.1863***	100.3633	0.0000
$foinfl_{(t-2)}$	0.0329***	178.3486	0.0000
$excd_t$	0.1632***	122.3487	0.0000
$excd_{(t-1)}$	0.0049***	356.5672	0.0000
$excd_{(t-2)}$	0.0973***	197.3842	0.0000
$mssp_t$	0.1367	1.0483	0.6879
$mssp_{(t-1)}$	2.4815	0.3479	0.7539
$mssp_{(t-2)}$	0.3095	1.0087	0.9678
$oilp_t$	0.1376***	101.3891	0.0000
$oilp_{(t-1)}$	0.2987***	146.5470	0.0000
$oilp_{(t-2)}$	0.3409***	109.3257	0.0000
(r^d-r^f)	0.2876**	1466.4911	0.0000
$(r^d-r^f)_{(t-1)}$	2.1955***	100.1728	0.0000
$(r^d-r^f)_{(t-1)}$	0.3627***	156.1379	0.0000
c	0.0239***	178.3860	0.0000
Diagnostics	S.E. of regression	0.0004	0.0001
	Durbin-Watson statistic	2.0193	0.560
Non-switching	AR(1)	0.2398**	0.0570
	AR(2)	0.3250***	0.0000
	AR(3)	0.0018***	0.0000
	AR(4)	0.0492	0.7589
	LOG(SIGMA)	-2.4859***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	0.5847***	133.4875	0.0000
$foinfl_{(t-2)}$	1.1270***	178.4890	0.0000
$excd_t$	0.1387***	109.3229	0.0000
$excd_{(t-1)}$	0.0124***	145.3911	0.0000
$excd_{(t-2)}$	0.0583***	0.3488	0.3478
$mssp_t$	0.1367	0.4572	0.675
$mssp_{(t-1)}$	1.1052	1.0092	0.6809
$mssp_{(t-2)}$	0.0114	166.3971	0.0000
$oilp_t$	0.4782***	198.9641	0.0000
$oilp_{(t-1)}$	0.0123***	122.3874	0.0000
$oilp_{(t-2)}$	0.1093***	178.9201	0.0000
(r^d-r^f)	0.3120**	144.2870	0.0000
$(r^d-r^f)_{(t-1)}$	1.1028***	156.0094	0.0000
$(r^d-r^f)_{(t-1)}$	0.4093***	145.1309	0.0000
Diagnostics	S.E. of regression	0.0002	0.0027
	Durbin-Watson stat	2.2039	0.05300
Non-switching	AR(1)	0.0121***	0.000
	AR(2)	0.0016**	0.050
	AR(3)	0.0001**	0.050
	AR(4)	0.0097***	0.000

Variable	Coefficient	z-Statistic	Prob.
	LOG(SIGMA)	-3.0043***	0.000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.1874620	0.223489***(0.0000)
	Expected durations	
Regimes	1	2
	30.5732	14.56739

Source: Authors' Eviews estimation results

Table 10. Markov (AR) Regime Switching Regression results for Kenya

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.3691***	140.5829	0.0000
$foinfl_{(t-2)}$	0.1528***	122.4891	0.0000
$excd_t$	2.3904***	127.3480	0.0000
$excd_{(t-1)}$	0.3870***	190.0523	0.0000
$excd_{(t-2)}$	0.1134***	198.0012	0.0000
$mssp_t$	0.2379***	6.4891	0.0000
$mssp_{(t-1)}$	0.1034	1.5879	0.5890
$mssp_{(t-2)}$	0.0117	1.4890	0.6900
$oilp_t$	0.1209***	123.4874	0.0000
$oilp_{(t-1)}$	0.2177***	150.3894	0.0000
$oilp_{(t-2)}$	0.2931***	190.1482	0.0000
(r^d-r^f)	0.0133**	789.289	0.0000
$(r^d-r^f)_{(t-1)}$	1.0325***	134.511	0.0000
$(r^d-r^f)_{(t-1)}$	0.0024***	1100.389	0.0000
c	0.0137***	155.2109	0.0000
Diagnostics	S.E. of regression	0.0560	0.0007
	Durbin-Watson statistic	2.1000	0.0500
Non-switching	AR(1)	0.0058***	0.0060
	AR(2)	0.0058**	0.0420
	AR(3)	0.0005**	0.0500
	AR(4)	0.0015**	0.0560
	LOG(SIGMA)	-5.6777***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	1.0243***	112.4720	0.0000
$foinfl_{(t-2)}$	0.1309***	163.1309	0.0000
$excd_t$	3.0246***	144.5890	0.0000
$excd_{(t-1)}$	1.0156***	120.0094	0.0000
$excd_{(t-2)}$	1.0275***	390.0613	0.0000
$mssp_t$	1.02981***	10.2873	0.0000
$mssp_{(t-1)}$	0.3467	1.4562	0.5681
$mssp_{(t-2)}$	0.0014	1.3291	0.5697
$oilp_t$	0.5402***	145.5872	0.0000

Variable	Coefficient	z-Statistic	Prob.
$oilp_{(t-1)}$	0.0183***	109.2871	0.0000
$oilp_{(t-2)}$	0.0304***	145.5970	0.0000
(r^d-r^f)	0.0166**	122.4890	0.0000
$(r^d-r^f)_{(t-1)}$	0.3871***	156.7892	0.0000
$(r^d-r^f)_{(t-1)}$	0.0258***	119.0387	0.0000
Diagnostics	S.E. of regression	0.0050	0.0012
	Durbin-Watson stat	2.0049	0.0547
Non-switching	AR(1)	0.0065***	0.0000
	AR(2)	0.0189	0.2495
	AR(3)	0.0621**	0.0500
	AR(4)	0.0013***	0.0000
	LOG(SIGMA)	-2.5468***	0.0000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.204340	0.562310***(0.0000)
	Expected durations	
Regimes	1	2
	50.368328	30.93467

Source: Authors' Eviews estimation results

Table 11. Markov (AR) Regime Switching Regression results for Congo Democratic

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	0.2486***	120.6390	0.0000
$foinfl_{(t-2)}$	0.1023***	190.3792	0.0000
$excd_t$	1.1765**	2.6540	0.0556
$excd_{(t-1)}$	0.0238**	2.1390	0.0556
$excd_{(t-2)}$	0.2487***	145.3591	0.0000
$mssp_t$	0.0138	0.2809	0.6823
$mssp_{(t-1)}$	0.0409	1.0069	0.5675
$mssp_{(t-2)}$	0.0247	1.4891	0.4628
$oilp_t$	0.0156**	2.4123	0.0556
$oilp_{(t-1)}$	0.0294**	2.8720	0.0556
$oilp_{(t-2)}$	0.1657***	156.1197	0.0000
(r^d-r^f)	0.0298***	133.5811	0.0000
$(r^d-r^f)_{(t-1)}$	0.3791***	192.3492	0.0000
$(r^d-r^f)_{(t-1)}$	0.0015***	145.2697	0.0000
c	0.1270***	190.5863	0.0000
Diagnostics	S.E. of regression	0.0001	0.0016
	Durbin-Watson statistic	2.2109	0.5690
Non-switching	AR(1)	0.2300*	0.0006
	AR(2)	0.0040**	0.0543
	AR(3)	0.0220**	0.0542
	AR(4)	0.0019***	0.0000
	LOG(SIGMA)	-3.5422***	0.0000

Variable	Coefficient	z-Statistic	Prob.
	Regime 2		
$foinfl_{(t-1)}$	0.1293***	290.3671	0.0000
$foinfl_{(t-2)}$	0.1324***	134.5872	0.0000
$excd_{t}$	1.1133***	156.229	0.0000
$excd_{(t-1)}$	0.0209***	120.3481	0.0000
$excd_{(t-2)}$	0.1230***	121.0342	0.0000
$mssp_{t}$	0.0145	1.5695	0.2543
$mssp_{(t-1)}$	0.0687	0.1908	0.7658
$mssp_{(t-2)}$	0.0409	1.6870	0.5912
$oilp_{t}$	1.0279***	144.0295	0.0000
$oilp_{(t-1)}$	0.0135***	166.7891	0.0000
$oilp_{(t-2)}$	0.1249***	190.393	0.0000
$(r^{d}-r^{f})$	0.1038**	178.3847	0.0000
$(r^{d}-r^{f})_{(t-1)}$	0.2461***	122.4710	0.0000
$(r^{d}-r^{f})_{(t-1)}$	0.0023***	190.3479	0.0000
Diagnostics	S.E. of regression	0.1059	0.0017
	Durbin-Watson stat	2.146	2.110
Non-switching	AR(1)	0.0012***	0.000
	AR(2)	0.0013**	0.050
	AR(3)	0.0094**	0.050
	AR(4)	0.02105***	0.000
	LOG(SIGMA)	-3.2489***	0.000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.3487925	0.985736***(0.0000)
	Expected durations	
Regimes	Regime 1	Regime 2
	35.187193	30.255926

Source: Authors' Eviews estimation results

Table 12. Markov (AR) Regime Switching Regression results for The Gambia

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	1.08134***	145.2892	0.0000
$foinfl_{(t-2)}$	1.024***	24.5330	0.0000
$excd_{t}$	2.0195***	17.5091	0.0000
$excd_{(t-1)}$	0.1348***	20.3479	0.0000
$excd_{(t-2)}$	0.0197**	2.2709	0.0500
$mssp_{t}$	0.0122	1.2809	0.5875
$mssp_{(t-1)}$	0.1296	0.0069	0.7892
$mssp_{(t-2)}$	0.1409	1.0891	0.5630
$oilp_{t}$	1.1642***	134.468	0.0000
$oilp_{(t-1)}$	0.1389***	156.689	0.0000
$oilp_{(t-2)}$	0.1457***	10.527	0.0000
$(r^{d}-r^{f})$	-0.1338***	-14.5805	0.0000

Variable	Coefficient	z-Statistic	Prob.
$(r^d\text{-}r^f)_{(t-1)}$	-0.1561***	-90.579	0.0000
$(r^d\text{-}r^f)_{(t-1)}$	-0.0495***	-106.481	0.0000
c	3.4367***	6.3450	0.0000
Diagnostics	S.E. of regression	0.0010	0.0019
	Durbin-Watson statistic	2.3012	0.5920
Non-switching	AR(1)	0.2100*	0.0006
	AR(2)	0.0110**	0.0523
	AR(3)	0.0230**	0.0522
	AR(4)	0.0015***	0.0000
	LOG(SIGMA)	-3.5422***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	1.2038***	120.4879	0.0000
$foinfl_{(t-2)}$	1.0137***	133.1194	0.0000
$excd_t$	1.1093***	101.3289	0.0000
$excd_{(t-1)}$	0.1382***	57.4183	0.0000
$excd_{(t-2)}$	0.12150***	60.124	0.0000
$mssp_t$	1.0348	1.0984	0.5587
$mssp_{(t-1)}$	0.0712	1.0013	0.6248
$mssp_{(t-2)}$	1.3092	1.2504	0.2379
$oilp_t$	1.0492***	135.0970	0.0000
$oilp_{(t-1)}$	0.1256***	40.2873	0.0000
$oilp_{(t-2)}$	0.1039***	786.1074	0.0000
$(r^d\text{-}r^f)$	1.0042**	122.3409	0.0000
$(r^d\text{-}r^f)_{(t-1)}$	0.1893***	795.3810	0.0000
$(r^d\text{-}r^f)_{(t-1)}$	0.1329***	542.4921	0.0000
Diagnostics	S.E. of regression	0.0001	0.0022
	Durbin-Watson stat	2.1000	0.0510
Non-switching	AR(1)	0.0011***	0.000
	AR(2)	0.0015**	0.050
	AR(3)	0.0013**	0.050
	AR(4)	0.0598***	0.000
	LOG(SIGMA)	-2.7919***	0.000

Transition parameters		
Regimes	Regime 1	Regime 2
	0.45387	0.782354***(0.0000)
	Expected durations	
Regimes	Regime 1	Regime 2
	27.86949	20.50875

Source: Authors' Eviews estimation results

Table 13. Markov (AR) Regime Switching Regression results for Egypt

Variable	Coefficient	z-Statistic	Prob.
	Regime 1		
$foinfl_{(t-1)}$	1.3089***	111.5879	0.0000
$foinfl_{(t-2)}$	1.0149***	160.3489	0.0000
$excd_t$	0.1452**	40.51268	0.0510
$excd_{(t-1)}$	0.0208**	190.3523	0.0512
$excd_{(t-2)}$	0.1567***	173.3489	0.0000
$mssp_t$	0.2408	1.1729	0.4678
$mssp_{(t-1)}$	0.0113	0.8329	0.5875
$mssp_{(t-2)}$	0.1466	1.2973	0.2389
$oilp_t$	1.0135***	17.2905	0.0000
$oilp_{(t-1)}$	0.1937***	16.5400	0.0000
$oilp_{(t-2)}$	0.1244***	23.5809	0.0000
(r^d-r^f)	1.0100**	29.7802	0.0000
$(r^d-r^f)_{(t-1)}$	0.1248***	24.5095	0.0000
$(r^d-r^f)_{(t-1)}$	0.1320***	19.0382	0.0000
c	2.7489***	12.456	0.0000
Diagnostics	S.E. of regression	0.0010	0.0005
	Durbin-Watson statistic	2.0113	0.0500
Non-switching	AR(1)	0.0003*	0.0006
	AR(2)	0.0014**	0.0501
	AR(3)	0.0002**	0.0501
	AR(4)	0.0036***	0.0000
	LOG(SIGMA)	-2.5879***	0.0000
	Regime 2		
$foinfl_{(t-1)}$	1.0279***	15.6809	0.0000
$foinfl_{(t-2)}$	0.0347***	29.0941	0.0000
$excd_t$	1.0293***	13.4894	0.0000
$excd_{(t-1)}$	0.1382***	39.3874	0.0000
$excd_{(t-2)}$	0.4569***	200.1327	0.0000
$mssp_t$	0.0328	0.4893	0.5678
$mssp_{(t-1)}$	0.1467	0.1863	0.5689
$mssp_{(t-2)}$	0.0349	0.2247	0.5427
$oilp_t$	1.0018***	12.34094	0.0000
$oilp_{(t-1)}$	0.1937***	19.3057	0.0000
$oilp_{(t-2)}$	0.1465***	11.3294	0.0000
(r^d-r^f)	0.1522**	24.5987	0.0000
$(r^d-r^f)_{(t-1)}$	0.1184***	10.3094	0.0000
$(r^d-r^f)_{(t-1)}$	0.0275***	23.4895	0.0000
Diagnostics	S.E. of regression	0.1000	0.0017
	Durbin-Watson stat	2.146	2.110
Non-switching	AR(1)	0.0012***	0.000
	AR(2)	0.0013**	0.050
	AR(3)	0.0094**	0.050
	AR(4)	0.02105***	0.000

Variable	Coefficient	z-Statistic	Prob.
	LOG(SIGMA)	-3.2489***	0.000
Transition parameters			
Regimes	Regime 1	Regime 2	
	0.683498	0.69043***(0.0000)	
	Expected durations		
Regimes	Regime 1	Regime 2	
	40.5975	28.94736	

Source: Authors' Eviews estimation results

4.1 Discussion

The parameters of MARSM in the unobserved states are estimated using a Marquardt step in the Markov switching regression estimation. The outcomes are shown in Tables 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13. Hence, we designate regime 1 as the state of low price volatility and regime 2 as the state of high price fluctuation. In both regime 1 and regime 2 for all countries, exchange rate depreciation at current and lagged values is positively correlated with consumer price inflation. This positive link between local currency devaluation shocks with and without lags in regimes 1 and 2 suggests that a rising food inflation shock is produced by a high degree of exchange rate market price variation. This suggests that exchange rates are significant contributors to food inflation in SSA countries. Unlike our study, Amaefula & Egba (2024) found a weak effect of the exchange the exchange rate on inflation. Our results are similar to those obtained for Ghana by Valogo *et al.* (2023), who found depreciation of the exchange rate surpassing each month limit of 0.70% significantly and positively correlated with inflation. The significance of the coefficient of depreciation is a pointer to the depreciation of SSA currencies. According to the accessible IMF statistics (2024), as of August 2, 2024, one US dollar exchanged for KSh128.8223 Kenya shillings; one US dollar was traded for 9.86 Moroccan dirhams (MAD); $1 USD could buy 601.50 i Sudan; $1 USD exchanged for 28.03 ZAR; one US dollar exchanged for ₦1635.8728; one US dollar exchanged for Zimbabwe; $1 USD was equivalent to Le21, 021.7 Sierra Leone; $1 USD exchanged for 20,987.5 GMD The Gambia; $1 USD exchanged for 15.55 Ghana Cedi; $1 USD was traded for 2,874.28 Congo D.R.; and $1 USD was traded for E£48.6238 Egyptian pound.

In Nigeria, following naira depreciation in January 2024 by 37.7% at the official rate to close at NGN1, 456/US$ and by 17.3% at the parallel market rate to close at NGN1, 470/US$, respectively, imported food inflation rose to 29.8% in February 2024 from 26.3% in January 2024. This change in inflation between January and February 2024 represents a 352 basis point increase. On a year-to-date analysis, the naira had depreciated by 43.4% and 24.7% to close at NGN1, 602.75/US$ and NGN1, 614/US$, respectively. A significant percentage increase in currency depreciation caused inflation to rise by 1.0216% in regime 1 and by 1.0142% in regime 2 respectively in Nigeria, by 1.0223% in regime 1 and by 0.0199% in regime 2 respectively in Ghana, by 1.1723% in regime 1 and by 1.1241% in regime 2 in South Africa; by 1.0145% in regime 1 and by 1.0122% in regime 2 in Sudan; by 2.0509% in regime 1 and by 1.0017% in regime 2 in Sierra Leone; by 3.0547% in regime 1 and by 1.0231% in regime 2 in Morocco, by 3.1632% in regime 1 and by 0.1387% in regime 2 in Zimbabwe, by 2.3904% in regime 1 and by 3.0246% in regime 2 in Kenya, by 1.1765% in regime 1 and by 1.1133% in regime 2 in Congo D.R., by 2.0195% in regime 1 and by 1.1093% in regime 2 in The Gambia, and by 0.1452% in regime 1 and by 1.0293% in regime 2 in Egypt respectively. This finding of a positive relation between inflation and depreciation was also obtained by Abdulhamid, Musa, & Rabiu (2022); Victor, Udo, & Abner (2020); and Alieu (2019). These studies established substantial positive inflation effects of exchange rates in Nigeria. The findings of Victor, Udo, & Abner (2020) revealed that exchange rate variation on a depreciation scale was a significant determinant of Nigerian inflation, having utilized the ARDL model. Alieu (2019) found that a 0.2750727 unit rise in inflation was induced by a unit rise in exchange rates in Nigeria.

Another striking result obtained for both regimes 1 and 2 in all countries is the significant positive nexus between food inflation and Brent crude oil prices. The upward shift in the Brent oil price shock is remarkable in its effect on consumer or food prices. This confirms the report of the World Bank (2024), which attributes the recent spike in food inflation to rising oil prices, which in turn required pandemic control measures that impeded production, hindered the importation of fertilizer products, and consequently resulted in a labor scarcity during sowing cycles. This was in addition to the export constraints imposed by some major food exporters. Precisely, the empirical estimates reveal that a substantial increase in percentage point in the Bent crude oil price caused inflation to rise by 1.2652% in regime 1 and by 1.8052% in regime 2 in Nigeria; by 1.0231% in regime 1 and by 1.2355% in regime 2 in Ghana; by 0.2105% in regime 1 and by 0.1131% in regime 2 respectively in South Africa; by 0.7901% in regime 1 and by 1.0075% in regime 2 in Sudan; by 0.0211% in regime 1 and by 0.0433% in regime 2 in Sierra Leone; by 0.0123% in regime 1 and by 0.0409% in regime 2 in Morocco; by 0.1376% in regime 1 and by 0.4782% in regime 2 in Zimbabwe; by 0.1209% in regime 1 and by 0.5402% in regime 2 in Kenya; by 0.0156% in regime 1 and by 1.0279% in regime 2 in Congo D.R.; by 1.1642% in regime 1 and by 1.0492% in regime 2 in The Gambia; and by 1.0135% in regime 1 and by 1.0018% in regime 2 in Egypt respectively. The findings from our study are econometrically buttressed by the findings obtained by Toni (2024), who established that a 10%

rise in oil prices caused an average increase of 0.5% inflation in economies. Our finding of a significant positive connection between food inflation and the Bent oil price shock is additionally supported by the study carried out for Nigeria by Okeke, Nwoha, & Duru (2024), where it was econometrically verified that inflation in Nigeria was considerably exacerbated by the upward variation in the Bent oil price. It was also acknowledged by Harun Alp, Matthew Klepacz, and AkhilSaxena (2023) that the global consumer price inflation was significantly pushed upward by the spike in oil prices following the post-COVID-19 economic ramifications and the Russian seizure of Ukraine. Specifically, the estimates obtained by Alp, Klepacz, & Saxena (2023) show that since the 2022Q4, the second-round impacts of past swings in oil prices have caused average four-quarter overall inflation in the UK, the Euro area, and Canada to jump by 0.5 percentage points, which has contributed to high inflation in those countries. Ayisi (2020) equally discovered the inflation effects of asymmetric oil price surges and cuts in Ghana. Our findings also gained supportive insights from the findings of Chen *et al.* (2020). According to these authors, the prices of food strongly rise in reaction to rising oil prices manifesting through transport costs in China. Our findings support the findings of Anyars & Adabor (2023), which employed the NARDL model and observed strong evidence of positive non-linear effects of oil price changes on consumers' price inflation. The deduction is that an external factor manifesting in the global oil price upsurge translates to imported inflation and causes consumer price inflation to rise in the domestic economies. The channel of pass-through is expensive for imported goods and services. Further analysis showed that since 2020, following the outbreak of COVID-19 in SSA, imported inflation has increased uninterruptedly for 5 years, largely driven by global supply chain shocks attributed mainly to the war and the COVID-19 pandemic. In sum, there is a domino effect that encompasses excessive depreciation of the local currency, causing high consumer price inflation and leading to rising costs of living in the midst of the scarcity of foreign exchange.

Also, in the present study, we found a positive but insignificant inflation-money supply association for both regimes across the eleven SSA countries in our sample. According to Stats South Africa (2022), inflation has regularly fluctuated across the countries of SSA, such that it reached 16.17% in 2023 (Statistics South Africa (Stats SA) 2022). The positive inflation-money supply association obtained for both regimes across the SSA countries in our sample is corroborated by the findings of Olaoye *et al.* (2023), who found an insignificant positive inflation effect of money supply. In our case, the coefficient of money supply was positive and significant only in Ghana and Kenya. In Ghana, we had significant coefficients of current and lagged values of broad money supply in regime 1, whereas in the second regime, only the current value of broad money in circulation was significant at the 5% level. In Kenya, only the current broad money supply with a coefficient of 0.2379 passed significance in regime 1 in the present study. The findings of Nguyena, Hoang, & Le (2022) also revealed that the growth rate of money supply increasingly drives the inflation rate in a positive direction in Vietnam between the periods of 2015 and 2021.

For both regimes with the exemption of The Gambia, the coefficient of interest rate differential was positive and significant for all countries, indicating that the domestic market interest rate in those other SSA countries, namely Nigeria, Ghana, South Africa, Sudan, Sierra Leone, Morocco, Zimbabwe, Kenya, the Congo D.R., and Egypt, is higher than the interest rate of the United States. A significant one percentage point rise in interest rate differential caused inflation to rise by 0.0175% in regime 1 and by 0.0199% in regime 2 respectively in Nigeria, by 0.16% in regime 1 and by 0.0177% in regime 2 respectively in Ghana, by 0.0417% in regime 1 and by 1.0109% in regime 2 in South Africa; by 0.0156% in regime 1 and by 0.0119% in regime 2 in Sudan; by 0.0134% in regime 1 and by 0.0126% in regime 2 in Sierra Leone; by 0.0135% in regime 1 and by 0.0164% in regime 2 in Morocco, by 0.2876% in regime 1 and by 0.312% in regime 2 in Zimbabwe, by 0.0133% in regime 1 and by 0.0166% in regime 2 in Kenya, by 0.0298% in regime 1 and by 0.1038% in regime 2 in Congo D.R., and by 1.01% in regime 1 and by 0.1522% in regime 2 in Egypt respectively. The positive coefficient of interest rate differential signifies that the domestic interest rate exceeds the foreign rate. The high level of domestic interest rates accords with the rapid increase in consumer price inflation, which is passed on to domestic food prices in SSA. This same result was obtained by Olaoye et al. (2020). Our research findings regarding the enormous magnitude of the impact of the difference between home and foreign interest rates on inflation gain support from the study of Amaefula and Egba (2024), who based their analysis on the VEC model and found that the 3-month deposit rate has a strong impact on inflation both in the short-run and long-run, while the exchange rate has a weak effect on inflation. Another line of support was found in the study of Egilsson (2020), who established that excessive long-lasting interest rate differentials stimulate chronic interaction between inflation and the depreciation of local currencies.

In the main, high interest rates are tools used by central banks as a policy response to curtail rising inflation and stabilize the economy; hence, when inflation escalates, central banks raise their monetary policy rate for commercial banks to follow suit and fix their lending rates to the general public. Unfortunately, apart from The Gambia, where we had a negative relationship between interest rate differential and inflation in regime 1, for all countries in the study, we found a positive correlation between interest rate differential and inflation. In other words, rather than inflation decreasing when interest rates rise, inflation is increasing. This is against the expectations of consumers, as found in the study by Knotek et al. (2024). Precisely, aside from The Gambia, our finding did not place evidence in support of the findings of Knotek et al. (2024), who reported substantial empirical evidence in favour of the conventional view of monetary policy transmission in Brazil. By implication, the conventional theoretical wisdom regarding the inflation-interest rate relationship does not hold in Nigeria, Ghana, South Africa, Morocco, Sierra Leon, Zimbabwe, Kenya, the Democratic the Democratic Congo,, and Egypt. Consequently, inflation tends to move in the same direction as interest rate increases in those countries, but with lags. For further discussion, we have chosen to explain this phenomenon as follows: An increase in interest rate is tantamount to increasing the cost of production and the cost of running or operating businesses, and the combined effects of these two are an increase in the price of products, which consequently results in inflation. Our study aligns with the findings of Amaefula and Egba (2024), who found that the 3-month deposit rate has a strong positive influence on inflation both in the short and long-term periods.

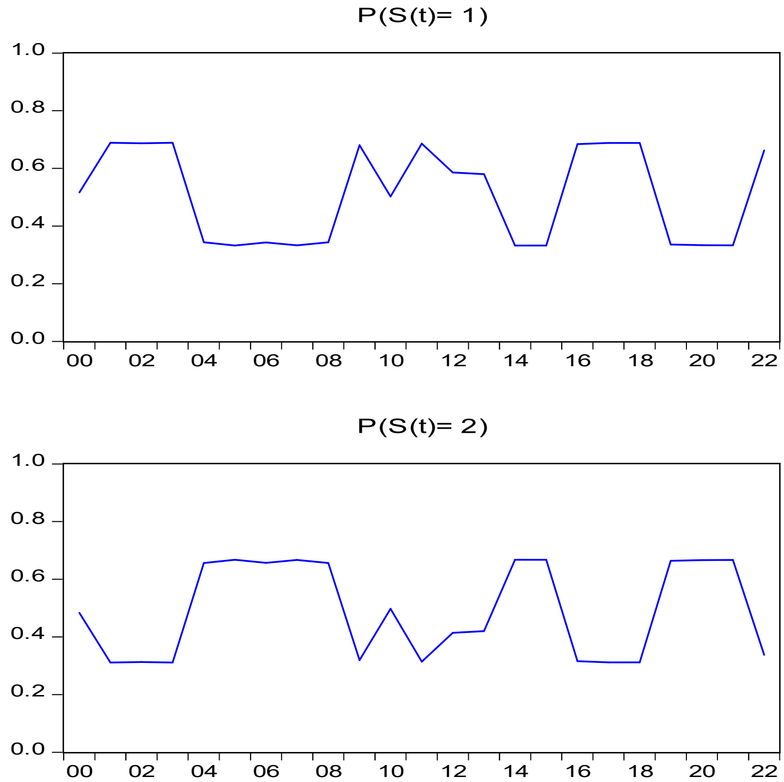
The likelihood of changing from one regime to another is shown by the transition probabilities reported at the bottom layer of each of the tables. The results are similar for all countries. The coefficient of duration for the transition parameter for food prices is higher in regime 1 than regime 2 for all countries, indicating that regime 1 has a higher chance of survival. However, the MARS model indicates that the transition probability is significant only for regime 2, indicating that events of high variability in regime 2 are more likely to occur and persist longer. This validates the significant dynamic adjustment amongst changes in the exchange rate, the price of oil, money supply, interest rate differentials, food CPI, and fuel CPI in the second regime. Using Nigeria as an example, there is a greater likelihood of a transition from regime 1 to regime 2 than there is from regime 2 to regime 1. Likewise, regime 1 is predicted to last for around 43.2 months, while staying in regime 2 is predicted to take roughly 26 months. This demonstrates that, compared to regime 2, regime 1 is more stable. This same analysis holds for other countries. We therefore refute the null hypothesis that there have been no regime transitions. The highly substantial Markov switching transition probabilities make these apparent and they correspond to regimes 1 and 2, respectively. The results show that for the two different regimes, one more erratic than the other, currency depreciation, oil price changes, and interest rate differentials all considerably caused hikes in food prices. These findings were corroborated by the transition regimes, which showed that belonging to regime 1 was more probable than belonging to regime 2. To aid in the examination of the various regimes using

Nigeria as a case study, Figure 1 demonstrates the smoothed probability plot of being in the high-volatility regime.

Diagnostically speaking for all countries, it was observed that the regression coefficient's standard error in regimes 1 and 2 for Nigeria, Ghana, South Africa, Sudan, Sierra Leone, Morocco, Zimbabwe, Kenya, Congo D.R., The Gambia, and Egypt are (0.0003, 0.0007), (0.0340, 0.014), (0.1000, 0.0051), (0.0022, 0.23000), (1.0873, 0.1092), (0.0025, 0.0004), (0.0004, 0.0002), (0.0560, 0.0050), (0.0001, 0.1059), (0.0010, 0.0001), and (0.0010, 0.1000). These standard errors are very low, just as expected to quantify the coefficient's variability;therefore, the smaller the standard error, the more accurate the estimates.According to the results, all the standard errors of the regression estimates are rather close to 0. This shows that there is no random error in the estimated sample statistic(s), indicating that the sample size is enough and the estimated coefficients are quite near the population parameters. Durbin Watson statistics have a range of 0 to 4, with 1.5000 to 2.5000 being appropriate. Positive autocorrelation is indicated by a number less than 1.5, while negative autocorrelation is shown by a statistic greater than 2.5000. Hence, 1.5000 to 2.5000 is an acceptable Durbin-Watson statistic, falling within the acceptable range. All estimated DW statistics for all countries are within the range of 2.000 to 2.500. This indicates that the regression model does not exhibit first-order autocorrelation.

Four non-switching AR terms and two regimes with switching mean regressors made up the equation specification. The AR (1), AR (2), and AR (3) components are significant autoregressive terms in the model. The statistically significant coefficients of 0.1038** (0.0006), 0.0420** (0.0010), and 0.0310* (0.0000) for the first, second, and third autoregressive components, respectively, demonstrate that past food prices significantly impacted current food prices. This result holds for every other country in the study. The implication is that dealers and suppliers of food items and other consumables can rely on the AR (1) term of 0.006 to forecast at a six percent level of significance that the same magnitude of a positive effect of food prices from last year will stimulate a 0.1038 percent boost in the food CPI of the current period. Relatively, dealers of food CPI can use the AR (2) term of 0.0420 to predict that, with five percent of the same magnitude, a similar direction would occur in two years. This indicates that the effect of food prices two years ago had a direct and significant impact on current prices. Dealers of foodstuffs can rely on the AR (3) term of 0.05 to forecast at a five percent level of significance that the same magnitude of food CPI from three years ago can stimulate a 0.0310 percent rise in current food price consumption in spite of the moderate impact of money in circulation and interest rate differentials.

Figure 2. One-step ahead predicted regime probabilities



Source: Authors' Eviews estimation results

4.2 Sensitivity/Robustness analysis

For a sensitivity analysis, we disaggregated the consumer price inflation rate to have food inflation (food CPI) and fuel consumption price (fuel CPI) and estimated the panel GMM model for our panel of ten nations. The Panel GMM model was found to be significant with a significant Wald statistic ($p<.05$). The total number of instruments used is 6, which is less than the number of groups or cross-sections and confirms model suitability. We found a significant positive correlation between the key variables of exchange rate depreciation and oil price upsurge, food CPI, and fuel CPI (see Tables 14 and 15). In particular, a percentage increase in depreciation was found to increase food price inflation for consumers by 1.03649%, while a similar rise in Bent oil prices caused a 0.39278% escalation in food consumption prices. Another significant variable in the panel GMM system estimators was the coefficient of interest rate differences between domestic and foreign interest rates proxied by the Federal Fund rate. Precisely, the estimated effect is 0.42156 for food prices. This effect is positive and significant, indicative of the fact that a positive difference between the local and international policy rates of the central monetary authorities causes food prices to rise within the domestic economies, and this results in inflationary pressures in the home economies of Nigeria, Ghana, South Africa, Morocco, Sierra Leon, Zimbabwe, Kenya, the Democratic Republic of the Democratic Republic of the Congo, and Egypt. This upholds our findings with the MARSM for both regimes 1 and 2. As found in previous estimations, the effect of money supply proved negligible in the panel GMM system estimation. Though, the magnitude of such an inconsequential impact is positively correlated with the prices of food measured as a food CPI.

Table 14. System-differenced Panel GMM estimates (dependent variable: Food CPI)

Variables	Coefficient	Error	z	P>|z|	[95% CI	
ln(foinfl(t-1))	0.87462	0.00356	245.6798	0.000	0.823561	1.39562
ln(Boilp)	0.39278	0.01024	38.3574	0.000	0.43178	0.78389
ln(excd)	1.03649	0.00918	112.9074	0.000	-0.24586	-0.00214
(r^d-r^f)	0.42156	0.00125	337.2480	0.000	-0.56487	-0.09387
ln(mssp)	0.13697	2.21024	0.0619	0.587	-0.42677	-0.00342
Cross-section fixed (first differences)						
Mean (DV)	0.00498	S.D. (DV)	0.00289			
S.E. of regression (S.e.e)	0.00013	Sum squared residuals (SSR)	1.39205			
Wald (chi2)	45689(0.0000)	J-statistic	13.4987			
Number of instruments	06	Prob(J-statistic)	0.453031			
Depend. variable: foinfl, instrument specification: @DYN(foinfl-2),excd(-1),indiff(-1), Boilp(-1),mssp(-1), r^d						

Source: Authors' Eviews estimation results

The results show the one-lag value of fuel price inflation had a coefficient of 0.99 and was found to be significant ($p<.05$). The positive and significant coefficient implied that consumer prices for the immediate past year had a large and direct influence on the current petrol CPI. We also discovered a remarkable positive impact of Brent crude prices on fuel consumption prices. A 1% rise in lnBoilp emitted an equivalent 0.5779% rise in the current period in fuel prices in the same direction. The upward movement in global oil prices caused consumer fuel prices to rise in relative terms. The considerable impact of oil prices on fuel CPI is corroborated by the research outcomes of Babuga and Naseem (2021), where it was discovered for SSA countries that the surge in oil prices causes transportation prices, often captured as transport CPI, to rise significantly. Currency exchange rate depreciation (lnexcd) also had a positive coefficient of 0.18526, which was significant in the model ($p > 0.05$). The result is similar to the above in Table 13 and hence validates previous estimations. More shocks to the interest rate differential increase consumer pricing of fuel up to the tune of 0.07493 in view of a percentage rise in interest rate differentials. Overall, the model was found to be significant with a Hansen-J statistic of 25.16 and a p-value of 0.45. For broad money supply (lnmssp), there was a positive and insignificant coefficient of 0.13097 in the predictive model of domestic fuel prices ($p<.05$).

Table 15. First-differenced GMM estimates (dependent variable: Fuel CPI)

Variables	**Coefficient**	**Error**	**z**	**P>|z|**	**[95% CI**	
ln(fuinfl(-1))	0.998695	0.016956	58.900	0.000	0.965461	1.03192
ln(Boilp)	0.57788	0.023003	25.1200	0.000	0.532795	0.62296
ln(excd)	0.18526	0.062157	2.9800	0.003	-0.30708	-0.06343
(r^d-r^f)	0.07493	0.014582	5.1400	0.000	-0.10351	-0.04635
ln(mssp)	0.13097	2.062875	0.0635	0.648	0.10351	0.21579
Cross-section fixed (first differences)						
Mean (DV)	0.032455		S.D. (DV)		0.05942	
S.e.e.	0.056127		SSR		1.635001	
Wald (chi2)	32468(0.0000)		J-statistic		25.16727	
Number of instruments	06		Prob(J-statistic)		0.453031	
Depend. variable: fuinfl, instrument specification: @DYN(fuinfl-2),excd(-1),indiff(-1),Boilp(-1), mssp(-1), r^d						

Source: Authors' Eviews estimation results

Tables 16 and 17 show the findings of the serial correlation test based on the Arellano-bond technique as a diagnostic test for the first differences panel of GMM. According to the results of Table 15, AR(2), which is the statistic of focus, is not significant at the 0.05 significance level ($p = 0.22 >.05$). The non-significance of AR(2) confirms that the GMM model is without serial correlation and is therefore adequately estimated. Table 16 similarly confirms the absence of autocorrelation in the estimated panel GMM results.

Table 16. Post-diagnostic test results (Food CPI)

Test order	**m-Statistic**	**rho**	**SE(rho)**	**Probability**
AR(1)	-9.853399	-0.823975	0.083623	0.0000
AR(2)	1.222939	0.097658	0.079855	0.2214

Source: Authors' Eviews estimation results

Table 17. Post-diagnostic test results (Fuel CPI)

Test order	**m-Statistic**	**rho**	**SE(rho)**	**Probability**
AR(1)	-10.382289	-0.823975	0.083623	0.0000
AR(2)	1.0592845	0.0614562	0.059814	0.2316

Source: Authors' Eviews estimation results

5. Conclusion

The research assessed empirically the persistence of the devaluation shock and the oil price shock on domestic inflation in Africa using the MARSM, while the panel GMM estimation was carried out to test the robustness of estimates obtained from the MARSM method over the sample period of 1980 to 2023. This period comprises two significant oil shocks. The results show that food prices and fuel prices are influenced by two regimes: one with low volatility and the other with high volatility. The study makes a contribution as well by examining the dynamic influence of the exchange rate and oil price fluctuation on food inflation and transportation price inflation. Food consumption prices and fuel prices in the researched economies are strongly impacted by shocks to oil prices. This also holds true for the currency rate, as the research has demonstrated that exchange rate shock, demonstrating its effect via currency rate depreciation, considerably escalated food and fuel prices in an upward direction. More importantly, changes in global oil prices have a positive effect on food prices through transport cost effects. As the majority of nations import oil, more efforts should be made to expand domestic food production in order to lessen the impact of rises in global oil prices on imported food products. Additionally, the research findings provide an empirical knowledge base for re-evaluating the monetary policy rate that curtails consumer price inflation in Nigeria, Ghana, South Africa, Morocco, Sierra Leon, Zimbabwe, Kenya, the Democratic Republic of Congo, and Egypt. In particular, the study establishes that the conventional theoretic view of monetary policy transmission, whereby higher interest rates translate to reductions in inflation, is misleading for the above-mentioned nations.

To minimize the detrimental impact of rising oil costs on food prices, governments need to create alternate energy sources. The implementation of sound macroeconomic policies aimed at ensuring currency stability is essential in order to prevent unpredictable fluctuations in the exchange rate, which can have a rising effect on food costs. Policies aimed at lessening the influence of currency rates on food inflation and fuel prices should be focused on fiscal and monetary authorities. Monetary policy is intimately linked to the currency rate. By lessening exchange rate swings, central banks may bring price stability to the market. These nations may also implement measures to reduce the import portion of foodstuffs that are susceptible to exchange rate fluctuations. The impact of the currency rate can be lessened in this way. Inclusively, the analysis demonstrates that, with lags involved, exchange rate depreciation and oil price increases led to significant upward pressure on domestic consumer prices in emerging nations. Oil price swings eventually had a greater impact on food inflation than did changes in exchange rates. The influence of oil price increases is time-dependent, whereas the exchange rate does exhibit notable fluctuations. These concerns are mostly associated with the domestic policies that governments and central banks implement as demand-driven economic policies. Governments can implement monetary and fiscal policies to establish stability. Researchers and policymakers concerned about the effects of oil market shocks on food prices should focus more on transport systems and their variable costs, as indicated by these estimated magnitudes and the fact that local food prices adjust to shocks in the global oil market much more quickly than they do to shocks in the global food market. In line with the recommendations of Abdulhamid, Musa, and Rabiu (2022), we advise that the central monetary authority ought to execute tighter monetary policy measures that curtail fraudulent usage of foreign currency. This would go a long way towards guaranteeing stability in the exchange rate and, by extension, stability in the macroeconomy. Our research estimations and findings therein are substantially robust and statistically consistent with changes in econometric modeling and specifications (from MARSM to panel GMM system regressions). However, there is a need for further studies that use more advanced econometric tools to investigate the symmetry and asymmetry impacts of oil price volatility on average food costs and fuel prices in rural and urban areas.

References

Abdulhamid J., Musa I., Rabiu S. (2022). Inflation and exchange rate in Nigeria. 5, 130-141.

Adam, A. M., & Tweneboah, G. (2008). Macroeconomic factors and stock market movement: Evidence from Ghana. *Available at SSRN 1289842.*

Adjei, E. (2019). Exchange rate volatility and economic growth in Ghana. *International Journal of Business and Social Science,* 10(4), 105-118. https://doi.org/10.30845/ijbss.v10n4p13

AfDB (2024). African economic outlook 2024: Driving Africa's Transformation. The Reform of the Global Financial Architecture

Agarwal, M., & Vandana, T. R. (2021). Exchange rate crises: Experiences of Latin America, East Asia and India. *South Asian Journal of Macroeconomics and Public Finance,* 10(2), 158-178.

Agyei, S. K., Isshaq, Z., Frimpong, S., Adam, A. M., Bossman, A., & Asiamah, O. (2021). COVID-19 and food prices in sub-Saharan Africa. *African Development Review,* 33, 102-113.

Ahmadi, M., Behmiri, N. B., & Manera, M. (2016). How is volatility in commodity markets linked to oil price shocks? *Energy Economics,* 59, 11-23.

Ahmed, R., Chen, X. H., Kumpamool, C., & Nguyen, D. T. (2023). Inflation, oil prices, and economic activity in recent crisis: Evidence from the UK. *Energy Economics*, 126, 106918.

Alessandro, G., & Marco, L. J. (2009). External shocks and international inflation linkages: a global VAR analysis.

Alieu, B. L. (2019). The impact of exchange rate on inflation: A case study of The Gambia. *European Scientific Journal, 15*(10). Doi:10.19044/esj.2019.v15n10p261

Alom, F., Ward, B. D., & Hu, B. (2013). Macroeconomic effects of world oil and food price shocks in Asia and Pacific economies: application of SVAR models. *OPEC Energy Review*, 37(3), 327-372.

Alp H., Klepacz M., & Saxena A. (2023). Second-round effects of oil prices on inflation in the advanced foreign economies

Alp, H., Klepacz, M., & Saxena, A. (2023). Second-Round Effects of Oil Prices on Inflation in the Advanced Foreign Economies.

Amaefula C. G. & Egba O. L. (2024). Do money supply, interest rates, external debt and exchange rates explain inflation in Nigeria? An econometric approach. *World Journal of Advanced Research and Reviews,* 22(02), 713-723. https://doi.org/10.30574/wjarr.2024.22.2.1421.

Anyars S. I. & Adabor, O. (2023). The impact of oil price changes on inflation and disaggregated inflation: Insights from Ghana. *Research in Globalization,* 6, 100125, https://doi.org/10.1016/j.resglo.2023.100125

Ayisi, R. k. (2020). The asymmetry effect of oil price changes on inflation, and the welfare implication for Ghana. *African Journal of Economic and Management Studies.*

Babuga U. T., & Naseem N. A. M. (2021). Asymmetric effect of oil price change on inflation: evidence from sub Saharan Africa countries. *International Journal of Energy Economics and Policy,* 11, 448

Bahmani-Oskooee, M., &Kanitpong, T. (2019). Thailand-China commodity trade and exchange rate uncertainty: Asymmetric evidence from 45 industries. *The Journal of Economic Asymmetries*, https://doi.org/10.1016/ j.jeca.2019.e00130

Bahmani-Oskooee, M., & Karamelikli, H. (2022a). Exchange rate volatility and commodity trade between UK and China: An asymmetric analysis. *The Chinese Economy,* 54(1), 41-65. https://doi.org/10.1080/10971475.2021. 1892919

Bala, U., & Chin, L. (2018). Asymmetric impacts of oil price on inflation: An empirical study of African OPEC member countries. Energies 11, 3017, 1-21.

Bhattacharya, R., & Jain, R. (2020). Can monetary policy stabilize food inflation? Evidence from advanced and emerging economies. *Economic Modeling,* 89, 122-141.

Blanchard, O. J., & Gali, J. (2007). The Macroeconomic Effects of Oil Shocks: Why are the 2000s so different from the 1970s?

Blanchard, O. J., & Gali, J. (2007). The macroeconomic effects of oil shocks: Why are the 2000s so different from the 1970s?

Calvo, G. A. (1983). Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics,* 12(3), 383-398. https://doi.org/10.1016/0304-3932(83)90060-0

Chen J., Zhu X., H. Li H. (2020). The pass-through effects of oil price shocks on China's inflation: A time-varying analysis. *Energy Economics,* 86 (2020), Article 104695

Chi, J. (2020). Asymmetric exchange rate affects cross-border freight flow between the United States and Canada. *Journal of the Transportation Research Board,* 2674(4), 348-361. https://doi.org/10.1177 /0361198120912242

Choi, S., Furceri, D., Loungani, P., Mishra, S., & Poplawski-Ribeiro, M. (2018). Oil prices and inflation dynamics: Evidence from advanced and developing economies. *Journal of International Money and Finance*, 82, 71-96.

Chowdhury, M. A. F., Meo, M. S., Uddin, A., & Haque, M. M. (2021). Asymmetric effect of energy price on commodity price: New evidence from NARDL and time frequency wavelet approaches. *Energy 23*1, 120934.

Dalheimer, B., Herwartz, H., & Lange, A. (2021). The threat of oil market turmoils to food price stability in sub-saharan Africa. *Energy Economics,* 93, 105029.

Egilsson, J. H. (2020). How raising interest rates can cause inflation and currency depreciation. *Journal of Applied Economics,* 23(1), 450-468.

Ekanayake, E. M., & Amila D. (2022). Effects of real exchange rate volatility on trade: An empirical analysis of the United States exports to BRICS. *Journal of Risk and Financial Management,* 15(2). https://doi.org/10.3390/ jrfm15020073

FSIN and GNACF (2024). Global report on food crises. Food security information network and global network against food crises. Rome

Furceri, D., Loungani, P., & Zdzienicka, A. (2018). The effects of monetary policy shocks on inequality. *Journal of International Money and Finance*, 85, 168-186.

Ginn, W., & Pourroy, M. (2020). Should a central bank react to food inflation? Evidence from an estimated model for Chile. *Economic Modeling,* 90, 221-234.

Gummi, U. M., Rong, Y., Bello, U., Umar, A. S. and Mu'azu, A. (2021). On the Analysis of Food and Oil Markets in Nigeria: What Prices tell us from Asymmetric and Partial Structural Change Modeling? *International Journal of Energy Economics and Policy,* 11(1), 52-64. Available at; https://doi.org/10.32479/ijeep.10299

Gummi, U. M., Lu, S. B., & Mu'azu, A. (2020). The impact of oil price fluctuations on food prices in high and low-income exporting countries. *Journal of Agricultural Economics*

Hurley, D. T., & Papanikolaou, N. (2021). Autoregressive distributed lag (ARDL) analysis of U.S.-China commodity trade dynamics. *The Quarterly Review of Economics and Finance,* 81, 454-467. https://doi.org/10.1016/ j.qref.2020.10.019

Ighosewe, E. F., Akan, D. C., &Agbogun, O. E. (2021). Crude oil price dwindling and the Nigerian economy: A resource-dependence approach. *Modern Economy,* 12(7), 1160-1184. https://doi.org/10.4236/me.2021.127061

IMF (2024). Global oil and food prices: Economic outlook. International Monetary Fund. Washington, DC.

International Energy (2024). Oil market report: September 2024 – Analysis

Iyke, B. N. (2019). Real output and oil price uncertainty in an oil producing country. *Bulletin of Monetary Economics and Banking,* 22(2), 163-176. https://doi.org/10.21098/bemp.v22i2.1095

Kallon, A. and Barrie, A. (2023). An empirical assessment of exchange rate depreciation and currency substitution in Sierra Leone. *Modern Economy,* 14, 1828-1848. doi: 10.4236/me.2023.1412096.

Kar, S., & Bhattacharya, B. B. (2011). Shocks, economic growth and the Indian economy," Working Papers id: 4319, eSocial Sciences.

Knotek II, E. S., Mitchell J., Pedemonte M. O., and Shiroff T. (2024). The effects of interest rate increases on consumers' inflation expectations: the roles of informedness and compliance. Working Paper No. 24-01. Federal Reserve Bank of Cleveland.https://doi.org/10.26509/frbc-wp-202401

Köse, N., & Ünal, E. (2021). The effects of the oil price and oil price volatility on inflation in Turkey. Energy, 226, 120392.

Kutu, A. A., & Ngalawa, H. (2016). Monetary policy shocks and industrial output in BRICS countries. *SPOUDAI-Journal of Economics and Business*, 66(3), 3-24.

Liming, C., Ziqing, D., & Zhihao, H. (2020). Impact of economic policy uncertainty on exchange rate volatility of China. *Finance Research Letters, 32,* Article 101266. https://doi.org/10.1016/j.frl.2019.08.014

Lin, B., & Su, T. (2020). Does oil price have similar effects on the exchange rates of BRICS? *International Review of Financial Analysis,* 69, Article 101461. https://doi.org/10.1016/j.irfa.2020.101461

Lin, S., Shi, K., & Ye, H. (2018). Exchange rate volatility and trade: The role of credit constraints. *Review of Economic Dynamics,* 30, 203-222. https://doi.org/10.1016/j.red.2018.05.002

Mahmoudinia, D. (2023). The asymmetric effects of monetary policy, currency crises and oil price on food inflation in Iran: an application of quantile regression. *Macroeconomics and Finance in Emerging Market Economies*, 1-23.

Mo, B., Chen, C., Nie, H., & Jiang, Y. (2019). Visiting effects of crude oil price on economic growth in BRICS countries: Fresh evidence from wavelet-based quantile-on-quantile tests. Energy, 178, 234-251. https://doi.org/10.1016/j.energy.2019.04.162

Mokni, K., & Ben-Salha, O. (2020). Asymmetric causality in quantiles analysis of the oil-food nexus since the 1960s. Resources Policy, 69, 101874.

Montes-Rojas, G., & Toledo, F. (2021). External shocks and inflationary pressures in Argentina: a post-Keynesian- structuralist empirical approach. *Review of Political Economy,* 34, 789-806.

Mukherjee, K., & Ouattara, B. (2021). Climate and monetary policy: Do temperature shocks lead to inflationary pressures? Climate Change, 167, 32.

Mukhtarov, S., Humbatova, S., Mammadli, M., & Hajiyev, N. G.-O. (2021). The impact of oil price shocks on national income: Evidence from Azerbaijan. *Energies,* 14(6), Article 1695. https://doi.org/10.3390/en14061695

Nakibullah, A. (2016). Impacts of foreign and domestic structural shocks on consumer prices of the GCC countries. *Research in world Economy*, 7(2), 34-43.

Nguyena V. A. T., Hoang T. T., and Le D. A. (2022). A study on the relationship between money supply and inflation in Vietnam from 2005 to 2021. *Accounting* 8 (2022) 395-402

Odionye, J.C., Ukeje, O.S., & Odo, A.C. (2019). Oil price shocks and inflation dynamics in Nigeria: Sensitivity of unit root to structural breaks. *International Journal of Business and Economics Research* 8(2), 58-64.

Okafor, T., Adegbite, E., & Abiola, B. (2018). Exchange rate fluctuations, inflation and industrial output growth in Nigeria. *International Journal of Supply Chain Management,* 7(5), 118-128.

Okeke, S.O., Nwoha C.E., and Duru A.N. (2024). Effect of crude oil price shock on inflation and exchange rate in Nigeria, *European Journal of Business and Innovation Research*, 12(2), 56-65

Olamide, E. G., Ogujiub, K. K., Maredza, A., & Adeleke, O. (2022). Monetary policy and productivity nexus for Africa's oil exporting countries: An econometric analysis. *Business Administration and Business Economics,* 18(1), 21-42. https://dj.univ-danubius.ro/index.php/AUDOE/article/view/1536

Olaoye O., Omokanmi O. J., Tabash M. I., Olofinlade S. O. &Ojelade M. O. (2023). Soaring inflation in sub-Saharan Africa: A fiscal root? *Qual Quant.* 19, 1-23. doi: 10.1007/s11135-023-01682-z

Olayungbo, D., & Hassan, W. (2016). Effects of oil Price on Food Prices in Developing oil Exporting Countries: A panel autoregressive distributed lag analysis. *OPEC Energy Review,* 40(4), 397-411.

Omotosho, B. S. (2019). Oil price shocks, fuel subsidies and macroeconomic (in)stability in Nigeria. *CBN Journal of Applied Statistics 10*(2), 1-38.

Pal, D., & Mitra, S. K. (2017). Time-Frequency Contained Co-Movement of Crude oil and World Food Prices: A Wavelet-Based Analysis. Energy Economics, 62, 230-239.

Pocol, B. C., Marinescu, V., Dabija, D., & Amuza, A. (2021). Clustering Generation Z university students based on daily fruit and vegetable consumption: Empirical research in an emerging market. *British Food Journal,* 123(8), 2705–2727.

Rabee Hamedani, H., & Pedram, M. (2013). Oil price shock and optimal monetary policy in a model of small open oil exporting economy-case of Iran. *Journal of money and economy*, 8(3), 21-61.

Rauff S. A. (2022). Determinants of exchange rate in Nigeria. The colloquium-A Multidisciplinary. *Thematc Policy Journal* 10 (1), 69-82. http://www.ccsonlinejournals.com

Rondina, F. (2018). Estimating unobservable inflation expectations in the New Keynesian Phillips Curve. *Econometrics*, 6(1), 6.

Rudi, L. (2018). The effect of macroeconomic variables on banking stock price index in Indonesia stock exchange. *Russian Journal of Agricultural and Socio-Economic Sciences*, 73(1), 155-162.

Saddiqui, S. A., Jawad, M., Naz, M., & Niazi, G. S. K. (2018). Exchange rate, fiscal policy and international oil prices impact on oil prices in Pakistan: A volatility and granger causality analysis. *Review of Innovation and Competitiveness*: *A Journal of Economic and Social Research,* 4(1), 27-46. https://doi.org/10.32728/ric.2018.41/2

Samal, A., & Goyari, P. (2022). Does Monetary Policy Stabilise Food Inflation in India? Evidence from Quantile Regression Analysis. *The Australian Economic Review,* 55, 361-372.

Sani, B., Abdullahi, I. S., Tukur, D. S., Barda, S. I., & Adams, Y. J. (2020). Asymmetric impact of oil price on inflation in Nigeria. *CBN Journal of Applied Statistics (JAS)*, 12(1), 85-113.

Selassie A. A. and Kovacs P. (2022). Africa faces new shock as war raises food and fuel costs commodities, April, Senadheera, S. P. Y. W. (2016). Essays on external shocks and monetary policy in the Sri Lankan economy. *Unpublished Doctoral Thesis. The Australian National University.*

Senadza, B., & Diaba, D. D. (2018). Effect of exchange rate volatility on trade in Sub-Saharan Africa. Journal of African Trade 4(1-2), 20-36. https://doi.org/10.1016/j.joat.2017.12.002

Sharma, C., & Pal, D. (2020). Exchange rate volatility and tourism demand in India: Unraveling the asymmetric relationship. *Journal of Travel Research*, 59(7), 1282-1297.

Smallwood, A. D. (2019). Analyzing exchange rate uncertainty and bilateral export growth in China: A multivariate GARCH-based approach. *Economic Modelling,* 82, 332–344.

Syzdykova, A., Abubakirova, A., et. al. (2022). Asymmetric causality relationship between oil prices and inflation in BRIC Countries. *International Journal of Energy Economics and Policy* 12(3), S. 184-191. doi:10.32479/ijeep.12814.

Taghizadeh-Hesary, F., Rasoulinezhad, E., & Yoshino, N. (2019). Energy and food security: Linkages through Price volatility. Energy Policy, 128, 796-806.

Tatjana, D., & Garima, V. (2014). *The impact of US monetary policy normalization on capital flows to emerging-market economies* (No. 2014-53). Bank of Canada working paper.

Tams-Alasia, O., Olokoyo, F.O., Okoye, L.U., & Ejemeyovwi, J.O. (2018). Impact of exchange rate deregulation on manufacturing sector performance in Nigeria. *International Journal of Environment, Agriculture and Biotechnology,* 3(3), 994-1001. doi: 10.22161/ijeab/3.3.36

Tolepbergen, A. (2022). A study of inflation persistence in Kazakhstan: what has changed? *Macroeconomics and Finance in Emerging Market Economies*. https://doi.org/ 10.1080/17520 843. 2022. 20770 55

Toni, M. (2024). An analysis of the relationship between oil prices and inflation in oil-dependent economies: with special reference to OMAN DOI:10.59762/sfr794324261120240118153849

Turan, T., & Özer, H. A. (2022). The impact of oil price shocks on inflation: Do asymmetries matter?. *Acta Oeconomica*, 72(3), 271-288.

Valogo M.K., Duodu E., Yusuf H., & Baidoo S. T. (2023). Effect of exchange rate on inflation in the inflation targeting framework: Is the threshold level relevant? *Research in Globalization,* 6(1): 100119. DOI:10.1016/j.resglo.2023. 100119

Victor I., Udo E. S. &Abner I. P. (2020). Other determinants of inflation in Nigeria. *European Journal of sustainable Development* 9(10), 338-348.

Wong, K..K.S., & Shamsudin, M.N. (2017). Impact of Crude Oil Price, Exchange Rates and Real GDP on Malaysia's Food Price Fluctuations: Symmetric or Asymmetric? *International Journal of Economics and Management, 11*(1), 259-275.

Word Bank (2023). Food security update: At a glance. April 20.

World Bank (2024). Commodity markets outlook. Washington, DC: World Bank.

World Bank (2024b). Commodity markets outlook. Washington, DC: World Bank.

Yildirim, Z., & Arifli, A. (2021). Oil price shocks, exchange rate and macroeconomic fluctuations in a small oil-exporting economy. *Energy,* 219, Article 119527. https://doi.org/10.1016/j.energy.2020.119527

Yunusa, L.A. (2020). Exchange rate volatility and Nigeria crude oil export market. *Scientific African,* 9, Article e00538. https://doi.org/10.1016/j.sciaf. 2020.e00538

Yusuf, W. A., Isik, A., & Salisu, N. I. (2019). Relative effects of exchange rate and interest rate on Nigeria's economic growth. *Journal of Applied Economics and Business,* 7(2), 28-37. http://www.aebjournal.org /article070202.php

Zivkov, D., Duraskovic, J., & Manic, S. (2019). How do oil price changes affect inflation in Central and Eastern European countries? A wavelet-based Markov switching approach. *Baltic Journal of Economics* 19(1), 84-104.

Zulfigarov, F., & Neuenkirch, M. (2020). The impact of oil price changes on selected macroeconomic indicators in Azerbaijan. *Economic Systems,* 44(4), Article 100814. https://doi.org/10.1016/j.ecosys.2020.100814