Journal of Economic Studies (JES)
Department of Economics,
NnamdiAzikiwe University, Awka,
Anambra State, Nigeria.

Web:www.nauecojournals.com *ISSN 1119-2259*

MONETARY POLICY PASS THROUGH TO INFLATION IN SELECTED SUB-SAHARAN AFRICAN COUNTRIES.

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ABSTRACT

Practical evidence suggests that monetary policy is a crucial tool for managing global inflation. This study, grounded in monetary and Keynesian theories, examined the impact of monetary policy pass-through to inflation in selected sub-Saharan African (SSA) countries from 1987 to 2022 using a panel vector error correction model (PVECM). This study considered inflation as the dependent variable and lending rate, deposit rate, nominal effective exchange rate, broad money supply and credit to the private sector as independent variables for monetary policy transmission. The results reveal that inflation positively reacts to lending rate and broad money supply shocks over a 10-year period, while deposit rate, nominal effective exchange rate and credit to the private sector exhibited varying elastic responses, both positive and negative. The results of the variance decomposition showed that interest rate proxied by the lending rate was identified as the most effective channel, followed by broad money supply, nominal effective exchange rate, deposit rate and credit to private sectors. Based on these findings, this study recommends that the central banks of selected SSA countries should raise lending rates and exercise stricter control over the money supply to combat inflation effectively. Also, there is a need to boost productivity, this will help to reduce import dependence and mitigate inflation stemming from trading partners in SSA countries.

***Key Words**: Broad money supply, credit to private sector, inflation, monetary policy pass-through, sub-Saharan Africa.*
JEL Codes: E31, E52, O23, O55

1.0 INTRODUCTION

Macroeconomic stability worldwide depends on policymakers' efforts to manage inflation, a crucial macroeconomic stability indicator. High inflation erodes purchasing power and hampers economic growth (Adaramola, 2020). Nonetheless, a certain level of inflation is essential for sustainable growth (Ahuja, 2016 as cited in Chindengwike, 2023). Inflation is a necessary evil that has drawn the attention of individuals, governments and the international community. The consumer price index (CPI), a measure of inflation, tracks changes in average prices paid by consumers for goods and services (Van Wyngaard, 2019).

Inflation in sub-Saharan Africa garnered attention during the COVID-19 pandemic,

influenced by global inflation, rising commodity prices and supply chain disruptions (Revelli, 2020). The median inflation in the sub-region approached the 12% threshold cautioned by the International Monetary Fund (IMF) and World Bank, reaching nearly 9% in July 2022 (IMF, 2022). Nigeria, the acclaimed giant of Africa experienced the highest inflation in 25 years at 21.34% in December 2022, while South Africa hit a 13-year high of 7.5% in 2022 (Central Bank of Nigeria [CBN], 2022; Statistics South Africa, 2022). Nguyen, Dridi, Unsal, and Williams (2017) noted that food inflation and energy prices are crucial drivers of inflation in SSA, with these factors spiking since 2019 and constituting around 50% of the region's consumption baskets. The reliance on food and energy imports in many countries has left SSA nations susceptible to the recent surge in international food prices, contributing up to two-thirds of inflation in fragile states and half elsewhere (IMF, 2022). Despite the recent rise in inflation rates, it is worth noting that certain sub-Saharan African countries, like Angola and Nigeria, have been grappling with high inflation since the 1990s.

While various policy measures can combat global inflation, one fundamental measure is monetary policy and its pass-through channels (Obinne, Okon & Chinelo, 2021). Monetary policy refers to the deliberate actions taken by a country's central bank or monetary authorities to regulate the money supply using tools like interest rates, money supply, and reserve requirements to achieve price stability (Olaoye, Omokanmi, Tabash, Olofinlade& Ojelade, 2023). The effectiveness of monetary policy in controlling inflation depends on various channels, including exchange rate, interest rate, credit, and money supply, and their speed of transmission ((Bada, Olufemi, Tata, Peters, Bawa, Onwubiko & Onyowo, 2016). Thus, the change in any of these channels due to monetary policy is known as monetary policy pass-through to inflation.

Monetary policy pass-through channels, such as the lending rate and exchange rate channel, have garnered significant attention in the literature. Aziakpono and Wilson (2013) suggested that the effectiveness of monetary policy in achieving its inflation targets relies on the interest rate's stickiness and the importance of rapid transmission of interest rate changes for a stronger impact on the real economy. More so, floating exchange rates have made the exchange rate channel a significant aspect of monetary policy pass-through in many sub-Saharan African countries. According to Pinshi and Sungani (2018), the continuous depreciation in the value of currencies in most sub-Saharan African countries has increased price levels due to heavy import dependence, as domestic production is weak. Other pass-through channels, such as the deposit rate and credit to private channels, have received less attention in the literature.

Although monetary policy has been employed to combat inflation, there has been limited progress in ensuring price stability in sub-Saharan African (SSA) countries due to a lack of understanding of how monetary policy channels work (Swaray, 2022). Central Banks in

SSA have adopted flexible exchange rates and various monetary policy tools, such as inflation-targeting frameworks (e.g., South Africa and Ghana), open market operations (OMO), monetary policy rates (MPR), and lending rates, to address inflation (Obinne et al., 2021). While these policies were effective in the short term, they failed to maintain long-term price stability. Recent World Bank data shows that SSA's inflation rate rose to 8.5% in 2022. Notably, Nigeria's inflation increased from 13.25% in 2020 to 21.34% in 2022 (National Bureau of Statistics [NBS], 2022); Ghana's surged from 10.4% to 54.1% (Statistical Ghana Service, 2022) and South Africa's increased from 3.1% to 7.2% (Statistics South Africa, 2022).

Previous research on monetary policy pass-through and inflation have produced conflicting results. Alfa, Sa'ad, and Abdulrasheed (2021) examined interest rate transmission to inflation, Adekunle and Tiamiyu (2018), and Jobarteh and Yeboua (2016) investigated the exchange rate channel while Wulandari (2012) focused on the credit channel. This study builds upon the work of Bulus et al. (2022), which explored both interest and exchange rate channels in Nigeria. However, this study extends beyond theirs by using a panel of selected sub-Saharan African countries and incorporating additional variables, including deposit rates and credit to the private sector. Furthermore, this current study addressed the lack of consensus on monetary policy pass-through and its effectiveness in the SSA region by employing a panel vector error correction model (PVECM) and utilizing data from 1987 to 2022. This study filled these identified gaps in literature by investigating the responsiveness of inflation to changes in monetary policy pass-through as well as the effectiveness of monetary policy pass-through channels on inflation in selected Sub-Saharan African countries. This current study on monetary policy pass-through in these SSA countries can provide valuable guidance to policymakers in formulating effective and conflict-reducing policies for price stability.

2.LITERATURE REVIEW

2.1 Conceptual literature review

This subsection discusses how different authors comprehended the different variables. For instance, Sayed (2021) defined inflation as the average price level allowing for fluctuations in individual goods. This means that inflation leads to an increase in the prices of goods and services. According to Badreldin (2014), inflation is the sustained rise in the prices of goods and services over time thereby reducing the purchasing power of money. It is considered a very important indicator affecting both business and government stability. Rising inflation has been shown to disrupt investment and exchange rates (Selvia et al., 2022). However, economic growth can be achieved with single digits or stable inflation (Adeboye, 2014, Ridwan, 2022). There are different ways to measure inflation such as gross national product, implicit deflator, consumer price index and producer price index (Henry & Sabo, 2020). In line with Emerenini and Eke (2014), this study conceptualised inflation as the continuous increase in general prices, thereby reducing

citizens purchasing power. It is measured using the consumer price index to reflect the changes in consumer purchasing power.

Monetary policy is described as a deliberate strategy employed by monetary authorities to influence the quantity and cost of money and credit, to achieve specific macroeconomic goals related to internal and external balances (CBN, 2011). The idea of monetary policy pass-through pertains to the transmission of changes in central bank policies throughout the economy, which subsequently affect interest rates and some financial variables (Mihaljek & Klau, 2008). The effectiveness of this process hinges on a deep understanding of the transmission mechanism. Chickeke (2009) outlined four distinct phases of this process, which can vary depending on factors such as the structure of the financial system, competition within the banking sector, and the credibility of central bank communication. The monetary transmission mechanism typically involves a time delay of 18 to 24 months before its full effects become evident (Feddersen, 2017). More so, Ekong and Ukoha (2018) identified four principal transmission channels such as interest rates, exchange rates, credit, and asset prices, while studies like Gitonga (2015) suggested additional channels such as the money supply channel, inflation expectation channel and balance sheet channel. A comprehensive understanding of these channels is crucial for achieving the objectives of monetary policy (South African Reserve Bank [SARB], 2017).

2.2 Theoretical Literature Review

Theoretical literature review discusses the theories on monetary policy pass-through to inflation in selected Sub-Saharan countries. Two basic theories of the monetary theory of inflation and the Keynesian monetary transmission mechanism were reviewed to act as foundation for this study.

The Monetarist theory of inflation was propounded by economist Friedman (1956), which gained prominence in the 1960s and 1970s. The theory emphasized the role of the money supply in inflation. This theory was further expanded with the help of a macroeconomic model by British economist Laidler (1975). The theory assumes that inflation is solely due to excessive money supply growth exceeding output capacity, hence they dismiss non-monetary factors. It also views money quantity and growth as externally determined variables influencing spending, prices, and income. Monetarists assert short-term non-neutrality of money but long-term neutrality, affecting only inflation, not real output or employment. Laidler's model implies that inflation results from excess demand and inflationary expectations generated by past inflation and past excess demand, which arises from excessive monetary growth. Critics fault the Monetarist theory for solely targeting money supply growth to control inflation, neglecting other macroeconomic factors like fiscal policy and exchange rates. It is also criticized for assuming a stable money velocity, ignoring its

impact on the money supply-inflation relationship. Despite criticisms, Laidler's modified Monetarist theory has enhanced understanding of money supply and expectations' role in inflation and influenced monetary policy in various economies.

The Keynesian theory of monetary transmission, introduced by Keynes (1936), posits that changes in money supply and interest rates indirectly impact aggregate demand, affecting output, employment, and inflation. The Keynesian theory assumes that money supply changes influence aggregate demand and inflation through interest rates or exchange rates. Investment decisions respond to interest rate changes, lower rates stimulate investment and boost demand. Liquidity preference theory suggests that changes in money supply and interest rates affect spending habits, impacting demand and inflation. Price and wage inflexibility in the short run affects output and employment. Critics argue that rational expectations and time lags limit the effectiveness of monetary policy. The complex financial market interactions also complicate policy transmission. Despite criticisms, the Keynesian theory recognizes the significance of interest rates in monetary policy's impact on the broader economy and inflation.

2.3 Empirical Literature Review

The review of empirical literature was done in a chronological analysis in line with the objectives of this study.

Monetary Policy Transmission Channel and Inflation Responses.

Different studies have explored the forecasting power of monetary policy transmission and how inflation responded. For instance, Wulandari (2012) explored Indonesia's monetary transmission mechanism's impact on inflation and economic growth, using the SVAR model. They found that the interest rate channel primarily influences inflation but has a limited impact on economic growth, while the credit-bank lending channel significantly affects economic growth. Raji (2013) studied exchange rate pass-through in the West African Monetary Zone from Q2 2000 to Q4 2010 using the vector autoregressive (VAR) model. The results showed an incomplete pass-through of exchange rate to consumer prices. However, exchange rate pass-through to import prices is more significant than to consumer prices. Nigeria and Gambia showed more pass-through than Ghana and Sierra Leone. Hassan (2015) also studied the transmission of monetary policy in Nigeria from 2000 to 2014using monthly data and the vector autoregressive (VAR) approach. The findings of the study include that there's no long-run relationship between monetary policy and real economic variables. Monetary policy was relatively effective, with weak interest rate and asset price channels, and the credit and exchange rate channels were most effective. Bada, Olufemi, Tata, Peters, Bawa, Onwubiko, and Onyowo (2016) analysed exchange rate pass-through to inflation in Nigeria from 1995Q1 to 2015Q1. Using the Johansen

cointegration approach, they discovered that nominal exchange rates negatively impacted inflation in the long run, while import prices positively affected the consumer price index. In the short term, exchange rate pass-through was incomplete. In another study, Jobarteh and Yeboua (2016) also studied exchange rate pass-through and consumer prices in The Gambia from 2001m12 to 2012m12 using Johansen cointegration and VECM as the methods of analysis. They found that exchange rate pass-through was slow and incomplete, with exchange rates contributing up to 35% of inflation changes. Adekunle and Tiamiyu (2018) also examined exchange rate pass-through to consumer prices in Nigeria from 2001 to 2015. They used a non-linear auto-regressive distributed lag model and found no long-term relationship between consumer prices and independent variables. In the short term, exchange rate pass-through was partial, and in the asymmetric model, it occurred mainly through exchange rate appreciation. More so, Alfa, Sa'ad, and Abdulrasheed (2021) examined the lag in monetary policy rate and broad money supply transmission to inflation in Nigeria from January 2007 to March 2018 using the autoregressive distributed lag (ARDL) model. They found that the full impact of a shock of monetary policy transmission on inflation is realized only after delaying for different periods. Bulus, Afiemo, and Isah (2022) also assessed how interest rate channels affect monetary policy in Nigeria from 2007 to 2020 using the structural vector autoregressive (SVAR) model. They discovered that the effectiveness of the monetary policy rate in influencing market interest rates was short-lived. Also, exchange rate movements played a more significant role in explaining inflationary pressures and output growth.

3. RESEARCH METHODOLOGY

This study examined how monetary policy through to inflation using five selected sub-Saharan African countries including Angola, Gambia, South Africa and Nigeria. These countries were selected due to their regional proximity, colonial history, similarity in monetary framework and also due to data availability. To achieve the objectives of this study, we adopted the traditional Keynesian monetary transmission theory and the monetary theory of inflation as the theoretical foundation of this study. The monetary theory of inflation highlighted the direct impact of money supply on inflation, while the Keynesian theory focused on the indirect influence of the interest rate. Combining these theories mathematically resulted in the equation

$$INF = f(Ms, r) \qquad (3.1)$$

Where inflation (INF) is a function of money supply (MS) and interest rate (r). Thus, the money supply and interest rate channels have been identified as monetary policy channels that pass through to inflation based on the Keynesian monetary transmission theory and monetary theory of inflation. Consequently, for our empirical analysis here, we introduced an open-economy extension incorporating the exchange rate channel proxied by the nominal effective

exchange rate in conjunction with the interest rate channel and money supply channel for monetary transmission in line with literature (See Obstfeld & Rogoff, 1995). The credit channel entered the model to provide a holistic monetary policy measure of inflation.

To achieve the study's core objectives of examining inflation's monetary pass-through channels in selected sub-Saharan African countries, the study incorporated Jackson et al.'s (2023) model, integrating Keynesian transmission theory and the monetary theory of inflation. This involved breaking down the interest rate channel into deposit and lending rates, representing the exchange rate with the nominal effective exchange rate, and assessing the money supply channel through broad money supply. In contrast, the credit channel was evaluated based on credit to private sectors. Consequently, the comprehensive relationship between inflation and the various monetary policy transmission channels is specified econometrically as follows

$$INF_{i,t} = \beta 0 + \beta_1 LR_{i,t} + \beta_2 DR_{i,t} + \beta_3 NEER_{i,t} + \beta_4 BMS_{i,t} + \beta_5 CPS_{i,t} + \mu \quad (3.2)$$

Where: INF is inflation rate, LR is lending rate, DR is deposit rate, NEER is nominal effective exchange rate, BMS is broad money supply, CPS is credit to private sector, μ is the stochastic error term while subscript i and t represent the country and time measured in years.

The consumer price index serves as an inflation metric, indicating the overall percentage increase in the prices of goods and services. It functions as the dependent variable in this study similar to studies like Mahmud and Akuoko-Konadu (2023). The independent variables encompass monetary policy pass-through channels as recognized by previous empirical studies and they include; lending rate (LR) which is the cost of borrowing money (See Jackson et al., 2023), deposit rate (DR) signifying the reward for saving money, broad money supply (BMS) denoting the total money in circulation within an economy (See Gitonga, 2015), credit to the private sector representing loans and credit extended by financial institutions (Ekong & Ukoha, 2018) and the nominal effective exchange rate (NEER) assessing a currency's value relative to a weighted average of foreign currencies (See Balcilar et al., 2019; Kassi et al., 2019). The data were collected from Central Bank Statistical Bulletins and World Bank Development Indicators from 1987 to 2022.

4. RESULTS AND DISCUSSION OF FINDINGS

The study employed the use of econometric tools in the analyses of the variables as shown in the model. The E-views 10 package was used in the estimation process and results are presented in tables.

4.1 Descriptive Statistics

The descriptive statistics provides a summary of the properties of a time series data and it is presented in Table 4.1

Table 4.1: Descriptive Statistics

	INF	LR	DR	NEER	BMS	CPS
Mean	107.6346	32.62344	15.08622	96.24888	32.71730	21.18744
Median	10.03548	20.02083	10.41042	103.6858	28.04723	10.21552
Maximum	4145.106	217.8750	147.1250	154.9551	74.11669	70.38188
Minimum	-0.692030	7.041667	3.145071	17.19552	9.063329	1.966540
Std. Dev.	445.8377	38.20133	18.09392	29.71815	17.87830	21.84890
Skewness	6.861196	2.895297	4.844818	-0.623498	0.719665	1.118553
Kurtosis	55.78177	11.10649	31.29040	2.716766	2.501512	2.514970
Jarque-Bera	17845.31	595.4765	5365.414	9.811333	13.92097	31.43936
Probability	0.000000	0.000000	0.000000	0.007405	0.000949	0.000000
Sum	15499.38	4697.776	2172.415	13859.84	4711.291	3050.992
Sum Sq. Dev.	28424287	208685.9	46816.74	126293.1	45707.59	68264.53
Observations	144	144	144	144	144	144

Source: Researchers' computation using EViews 10.

The result of the descriptive statistics from Table 4.1 shows that during the period of 1987 to 2022 the average values of inflation, lending rate, deposit rate, deposit rate, nominal effective exchange rate, broad money supply and credit to private sector is 107%, 32.6%, 15.08%, 96.24 unit, 32% and 21% respectively, which falls within the range defined by the maximum and minimum values of each of these variables. Standard deviation values indicate the extent of variability in the variables compared to their long-term mean values each year. Most importantly, the probability of the Jacque Bera of each variable (inflation rate, lending rate, nominal effective exchange rate, deposit rate, broad money supply and credit to private sectors) shows that they are not normally distributed.

4.2 Unit Root Result

The Panel Unit Root test using the IM, Pesaran and Shin; Levin, Lin and Chu and ADF-Fisher Chi-square was used to determine the stationarity of all the variables as seen in Table 4.2.

Table 4.2: Summary of Panel Unit Root Test at First Difference

	Statistics	Prob	Cross section
Levin, Lin & Chu (Common unit root process	-7.55027 (INF)	0	4
	-9.0539 (LR)	0	4
	-9.50701 (DR)	0	4
	-3.61871 (NEER)	0.0001	4
	-5.76604 (BMS)	0	4
	-3.91643 (CPS)	0	4
Determination: Specification: Individual effects and Individual linear trend (INF)			
Im, Pesaran and Shin W-stat	-9.37277	0	4
ADF - Fisher Chi-square	83.123	0	4
Determination: Specification: Individual effects and Individual linear trend (LR)			
Im, Pesaran and Shin W-stat	-9.58997	0	4
ADF - Fisher Chi-square	84.5167	0	4
Determination: Specification: Individual effects and Individual linear trend (DR)			
Im, Pesaran and Shin W-stat	-9.86369	0	4
ADF - Fisher Chi-square	87.2457	0	4
Determination: Specification: Individual effects and Individual linear trend (NEER)			
ADF - Fisher Chi-square	16.5756	0.0348	4

PP - Fisher Chi-square	20.0687	0.0101	4
Determination: Specification: Individual effects and Individual linear trend (BMS)			
Im, Pesaran and Shin W-stat	-6.28204	0	4
ADF - Fisher Chi-square	52.0481	0	4
Determination: Specification: Individual effects and Individual linear trend (CPS)			
Im, Pesaran and Shin W-stat	-6.07192	0	4
ADF - Fisher Chi-square	49.8839	0	4

Source: **Researchers' computation using EView 10.0**

As shown in Table 4.2, all panel unit root tests confirmed that the variables of interest (inflation, lending rate, deposit rate, nominal effective exchange rate, broad money supply and credit to the private sector) are stationary at first differencing. Consequently, the Kao panel cointegration test and the Johansen Fisher panel co-integration test are presented in Table 4.3.

4.3 Cointegration Test Result

The Kao Panel and Johansen Fisher Panel Cointegration Test were used to assess the presence of the long-run relationship between inflation and monetary policy pass through channels.

Table 4.3: Kao Panel and Johansen Fisher Panel Cointegration Test

Kao Panel Cointegration Test			
Test	T – Statistic -2.048186	Prob. 0.0203	
Residual Variance	44581.78	HAC Variance	16932.68

Johansen Fisher Panel Cointegration Test Results

Hypothesized	Fisher Stat.*		Fisher Stat.*	
No. of CE(s)	(from trace test)	Prob.	(from max-eigen test)	Prob.
None	72.20	0.0000	46.00	0.0000
At most 1	36.66	0.0000	20.50	0.0086
At most 2	20.39	0.0090	12.69	0.1230
At most 3	12.71	0.1223	9.622	0.2926
At most 4	7.247	0.5102	5.975	0.6500
At most 5	10.48	0.2329	10.48	0.2329

Source: Researchers' computation using EView 10.0

From Table 4.3, the Kao panel co-integration test rejected the absence of co-integration based on residual and HAC variances surpassing the t-statistic value, with a probability value below 0.05. This finding is corroborated by the Johansen Fisher Panel co-integration test, which identifies 3 co-integrating equations. The max-eigen test confirms 2 co-integrating equations, indicating a long-run relationship between the inflation and co-integrating variables LR, DR, NEER, BMS, and CPS. Given this result and in line with the objectives of this study, the vector error correction model (VECM) was employed.

4.4 Regression Test Result

The Vector Error Correction Model is a co-integrated VAR model. This concept of the Vector Error Correction Model (VECM) consists of a VAR model of order p - 1 on the differences of the variables plus an error-correction term generated from the known (estimated) co-integrating relationship. Given this assertion, the VECM result is presented in Table 4.4

Table 4.4: Summary of Vector Error Correction Technique

CointegratingEq:	INF(-1)	LNDR(-1)	LNLR(-1)	LNNEER(-1)	LNBMS(-1)	LNCPS(-1)	C
CointEq1	1	145.7706	-1467.41	856.878	790.5958	-799.998	-299.491
Standard deviation		-225.831	-285.092	-282.918	-249.451	-184.889	
T-statistics		[0.64548]	[-5.14714]	[3.02872]	[3.16935]	[-4.32690]	

R-squared	0.638131	Log-likelihood	-862.332
Adj. R-squared	0.545817	Akaike AIC	14.32793
Sum sq. residals	7968276	Schwarz SC	14.91928
S.E. equation	285.1472	Mean dependent	-0.48135
F-statistic	6.912648	S.D. dependent	423.1106

Source: Authors' computation from EViews 10

Table 4.4 shows that deposit rate, a faction of the interest channel has a positive and insignificant impact on inflation in the selected sub-Saharan African countries. This is deduced from the estimate that a 1% increase in deposit rate, on average, increases inflation rate by 145.7% in SSA countries. This result does not conform to economic expectations and this could be attributed to the public insensitivity to increasing deposit rates in the selected SSA countries. Thus, the increase in deposit rate is not sufficient to drive people to increase savings. Therefore, still increases inflation but by an insignificant amount.

The estimated value of lending rate, a proxy for the interest rate channel shows a negative and significant impact on inflation in the SSA countries. Hence, this result conformed to economic expectations. Therefore, a 1% increase in lending rate, on average, reduces inflation by 856% ceteris paribus. Contrary, nominal effective exchange rate which proxied the exchange rate channel indicated a positive and significant impact on inflation in the selected SSA countries. This was deduced from its estimate that a 1% increase in nominal effective exchange rate, on average, increases inflation by 857%. This result does not conform to theoretical expectations; however, this can be attributed to the increase in inflation in trading partners' countries which is invariably transmitted to the selected Sub-Saharan countries given that most of the SSA countries are import-dependent.

Broad money supply which proxied by the money supply channel has a positive and significant impact on inflation in selected SSA countries and this result conformed to a prior

expectations. Thus, a 1% increase in broad money supply increases inflation by 790% on average. Credit to private sector has a negative and significant impact on inflation. Thus, a 1% increase in credit to private sector decreases inflation in selected SSA countries by 800% on average. This result does not conform to economic expectation but it proves the ability of credit to the private sector to improve investment and productivity which can help reduce inflation caused by supply-side shortages in the selected SSA countries. Statistically, the coefficient of determination (R^2) of 0.63 indicates that 63% of variations in inflation in the selected sub-Saharan countries are explained by changes in deposit rate, broad money supply, nominal exchange rate, lending rate and credit to private sector. This implies that about 37% of variations in inflation in the selected sub-Saharan countries were not captured in the model. Nevertheless, given that the calculated F-statistic of 6.19 is greater than the tabulated F-statistic of 4.36., it was concluded that the independent variables hold a significant impact on inflation.

4.5 Impulse Response Function

Next, the impulse response function was conducted to check the forecasting ability. The impulse response function focuses on how inflation responds to innovations in monetary transmission mechanisms, including lending rate, deposit rate, nominal effective exchange rate, broad money supply, and credit to private sectors.

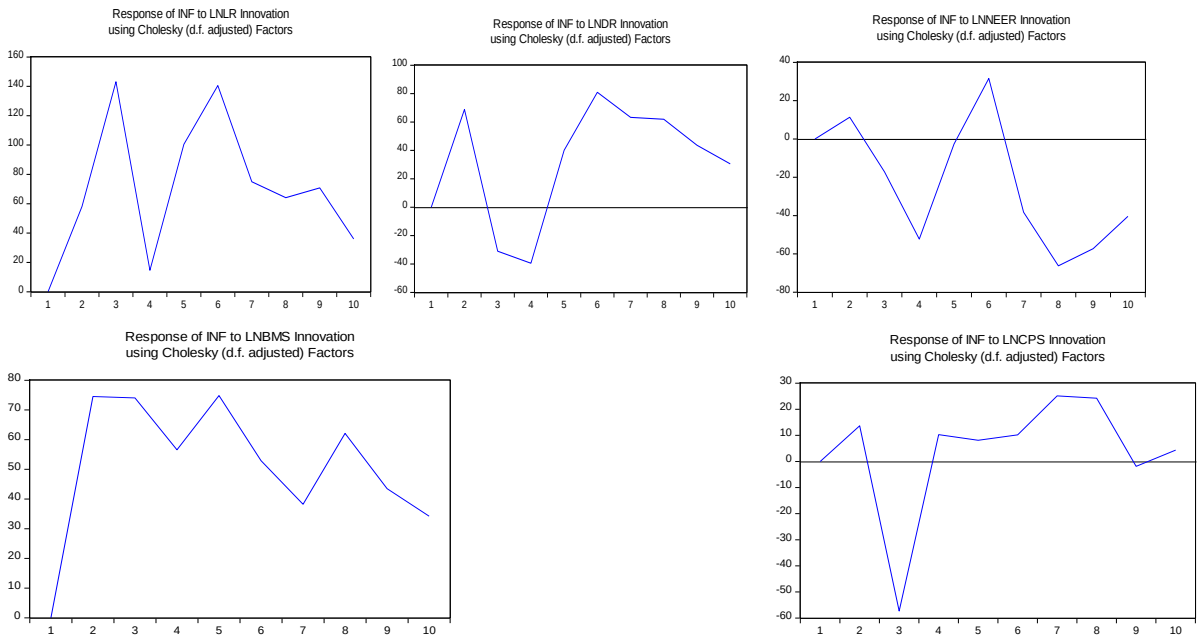

Figure 1: Summary of the Impulse response function of inflation

From the impulse response function, these diagrams display inflation's response to shocks in monetary transmission mechanisms. It can be deduced that shocks in deposit rate, lending rate,

broad money supply and credit to private sector cause inflation to respond positively while a shock in nominal effective exchange rate majorly causes inflation to respond negatively. On the other hand, innovation in all the monetary transmission channels caused an elastic change in inflation except from credit to private sector which caused an inelastic change in inflation. In summary, these variable changes drive inflation shifts over the observed period. As a result, inflation is highly responsive to changes in these monetary policy pass through channels for the chosen Sub-Saharan African countries.

4.6 Variance Decomposition result

The variance decomposition test was used to investigate the level of information each monetary transmission channel contributes to inflation in the VECM. It was used to confirm the extent of the pass-through of the various monetary policy transmission channels to inflation. The decomposition strongly depends on the ordering and the result is shown in Table 4.5.

Table 4.5: Summary of Variance Decomposition

Variance Decomposition of Inflation							
Period	S.E.	INF	LNDR	LNLR	LNNEER	LNBMS	LNCPS
1	285.1472	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	394.0455	90.99596	3.052332	2.170221	0.082938	3.577759	0.120795
3	440.4152	77.05788	2.937604	12.30374	0.218805	5.691735	1.790241
4	455.7611	74.81774	3.491832	11.59199	1.520949	6.854867	1.722623
5	475.0481	69.11828	3.928274	15.14375	1.402973	8.792069	1.614655
6	506.4949	61.05973	6.010558	21.02067	1.623047	8.825217	1.460783
7	530.7306	59.85665	6.894913	21.13821	1.998629	8.557008	1.554590
8	552.1646	57.40643	7.628970	20.87804	3.285751	9.171644	1.629162
9	568.5847	56.08654	7.784905	21.24175	4.114338	9.234977	1.537496
10	585.2078	57.07300	7.620315	20.43028	4.359645	9.059874	1.456883

Source: Researchers' derivation using EView 10.0

Given the result in Table 4.5, it can be deduced that all the independent variables hold high forecasting power over inflation, especially from the second period to the tenth period. Put simply, Table 4.5 shows that the forecast error variance of inflation is dependent on the exogenous shocks to lending rate, deposit rate, nominal effective exchange rate, broad money supply and credit to private sector. However, it can be seen that the pass-through of lending rate is more effective as it accounts for more changes in inflation. This is followed by broad money supply which accounted for 9.1% in inflation in the long run; then deposit rate of 7.6%; nominal effective exchange rate of 4.4% and lastly credit to private sector which has the least pass-through to inflation by accounting only 1.5% changes in inflation in the selected sub-Saharan African countries. Since the elasticities exceeded 1, this indicates that these monetary policy pass-through channels have complete and effective pass-through to inflation for selected Sub-Saharan African countries in both the short and long run.

4.7 Post Estimation Test

The post-estimation test was conducted using the AR polynomial and serial correlation test. The AR polynomial as seen in Fig 2 showed

that all that no root lies outside the unit circle. Thus, the VECM model satisfies the stability condition. Also, the serial correlation test as presents in Table 4.6 showed that the model is free from autocorrelation given that the probability value from lag 1 to lag 2 are greater than 0.05. Both tests showed that the model is reliable for prediction and policy-making.

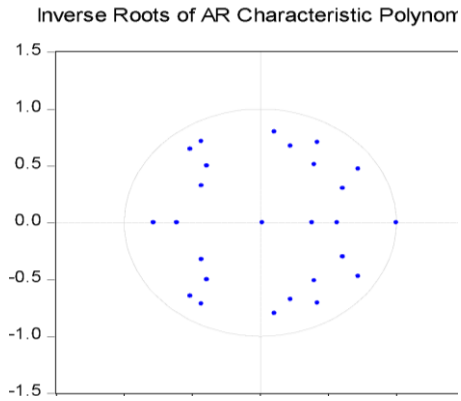

Fig 2: Diagram of AR polynomial.

Table 4.6: Summary of Serial Correlation LM Test

Null hypothesis: No serial correlation at lag h						
Lag	LRE* stat	Df	Prob.	Rao F-stat	Df	Prob.
1	40.94656	36	0.2624	1.146719	(36, 384.8)	0.2634
2	50.21978	36	0.0580	1.423051	(36, 384.8)	0.0584
3	46.12061	36	0.1203	1.300113	(36, 384.8)	0.1210
4	47.86724	36	0.0892	1.352343	(36, 384.8)	0.0898

Source: Researchers' derivation using EView 10.0

4.8 Discussion of Findings

Based on the major findings of this study, it was observed that the included variables have shock effects on inflation rate in the selected sub-Saharan countries. For example, the responses of inflation to shocks in lending rate and broad money supply were elastic and positive over the 10-year horizon while that of deposit rate, nominal effective exchange rate and credit to the private sector fluctuated elastically both positively and negatively over the 10-year horizon. This shows that an effective use of these monetary policy channels is adequate to control inflation in the selected sub-Saharan African countries. Using the worst-case scenario of Angola which had a high rate of inflation, the Central Bank of Angola (BNA) adopted measures such as the monetary target framework with broad money serving as an intermediate target and reserve money as an operating target to control inflation and this has been applied by other countries like South Africa and Nigeria. This finding agrees with the work of Alfa, Sa'ad and Abdulrasheed (2021) who also revealed that the full impact of a shock of monetary policy transmission on inflation which is realized only after delaying for different periods across monetary policy rate, broad money supply and lending rate.

Second, the findings from the second research question and research hypothesis prove the effectiveness of monetary pass-through to inflation in the selected sub-Saharan African countries and this is buttressed by the elasticity of the PVECM both in the short and long run which are greater than 1. Therefore, the monetary policy has a complete pass-through to inflation in the selected Sub-Saharan African countries. However, the results of the variance

decomposition test indicate the most effective channel as the interest rate channel which is proxied by lending rate given that it accounts for more variability in inflation rate in the selected Sub-Saharan African countries. This result is in line with the findings of Wulandari (2012) but contradicts Bulus, et al. (2022) who found exchange rate channel to be more effective compared to interest rate channel. More so, the variance decomposition indicates that the credit channel proxied by credit to the private sector is less effective since it accounts less for the variations in inflation rate in the selected Sub-Saharan African countries. This is in line with the results of Wulandari (2012).

5. CONCLUSION AND RECOMMENDATION

This study examined monetary policy pass-through to inflation in SSA countries from 1987 to 2022 and concludes that significant shifts in monetary policy transmission mechanisms are likely to lead to substantial changes in inflation rates in sub-Saharan African (SSA) countries. It is, therefore, imperative to carefully assess the consequences of implementing such policies. Based on these findings, it is recommended that the central banks of selected SSA countries should raise lending rates and exercise stricter control over the money supply to combat inflation effectively. Also, there is a need to boost productivity, this will help to reduce import dependence and mitigate inflation stemming from trading partners in SSA countries. This suggests that focusing on lending rates, the broad money supply and exchange rates are vital tools for managing inflation in sub-Saharan nations.

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