Effect of Monetary Policy on Lending Interest Rate in Sub-Saharan Africa: A Panel VAR Analysis

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Highlights

- We use panel VAR model to examine lending interest rate movements in the Sub-Saharan African region.
- Shocks of shadow rate, inflation, foreign exchange rate, M2 and public debt are assessed.
- Foreign exchange rates guide better lending rates than domestic variables.
- Both M2 and public debt had a key domestic impact on the lending rates, not the inflation.

Abstract

It can be emphasized that lending interest rate plays a crucial role in the financial system as well as propelling investment for economic activities in an economy. However, the recent global economic crises and shocks from monetary policy have destabilized the lending interest rate in the financial markets of most Sub-Saharan Africa (SSA) countries, thus increasing the cost of borrowing in the sub-region. This paper thus, examines the effect of monetary policy on lending interest rate in SSA. To achieve this, the paper employs the panel vector autoregressive (VAR) model based on a sample of 23 countries in SSA using quarterly panel data for the period 2013Q1 to 2022Q4. The paper finds that monetary policy has a profound effect on lending interest rates in the sub-region. This paper offers valuable insights in terms of how shocks from monetary policy translate to lending interest rate in the case of SSA. The study also reveals that excessive domestic and external borrowing, high inflation adjustments, and exchange rate fluctuations have consequences on lending interest rate in SSA economies. The paper recommends that, governments and monetary authorities in SSA pursue credible monetary policy to ensure a sound macroeconomic environment in order to boost the activities of the financial sector in the sub-region.

Keyword: Monetary policy; Lending interest rate; Sub-Saharan Africa; Panel VAR analysis

JEL: *G21, E43; E51; E61; O11*

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1. Introduction

It should be noted that in the majority of economies, financial institutions play a major role in supplying liquidity to firms to undertake economic activities in order to propel economic growth (Michail & Koursaros, 2022; Hartmann et al., 2003; Allen et al., 2004). Consequently, it is not only imperative that policymakers comprehend the variables influencing loan granting behaviour of these financial institutions, but also whether or not they can influence them by altering interest rates. This is because shocks from these variables can affect the borrowing cost and can deter investment activities in a country. This in the end can also disrupt the stability of the financial system. Moreover, due to the current global financial crisis, the majority of central banks in developed and developing economies have turned their focus to financial stability.

According to Hussain and Bashir (2019), economic growth, managing inflation, determining the cost and accessibility of credit, and maintaining an equilibrium balance of payments are all significantly influenced by monetary policy. Thus, monetary policy uses a variety of quantitative and price-based instruments to transfer the intended goal of price and financial stability to the real economy in order to derive such aims seamlessly. As a result, comprehending the transmission mechanism of monetary policy is a crucial area of research for the academic community as well as policymakers.

Umoru and Imimole (2023) indicated that monetary policy is essential to macroeconomic management because of its impact on economic variables (Umoru & Imimole, 2023). Further, as indicated by Alavinasab (2016) and Anowor and Okorie (2016), money supply, exchange rate, and short-term interest rate are the intermediate variables that monetary policymakers target the most frequently. Thus, the central bank authority of a country uses monetary policy as a tool to influence the economic goals of the country. It is evident that many developing countries already employ monetary policy, nevertheless, many of these policies are not developed to take into account the fact that their financial markets are still developing, leading to a great deal of inconsistency in their financial markets (Umoru & Imimole, 2023).

It can be emphasized that the degree to which private sector expectations can be altered is directly tied to the efficacy of monetary policy (Kwapil & Scharler, 2013). According to Goodfriend (1991), monetary policy affects long-term interest rates by influencing expectations of the path of future short-term rates, which is a significant factor in determining long-term interest rates. This is in addition to altering the target for current short-term rates, which is possibly even more significant. Since lending interest rates of banks are a key component of the monetary transmission mechanism and significant predictors of financing circumstances as

indicated by Borio and Fritz (1995), this study concentrates on them to determine how they respond to shocks from monetary policy.

When changes in bank lending interest rates translate into changes in overall domestic demand, investment, and ultimately output, monetary policy is considered effective (Xu & Chen, 2012). The recent downturns in the world economy have brought monetary policy to the forefront. Because of this, monetary policy is seen by economists as the first line of defence against economic downturns, particularly in situations where prompt action is required to stabilize the economy (Matemilola et al., 2015). Kandil (2014) emphasizes the significance of monetary policy in stabilizing developing countries' economies. However, as noted by Metemilola et al. (2015), among other factors, the pass-through to bank lending rate and the growth of the financial market determine how quickly economic stability is attained.

The relationship between monetary policy and lending interest rates has been a subject of research, particularly in the context of Sub-Saharan Africa (SSA). This is due to the fact that the global economic crisis brought about distortions in the financial markets of many SSA countries which destabilized the borrowing costs of banks, thereby affecting aggregate demand. This situation was exacerbated by shocks from monetary policy as a result of the attempts by central banks to address the mismatch (Ouko & Odiwuor, 2023; Fiszeder & Malecka, 2022). The motivation of this study is based on the fact that most of the studies in this area of research concentrated on monetary policy and bank lending relationship without particularly paying attention to the borrowing cost of banks which has a significant impact on investment and the overall economic activity in an economy.

Also, of the fact that despite the numerous studies done elsewhere, to the best of knowledge, research in this manner is limited in the case of SSA, the need for this research. Figure 1 depicts the trend of lending interest rate in SSA from 2013Q1 to 2022Q4. From Figure 1, it can be indicated that the lending interest rate in the region has not been stable. Especially, from 2015 to 2021 the lending interest rate increased astronomically. Other periods also saw increases and decreases in the region. This situation impacted the cost of borrowing and in turn affected investment and consumption as well as cost of living which needs to be addressed. As indicated early on, the destabilizing nature of the lending interest rate was also affected by shocks from monetary policy response to the crises.

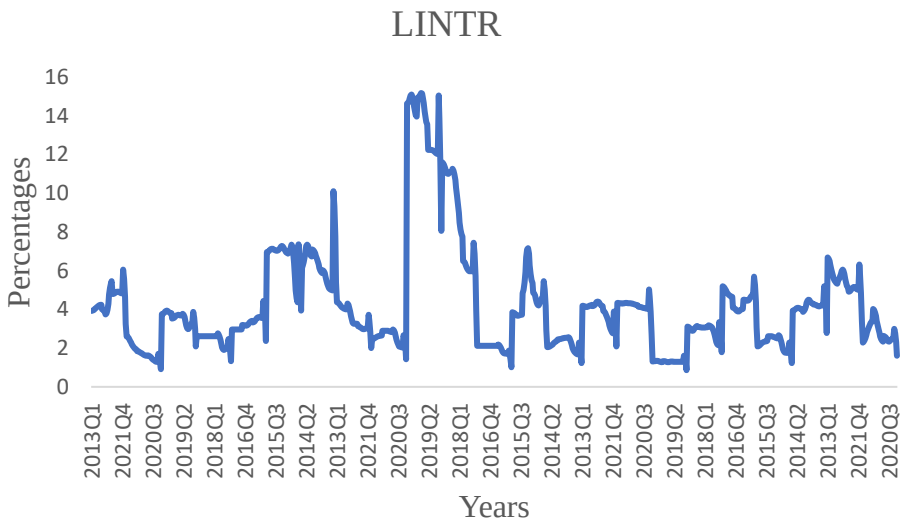

Figure 1: Trend analysis of lending interest rate in SSA from 2013Q1-2022Q4

Source: Own Computation from the World Bank World Development Indicators Dataset from 2013-2022

Figure 2 also depicts the trend of monetary policy which is being proxied by shadow rate. From Figure 1, it can be stressed that monetary policy responses have not been stable throughout the study period. Thus, the responses have been higher from 2013Q1 to 2016Q3 even though there was a fall between 2016Q3 and 2017Q1. There were further increases from 2017Q3 to 2019Q3 and still increased from 2020Q1 to 2022Q1 and beyond, indicating monetary policy shocks within the region. It can be indicated that the monetary policy, implemented by central banks, plays a crucial role in influencing the cost and availability of credit, thereby affecting lending rates. Understanding the impact of monetary policy on lending rates in SSA is of importance due to the unique characteristics and challenges faced by the region's economies.

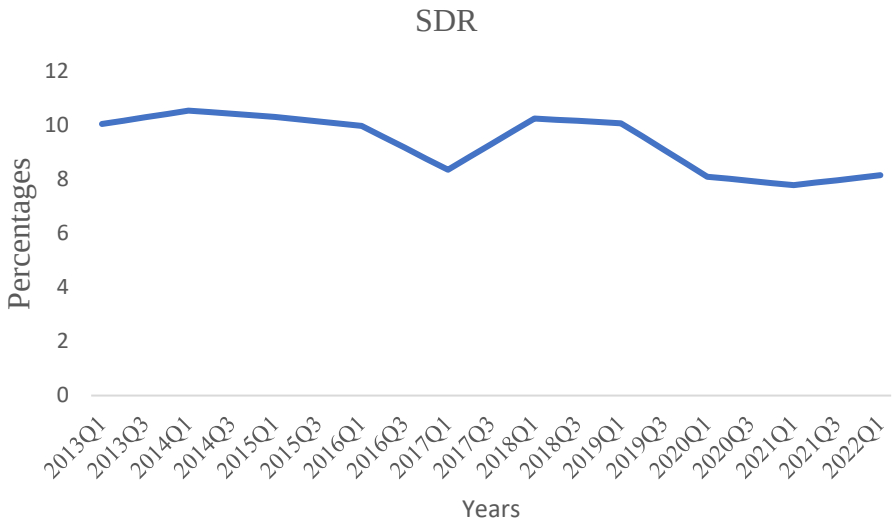

Figure 2: Monetary policy trend from 2013Q1-2022Q1

Source: Own Computation from the World Bank World Development Indicators and Central Banks' Databases 2013-2022

This study is deemed to be relevant since the findings can provide insights into how central banks can effectively influence credit availability, which in turn affects investment, business expansion, and overall economic growth. Also, the findings can help policymakers to assess the effectiveness of their policy interventions and make informed decisions to achieve their macroeconomic objectives. Further, the outcome of the study can help identify barriers to financial inclusion and inform policies aimed at promoting affordable credit for underserved segments of the population. Lastly, since higher interest rates can deter investment, leading to reduced economic activity, the study can shed light on the investment climate in Sub-Saharan Africa and provide insights into the factors that affect borrowing costs for businesses and individuals. The rest of the study is organised as follows. Section 2 presents the literature review on the subject matter. Section 3 indicates the methodology used while section 4 presents the results. Section 5 depicts the discussion on the results. The last section presents the conclusions and policy recommendations of the study.

2. Literature review

This section presents the relevant literature which this study tries to link with in order to serves as a foundation to shape the focus of the study and properly integrate it into the existing body of literature. This section specifically considers some theoretical underpinning and empirical studies conducted within this area of research.

2.1.Overview of bank lending in SSA

This section presents the overview of bank lending activities in the SSA. It is impossible to overstate the significance of banks and the roles they play in all economies, developed and emerging. As a result, banks are crucial to the funding of a nation's economic activity (Amidu, 2014). According to Kashyap et al. (2002), as cited by Amidu (2014), they offer depositors liquidity on demand and extend loans as well as liquidity for borrowers through lines of credit. Despite this assertion, in the context SSA, the financial sector is underdeveloped. According to Bending et al. (2015), Sub-Saharan Africa's banking sectors are still very shallow and lacking in financial expertise when compared to other regions of the world. Additionally, it is important to note that Africa's financial system is still in its infancy, is largely controlled by the banking industry, and is mostly found in urban and peri-urban areas (World Bank, 2015) as cited by Chikalipah (2020).

According to Ojah and Kodongo (2015), for many small enterprises in Africa, the inability to access official financial institutions poses a major obstacle to their expansion. Furthermore, in Sub-Saharan Africa (SSA), 75% of families lack adequate collateral to offer as security for a loan. As a result, low-income individuals are forced to borrow money at exorbitant interest rates and under strict repayment terms from individual moneylenders (Dixon et al., 2007). According to Monga and Lin (2015), about 100 million adults in the SSA area rely on unregulated private money lenders for their informal financial needs.

Further, the majority of the loan activity by the region's banks, despite their generally strong capitalization and profitability, is directed toward funding governments and large business clients. Too many low- and middle-class people in the area, as well as SMEs, continue to lack formal bank accounts (Bending et al., 2015). Nonetheless, the banking industry in SSA has expanded significantly in recent years, and the rate of financial access is rising. There are very few exceptions to this pattern in any of the SSA nations.

Specifically, SSA is setting the global standard for the use of mobile banking technology. However, there some challenges relating to this digital technology. Thus, the problem is that regulation, oversight, and resolution capabilities have not kept up with these advancements, which poses a threat to systemic risk and causes certain bottlenecks for future growth. Lending in this region is carried out most by non-financial institutions with many people being unbanked (Ojah & Kodongo, 2015). Thus, it can be indicated many people do not have access to credit from the formal financial institutions operating in SSA. Moreover, credit offered by both the formal and non-formal financial institutions attract high borrowing costs (high lending interest rates) which affects investment activities and consumption. The main question that needs to be

addressed is: Are the high lending interest rates on loans in SSA because of circumstances unique to individual banks, or is there a problem with the fragmented financial system, monetary policy, the macroeconomic environment, or regulatory frameworks?

Consequently, research on the efficacy of monetary policy as well as the mechanisms by which it operates has grown (Kakes & Sturm, 2002). This resurgence of theories emphasizing the influence of the financial sector on overall economic activity should be considered in the light of the revived interest in monetary transmission (Kakes & Sturm, 2002). These studies, referred to as the "credit view," begin with the premise that bank assets, such as securities and loans, are imperfect substitutes and that financial markets are flawed (Bernanke & Gertler, 1995; Kakes, 2000). One implication is that bank lending could be a route via which monetary policy influences the economy. This mechanism states that banks reduce loan availability in response to a monetary contraction, which ultimately impacts inflation and real activity as further indicated by Kakes and Sturm (2002).

Additionally, research indicates that the level of interest rates, which represent the stance of monetary policy, has an impact on the availability of bank loans (Amidu, 2014). Hofmann (2004), as cited by Amidu (2014), came to the conclusion that the supply of bank loans could result from two things: either a drain of reserves and thus loanable funds from the banking sector after changes in the stance of monetary policy operated through open market operations sales by the Central Bank, or from the effect of monetary policy on the creditworthiness of firms and of households via its effect on their financial positions. Thus, it can be indicated lending by banks especially formal banks in SSA is limited to a few people, which is also influenced by many factors of which shocks from monetary policy is key, therefore impacting on the cost of borrowing.

2.2. Theoretical underpinning

This section presents the overview of the theories that explain the relationship between monetary policy and lending interest rate which are important for econometric modelling of the study. According to the theory of the transmission mechanism of monetary policy, there are various channels in which monetary policy can impact real economic activity. These include channels related to interest rates, exchange rates, credit, and asset prices (Opolot & Nampewo, 2014). Considering this, there are two potential credit channel mechanisms that Bernanke and Gertler (1995) illustrate, namely the balance-sheet channel (BSC) and bank-lending channel (BLC) are two potential credit channel mechanisms that Bernanke and Gertler (1995) illustrate. While the bank-lending channel focuses on the potential direct consequences of monetary policy actions on the provision of loans by the banking system, the balance-sheet channel

highlights the influence of changes in the monetary policy stance on the borrower's balance sheet.

Here, the concentration hovers on the interest rate channel of monetary policy. It can be emphasized that the transmission mechanism of monetary policy has implications on the activities within an economy of which the operations of banks are inevitable (Iddrisu & Alagidede, 2020). Matemilola et al. (2015) asserts that a high interest rate pass-through is implied by a relationship between bank lending rates and policy rates or money market rates. A more efficient banking system and successful monetary policy are indicated by a higher pass-through rate from the money market rate to the bank lending rate (Fuertes et al., 2010). According to Ibrahim (2005), monetary economists and decision-makers have long been interested in the impact of monetary policy on the economy. The monetary policy shocks may cause the bank lending rate to fluctuate asymmetrically (Van Leuvensteijn et al., 2013). Here, as indicated by Matemilola et al. (2015), two opposing theories, namely the consumer reaction theory and the collusive behaviour of banks can be used to explain the asymmetric adjustment of interest rates.

The degree of bank competition and the degree of retail market concentration are related to the collusive behaviour theory. According to this theory, banks are unlikely to lower lending rates since they do not want to break up their cooperative relationship. In addition, the theory indicates that, as the policy rate changes, lending rates will be rigidly lowered (De Bondt, 2005). On the other hand, the customer reaction theory describes how borrowers respond to adjustments in policy rates. According to this theory, banks that operate in fiercely competitive markets can be reluctant to raise lending rates out of concern for their clients' unfavourable reactions (Matemilola et al., 2015). As indicated by De Bondt (2005), the customer reaction theory posits that a rise in the policy rate will result in stiff higher lending rates.

It can be emphasized that, the above theories offer a valuable support to the current study. For instance, the customer reaction theory focuses on how borrowers react to changes in monetary policy. Thus, when central banks implement monetary policy measures such as increasing or decreasing interest rates, it affects the cost of borrowing for individuals and businesses. According to the theory, changes in interest rates influence the demand for loans and subsequently impact lending interest rates. More specifically, if monetary policy involves a decrease in interest rates, it generally leads to lower borrowing costs. This may stimulate borrowing and increase the demand for loans, resulting in a downward pressure on lending interest rates.

Conversely, if monetary policy involves an increase in interest rates, borrowing costs tend to rise, which can dampen borrowing activity and lead to higher lending interest rates. The collusive behaviour theory on the other hand explains the if lending institutions engage in collusive behaviour, the effect of monetary policy on lending interest rates may be influenced. For example, if central banks lower interest rates to stimulate borrowing and economic activity, colluding lenders may resist passing on the full benefits of the rate cut to borrowers. Instead, they may maintain higher lending rates collectively to maximize their profits. This can undermine the intended impact of monetary policy on lending interest rates.

2.3. Empirical evidence

On the empirical front, studies have been conducted to determine how monetary policy transmission relates to bank lending behaviour. For instance, Orellana (2023) examines the determinants of short-term and long-term commercial banks' lending rates in Peru by employing the autoregressive distributive lag (ARDL) model for the period 2010-2022. The results show that monetary policy is effective since the BCRP reference rate creates a long-term link for both short- and long-term rates. Michail and Koursaros (2022) use three different approaches (ordinary least squares, vector autoregressive model, and quantile regression model) to investigate how conventional monetary policy affects bank credit standards in the USA. According to the analysis, there is a favourable correlation between policy rate and bank credit standards.

Using disaggregated bank-level data for Saudi Arabia over the period 2008Q1-2020Q4, Boukhatem and Djelassi (2022) employ the panel VAR approach and the impulse response functions to examine the variations in the monetary transmission processes of Islamic and conventional banks. The results demonstrate the important role Islamic banks have in using the balance sheet channel to communicate monetary policy decisions to the actual economy. Furthermore, the findings indicate that Islamic banks exhibit a comparatively milder response to monetary policy and price shocks in comparison to conventional banks.

Boungou (2021) also examines the lending channel of monetary policy under negative interest rates using the Difference-in-Difference (DID) methodology based on a panel dataset covering 2009-2018 with a sample of 4,072 banks in 54 countries. According to the study, banks in countries where negative interest rates are prevalent increased their lending activity in order to modify their lending behaviour. The results also show that banks lowered lending costs in reaction to negative interest rates and expanded lending supply, especially for loans with maturities of three to twelve months and longer than five years.

Similarly, the impact of the Swiss National Bank's (SNB) adoption of negative interest rates on individual Swiss corporate loans is examined by Schelling and Towbin (2020). Using a Difference-in-Difference methodology, the study discovers that banks with large deposit bases attempt to gain market share by providing more lenient lending terms to offset their comparatively higher financing costs. Moreover, after reviewing the lending and interest rate channels of monetary policy transmission in the context of theoretical prescriptions, Iddrisu and Alagidede (2020) came to the conclusion that, for the interest rate channel, a percentage restriction in monetary policy raises the lending rate by 0.29%. Yunusa et al. (2020) use macroeconomic time series data covering the period 1980-2018 to examine the effects of monetary variables on bank lending in Nigeria. The study, which employs the Autoregressive Distributed Lag (ARDL) econometric technique concludes that interest rates and inflation rates significantly affect bank loans and advances negatively.

Chikalipah (2020) uses a panel dataset consisting of 292 microfinance institutions drawn from 34 countries between 2003 and 2011 to investigate the factors that contribute to the persistently high microcredit interest rates in SSA. The study uses the System GMM estimator to show that the operating costs associated with making small loans, underutilized economies of scale, and institutional deficiencies all contribute to the microcredit interest rates increase. Additionally, the study finds that volatile macroeconomic fundamentals have an unfavourable effect on the microcredit interest rates in SSA. The influence of monetary policy on credit supply decisions for Malaysian Islamic and conventional banks is investigated by Rashid et al. (2020). Comparing Islamic banks to their conventional counterparts, the study reveals that the loan supply of Islamic banks is less sensitive to tight monetary policy. Furthermore, the analysis demonstrates both conventional and Islamic banks that are smaller and less liquid are more sensitive to rising interest rates in the overall economy.

In their study, Abuka et al. (2019) investigate the connection between bank lending and monetary policy in developing countries, concentrating on loan applications, interest rates, and real effects in Uganda. The study's use of microdata demonstrates how a monetary contraction lowers the availability of bank credit, which leads to a rise in loan application rejections as well as a tightening of lending volume and rates, particularly for banks that have a higher exposure to sovereign debt and more leverage. Magnus (2018) uses a regression model to examine how monetary policy affects commercial banks' lending to the real sector in Nigeria between 1981 and 2014. The study finds that monetary policy rate has favourable link with commercial banks' lending to the agricultural sector.

Asoamoah and Adu (2016) use annual time series data from 1970 to 2013 within the ARDL model to investigate the factors influencing the bank lending rate in Ghana. According to the study, the monetary policy rate of the Bank of Ghana and bank lending rates have a favourable long-term association. In South Africa, Matemilola et al. (2015) examine the impact of monetary policy on bank lending rate by using the momentum threshold autoregressive and asymmetric error correction models. The results of the asymmetric error correction show that the bank lending rate in South Africa responds to a decline in the money market rate. The results also demonstrate that while South African commercial banks seem to rigidly raise lending rates, they really shift them downward.

Using the Chow test approach, Eke et al. (2015) also investigate how interest rate deregulation affects the lending activities of commercial banks in Nigeria. The study shows that the volume of loans made by commercial banks is significantly and negatively impact by the statutory liquidity ratio and interest rate spread throughout the period of interest rate regulation. The study also reveals that the rate of inflation and monetary policy have a significant and substantial effect on bank lending throughout that time. The findings indicate that throughout the deregulation era, bank loans and advances are significantly impacted by MPR and the exchange rate.

Amidu (2014) uses data from 264 banks spread over 24 Sub-Saharan African (SSA) countries between 2000 and 2007 to assess the main factors influencing bank lending in the region. By employing using a panel data regression model the study shows that in an environment where the financial sector is reformed and banks are permitted to operate freely, the structure of banking markets affects credit delivery in Sub-Saharan Africa (SSA).

2.4. Empirical strategy

The theoretical model depicting the relationship between lending interest rate and the explanatory variables in this study following the standard literature (Orellana, 2023; Boukhatem & Djelassi, 2022; Iddrisu & Alagidede, 2020; Ousseini et al., 2017; Matemilola et al., 2015; Van Leuvensteijn et al., 2013), can be stated as:

$$LIR = f(SRD, INFL, EXR, M2, PD, D\_COVID19, D\_FR\_MR, D\_IMF) \quad (1)$$

From equation (2), the empirical panel form of the model can be stated as:

$$LIR_{it} = \beta_0 + \beta_1 SRD_{it} + \beta_2 INFL_{it} + \beta_3 EXR_{it} + \beta_4 M2_{it} + \beta_5 PD_{it} + \gamma_1 D\_COVID19_{it} + \gamma_2 D\_FR\_MR_{it} + \gamma_3 D\_IMF_{it} + v_{it} \quad (2)$$

Where LIR_{it} is the lending interest rate, SRD_{it} represents the shadow rate, $INFL_{it}$ is the inflation rate, EXR_{it} is the exchange rate, $M2_{it}$ is the broad money, PD_{it} is the public debt. To represent

exogeneous shocks, $D\_COVID19_{it}$ is the dummy for Covid-19 pandemic, $D\_FR\_MR_{it}$ represents the pegged foreign exchange regime and D_IMF_{it} any funding from the IMF. β_0 is the constant term, i represents specified countries, v_{it} represents the residual term for each country, β_1 to β_8 represent vector of coefficients, and t represents time period. The apriori expected signs of the variables are:

$\beta_1>0$; $\beta_2>0$; $\beta_3<0$; $\beta_4<0$; $\beta_5>0$.

However, for robustness test, we will also test a reduced model (2b) without the foreign exchange rate and shadow rate to understand better the domestic variables' impact on the lending conditions.

$$LIR_{it} = \beta_0 + \beta_2 INFL_{it} + \beta_4 M2_{it} + \beta_5 PD_{it} + \gamma_1 D\_COVID19_{it} + \gamma_2 D\_FR\_MR_{it} + \gamma_3 D\_IMF_{it} + v_{it} \quad (2b)$$

3. Data and methodology

3.1 Data source

The study employed a panel vector autoregressive (VAR) model to examine the effect of monetary policy shocks on lending interest rates in the context of SSA. There are currently 48 countries in the sub-region and due to unavailability for some countries, only 23 of them were considered. These countries include Angola, Botswana, Burundi, Comoros, Ethiopia, Gambia, The, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Nigeria, Namibia, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Tanzania, Uganda, and Zambia. All the data used were extracted from secondary sources. Data on the variables understudy; lending interest rate (LIR), shadow rate (SDR) (proxy for monetary policy), inflation rate (INFL), exchange rate (EXR), non-performing loan ratio (NPLR), banks' reserves requirements (BRR), broad money (M2), and public debt (PD) were extracted from the World Bank World Development Indicators (WDI), Global Financial Development Indicators, Sustainable Development Goals Indicators and databases of the central banks of the countries using the criterion-based sampling technique from 2013 to 2022. The study also considered a dummy variable (COVID-19) to capture external shocks to lending interest rate. Specifically, a panel quarterly data covering a period of ten (10) years spanning from 2013Q1 to 2022Q4 were built. These variables were selected based on the body of literature (Orellana, 2023; Boukhatem & Djelassi, 2022; Iddrisu & Alagidede, 2020; Abuka et al., 2019; Ousseini et al., 2017; Asoamoah & Adu, 2016; Matemilola et al., 2015; Van Leuvensteijn et al., 2013). The measurements of the variables are presented in Table A1.

3.2 Panel Var model

The study estimates a panel vector autoregressive model (3) developed by Canova and Ciccarelli (2013). Thus, following Canova and Ciccarelli (2013), the panel vector autoregressive model can be specified as:

$$Y_{it} = A_{0i}(t) + A_i(\ell)Y_{it-1} + Z_i(\ell)W_t + \varepsilon_{it} \quad (3)$$

Where $A_i(\ell)$ is a polynomial in the lag operator, where restrictions are imposed on the coefficient matrices A_i to make the variance of the Y_{it} bounded. The predetermined or exogenous M variables are represented by the W_t vector, common to all i units. The existence of the $A(\ell)^{-1}$ is secured by that there are no roots of $A(\ell^{-\omega})^{-1}$ on or inside the unit circle. Then the standardised condition for stability is tested to see if modulus values are smaller than the one which implies the invertible interpretations and the interpretations of infinite order-vector moving averages (Lütkepohl, 2005). The above model is adopted since it helps to estimate spillovers from idiosyncratic interdependences existing across countries to identify shocks among endogenous variables (Jouida, 2018). Also, in this model, all the variables can be considered as endogenous and interdependent, both in a dynamic and a static sense, with a set of predetermined or exogenous variables, but with a cross sectional dimension as well. For instance, if Y_t is the vector of G endogenous variables in time $t(t = 1,...,T)$, its stacked version for the $ith(i = 1,...,N)$ generic unit (country) is Y_{it}. Here, the optimal lag-length of the model will be selected by the minimum of Bayesian information criteria (BIC), Akaike information criteria (AIC) or Hannan-Quinn information criteria (HQ).

To examine the long-run effects of shocks among the variables, the structural form of equation with Blanchard-Quah's (1989) long-term restriction (4) can be developed as indicated in equation (5).

$$Y_{it} = \sum A_p^s Y_{it-p} + F_i W_t + B\mu_{it}, \text{ where } \varepsilon_{it} = A^{-1}B\mu_{it} \text{ and } S = A^{-1}B \quad (4)$$

Here, F_i represents the matrix (NxN) autoregression coefficients and the $\varepsilon_t = (\mu_{1t,...,}\mu_{kt})$ represents the unobserved error term vector with (Nx1) Gaussian distribution, where $\varepsilon_t \sim (0, E(\mu_t, \mu'_t))$ is a positive definite covariance matrix.

The F-matrix of the variables where the shock is indicated in equation (5). From equation (5), the cumulative long-term impact of the shock is zero, and ψ shows the long-term multiplier (with F = ψS).

$$F = \begin{bmatrix} SDR \\ EXR \\ INFL \\ PD \\ M2 \\ LIR \end{bmatrix} = \begin{bmatrix} f11 & 0 & 0 & 0 & 0 & 0 \\ f21 & f22 & 0 & 0 & 0 & 0 \\ f31 & f32 & f33 & 0 & 0 & 0 \\ f41 & f42 & f43 & f44 & 0 & 0 \\ f51 & f52 & f53 & f54 & f55 & 0 \\ f61 & f62 & f63 & f64 & f65 & f66 \end{bmatrix}, \text{ While } S =$$

$$\begin{bmatrix} f11 & f12 & f13 & f14 & f15 & f16 \\ f21 & f22 & f23 & f24 & f25 & f26 \\ f31 & f32 & f33 & f34 & f35 & f36 \\ f41 & f42 & f43 & f44 & f45 & f46 \\ f51 & f52 & f53 & f54 & f55 & f56 \\ f61 & f62 & f63 & f64 & f65 & f66 \end{bmatrix} \begin{bmatrix} \in_{1t} \\ \in_{2t} \\ \in_{3t} \\ \in_{4t} \\ \in_{5t} \\ \in_{6t} \end{bmatrix} \quad (5)$$

Thus, equation (5) above describes long-term effects, assuming that there will be a shock that will affect each variable, while the last item of the sequence will be the one that affects itself only.

It can be indicated that, the panel VAR is not without limitations. One limitation of panel VAR is the assumption of time-invariant coefficients. Thus, the panel VAR assumes that the relationships between variables remain constant over time for all cross-sectional units. However, in practice, these relationships may vary over time due to changes in economic conditions, policy interventions, or other factors. Another limitation is the requirement of a large number of observations. Despite these, the model is suitable for this current study.

4. Results and discussion

4.1 Descriptive statistics

The study first examined the basic statistical properties of the variables understudy and the results are presented in Table 1. The results in Table 1 show that all the variables have their means not close to zero with the exception of shadow rate whose value is negative. The standard deviation shows some quite variability of the variables from their means. In terms of skewness, majority of the variables have their values greater than zero with the exception of shadow rate whose value is negative. The results indicate that there are extreme values both to the left and to the right of the distribution of the data. The results of the kurtosis indicate that there some extreme values since the p-values for some variables are greater than 3. With the Jargue-Bera test (normal distribution test), all the variables passed the test. In the case of Ljung-Box test (autocorrelation test), all the variables have their values being less than 0.05, indicating the presence of autocorrelation. However, this was corrected using the lag values of the variables. Regarding the ARCH-LM test (heteroskedasticity test), only lending interest rate, exchange rate

and broad money passed the test, the rest did not. Finally, for unit root tests, using the Im, Pesaran, and Shin (IPS) (2003) and Levin, Lin, and Chu (LLC) (2002), indicated that all the variables became stationary after their first difference.

Table 1. Descriptive statistics

	LIR	SDR	INFL	EXR	M2	PD
Mean	4.2853	-118809.5	1.7166	1.2421	10.6175	5.5873
Std. Dev.	2.8117	1357433.	1.4371	0.5732	6.7317	6.1447
Skewness	2.0105	-12.1210	1.5553	0.1772	1.7990	1.6485
Kurtosis	7.3951	163.2045	5.8908	1.7903	6.8658	4.7854
Jarque-Bera test	1301.123	962615.5	661.1647	58.2595	1022.617	515.4840
Ljung-Box test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ARCH-LM test	0.1996	0.0000	0.0485	0.3930	0.0590	0.0042
LLC and IPS tests	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000
Obs.	880	880	880	880	880	880

Source: Authors' Own Computation

4.2 FX rate dominance

This section presents the results of the impulse response functions and forecast error variance decomposition based on equation (2) as seen in Figure 3 and Table 3. Thus, Figure 3 shows how lending interest rates respond to sudden shocks in the economies from the independent variables under consideration.

Moreover, it can be shown that, lending interest rate has a positive effect from its own shock from the 1st quarter to the 2nd quarter since the mean is within the standard errors' critical bounds. In addition, lending interest rate has a negative effect from its own shock from 2nd to the 5th quarters. These positive and negative shocks continue in the long-run but at decreasing levels. Further, exchange rate is the only variable whose shocks have more profound effect on the lending interest rate. For instance, a shock to exchange rate leads to a positive effect on

lending interest rate from the 1st to 2nd quarters. Additionally, a shock to exchange rate leads to negative shocks to the lending interest rate from the 2nd to 4th quarters. There were positive shocks to lending interest rate from the 4th to 7th quarters from exchange rate as well.

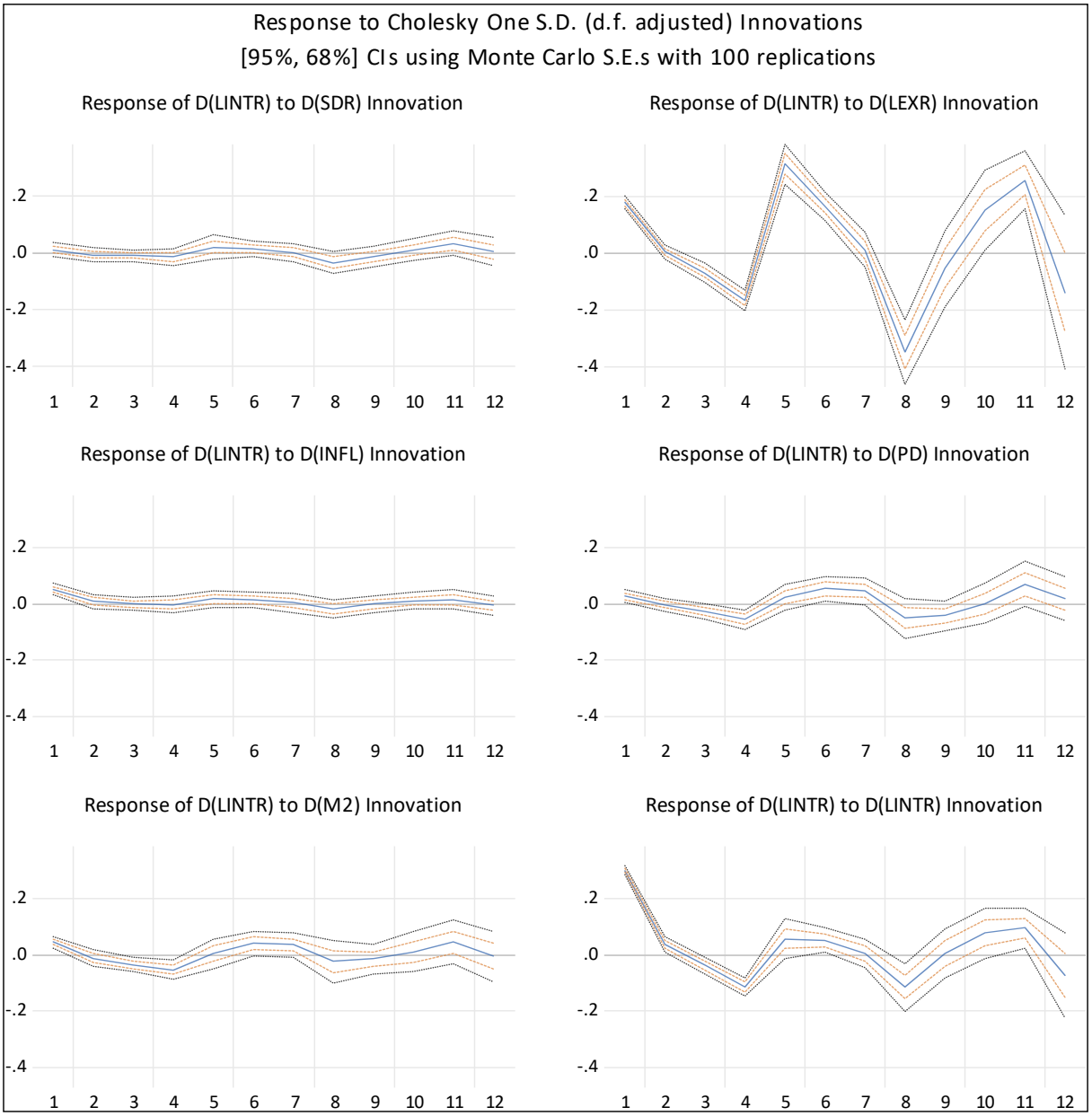

Figure 3: Impulse response functions among the variables

Source: Authors' Computation

Also, there were negative and positive shocks to lending interest rate from exchange rate up to the 12th quarter. The results confirm the findings by Eke et al. (2015) who indicated that bank loans and advances are significantly impacted by monetary policy rate and the exchange rate. Further, a sudden shock to public debt leads to an increase (positive shock) in lending interest rate from the 1st to the 2nd quarters. Lending interest rate also responds to negative shocks from public debt between the 3rd and 5th quarters. Further, there were some positive shocks from public debt between the 5th and 7th quarters as well as negative shocks between the 7th and 9th quarters to the lending interest rate.

Thus, a positive shock also occurs in the 11th quarter in the long-run. Finally, a sudden shock to broad money supply leads to a positive shock to lending interest rate in the short-run (between the 1st and 2nd quarters). Between the 2nd and 5th quarters witnesses a negative shock to lending interest rate and a positive shock between the 6th and 7th quarters from M2. There is a long-run positive shock to lending interest rate from M2 during the 11th quarter. This indicates that a shock from monetary policy affects lending interest rate in the long-run. The results confirm the findings by Orellana (2023), and Boukhatem and Djelassi (2022).

Furthermore, Table 2 presents the results of how innovations in lending interest rate are explained by the innovations in the independent variables under study. Here, the variance decomposition is done for twelve periods. It can be emphasised that the results in Table 3 confirm the results in Figure 3 except that shadow rate happens to be insignificant in explaining the innovations in lending interest rate throughout the periods. From Table 2, it can be shown that exchange rate has been the fundamental variable in explaining the innovations in the ending interest rate throughout the periods. However, the results indicate that greater percentage of innovations in the lending interest rate is explained by itself from the 1st period up to the 4th period.

For instance, it can be seen that in the early periods, 70% to 57% of the innovations in the lending interest rate are explained accordingly by the preponderance of its own past values but the contributions to its own decrease with time. As can be seen in Table 3, by period twelve, contribution has dropped from a high of 70% down to around 23.7%.

Table 2. Forecast error variance decomposition

Period	S.E.	D(SDR)	D(LEXR)	D(INFL)	D(PD)	D(M2)	D(LINTR)
1	0.35	0.11	25.11	1.96	0.51	1.49	70.82
2	0.36	0.14	24.83	1.98	0.52	1.61	70.92
3	0.37	0.19	26.86	1.85	1.07	2.51	67.51
4	0.43	0.26	35.05	1.38	2.63	3.49	57.18
5	0.53	0.31	56.91	0.97	1.83	2.24	37.75
6	0.57	0.35	59.32	0.92	2.46	2.47	34.48
7	0.57	0.35	58.77	0.91	3.02	2.80	34.14
8	0.68	0.49	67.31	0.72	2.69	2.10	26.69
9	0.68	0.52	67.16	0.72	3.08	2.14	26.38
10	0.71	0.51	67.86	0.69	2.90	2.03	26.01
11	0.76	0.63	69.59	0.62	3.30	2.06	23.79
12	0.78	0.61	69.86	0.61	3.21	1.98	23.72

Source: Authors' Computation

Furthermore, it is interesting to show that the innovations in the lending interest rate are greatly explained by exchange rate from the 5th quarter up to the 12th quarter, thus from 56.9% to 69.8%. The result still confirms the findings by Eke et al. (2015). In addition, apart from exchange rate, inflation also explained innovations in lending interest rate from the 1st period to the 2nd (i.e., from 1.96% to 1.98%), then decreases to zero with time.

Broad money supply (M2) explained the innovations in lending interest rate from the 3rd period to the 6th period, from 2.5% to 2.47%, then the innovations fluctuate in the long-run. The results still confirm the findings by Orellana (2023), and Boukhatem and Djelassi (2022). Additionally, public debt later takes over in explaining the innovations in the lending interest rate from the 7th period to the 12th period, from 3% to 3.21% even though it fluctuates in the long-run. It can be emphasised that the greater percentage of the innovations in the lending interest rate is explained first by exchange rate followed by broad money supply, followed by public debt, and then by inflation.

4.2 No external shocks

This section also presents the results concerning the relationship between lending interest rate and other independent variables without external shocks (i.e., without the exchange rate variable) as depicted in equation (2b). The reason for this is to determine how lending interest rate responds to shocks from within and this is due to the dominant nature of exchange

rate in the previous model. Thus, it can be shown in Figure 4 that greater percentage of shocks to the lending interest rate was due to its own shocks and the rest by the other independent variables, and the shocks drop with time. For instance, it has a positive effect from its own shock from the 1st quarter to the 2nd quarter as also seen in Figure 3. However, unlike in Figure 3, the shock to its own is greater than the one in model (2). Additionally, lending interest rate has a negative effect from its shock from 2nd to the 5th quarters. These positive and negative shocks continue and vanish in the long-run. Further, a shock to inflation impacts more to the lending interest rate from the 1st to the 3rd quarters than do the public debt and M2 variables. For example, a shock to inflation impacts positively to the lending rate in the first three periods.

Moreover, a shock to inflation leads to both negative and positive shocks to the lending interest rate throughout the periods. This is expected in the case of SSA since a shock to inflation has a profound impact on the financial market and the banking industry. This outcome confirms the findings by Boukhatem and Djelassi (2022) and Yunusa et al. (2020). Furthermore, shocks to public debt have profound impacts on the lending interest rate from the 4th period and beyond compared to inflation and M2. Thus, shocks to public debt negatively and positively impact more to lending interest rate throughout the periods. In the context of SSA, many governments are still battling with huge debts which have had enormous effects on these economies.

In addition, shocks from M2 have been profound throughout the periods apart from public debt. For instance, a shock to M2 leads to a positive shock to the lending interest rate between the 1st and 2nd periods, between the 5th and 8th periods as well as between the 11th and 12th periods. Further, between 2nd and 5th periods, and the between the 8th and 10th periods, a shock to M2 leads to negative shocks to the lending interest rate. This implies that lending interest rate responds more to shocks from monetary policy. The results confirm the findings by Orellana (2023) in Peru, Michail and Koursaros (2022), and Abuka et al. (2019). It can be indicated that public debt and M2 impact more to the lending interest rate in the case of SSA.

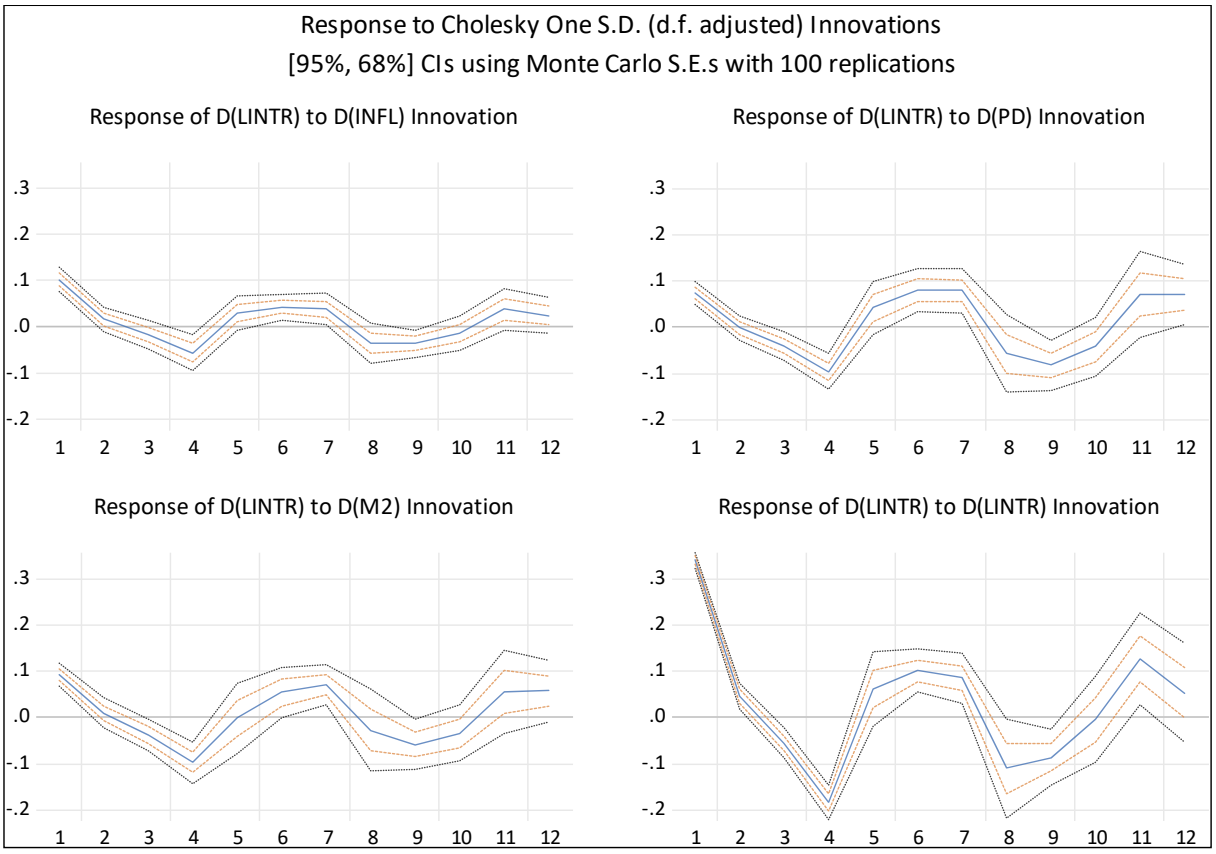

Figure 4: Impulse response functions among lending interest rate, inflation, public debt, and M2.

Source: Authors' Computation

Moreover, Table 3 presents the results of the forecast error variance decomposition regarding the relationship between lending interest rate, inflation, public debt, and broad money (M2). The results reveal that greater percentage of the innovations in the lending interest rate is explained by itself throughout the periods. Thus, at the initial period, about 83% of its innovations is explained by itself. This implies that past values of lending interest rate explain greater portions of its innovations. However, it did not explain its innovations wholly (100%) in the initial periods. Here too, as seen in the impulse response functions, inflation explained greater portions of innovations in the lending interest rate from the 1st to the 3rd periods (from 7.5% to 7.3%), though it decreases in the subsequent periods, then money supply took over from the 4th to 5th periods (from 9.6% to 9.4%). The results imply that lending interest rate is more sensitive to shocks to inflation in the case of SSA. This is supported by the findings of Boukhatem and Djelassi (2022) and Yunusa et al. (2020).

Furthermore, from the 6th up to the 12th periods, innovations in the lending interest rate were greatly explained by public debt (from 10.6% to 16. 1%). This implies that in the absence of external shocks, shocks to public debt have greater impact on the lending activities of banks in SSA. Additionally, M2 is the next variable that contributed to explaining the innovations in the lending interest rate, throughout the periods followed by inflation. The results imply that shocks from monetary supply impact more to the lending interest rate in the context of SSA. The results still confirm the findings by Michail and Koursaros (2022), and Abuka et al. (2019). It can be emphasised that public debt has a profound impact on the banking lending activities in the context of SSA.

Table 3. Forecast error variance decomposition

Period	S.E.	D(INFL)	D(PD)	D(M2)	D(LINTR)
1	0.37	7.45	3.86	6.04	82.66
2	0.38	7.50	3.80	5.98	82.72
3	0.38	7.34	4.87	6.76	81.04
4	0.45	6.89	8.19	9.64	75.28
5	0.46	7.10	8.75	9.36	74.78
6	0.48	7.23	10.65	9.72	72.41
7	0.50	7.24	12.20	10.95	69.61
8	0.52	7.23	12.67	10.53	69.57
9	0.54	7.22	14.26	11.04	67.48
10	0.54	7.21	14.74	11.35	66.69
11	0.56	7.08	15.13	11.38	66.41
12	0.57	7.03	16.08	11.93	64.97

Source: Authors' Computation

5. Conclusion and policy recommendations

It is worth emphasising that the ability of commercial banks to offer credit to economic agents to undertake economic activities is strongly affected by the macroeconomic environment within which they operate. The recent global financial and economic crises have contributed to the distortions in the financial markets as well as the banking industry in developing countries, especially the SSA sub-region. Due to the limited nature of fiscal policy measures to address the situation monetary policy has been an alternative tool for monetary authorities in these economies. For this reason, the conduct of monetary policy has implications for financial institutions' actors in SSA. This study thus examines the effect of monetary policy on lending interest rate in the context of SSA by employing the panel VAR methodology based on quarterly panel dataset for the period 2013 to 2022 with 23 countries.

To be able to determine how lending interest rate responds to monetary policy shocks as well as the influence of other independent variables, apart from the general model stated, specifically, two different models were further set up. That is, the first model included the external shock variables while the second model did not (i.e., (2), (2b)) respectively. The reason is to determine how these different variables impact to lending interest rate in SSA for policy purposes. The study results from the impulse response functions in model (2) revealed that at

the initial periods, shocks to the lending interest rate are greatly orchestrated by its own shocks and the rest by the independent variables considered in the model.

Moreover, for individual independent variables' shocks, the study revealed that shocks to the lending interest rate are due to a shock to exchange rate followed by broad money supply, followed by public debt, and then by inflation. A shock to shadow rate impacts small to the lending interest rate. In addition, the results from the forecast error variance decomposition also affirm the results from the impulse response functions. Specifically, the results revealed that greater percentage of the innovations in the lending interest rate is explained by exchange rate followed by broad money supply, public debt, and then by inflation.

In the case of model (2b) where no external shocks were not considered, the results from the impulse response functions revealed that greater percentage of shocks to the lending interest rate was due to its own shocks and the rest by the other independent variables, and the shocks drop with time. However, the shock to its own is greater than the one in model (2). Furthermore, the study revealed that apart from its own, greater percentage of its shock is due to a shock to public debt followed by M2, and then inflation. Regarding the results of the forecast error variance decomposition, the study revealed that innovations in the lending interest rate are explained greatly by public debt followed by M2 and then inflation. This study has some practical implications. First, the study has shed more insights into how the conduct of monetary policy as well as other macroeconomic indicators can influence the operations of the money markets and banking industry in SSA thereby informing monetary policy authorities and policy makers. Second, Governments and central banks in SSA countries could benefit by properly conducting monetary policy to avoid distortions in the financial and money markets.

Third, excessive domestic and external borrowing, high inflation adjustments, and exchange rate fluctuations have consequences on the lending interest rate in SSA economies. It is recommended that, governments and monetary authorities in SSA pursue credible monetary policy to ensure a sound macroeconomic environment in order to boost the activities of the financial sector in the sub-region. The study has some limitations. The main limitation has to do with the unavailability of data for some countries which led to the analysis of only 23 countries. This kind of study is limited in the case of SSA, since to the best of the authors' knowledge specific study in this area is limited. However, these did not affect quality and generalisability of the results. It can be indicated that this paper examined the effect of monetary policy on the lending interest rate in the case of SSA, hence, future studies could consider examining these variables and others using country-specific time series data for the purpose of country-specific policy development.

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6. Appendix 1

Table A1. Description of variables and source of data

Variable	Explanation	Data source
Exchange rate	This is measured as using the bilateral rate against the US Dollar.	World Development Indicators and Central Banks' Databases 2013-2022
Inflation	Measured as using the consumer price index.	World Development Indicators 2013-2022
Shadow rate	This is the monetary policy instrument used by central banks. This is measured using the central banks' shadow rate (Wu and Xia, 2016).	World Development Indicators and Central Banks' Databases 2013-2022
Public Debt	This is measured as the public debt as a percentage of GDP.	World Development Indicators 2013 to 2022
M2	This is measured as broad money as a percentage of GDP.	World Development Indicators 2013 to 2022
Lending interest rate	This is the bank rate charged by financial institutions that meets the financial needs of the private sector.	World Development Indicators and Central Banks' Databases 2013-2022

Source: Authors' construction

7. Appendix 2 – FX rate model

Roots of Characteristic Polynomial

Root	Modulus
0.244752 + 0.963249i	0.9939
0.244752 - 0.963249i	0.9939
-0.694856 + 0.706772i	0.9911
-0.694856 - 0.706772i	0.9911
-0.9370	0.9370
0.596266 + 0.708661i	0.9261
0.596266 - 0.708661i	0.9261
0.772694 + 0.494727i	0.9175
0.772694 - 0.494727i	0.9175
0.551232 + 0.624770i	0.8332
0.551232 - 0.624770i	0.8332
0.388886 - 0.618703i	0.7308
0.388886 + 0.618703i	0.7308
0.610429 + 0.399289i	0.7294
0.610429 - 0.399289i	0.7294
-0.6648	0.6648
-0.477758 - 0.442568i	0.6512
-0.477758 + 0.442568i	0.6512
-0.470990 - 0.380792i	0.6057
-0.470990 + 0.380792i	0.6057
0.5785	0.5785
-0.406381 - 0.374166i	0.5524
-0.406381 + 0.374166i	0.5524
0.2518	0.2518

No root lies outside the unit circle.

VAR satisfies the stability condition.

VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-13332	NA	46885542	34.69	34.84	34.75
1	-12973	708	20284915	33.85	34.21	33.99
2	-12952	42	21060095	33.89	34.47	34.11
3	-12760	373	14044667	33.48	34.28	33.79
4	-12466	566.8235*	7184567.*	32.81*	33.83*	33.20*

8. Appendix 3 – No external shocks

Roots of Characteristic Polynomial

Root	Modulus
0.347684 - 0.884795i	0.9507
0.347684 + 0.884795i	0.9507
-0.8663	0.8663
0.523775 - 0.660183i	0.8427
0.523775 + 0.660183i	0.8427
0.615448 - 0.409677i	0.7393
0.615448 + 0.409677i	0.7393
0.375426 - 0.603787i	0.7110
0.375426 + 0.603787i	0.7110
-0.6536	0.6536
-0.485656 - 0.332516i	0.5886
-0.485656 + 0.332516i	0.5886
-0.397324 - 0.417525i	0.5764
-0.397324 + 0.417525i	0.5764
0.3360	0.3360
0.3012	0.3012

No root lies outside the unit circle.

VAR satisfies the stability condition.

VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2771	NA	0.02	7.24	7.34	7.28
1	-2585	369	0.01	6.80	6.99	6.87
2	-2571	27	0.01	6.80	7.09	6.91
3	-2418	300	0.01	6.45	6.832613*	6.60
4	-2384	66.63*	0.01*	6.40*	6.88	6.58*