United Sates of America's Monetary Policy Transmission to African Countries: Evidence from Ghana and Nigeria

Abstract

This paper argues that the expansionary U.S. monetary policy drive following the post Covid-19 economic crises generated spillover effect on Ghanaian and Nigerian economies resulting in macroeconomic turbulence. The hypothesis is tested using OLS estimation in a BVAR model prior to which the time series properties of the data were investigated. The results show that overall, Fed's unconventional monetary policy shocks positively impacts domestic monetary policy rates, interest rate spread and GDP growth rate but negatively impacts inflation in both countries. This suggests that emerging economies respond to shocks from the advanced world. We recommend that emerging countries authorities should make effort to moderate negative monetary spillovers, while harnessing benefits of positive spillovers from advanced countries.

Key words: Spillover, transmission, monetary, conventional, and unconventional

1. INTRODUCTION

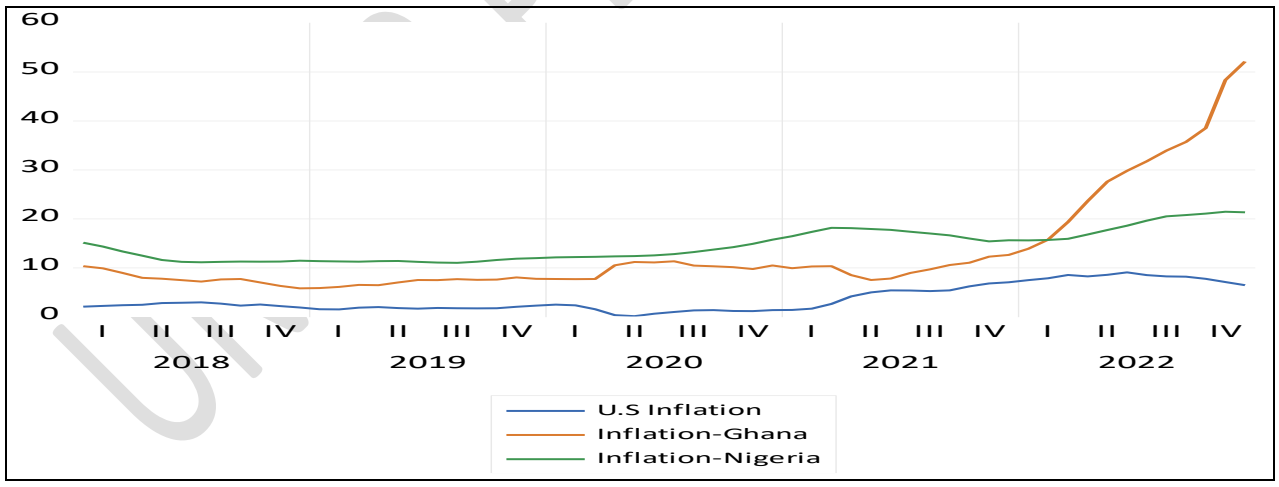
Advanced countries have resorted to unconventional monetary policy (UMP) measures, in times of economic crises such as the global financial crises (GFC), the Eurobond debt crises and the post COVID-19 economic crises (Pinter, 2022; Ocampo & Ojeda-Joya, 2023). These UMP instruments: forward guidance (FG)-communication about the future evolution of interest rates and quantitative easing (QE) - large scale asset purchases (LSAPs) are employed by central banks alongside the conventional short-term interest rate to stabilize their economies (Curan & Adnan, 2020). Following the post COVID-19 global economic crises, the European Central Bank (ECB) announced a 750 billion euros programme of asset purchase in March 2020, which was later scaled up to 1850 billion euros (about 10% of GDP of the euro area in 2019) (Ahmed et al., 2021; Pinter et al., 2022). The Federal Reserve (Fed) also almost doubled the size of its balance sheet around the same time, and similar actions took place in other jurisdictions (Hofman & Kamber, 2020; Cortes et al., 2022).

Consistent with' the prediction that Federal Reserve's monetary actions has consequence for the global economy, these actions brought about significant increase in global monetary aggregates and inflation (see Dées & Galesi, 2021). Consequently, U.S. inflation short up from 1.11% in 2020Q2 to 6.63% in 2022Q2 before it began to fall (see Figure 1). The rate of inflation

plummeted in 2021 when Federal Reserve announced taper (signaling a slow down or an end to the LSAP) in September that year. Fed then responded by raising the effective Federal Funds rate from 0.08% in February 2022 to 3.64% in November 2022 (see Figure 2), which appreciated the U.S. dollar, and thus triggered macroeconomic economic turbulence in emerging and developing economies (EDEs). Conversely, the rising inflation that accompanied the U.S. dollar depreciation following the global financial easing after the COVID-19 pandemic, forced central banks around the world to tighten monetary policy. This is further evidence of the global consequence of Fed's actions.

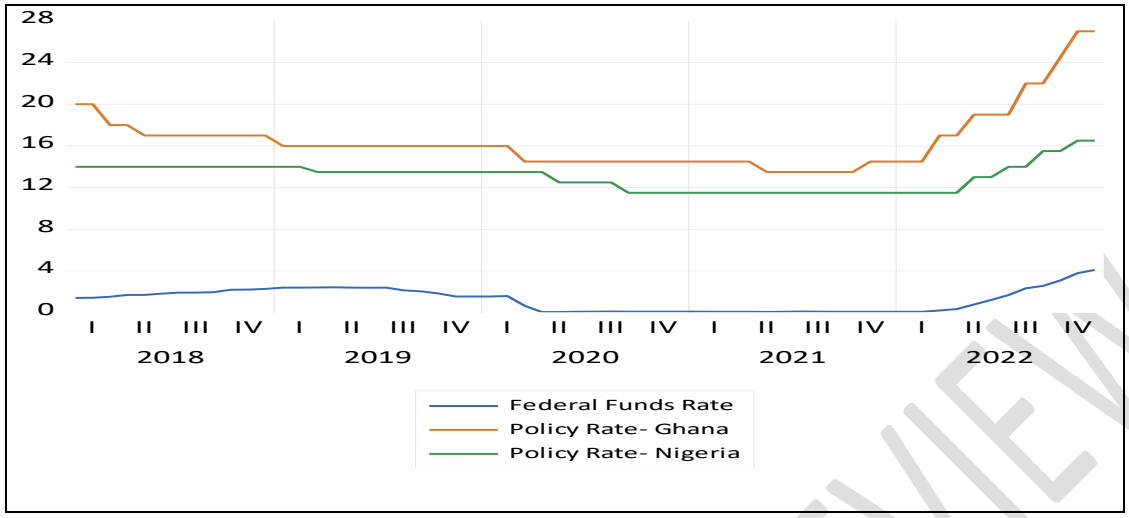
Ghana and Nigeria did not implement unconventional monetary policies, yet, they also experienced rising inflation around the same time, with their core inflation rates moving from 11.10% and 12.56% in 2020Q2 to 29.82% and 18.60% in 2022Q2 (see Figure 1) respectively. Although some authorities attributed this trend to the global commodity price shocks due to the Russian-Ukraine war and the developments thereafter, this paper contends that the trend predated the Russia-Ukraine crises and could have more to do with the Fed and global easing. More importantly, similar to the inflationary trends in U.S. on one hand, and Ghana and Nigeria on the other hand, the peripheral countries' central banks tightened their policy rates from 13.5% and 11.5% in October 2021 to 27% and 16.5% in December 2022 respectively ostensibly in response to the rising inflation. Apparently, these three countries run inflation targeting monetary policy and respond to inflation threats with monetary actions, as evidenced in Tule et al (2019), Ekeocha and Edeaja (2020) and Tumala et al (2021) in the case of Ghana and Nigeria, and in Coachrane (2022), Coibion, et al (2023) and others in the case of U.S.

Figure 1: Inflation trends in U.S., Ghana, and Nigeria



Source: Author's construct

Figure 2: Policy rate trends in U.S., Ghana, and Nigeria



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The monetary policy tightening in Ghana and Nigeria following the tightening in U.S. contrasts the New Keynesian model's (NKM) recommendation that peripheral economies should loosen their monetary policy in response to center countries (in this case U.S.) policy tightening (Ahmed et al., 2021; Chan, 2021). The intuition is that Federal Reserve's monetary tightening strengthens the U.S. dollar against local currencies, making imports from U.S. expensive, thus increasing domestic inflation, and hence, the need for domestic monetary policy loosening to foil the potential output decline (see Curan & Adnan, 2020; Chan, 2021). Nevertheless, loosening domestic monetary policy and allowing domestic currency depreciation in response to foreign policy shocks has the consequence of worsening the already high inflation and trigger other macroeconomic volatilities in the domestic economy, thus justifying the policy tightening response of the central banks in Ghana and Nigeria.

Additionally, Figure 2 reveals that the policy rates in Ghana, Nigeria and U.S. largely move together especially after the Covid-19 pandemic, suggesting there could be some common factors driving these comovement, or that there exists a commonality in their monetary policy frameworks, which is worth investigating. It is therefore not surprising that, rising inflation in these countries forces their Central Banks to tighten monetary policy stance, hence the seeming relationships between monetary policy variables in these countries. However, this apparent nexus between the two magnitudes in the three jurisdictions has not been empirically explored to the best of the researchers' knowledge. Wan (2021) found that U.S. monetary policy showed strong and significant spillover effects on China's short-term interest rates after the GFC. While Olamide et al (2022) found domestic monetary policy as transmission channel for external shocks to East African Countries, Timmer (2018) found the policy as the most effective channel for U.S. monetary shocks transmission to emerging and developing economies.

These studies nevertheless did not consider the transmission effect of the peripheral countries' central banks' policy rates, the interest rate spread and the influence of domestic inflation which is an important variable in the transmission process because of its relationship with the policy rate due to the inflation targeting monetary policy regimes in those countries. The current study fills the void by examining the domestic monetary policy rate and interest rate spread channels of the international transmission of U.S. monetary policy spill overs, considering the influence of inflation on the transmission process. The rest of the paper is organized as follows: section two reviews relevant literature, section three presents estimation strategy, section four presents' results and section five concludes and recommends.

1.2 Literature

A brief outline of monetary policy conduct in the United State of America (U.S.), Ghana and Nigeria, followed by a look at the relevant theories and empirical works relating to the study is presented here.

1.2.1 Monetary policy determination

Central banks around the world conduct monetary policy using a variety of monetary policy instruments including the policy rate, treasury trading (Open Market Operation), reserve requirements, moral suasion (central banks appeal to commercial banks to reduce or increase credit supply) and direct money supply as the conventional tools. The monetary policy rate in most African countries especially those with inflation targeting policy regimes such as Ghana, Nigeria etc. is determined by the monetary policy committees (MPC) of the central bank usually on quarterly bases upon reviewing the health of the economy for the preceding quarter (Tule et al., 2019; Tumala et al., 2021). The manipulation of the policy rate in inflation targeting economies controls interest rates and money supply and thus rakes up excess liquidity or otherwise in order to put inflation in a desired direction.

In the U.S., the Federal Reserve (Fed) determines the policy rate (Federal Funds rate) through the operations of the Federal Open Market Committee (FOMC) (Ocampo & Ojeda-Joya, 2023) and engages in periodic treasury purchases. The U.S. has also triggered two main unconventional monetary policy instruments forward guidance (FG) and Quantitative easing during economic downturns. While the former involves Fed's communication about its future cause of monetary policy actions in order to make the policy effective as implied by the new Keynesian theory, the latter involves Fed's buying of large amount of financial assets from private firms and crediting their accounts, "while their bank hold a corresponding claim against the Fed, thus increasing money supply in the economy (Inou & Rossi, 2019; Batharai & Neely, 2022). The quantitative easing policy mainly works through lowering the long-term interest rate directly, while the forward guidance works indirectly by shaping public expectations to a desired future policy path (Bhattarai et al., 2020; Curan & Adnan, 2020).

It is through these policy rates, treasury purchases (Open Market Operations (OMO)), domestic currency management (manipulations) relative to foreign currencies (those of major trading partners), reserve requirements, large asset purchase programs (quantitative actions) and central bank communications (forward guidance) that monetary authorities transfer their policy goals or actions to the domestic market and possibly respond to external monetary shocks. A review of literature in examining whether African monetary authorities react to Fed's monetary actions through their policy rates, output and interest rate spread is presented in the section following.

1.2.2 Empirical framework

Several studies have examined the international transmission of U.S. monetary policy spillover (see Miranda-Agrippino & Rey, 2020; Stann & Grigoriadis, 2020; Ekeocha & Udeaja, 2020; Tumala et al., 2021). Tian et al (2022) examined the spillover impact of U.S. monetary policy on China's economy using a time-varying parameter Bayesian vector-auto regressive (TVP-VAR) model, and found that U.S. nominal interest rate negatively affects China's capital inflow, which has negative spillover impact on its real output. Ho et al (2018) and Huang et al (2021) found significant spillovers effects of U.S. monetary policy on China's housing investment; explaining that while contractionary policy shocks have significant negative effect on Chinese housing prices, increased hot money inflows causes a significant but transitory rise in housing prices, and that the U.S. quantitative easing caused the surge in China's capital inflows.

Examining the global dimension of Fed's policy transmission, Bhattarai et al (2020) in a Bayesian VAR panel framework, found that Fed's QE shock causes exchange rate appreciation, reduction in long-term bond yields, stock market boom, and increase in capital flows in EEs, with the effects being stronger for Fragile economies, but found no consistent and significant effects of the shock on output and consumer prices. Further, Miranda-Agrippino and Rey (2020) established strong spillover effect of Fed's monetary actions on the global economy, adding that U.S. monetary contractions lead to significant deleveraging of global financial intermediaries, decline in domestic and international credit flows, tightening foreign financial conditions, and that floating exchange rates do not insulate economies from spillovers. Similarly, Wei and Han (2021)'s finding that COVID-19 pandemic significantly weakened international transmission of monetary policy in 37 countries lends credence to the empirics that global factors alter the ability of central banks to moderate the trade-off between optimizing inflation level and other macroeconomic factors such as unemployment and financial stability.

In Africa, Tumala et al (2020) traced the transmission of monetary policy shocks from U.S., Europe, and China to Nigeria and South Africa, from 1979 to 2019 in a GVAR model. They found that monetary tightening in the U.S. and E.U moderate inflation in Nigeria but worsen it in South Africa, whilst exerting positive impact on the Naira and the Rand, and that monetary decisions in China and U.S. have greater influence on monetary policy in Nigeria and South Africa relative to similar decisions in the E.U. Ekeocha and Udeaja (2020) examined the spillover effects of U.S. monetary policy on Nigeria from 1985 to 2018, and found the U.S. spillovers significantly impacting interest rate, exchange rate and inflation rate in Nigeria. They

observed that while the CMP may be a significant accelerator of shocks persistence on interest rates and exchange rates, the extent to which the UMP accelerates shocks in inflation rate tends to vary for different measures of quantitative easing.

On the transmission channels, the U.S. monetary policy spillovers can be transmitted through the international bank lending channel, and international investment portfolio channel (Auer et al., 2019; Aderajo & Olaniran, 2021). A change in U.S. monetary conditions impacts the cost of credit and foreign credit disbursement of international banks to emerging economies (EEs); thus transmitting the U.S. shock to the emerging economies (see Tule et al., 2019; Morales et al., 2022). Similarly, a change in U.S. monetary policy changes the value of the U.S. dollar which affects the net worth of domestic borrowers, thus causing international banks to drift away from risky domestic lending or towards safer foreign lending (Auer et al., 2019; Morales et al., 2022). Other transmission channels include interest rate, domestic credit, exchange rate, stock market, the U.S. dollar and oil price channels. Kalu et al (2020) traced the stock market channel showing that the U.S. 10-year bond yield and Treasury bill rate shocks negatively affect African stocks.

Despite the numerous studies on U.S. monetary policy transmission to African countries (see Ekeocha & Edeoja, 2020; Kalu et al., 2020; Tumala et al., 2021 etc.), there is still lack of evidence of its spillover effects on domestic output and interest rate spread. Besides, most of the studies focused largely on the strongest and largest African economies (Nigeria and South Africa) that are more integrated with the advanced and more globalized financial markets. Nevertheless, the finding that U.S. monetary policy influences monetary conditions in emerging economies (see Myranda-Agrippino & Rey, 2020, Tian et al., 2022) implies it could influence growth since growth is a major monetary policy target and a function of inflation in an economy. Also, the dilemma of impossibility trinity theory; "whether emerging economies can conduct monetary policy without recourse to external monetary influences" (see Degasperi et al., 2020; Wan, 2021) suggest a connection between emerging and advanced countries monetary policies.

In a nut shell, to the extent that domestic monetary policy, interest rate spread and output has not been catered for in previous studies implies the results of such studies might not capture the full dynamics of spillovers of Federal Reserve's monetary actions on African countries. Again, the transmission paths or mechanisms of international monetary policy shocks have not been exhaustively explored as literature established that some of the channels are more effective than others, and that the strength of spillovers may vary depending on the transmission mechanism employed (see Miranda-Agrippino & Rey, 2020; Morales et al., 2022). This study investigates the effect of U.S. monetary policy on African countries, by examining how Ghanaian and Nigerian economies responded to the U.S. policy shocks.

1.2.3 Theory

The Mundell-Fleming trilemma model predicts that in a flexible exchange rate regime, monetary expansion in an economy expands the economy's output but contracts other country's output, and the reverse works (see Mundell, 1963; Fleming, 1962). Though robust in its prediction, this

model has been criticized for basing its predictions on ad hoc equations rather than the results of optimal agent behavior. The Redux model which was proposed to fill this void predicts that domestic expansionary monetary shocks raise the level of domestic output but shows ambiguous effect on foreign output (Tule et al., 2019; Curan & Adnan, 2020). The Redux model has been empirically tested by different authors using international transmission of U.S. monetary shocks. Yet, there still exists an empirical vacuum in the prediction of foreign monetary policy effects on other country's output. Thus, the ambiguity of the effect of foreign monetary policy shocks on domestic output remains unresolved and needs further examination.

Additionally, the international monetary theory predicts the contribution of global financial markets to growth and developments around the world and that these advance markets are means by which economic disruptions are transmitted across national boundaries (see Degasperi et al., 2020; Wan, 2021). This theory coupled with the external vulnerability and spillover theory explains the transmission of macroeconomic shocks from advanced to emerging economies following global economic crises. In line with Bhattarai et al (2020) finding that the effect of Fed's quantitative easing shocks is greater for fragile economies than other emerging ones, it is imperative to examine what the effect is for African countries, since most of them are fragile. Thus, this study examines the spillover effect of Fed's monetary policy on domestic monetary policy, output and interest rate spread in Ghana and Nigeria in anticipation that the uncertainty surrounding Redux model's prediction of foreign monetary policy effects on other economies would be resolved and thus test the hypothesis;

H_A: U.S. monetary policy has spillover effect on domestic monetary policy, economic output, and interest rate spread.

The hypothesis is tested using the Bayesian vector auto regression (BVAR) framework as outline in the methodology and the results is presented in section four (4).

2 METHODS

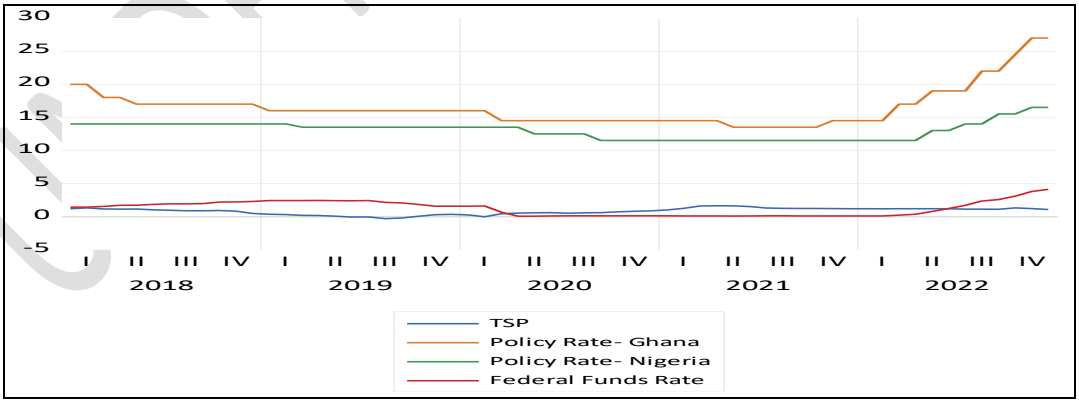
To examine the effect of U.S. monetary policy on Ghanaian and Nigerian economies, this study employs data from 2018M01 to 2022M12 in a BVAR model. The monetary policy variables are Term spread (TSP) for unconventional policy in U.S., Federal Funds rate in U.S. and Policy rate (PR) for conventional policy, while GDP growth rate (GDPGR), interest rate spread (IRSP) and inflation rate (INFR) are the other model variables for Ghana and Nigeria. Average monthly changes in these variables are used to minimize the effect of differences in business hours between the countries on the spill over transmission process. Monthly GDP growth data is not available and so the annual data is split into the monthly equivalents following Tian et al (2022), footprints and using statistical and econometric software package Eviews. Only the GDP data is obtained from the World Bank database, the rest of the data is drawn from international financial statistics database of the International Monetary Fund.

2.2 Variable Measurement

Following the exploits of Wan (2021), Bhattarai et al (2020), and Inoue and Rossi (2019) in identifying Fed's unconventional monetary policy (UMP) shocks, this study employs term spread (TSP) as proxy for the U.S. UMP. Measured as the spread between 10-years U.S. government bond yield and the 3-month Treasury bill yield, term spread reflects the different policy shifts of Fed during the UMP era, and will thus, properly capture the Fed's policy 'twist' during the post- GFC era. Similarly, central banks lend to commercial banks at the policy rate, which it uses to control credit cost and supply in order to boost investment and output level, and to control inflation in the economy. Policy rate relates directly to interest rates, but inversely to money supply and inflation, thus interest rates banks charge on loans is influenced by policy rate (Curan & Adnan, 2020; Ali, 2022).

Generally, changes in advance countries' monetary conditions, change the risk perception of international financial institutions and other global investors, the interest rate differential between the central and peripheral countries and the risk premium of international capital flows that triggers fluctuations in international capital flows (Auer et al., 2019). This induces monetary, interest rate, and inflationary movement that tightens or loosens the macroeconomic environment in peripheral countries (Curan & Adnan, 2020; Morales et al., 2022). Therefore U.S. monetary policy spill overs are expected to influence monetary policy conduct in African countries as African countries respond to the U.S. shocks. Figure 3 shows a common trend between the conventional (Federal Funds rate) and unconventional policy measures and also reveals a week comovement between monetary policy variables (Federal Funds rate and term spread) in U.S., and the policy rate in Ghana and Nigeria. This study seeks to examine the observed comovement empirically.

Figure 3: Policy rate in Ghana and Nigeria, Federal Funds rate and the term spread in U.S.



Source: Author's construct

Inflation determines the value of money in an economy with net effect on economic output (GDP) which measures an economy's health in terms of nominal output and growth rate (pace of

growth). Keynesians established positive relationship between inflation and GDP growth, but the classical school maintains a neutral relationship between the two magnitudes arguing that relative prices, employment level and output may affect nominal inflation but not GDP growth (see Azam & Khan, 2020; Salamai et al., 2022), and the Neo-classical theorists established mixed relationship between the two. In all, while the theoretical debates have come to no clear conclusion, there have been empirical consensus that inflation is harmful to GDP growth, only that there is a certain inflation threshold below and above which the relationship is positive and negative respectively (Salamai et al., 2022; Asafo-Adjei et al., 2023).

Lending rate less deposit rate (Interest rate spread), relates to foreign monetary conditions. Developing countries' interest rate spread relates negatively with domestic economic growth and is expected to relate to Fed's unconventional monetary policy negatively, consistent with the theory that interest rate spread measures banking efficiency, even better than net interest margins. This spread relates negatively with economic growth and is influenced by factors including non-performing loan ratios, non-interest income, capital adequacy ratio, return on asset ratio, inflation and exchange rate.

2.3 Model Specification

The country-specific Bayesian VAR model with a finite order p (i.e VAR(p)) employed to analyze the dynamic effects of U.S. monetary policy shocks on Ghana and Nigerian economies is specified as:

$$y_{i,t} = a_i + \sum_{j=1}^{p} A_j\, y_{i,t-j} + \varepsilon_{i,t};\ \ \varepsilon_{i,t} \sim N(0, \Sigma) \ldots\ldots\ldots\ldots\ldots\ \mathbf{1}$$

$y_{i,t}$ is K × 1 vector of endogenous monetary policy (policy rate, Federal Funds rate, Term spread, GDP growth rate, interest rate spread, and inflation rate) in U.S., Ghana, and Nigeria in period t. Further, a_i is K × 1 intercept vector, Aj (j = 1, . . . ,p) are K×K coefficient matrix corresponding to the j^{th} lag of $y_{i,t}$, and $\varepsilon_{i,t}$ is K ×1 vector of exogenous Gaussian shocks with zero mean and variance-covariance (VCOV) matrix Σ.

The BVAR framework uses the Bayesian approach to estimate vector autoregression (VAR) models, and it is advantageous over the traditional VAR method because it improves out-of-sample performance and overcomes the problem of poor forecasting emanating from in-sample overfitting (see Bhattarai et al., 2020). The Bayesian strategy improves model's forcasting performance by treating model parameters as random variables with prior probabilities, rather than fixed values as opposed to the standard VAR (see Ocampo & Ojeda-Joy, 2023). The model is estimated using Litterman/Minnesota prior as against other priors (Sim-zha, Normal-Wishat, Normal-Diffuse etc.) due to our prior knowledge about the data in order to obtain improved forecast performance. Minnesota prior assumes random walk process of

parameter estimates possibly with drift and therefore consists of normal priors on the set of parameters with fixed and known covariance matrix.

2.3.1 Study Statistic

The main statistic for analysis is the impulse response functions (ifr) of the variables estimated from the residuals of the BVAR model estimation. This impulse response is the reaction of any dynamic system in response to an external change and is more informative in analyzing responses than the BVAR model posterior mean coefficients and thus preferred for analysis. The BVAR model is preferred to the traditional VAR since it treats the model parameters as random variables, with prior probabilities rather than fixed values, and it takes on many free parameters and therefore deals with the problem of over-parametrization. Bayesian approach uses informative priors to shrink unrestricted models towards parsimonious naïve benchmark, thus reducing parameter uncertainty and improving forecast accuracy (see Bhattarai et al., 2020; Ocampo & Ojeda-Joy, 2023).

3 RESULTS

This section presents the results beginning with the time series properties (integrational or cointegrational attributes) test results, followed by the main model estimation and the impulse response functions graphs results. The discussion and summary of the results alongside model stability, some important extensions and robustness check concludes the section.

3.1 Preliminary test results

To determine the degree of correlation among the regressors the correlation coefficient matrix of the study variables is presented in the Table 1.

Due to the very high degree of correlation between the term spread (TSP) and Federal Reserve funds rate (FFR) (see Table 1 a & b), the Fed funds rate is dropped from the model for both countries in order to avoid multicollinearity problems. The Federal funds rate and money supply (broad money) are inversely related thus there will be no loss of information as a result of dropping the Fed funds rate variable from the model as its effects will reflect in the money supply variable.

3.2 Stationarity test results

To avoid spurious regression results from non-stationary data as suggested by Engle and Granger (1987), this study conducts unit root test on the model variables under the null hypothesis: unit root (assume common unit root process) capturing both trend and the result is presented in Table 2:

Results in Table 2 suggest that all the variables are stationary at first difference. Thus we proceed to lag length selection before the model estimation.

3.3 Lag length selection results

To obtain the models with high prediction accuracy it is imperative to estimate the model at the optimum lag length. Thus, we perform the optimum lag length selection criterion test and present the results in Table 3. The results show that the optimum lags for the Ghana and Nigeria models are 5 and 4 respectively, thus the models are estimated as such.

3.4 Model estimation

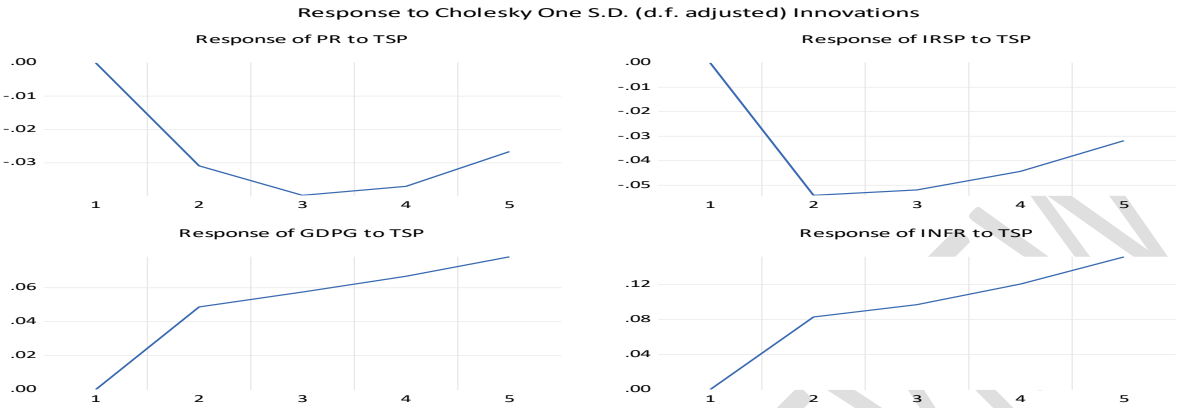
After determining the optimum lag lengths, the Bayesian VAR models for the two countries Ghana and Nigeria are estimated and the impulse response functions derived from the residuals of the model estimates. The posterior covariance matrix and the residual graphs from the model estimation shows that both the variables and the model are stable and forecast or prediction made thereof are accurate and reliable.

3.4.1 Impulse response functions

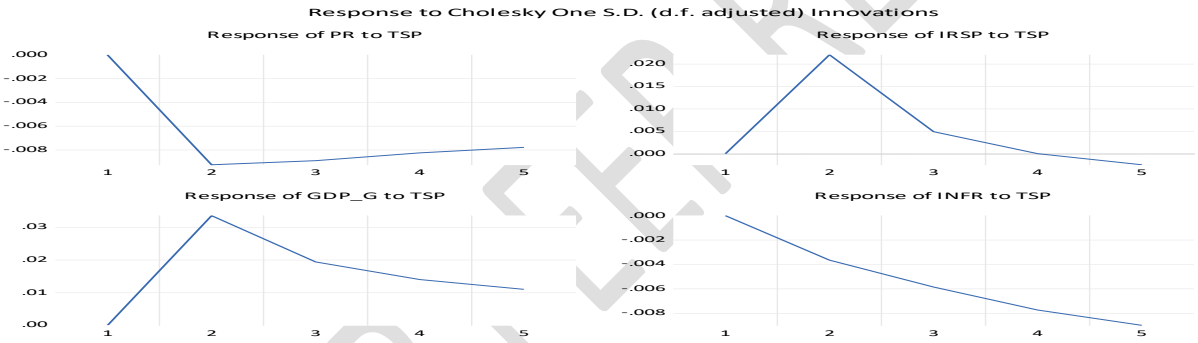
To determine the effect of one unit shock in one variable on the other, we estimate the impulse response functions from the model estimates and the graphs are as shown in Figures 4a and 4b

figure 4: Impulse responses of policy rate, interest rate spread, GDP growth and inflation to U.S. UMP (TSP) shock

a – Ghana



b – Nigeria



3.4.2 Interpretation of the IRFs Graphs:

In response to one standard deviation shock in the U.S. unconventional monetary policy (TSP);

Ghana model: Both policy rate and interest rate spread declined with maximum impact -0.031% and -0.055% respectively up to the end of the second year. The two remained relatively stable between period two and four, and then inched up steadily. GDP growth and inflation increased sharply with maximum impact 0.05% and 0.082% respectively at the end of the first period but the rate of increase decreased thereof.

Nigeria model: Policy rate and inflation rate decreased by about -0.008% and -0.004% respectively, in the first year. Policy rate then remained stable in the medium term and saw marginal upward adjustment in the long run, whilst inflation declined steadily. Interest rate spread and output growth increased with maximum impact 0.025% and 0.035% respectively in the first one year, they declined sharply up to the third year ending, and then continued decreasing steadily.

4. DISCUSSION

The main results as captured in section 3.4.2 under; "the interpretation of impulse response function graphs" and separated as Ghanaian and Nigerian models, is discussed with empirical and theoretical linkages in this section.

To begin with; the decreasing policy rate and interest rate spread, and rising inflation and GDP growth, in response to Fed's expansionary monetary policy shock is consistent with Ekeocha and Udeaja (2020) finding that U.S. monetary policy spillover affects interest rates and inflation in Nigeria. It is also consistent with Wan (2021)'s evidence that U.S. monetary policy showed strong and significant spillover effects on China's short-term interest rates after the GFC. While the results confirms Bhattarai et al (2020) evidence that U.S. expansionary quantitative easing has significant effect on emerging economies' financial variables, it contrasts the same author's prediction of U.S. UMP having no consistent and significant effects on output and consumer prices, and that the U.S. shocks exert positive effect on inflation in emerging economies. Similarly, these findings support Tumala et al (2020) and Ekeocha and Udeaja (2020) finding that U.S. monetary policy spillovers significantly impact monetary policy in Nigeria and South Africa. Further, the finding of rising inflation in response to U.S. monetary shocks is in tandem with Ho et al (2018) and Huang et al (2021) finding that the expansionary U.S. policy shocks after the GFC led to rising housing prices in China.

To the extent that domestic policy rates in Ghana and Nigeria are affected by U.S. monetary variables means domestic monetary policy act as channel for international transmission of U.S. monetary policy. The findings of Olamide et al (2022) of domestic monetary policy been transmission channel for external shocks to East African Countries, and that of Timmer (2018) evidence of domoestic policy been the most effective channel for international transmission of U.S. monetary shocks supports this conclusion. Further the finding of increasing GDP in reponse to Fed's unconventional monetary policy shocks supports Tian et al (2022)'s evidence that U.S. monetary shocks exert significant spillover effect on China's output.

In another vane, the increasing GDP growth response to expansionary Federal Reserve (Fed)'s policy shock contradicts Mundell-Fleming prediction that monetary expansion in advance economies contracts output in other foreign emerging economies. Intuitively and empirically, whilst the seaming fluctuation of GDP growth may reflect different and subsequent Fed's assets purchase shocks, it equally lends credence to Redux model's prediction of an ambiguous effect of foreign monetary policy on domestic output. The results however is consistent with Bhattarai et al., (2020) prediction that Fed's quantitative easing shocks reduce long term interest rates in emerging economies (EEs). Overall, the result reflects the external vulnerability and spillover theory's postulate that macroeconomic risks of advance countries have contagion effect on emerging countries (see Tule et al., 2019; Kalu et al., 2020). It also confirms the international monetary policy theory and policy fields' stance that global financial

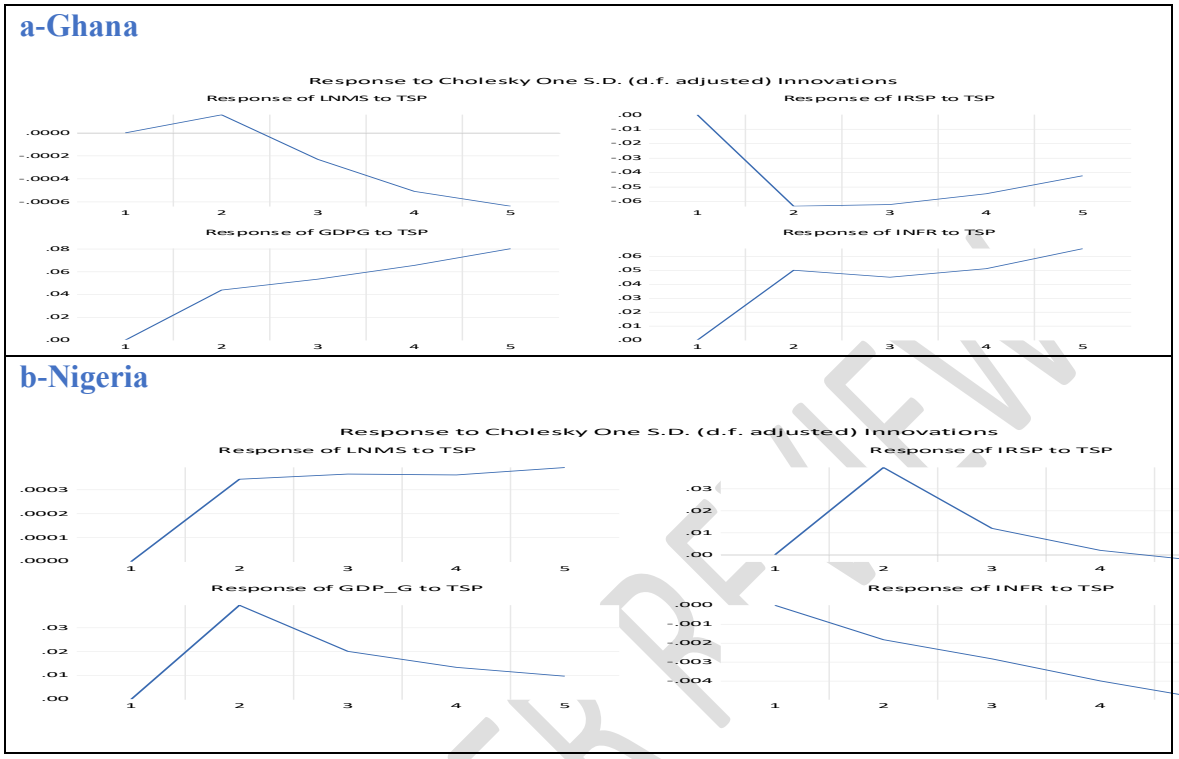
markets contributes to growth and developments and serve as means by which economic disruptions in one country is transmitted to others.

Noticeably, while Ghana's policy rate decreased and its inflation increased, Nigeria's policy rate and inflation both decreased in response to the U.S. unconventional monetary policy shocks. Generally, U.S. unconventional monetary policy shocks positively impact policy rate, interest rate spread and growth but negative impact on inflation in Ghana. The shocks however positively impact policy rate, growth and inflation, while negatively impacting interest rate spread in Nigeria. This difference in policy rate and inflation response could be accounted for by the different economic structures and economic policy direction or response at the time. Again, a decreasing interest rate spread in Ghana and an increasing interest rate spread response in Nigeria indicate improving banking system efficiency in Ghana and worsening efficiency in Nigeria, possibly through the inflow of capital from the expansionary monetary drive of the U.S. during the quantitative easing era. Overall, these findings suggest that emerging and developing economies do react to monetary shocks from advanced economies especially United States.

4.1 Robustness

As an extension and robustness check, we considered money supply (broad money) in place of monetary policy rate in Ghana and Nigeria to see whether our results are robust to the choice of different monetary policy measures or variables. The results as shown in Figure 5 reveals that the trends regarding interest rate spread, output growth, and inflation has not changed and the traditional dispositions of the domestic monetary policy variables remained: while policy rate showed a decreasing trend, money supply showed an increasing trend in both Ghana and Nigeria. This shows our study model is robust and that either policy rate or money supply can be a good proxy for domestic monetary policy in an international monetary policy transmission studies.

Fig. 5: Policy rate, interest rate spread, GDP growth and inflation to U.S. UMP shocks



The study contributes to literature by considering the effects of U.S. UMP shocks; identified as the spread between long term and short term yields, which reflects Fed's policy shift from short term interest rates manipulation to large asset purchase and policy announcements as the predominant monetary policy conduct over the period. This contrasts previous studies that focused only on Nigeria (Ekeocha & Edeoja, 2020; Kalu et al., 2020) and Tumala et al (2021) others who focused on the effects on financial variables in Nigeria and South Africa but failed to consider the influence of UMP shocks in the transmission process. Extending the study period by four years (2018 – 2022) as the latest by any known study, and establishing domestic monetary policy and interest rate spread as effective transmission channels of U.S. UMP, are significant contributions. The inability to capture the influence of the CMP shocks and of forward guidance in the transmission process is a major limitation, as capturing all variables in a single model would most appropriately measure the full transmission effect of U.S. monetary policy shocks.

5. Conclusion

This study examined the spillover effect of U.S. monetary policy on Ghanaian and Nigerian economies over the period 2018 to 2022 during which the Federal Reserve and other advanced central banks implemented another round of unconventional monetary policies, as a response to the post-Covid-19 economic crises. The study focused on the effect of U.S. unconventional

monetary policy (UMP) measured as the yield spread between short term and long term U.S. government treasury instruments (term spread (TSP)) on output via the domestic monetary policy and interest rate spread channels whiles considering the influence of domestic inflation on the transmission process.

The study finds that overall, the expansionary U.S. unconventional monetary policy response to the post COVID-19 economic crises, positively impacted domestic policy rate and growth in both Ghana and Nigeria. While the shocks negatively and positively affected inflation in Ghana and Nigeria respectively, it positively and negatively impacted interest rate spread in Ghana and Nigeria respectively. The findings supports Bhattarai et al., (2020) prediction that Fed's quantitative easing shocks reduce long term interest rates in EEs, but partly confirms the Redux model's prediction of an ambiguous effect of domestic monetary policy on foreign countries' growth. The findings however contrast Mundell-Fleming model's prediction that foreign monetary expansion contracts output in other economies. The establishment that domestic monetary policy and interest rate spread in Africa are effective transmission channels of Fed's UMP is a major contribution to literature as that had been overlooked in previous studies. The finding is enough evidence that emerging and developing African economies react to monetary shocks from advance countries, particularly the U.S.

We recommend that monetary authorities in African countries should keenly monitor the inflationary trend of U.S. monetary policy especially that emanating from the expansionary Fed's unconventional policy shocks and should adopt a strategy to cushion their economies from the negative inflationary shocks. A strategy should also be adopted to harness the positive impact of the unconventional monetary policy spill overs on growth. The Federal Reserve should be mindful of the spillover effect of their policy actions any time they intend to embark on monetary policy actions as the spillover to emerging economies, can spillback to the U.S. economy with devastating consequences.

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Appendix A – Tables

Table 1Correlation coefficient matrix for Ghana and Nigeria models

a. Ghana

	FFR	PR	TSP	IRSP	GDPG
FFR	1.000				
PR	0.161	1.000			
TSP	-0.594	-0.051	1.000		
IRSP	0.247	0.871	-0.048	1.000	
GDPG	0.068	-0.021	0.219	-0.057	1.000
INFR	0.068	0.537	-0.107	0.418	-0.090

b. Nigeria

	FFR	PR	TSP	IRSP	GDP_G
FFR	1.000				
PR	-0.226	1.000			
TSP	0.976	-0.214	1.000		
IRSP	0.056	0.207	0.058	1.000	
GDP_G	0.145	0.038	0.170	-0.150	1.000
INFR	-0.220	0.248	-0.202	-0.109	-0.038

Source: Author's construct with data from IMF's financial statistics database

Table 2a: Unit root test result –Ghana

Level		
Test	Statistic	Prob.
Levin, Lin & Chu t*	8.329	1
Breitung t-stat	8.268	1
Im,Pesaran &Shin W-stat	9.082	1
ADF - Fisher Chi-square	2.824	0.985
PP - Fisher Chi-square	2.017	0.996
First Difference		
Levin, Lin & Chu t*	-2.601	0.005
Breitung t-stat	0.664	0.746
Im,Pesaran &Shin W-stat	-3.177	0.0007
ADF - Fisher Chi-square	51.346	0
PP - Fisher Chi-square	145.94	0

Source: Eviews output

Table 2b: Unit root test results – Nigeria

Level		
Test	Statistic	Prob.
Levin, Lin & Chu t*	1.046	0.852
Breitung t-stat	2.536	0.994
Im,Pesaran &Shin W-stat	1.649	0.950
ADF - Fisher Chi-square	6.145	0.802
PP - Fisher Chi-square	5.977	0.817
First difference		
Levin, Lin & Chu t*	-1.535	0.062
Breitung t-stat	3.037	0.998
Im,Pesaran &Shin W-stat	-5.485	0
ADF - Fisher Chi-square	60.7	0
PP - Fisher Chi-square	119.246	0

Table 3: Lag length selection results

3a: Lag length – Ghana

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-466.292	NA	19.078	17.138	17.320	17.208
1	-177.643	514.319	0.001	7.551	8.645575*	7.974076*
2	-150.542	43.362	0.001	7.474	9.482	8.251
3	-126.019	34.778	0.001	7.492	10.411	8.621
4	-87.055	48.174	0.001	6.984	10.816	8.466
5	-44.840	44.51764*	0.000597*	6.357817*	11.102	8.193

3b: Lag length – Nigeria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-466.900	NA	19.504	17.160	17.342	17.231
1	-203.675	469.019	0.003	8.497	9.592195*	8.921
2	-157.784	73.426	0.002	7.738	9.745	8.514
3	-125.755	45.423	0.001	7.482	10.402	8.611
4	-82.413	53.58701*	0.000769*	6.815004*	10.647	8.296939*
5	-61.506	22.047	0.001	6.964	11.708	8.799

Source: authors construct with data from IMF

* indicates lag order selected by the criterion