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Global Shocks Alert and Monetary Policy Responses[1]

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Abstract

The study examines the role of global predictors on national monetary policy formation for Kenya and Ghana within the New Keynesian DSGE framework. We developed and automatically calibrated our DSGE model using the Bayesian estimator, which made our model robust to rigorous stochastic number of subjective choices. Our simulation result indicates that global factors account for the inability of national Central Banks to predict the behaviour of macroeconomic and financial variables among these developing nations.

Key Words: Business Cycle, Macroeconomic policy, Financial crises

JEL Classification: E32, 62

1. Introduction

During the 1950s, literature appears suggesting that the world shares a common monetary phenomenon and that unified monetary policy can help reduce fluctuation and balance of payment crises as well as the mounting debt among trading nations. This literature thus took for granted the international spillover effect of monetary policy formation. Recent development in the studies of international financing has, however, challenged this position on the ground that the so-called Fisher Effects that allowed unified policy to expose the emerging market to global shocks needed to be revisited.

This paper discusses the ability of Fisher Effect to explain the spill over in global shock from a unified monetary policy framework in Kenya and Ghana. It examined whether the evolution of international order has severe implication on the ability of national Central Banks to predict the behaviour of macroeconomic indicators of their nations without being subjected to external control. It also interrogates the consequence of conducting the national monetary policy of a nation on the shock surrounding the misfortune of another nation due to asymmetric leadership and integrated ties.

The general framework of this discussion is focused on balancing the perception of generality, research dilemma, policy misfortune and national monetary policy credibility. To set the stage, we begin the paper by discoursing the empirical regularities in monetary policy framework and the earlier warning signs by the mainstream macroeconomic economists who once challenged the implication of Fisher effects, paving way for the unification of national monetary policy and financial integration today. Of specific importance is Fisher's proposition, which suggested that integration of national financial markets would facilitate financial flows from developed to developing countries, based on the premise that it might improve their economic wellbeing (Matsuyama, 2004). However, a recent revisit of the evolution of international order showed that financial integration constrained domestic monetary policy.

It is important to note and bring to fore, once again, that the unification of monetary policy has once been queried by the structuralists whom earlier advocated that poor countries should stem the outflow of domestic saving and official aids from rich counties as it appeared financial globalization magnifies national monetary policy control (Auer & Mehrotra, 2014; Kabukçuoğlu & Martínez-García, 2018; Roy, 2017). This is consistent with the earlier signal by Lewis (1977) who warned that economists should not dismiss the argument that integration of financial markets might constrain national monetary policy.

In his recent paper, Matsuyama (2004) established that in the absence of international financial markets, the world economy enjoys a unique steady state. The scholar recognized that global financial liquidity that led to the formation of the unified monetary policy control might have been a theoretical mistake. According to him, in the absence of international lending, borrowing and international capital flow, domestic economies are controlled with the framework of savings and investment; and financial stability are maintained by the Central Banks, even in the means of cyclical fluctuation (Asongu, 2013a, 2013b; Dilaver, Calvert Jump, & Levine, 2018; Dongkoo Chang, Jaffar, 2014; Patrick, Moura, & Pierrard, 2019). This justifies the position of the Keynesian theory since the interest rate transmission mechanism can be adjusted to domestic savings and investment to normalize the system during economic shocks. This implies that national Central Banks can respond to shocks by creating surprise if made independent. For instance, Pang (2013) developed a model and analyzed the welfare impact of financial integration in a standard monetary open economy model with nominal price rigidity and reported that developing countries, which are experiencing financial integration may attempt to alleviate the welfare cost of integration by stabilizing the exchange rate in the long run.

Crowley and Rowley (2007) explored the interaction between the political driving forces behind further integration in Europe and the perceptions of economic benefits to be derived by the member States. They evaluated the various configurations that could result from an Economic and Monetary Union (EMU), and how these may impact on other activities of the European Union (EU). Their study considered the design of fiscal and monetary policy for a monetary union and the consequent development of community institutions. They argued for appraisals of actual and potential European developments, which must contain two primary features; namely, they must be 'structural' in the sense of recognizing the institutional character of economic evolution in Europe, and they must be multifaceted to draw directly on relevant contributions from economics, political science, and both legal and social-policy studies.

In the same token, Beetsma and Giuliodori (2010), surveyed and interpreted recent research on the costs and benefits of the EMU. They explored how unification affects the trade-off between credibility and flexibility of monetary policy and argued that unification offers an opportunity that provides a Central Bank with more independence from its government, thereby adding to the credibility of monetary policy and thus the reduction of inflation expectations. The scholars further claimed that repeated political pressures on the European Central Bank (ECB) to pay more attention to the external value of the euro and to lower interest rates that underline the importance of its independence and its mandate for price stability has been enshrined in the Treaty.

Some studies have argued that globalization might have dramatic consequences for the nature of monetary transmission mechanism and could threaten the ability of national Central Banks to curtail inflation within their borders, at least in the absence of coordinated failure of policy with other Central Banks (Belke & Rees, 2014; Asongu, Biekpe & Folarin, 2019a, 2019b). On the other ledger, earlier studies have challenged this position noting that it should remain possible for a Central Bank, with a consistent strategy directed to the achievement of a clearly formulated inflation target, to achieve that goal, without any need for coordination of policy with other Central Banks Folarin & Asongu, 2019).

Woodford (2007) considered three possible mechanisms through which it might be feared that globalization can undermine the ability of monetary policy to control inflation within a two-country new Keynesian model with complete financial integration. He showed that domestic inflation would always depend on current and expected future domestic monetary policy. The scholar’s results further confirmed the possibility of Central Bank’s control of domestic inflation by varying the interest rate on the based money. In contrast, Rose (2014) considered the interest in monetary crises, its impacts on the monetary policy and the macroeconomics dynamics by estimating a panel annual data from more than 17 countries between 2007 and 2012 and found that macroeconomic and financial variables have greater consequences on regime choice but, with a surprising smaller margin on the national economy, which is said to be consistent with business cycle and capital flow among the countries examined.

Contrariwise, Boivin et al. (2008) estimated factor-augmented VAR (FAVAR) framework exploiting the richness of the cross-country differences and the change in monetary regime in the 1999 adoption of euro by 11 European countries. The scholar reported that the combination of cross-country heterogeneity and the changes over time provided monetary shocks on countries before the launch of the aforesaid euro. They further reported that the combination of a change in policy reaction function towards a more aggressive response to inflation and output as well as the elimination of perceived exchange rate risk, could possibly explain the evolution of monetary transmission mechanism observed empirically. Similarly, Forni and Gambetti (2010) estimated a structural factor model for 112 US monthly macroeconomics series based on their dynamic effects on monetary policy and reported the maximal effect on bilateral real exchange rate impacts.

Consistently, Forni and Gambetti, (2010), and Belke and Rees (2014) estimated a FARVAR (i.e. a mixture of a factor model and a VAR model) for the Great seven (G7) and the eurozone between $Q_1$1974 to Q_4 2007 and reported that global liquidity shocks significantly influenced the world economy and also various national economies and common shocks driving real estate prices. By incorporating latent variables, Fernald, Spiegel and Swanson (2014) estimated augmented Vector autoregressive (FAVAR) model to analyse the effectiveness of monetary policy in the Chinese economy and established that the interest monetary transmission channel was a key determinant of both real economic activities and prices in the Chinese economy.

Roşoiu (2015) estimated a factor-augmented (FAVAR), and Bayesian inference for Romanian economy between 2001m and 2013m, using 92 variables representing the evolution of production index, producer price index, consumer price index, as well as the unemployment rate. The study further compared the response of monetary policy to the misery index and reported that unemployment and inflation are sensitive to a number of shocks in Romania. In the same vein, Adeoye and Shobande (2017) applied a Vector Error Correction (VEC) model to determine the short and long run responses of monetary policy transmission mechanism to macroeconomic predictors between 1985q1 and 2015q4 and reported that monetary policy can act as a response to interest rate only, if the exchange rate is carefully managed as empirically observed.

Chen, Chow, and Tillmann, (2017) estimated Qual Var, a conventional VAR system augmented with a binary policy announcement to extract a latent indicator of fighting monetary policy in China between 1999 and 2015 and reported that bank loan is not sensitive to policy change, implying that the impact of bank loan is not sensitive to policy change. Considering a generalized method of moments (GMM) approach and paying attention to the issue of simultaneity bias, Egwaikhide and Eregha (2018) observed the effect of global factors on domestic monetary policy reaction functions of five West African Monetary Zone (WAMZ) countries for the period 1980–2015. They reported that global inflation and output gap influenced monetary policy decisions of Central Bankers in the countries of WAMZ[2]. Besides, the scholars further suggested that global variables should not be ignored but should be given appropriate weight while forecasting domestic inflation and making monetary policy rules.

In Nigeria, Apanisile and Osinubi (2019) examined the effect of financial development on the effectiveness of monetary policy transmission channels in Nigeria, using the DSGE model for the period 2004qi and 2016q4 and reported that financial development has a positive effect on monetary policy transmission channel during the period examined. Consistently, Enisan and Tolulope (2019) examined the effect of anticipated and unanticipated monetary policy shocks on the effectiveness of monetary policy transmission mechanism in Nigeria using the DSGE model between 1986q1 and 2013q4 and reported that unanticipated monetary policy shock had a short-run impact on monetary policy transmission channels during the period reviewed.

In South Africa, Gupta and Jooste (2017) considered the evolution of monetary policy uncertainty using the nonlinear DSGE model. They reported that uncertainty in the South African economy was due to interest rate risk during the period examined.

[2] Asongu, Nwachukwu and Tchamyou (2017) have documented a survey of proposed African monetary unions, which includes, *inter alia*, concerns about real exchange imbalances and macroeconomic adjustments in the proposed West African Monetary Unions (Asongu, 2014a); real, monetary and fiscal policy convergence in the proposed West African and East African Monetary Unions (Asongu, 2014b) and effectiveness of monetary policy in an African monetary union (Asongu, 2014c, 2014d).

Consistently, Waal, Gupta, and Jooste (2018) investigated the response of South African monetary policy decisions to foreign monetary policy shocks, using DSGE model and reported that foreign monetary policy shocks and the South African interest rates are complicated in South Africa

The above episodic literature presents a different view of the world on the effectiveness of monetary policy and the extent to which Central Bank's response to real economy can be constrained by global factors. Unfortunately, the resulting literature shows that consensus is still missing in literature. However, we will be biased if we fail to acknowledge that the potential of national monetary policy has been undermined by the quest for monetary integration resulting from the international bond. The study by Sibert(1999) claimed that the unification of monetary unions has a positive impact on the national economy. Contrariwise, Roşoiu, (2015), Egwaikhide and Eregha's, (2018) study admitted that global factor has an implication on the national policy response. While Woodford (2007) claimed that global factor impacts negatively on national policy, national Central Banks can still stimulate the economy using monetary base. Surely, the above review has shown that there seems to be empirical inconsistency in the results documented. Presently, the current investigation techniques used are still subject to dispute. Thus, the need to reconcile the theoretical framework connecting financial and trade integration with national monetary policy is a major concern of this present study.

Similarly, we understand that the dynamic nature of global trade might be the potential cause of the slow growth and macroeconomic imbalances recently experienced in the chosen environment of study. Given that majorities of African countries are rather importers of consumable goods, as such erosion in inflation is possible. Perhaps, the linkage between the product market, financial market, exchange rate market, as well as, the supply side might have a cumulative effect on the so-called monetary policy formation. Thus, the likelihood that the inefficiency of Central Banks might be the case, justifies the position this study holds in the contexts of inflation targeting.

2. Model

We start by considering a household confronted with the following preference over a stream represented as:

$$E_t \sum_{t=0}^{\infty} \rho^t U(C_t) \tag{1}$$

$$C_t = \left(\int_0^1 C_t(i)^{1-1/_{1-e}} \, di \right)^{\frac{e}{e-1}}, \qquad e > 1 \tag{2}$$

Where ρ^t denotes discount factor, $C_t$represents consumption, e denotes elasticity of substitution, and C_t is an increasing function of $C_t(i)$. Price index becomes:

$$P_t = \left(\int_0^1 P_t(i)^{1-1/_{1-e}} \, di \right)^{\frac{e}{e-1}}, \qquad e > 1 \tag{3}$$

Demand for household good becomes: $\left({P_t(i)}/{P_t} \right)^{-e} C_t = C_t(i)$ (4)

Total household consumption expenditure becomes:

$$P_t C_t = \int_0^1 C_t(i) \, P_t(i) di \tag{5}$$

Substitute (4) in (5) to obtain the price level as:

$$P_t C_t = \int_0^1 \left({P_t(i)}/{P_t} \right)^{-e} C_t \, P_t(i) di \tag{6}$$

$$P_t = \int_0^1 P_t(i)^{1/_{1-e}} di \tag{7}$$

Household financial market

Household capital is taken to be stock where household can either invest at home or abroad due to the quest for financial integration. This depends on the attractiveness of the financial market return as compared with foreign market, which is adequately explained in the Fisher effect.

$$M^*_{i,j,t} / P_t = f(C_{i,j,t}, i_{i,j,t}) \quad (11)$$

Where $M^*_{i,j,t} =$ is money demand at time t, in country i and j (where j is the international financial market), P_t denotes price level (this obeys the law of one price), , $i_{i,j,t}$ represents interest rate (that exhibit the Fisher effect) and f denotes household preference to invest in financial markets or to consume (Azariadis, 2018; Patrick et al., 2019; Reis, 2018).

Thus, household demand for goods can be summarised and log-linearized as:

$$C_t = E_t(C_{t+1} - \frac{1}{\rho}(r_t{}^e - E_t(\pi_{t+1}) \quad (12)$$

Where $r_t{}^e$ denotes nominal interest rate and π_{t+1}represents expected inflation.

Firm

Here, we considered a domestic firm technology with two inputs CES form and it faces a cost minimisation problem in the context of global supply.

$$\underbrace{Min}_{L\geq 0, K\geq 0} : wL + rK \ , \ s.t. \ (L^\alpha + K^\alpha)^{1/\alpha} \geq Y \quad (13)$$

Taking the first order condition Lagrangian condition becomes

$$\frac{w_t}{r_t} = \left(L/K\right)^{\alpha-1} \quad (14)$$

Where

$$y_t = \varepsilon_t^a (L_t)^\alpha \phi K^{1-\alpha} - \varpi_t^e \psi$$

$$MC_t = \alpha^{-\alpha}(1-\alpha)^{(1-\alpha)} w_t^{1-\alpha}$$

Where, y denotes output, Lrepresents Labour, K capital, MC is marginal cost, and α elasticity of substitution which is assumed $0 < \alpha < 1$.

While firm profit index becomes:

$$Max \prod_{y,L,K}^{j} py - wL - \widetilde{r_t}\,\widetilde{K}_t$$

$$s.t.\ f(L^{\alpha},\ K^{1-\alpha})\ \geq Y$$

Using Cobb Douglas framework, we have:

$$Max \prod_{y,L,K}^{j} P(L^{\alpha},\ K^{1-\alpha}) - wL - rK$$

$$\prod_{y,L,K}^{j} = P^{1/_{1-\alpha}}\, w^{\alpha/_{\alpha-1}} \alpha^{\alpha/_{1-\alpha}} (1-\alpha)K - rK \qquad (15)$$

Firm indexed and Dynamic Inflation

Here, we integrated the Calvo adjustment mechanism as used by (Blanchard & Gali, 2008; Clarida, Gali, & Gertler, 1998) as:

$$P_t = \left[\int_{s(t)}^{1} P_{t-1}^{1-e}(i)^{1/_{1-e}}\, dt + (1-\vartheta)P_t^{*\,1-e}\right]^{1/_{1-e}} \qquad (16)$$

This adjusted mechanism implies that inflation has been accounted into the firm pricing, which implies that:

$$\prod {j_t}^{1-e} = \vartheta + (1-\vartheta)\left({P_t^*}/_{P_{t-1}}\right)^{1-e} \qquad (17)$$

Where$\prod j_t = {P_t}/_{P_{t-1}}$, when log linearized, it becomes a steady state as $P_t = P_{t-1} = P^*$

Hence, we can state conveniently that: $\pi_t = (1-\vartheta)(= P^* - P_{t-1})$, see (Clarida, Gali, & Gertler, 1999).

Firm and Money in Production

We then work with theBenchimol (2015) model that linked the role of money in production function as:

$$Y_t{}^p(i) = \varepsilon^{a_t}\left[\left(\varepsilon^{p_t}\, {M_{P,t}}/_{P_t}\right)^{\alpha_m} ((L_t)^{\alpha}\phi K^{1-\alpha})(i)^{1-\alpha_n}\right]$$

Where ε^{a_t} denotes exogenous shock from technology difference of firms across the globe, $M_{P,t}$ is nominal money stock in production function, P_t represents aggregate price difference across firms and $(i) \in (0,1)$ *is the* firm continum index.

Global output shocks indexed and Dynamic Inflation

We developed a new Keynesian Philip Curve with IS equation in the context of world output as:

$$y_t = E_t(y_{t+1}) - \frac{1}{\tau} r_t{}^e - E_t(\pi_{t+1}) - \rho \qquad (18)$$

Where,

$$r_t = r_t{}^e - E_t(\pi_{t+1}) \text{ (Fisher effect)} \qquad (19)$$

$$\pi_t = BE_t(\pi_{t+1}) + k\tilde{y}_t \text{ (inflation forecast for output)} \qquad (20)$$

Real exchange rate and Price under tradable and non-tradable

$$P_t = \phi \left[{}^{P_v}\!/\!{}_{P_\eta}, \right] \qquad (21)$$

Where P_v denotes price of tradable and P_η represents price of non-tradable, and ϕ is homogenous of degree 1 (i.e. it conforms the law of one price)(Blanchard, 2018; Stucki, Woerter, Arvanitis, Peneder, & Rammer, 2018). Thus, exchange rate becomes:

$$e = {}^{EP^*}\!/\!{}_{P}, \qquad (22)$$

Following the uncover interest rate principle that stipulated that interest rates disparity is equivalent to expected variation of interest rate plus expected inflation in home country.

$$\sum_{\substack{0 \le i \le m \\ 0<j<n}} P(1+i) = \sum_{\substack{0 \le i \le m \\ 0<j<n}} P(1+i^*)\, {}^{E^*_{t+1}}\!/\!{}_{E_t} \qquad (23)$$

Where $(1+i)$ is return on domestic bond, $(1+i^*)$ return on foreign bond.

International Fisher Effects (IFE) and New Keynesian Philip Curve (NKPC)

From the Irving Fisher money model, we understand that:

$$P_tY_t = M_t^{*} \;\; or \; P_t = {M_t^{*}}/{T_t} \qquad (24)$$

where $M_t =$ Money stock, $P_t =$ price level and $T_t =$ transaction or output level (goods or service).

Thus, $logM_t - \log P_t = \emptyset \log T_t + \sigma_i$ or, $logM_t - \log P_t = \emptyset \log Y_t + \sigma_i$,]

(25)

In this present study, we are using transaction for financial market and goods for output.

In the context of interest rate the above analysis becomes:

$$i_t = {1}/{\sigma_i} \, (\emptyset \log y_t - \log M_t + \log P_t) \qquad (26)$$

Recall, that the IFE is an economic intuition that explained how the expected variation between exchange rates of two currencies is exactly the same as their nominal interest rates. The fisher equation is presented as:

$$i_t = r_{i,j,t} + \Phi\pi_t$$

Where, i_t is the nominal interest rate defines as $i_t = E_t\pi_{t+i} + r_t^r + \Phi_t^*$, $\pi_t = ln \; {p_{t+1}}/{p_t}$ denotes as inflation and r_t^r represents real interest rate, Φ_t^* is risk premium inflation shock. We then subtracted the inflation expectation over the eight quarters, π_{t+8} to determine the long run as used byOrphanides and Wieland(2004).

Thus, interest rate differential can be written as:

$$i_t - i_t^{*} = {1}/{\sigma_i} \, \emptyset(\log y_t - y_t^{*}) - (\log M_t - \log M_t^{*}) + (\log P_t - \log P_t^{*}) \qquad (27)$$

Fixed exchange rate and Unified Monetary policy

This requires that Central Banks must pursue a policy of unilateral fixed exchange rate which implies that

$$\log M_t = \log M_t^{*} + \emptyset(\log y_t - y_t^{*}) + (\log P_t - \log P_t^{*}) \qquad (28)$$

So, the Fisher effect affects domestic monetary policy through the equation set below.

$$i_t = \psi i_{t-1} + \tilde{r} + \tilde{\pi} + y_\pi(\pi_t - \tilde{\pi}) + \psi_y(y_t - y_{t-1} - g_z) \qquad (29)$$

$\sum_{\substack{0\leq i \leq m \\ 0<j<n}} P(1+i^*) \, {E^*_{t+1}}/{E_t}$ denotes return on foreign bond in domestic currency, E^*_{t+1} denote expected nominal exchange rate at time t which conform to rational expectation principle.

Estimation Procedure

We employ the Bayes Theorem as used in the work of Fernández-Villaverde(2009)stated as:

$$\pi(\theta|Y_i^T) = {\rho(Y_i^T|\theta,i)\pi(\theta|i)}\Big/{\int(Y_i^T|\theta,i)\pi(\theta|i)d\theta}$$

Where $\pi(\theta|i)$denotes sample information in the personified likelihood,$f(Y_i^T|\theta,i)$ and $\pi(\theta|Y_i^T)$is the new set of obtain posterior belief, $Y_i^T$and θrepresent the whole set of observed data and model parameter, respectively.

The consideration for using Bayes theorem in this paper is based on set of axiomatic decision logic, which are built upon the rational expectation of an economic agent. Also, Bayes framework has a predictive mechanism embodied in the scientific procedure that presumes parameters of population are unidentified and are measurable randomly, which is appropriate for analysing business cycle.

With Simulation we have

$$\rho(Y_i^T|\theta) \cong \frac{1}{m}\sum_{t=1}^{T} \rho\left(Y_t|s^i_{(0|0)} \downarrow\right) \prod_{t=2}^{T} \frac{1}{m}\sum_{i=1}^{m} \rho\left(Y_t|s^i_{(t|t-1)};\ \theta\right)$$

Where, $\left(s^i_{(0|0)}\right)_i^m$represents initialisation set $(s_0|\ \theta)$, $\left[s^i_{(t|t-1)}\right]_{i=1}^m$ denotes the prediction base on the law of motion (random shock distributed, (iid) independent and identically distributed), $s^i_{(t|t-1)}$denotes weight assigning of filtering, sample $t < T\ set\ t \ \leftrightsquigarrow t+1$, and θ remains the likelihood of the model.

3. Data

In this paper, we used annual time-series data (1980-2017) from the Bank of Ghana statistics and publication, Central Bank of Kenya statistics, Federal Reserve of St.

Louis, World Bank -World Development Index and International Monetary Fund-IFS (International Financial Statistics). The research data measurement replicates our past work for South Africa (SA) and Nigeria. We used the annual change of consumer price index in percentage term for inflation data. We have also previously narrated the importance of the imported inflation information in the structural model; from our empirics for these neighbouring economies, we proved beyond doubt how global inflation shocks synchronize into the domestic inflation framework such that it changes the boundaries of the smooth persistency in the inflation data. Likewise, the possibility to ignore the dynamics in price rigidity index that is introduced through inflation from abroad can breed model misspecification and estimation bias to the conventional Calvo's price model. From this perspective and based on our empirical findings in the region, we incorporate global inflation data in the Calvo's price model. Furthermore, in our attempt to eliminate biasness in the Calvo's price model formed based on expectation, we replaced the inflation expectation in the Phillips Curve with inflation inertia and conducted a separate but similar estimation. This follows the Christiano, Eichenbaum, and Evans (2001, 2005) and Christiano, Eichenbaum, and Trabandt (2016, 2017) research paper on price indexation in the firm optimization framework. Our intention was to investigate the sensitivity of the structural posterior parameters due to the different inflation inertias. This is because the rigid assumption of Taylor-Calvo pure forward-looking staggered wage-price setting has long-encountered scholarly debates, though, with some empirical successes and failures. These insights into versions of the Phillips Curve are apparent in, *inter alia*: Christiano et al. (2005), Boivin et al. (2008); Gelain (2010); Smets and Wouters (2007); Blanchard and Gali (2008); Clarida, Gali, and Gertler (1998, 1999). However, we severed our estimation from the hybrid Phillips Curve DSGE and suggested it for further research inquiry. Nonetheless, what we have done is to estimate and reconsider the conventional pure-forward looking NKPC in DSGE with the inflation inertia and how well this framework matches up with the data. In this piece of work, we have pursued the policy implications of the global inflation shocks, without losing concentration from the changes in the model parameters resulting from different price indexation.

The interest rates issued by the Bank of Ghana (BOG) and Central Bank of Kenya(CBK) captured the nominal interest rates in the monetary policy reaction function in the system of equations. The US fed fund rate is used as the global interest rate. In this study, we avoid discussing our rationale for using the US fed fund rate as proxy for the global interest rate as we have already expounded this in our previous study for SA and Nigeria. Our stance for advocating the inclusion of global interest into the monetary policy functioning in Africa arises from the conjectured influences of the wondering global monetary transmission innovation that result from the diffused global inflation, financial interdependency, dynamics in foreign exchange, oil shocks and the economic interaction from liberalization of the interest rates. This justification concludes the Macdonald (1999), Ratti and Vespignani (2015), submission that the monetary policy rates in the developing and developed economies are derivatives of the global interest rate. As a result, we do not take for granted the spill over effect of global shocks on the BOG and CBK monetary policy capabilities and functioning in their stabilization goals.

The real gross domestic product from which output gaps are derived is estimated by dividing the gross nominal GDPs by the CPIs including the global real output. Our previous assumption is still valid in the current study that dynamics in the global output pose risks to African economic performance through incessant instability in income from jobs outsourced by foreign multinational firms, less productivity enhancement in Africa, unstable remittances and, less changes in financial aids from the developed economies. This conjecture aligns with recent global decline in growth expansion momentum and its consequences, which may be heightened by ongoing trade wars, the below-average growth among the European economies, the Chinese economic slowdown and chaotic Brexit referendum as expounded in theOrganisation for Economic Co-operation and Development(OECD, 2019).

In our system of equations, we propose the inclusion of the global output gap in the monetary policy reaction function and the firm's optimization equation- NKPC. Therefore, we allowed monetary policy to derive reactions to global economic fluctuations through global output to severe global factors from destabilizing domestic monetary performance. Moreover, our basic intuition for allowing the monetary response to global output stems from stabilization struggles from the past model misspecification. Thus, we infer that for Africa (especially Ghana and Kenya) to achieve stabilization goals through monetary policy discretion, there should be a comprehensive policy rule of this type. We also approached the NKPC with similar perspective. The global shock synchronization in form of hike in marginal cost for trading firms explained the inclusion of the global factor in our firms' behaviour. For instance, oil price generates structural shocks to marginal cost of firms and decides the world productivity performances. The impact of technology diffusion on firms' production in Africa also informed us to open this model to foreign factors. However, we have summed technology with several unobserved factors as shocks in the NKPC framework.

Before the Bayesian estimation, we constructed steady state parameters through calibration and transformed the observed variables to reflect the deviations from the steady state using the Hodrick Prescott procedure; the latter allowed us to diagnose frequency of dispersion and the convergence time-lags of the disequilibrium-inflation and deviation of output from steady-state because of the shocks as depicted by impulse response function.

Priors and Bayesian Estimation

Previous econometric estimation narrative for dynamic stochastic general equilibrium has become less central to the fast-paced dynamics in the model structure of the DSGE framework. These procedures are deficient in some ways. In this light, this paper joins the trail of the growing body of literature that favours the Bayesian estimation. To our knowledge, Bayesian estimation is more suitable for system-based equation such as DSGE, the procedure allows us to combine prior empiric information with likelihood of the parameters in the updated data to generate the posterior information; which is empirically beneficial to further research in that continuum, create the posterior distribution through simulation – Metropolis-Hastings algorithm, also the inferences are made based on likelihood. Although, we do not blame the empiric failure of the DSGE estimation on the estimation techniques' mistakes, however, we advocated that the Bayesian DSGE estimation is more econometrically plausible. In this paper, we do not make further discussion on econometric abilities of Bayesian estimation vis-à-vis VAR and GMM, our focus is inclined towards the economies' interdependencies captured in our model structure. It is thus honest to say that the Bayesian procedure attempts to generate posterior parameters at the neighbourhood of true estimates, however, the prior information can usually create an estimate bias. This points to the central role of the prior distribution we adopted for estimation. Moreover, the ability of the prior to influence the likelihood functions of the posterior information also requires us to simulate the priors and diagnose the simulation result within the acceptable regions. Our decision for simulation also arises from the lack of literature on Bayesian DSGE estimation in Kenya and Ghana. From what we know, only the Jihad, Jan and Rafael (2010) paper considered DSGE for Ghanaian data; yet did not use Bayesian inferences and there were no published DSGE studies for the Kenyan data. Taking this into consideration, we allowed the studies of similar economies in the regions to guide our selection of the priors to be simulated. Table 1 depicts the priors and the density of the distribution we chose for the model parameters based on simulation. The original priors and values are findings from contemporary literature on the subject(Apanisile &Osinubi, 2019; Enisan & Tolulope, 2019; Gupta & Jooste, 2017; Ramey & Zubairy, 2018; Waal, Gupta, & Jooste, 2018; Zubairy, 2009), and estimated parameter is guided by these past studies (***Appendix Table 1).***

4. Results

Posterior Estimation

We proceed to the Bayesian estimation by computing the posterior parameters based on the Metropolis-Hastings algorithm. Table 2a depicts posterior estimates of the purely forward-looking Phillips Curve framework and Table 3a shows the generated variance decomposition for the Ghanaian and Kenyan data. The monetary policy response to inflation, i_{π} , 0.77 and 0.74 for Ghana and Kenya; evidence of weak monetary policy. We reached this conclusion for SA and Nigeria from previous studies, however, smaller than the later economies. The monetary policy response of Ghana and Kenya to inflation is slow, inelastically responsive and shows evidence of incapability to control the market forces in both the financial market and real sectors; characteristic evidence for most developing economies of Africa. Our model reveals that policy rule reacts adequately to the domestic output gap, i_y, 1.13 and 1.20. The result shows the BOG and CBK smoothen interest rate, i_p, by 0.59 and 0.60; an indication of interest rate-output co-movement. The policy response to global interest rate and output gap, $i_{wi}\&i_{w\pi}$, 0.34, 0.32 & 0.23, 0.34 respectively; these are smaller than the simulated priors. With these estimates, we discovered the presence of global influence on the monetary policy functions and the lackadaisical responses to these factors. This research evidence forms the basis for international monetary policy and framework re-evaluation for the African economies. We alluded in our past study that capital repatriation is a possibility in lagging monetary system and African economies face the likelihood of crowding out effect on investment and capital flight in a mismanaged monetary policy. With this in view, we noticed that economies are more averse to crowding out on domestic investment than capital outflow.

The posterior means for the inflation expectation, π_e, are 0.76 & 0.90 for the Ghana and Kenya. We see the potential impact in the global and domestic economic swings, π_y&π_{yw}; 0.73,0.66 & 0.34, 0.26 on the domestic inflation and the high frequency of price optimization by the firms. These parameters are higher than the chosen priors.

The elasticity of intertemporal substitution (preference),σ, 0.56, 0.55 are within the neighbourhood of the priors and indicate the higher agents' risk aversion. The gap smoothening, y_p, 0.68, 0.63 are relatively higher indicating persistence in the agents' consumption habits.

The first autoregressive (AR1) of the shocks to technology, preference, global out gap, interest rate and inflation, φ_π; φ_i; φ_y; φ_{wi}; φ_{yw}; $\varphi_{\pi w}$; 0.54, 0.35; 0.51, 0.52, 0.52, 0.44; 0.31, 0.28; 0.38, 0.38; 0.52, 0.61, are significant indications for persistence. These parameters are within the region of the simulated priors, likewise the standard deviation of shocks.

Table 2b depicts the Bayesian posterior estimates for the inflation inertia DSGE model and Table 3b shows the generated variance decomposition. We do not observe evidence that could inform a change to a position we reached for the purely forward-looking Phillips Curve DSGE, except that the Metropolis-Hastings algorithm generated posterior means and confidence interval that only change by insignificant amounts. Based on these empirics, we argue weakly that the firms' price indexation formations do not matter in the stabilization goals of the BOG and CBK. However, we generalized that there is presence of global influence on the monetary discretions in these economies (Appendix ***Table 2a & 2b).***

Table 3a depicts variance decomposition. It shows the variations of output, interest rate and inflation to innovation in technology, monetary policy, preference, global interest rate, gap and inflation. The global interest rate,ε_{wi}, explains 15.81%, 20.41%, 13.5% and 11.25%, 25.05%, 14.5% variations in output gap, interest rate and inflation in Ghana and Kenya, respectively. These contributions are sizably high and significant to hamper the monetary stabilization objective of the BOG and CBK, (Appendix ***Table 3a).***

Impulse Response Function (IRF) and Variance Decomposition

Panel 1 depicts the responses to exogenous shocks in the forward-looking Phillips Curve model for Ghanaian data. We allowed our model to generate IRFs to track impulse responses of endogenous output, domestic inflation and interest rate to the one- standard deviation to dynamic and structural innovation in preference, monetary policy, technology, global output gap, interest rates and inflation. A positive shock to preference in Panel 1 shows output, interest rate and inflation initially rose above the steady states, persistently declined and rebounded around the equilibrium for few periods and converged back to their potential level at approximately after eleven periods. The monetary policy shocks caused a rise to endogenous macroeconomic variables, humped for few periods and set to converge to equilibrium at approximately the seventh period. The responses of inflation and interest rate to innovation in technology rose and fell sharply to steady state but the output humped twice before convergence to the steady state at approximately twelfth periods. Innovation in global factors (output, inflation and interest rate) destabilised the monetary policy and inflation and persistently fell back to steady states; the convergence speed back to equilibrium was approximately larger than monetary policy rule from shocks to global output and interest rate. Except for the humped shape response of output to innovation in global inflation, initial shocks to global factors destabilised the domestic endogenous macroeconomic variables and ran smoothly to convergence. Therefore, our system model suggested that innovations in the global factors might be less severe to domestic innovations (preference, technology and monetary policy shocks); they are statistically significant for destabilising the monetary policy function to regulate the Ghanaian economy. Table 3a substantiates the IRFs. Approximately, the global factors, ε_{wi}, ε_{yw}, $\varepsilon_{\pi w}$, account to 30%, 40% and 28% for variations in the output, monetary policy and inflation in Ghanaian economy (see appendix: ***Table Panel 1)***.

Panel 2 shows the dynamic responses to one -standard deviation innovations in the forward-looking Phillips Curve model for Kenyan data. A positive innovation in preference reveals humped responses in output, interest rate and inflation and persistently falls below the steady states at approximately tenth periods but converged to equilibrium in the fifteenth periods. The monetary policy innovation caused a positive response to the inflation rate, interest rate and output, humped and persistently declined to the steady state at approximately fifteen periods. The macroeconomic response to monetary shocks in Kenya was slightly slower than the Ghanaian. The responses of inflation and interest rates to shocks to technology rose and fell sharply to equilibrium but the output, which initially responded negatively, rose and persistently fell back to steady state. Like the Ghanaian data, there was high speed of convergence to equilibrium from innovations in global factors. Interest rate and inflation response to global shocks rose and persistently declined to steady state at third and seventh periods. The global interest rate innovation caused the interest rate, inflation and output to hover the equilibrium and sharply converged to steady state. The output gap rose to innovation in the global interest rate, humped and fell persistently to equilibrium at twelfth period. Table 3a. reveals the global factors,ε_{wi}, ε_{yw}, $\varepsilon_{\pi w}$, account to 23%, 45% and 33% for variations in the output, monetary policy and inflation in Kenyan economy. We have pushed the generated impulse response function in the inflation inertia Phillips Curve to the appendix. (***Insert Table Panel 2)***

Endogenous Variable Simulation

We used our model to generate simulated innovations in the preference, technology, monetary policy, global gap, interest rate and inflation, and examined the responses of the domestic interest rate, inflation and output gap for the purely forward-looking inflation and inflation inertia Phillip Curve. The results of the simulation show sizable spikes in the global inflation and gap innovations and high volatility in the domestic inflation and interest rates because of the simulated shocks. This striking evidence reveals the possible policy vulnerability and hinders the monetary policy performance in their stabilisation strategies (Appendix ***Table Panel 3 & 4).***

5. Concluding Remarks

The paper examined the impact of global factors on the effectiveness of national monetary policy responses in Kenya and Ghana with the New Keynesian DSGE model. We develop, interact and tested a DSGE model that enabled us obtain the estimated parameters, which describe the subjective behaviour of an economic agent confronted with a global factor under imperfect information. We used the integrated theoretical intuition in International Fisher Effect (IFE) to predict how unified monetary policy conducted on fixed exchange rate and global trade exposes the agent to exogenous shock and constrained their national monetary policy reaction function to respond positively to domestic financial turmoil and macroeconomic turbulence.

The result of our simulation was robust some checks in both economies. First, we observed persistent inflationary pressure transmitted from global inflation and output. Second, the result shows that international financial market cost-price inflation makes it difficult for national monetary policy function to respond to macroeconomic predictors. Third, we observed instability in interest rate, which implies that national monetary policy cannot respond to economic conditions due to growth in money supply in the economy.

In Ghana, we saw the need to reconcile conservative biased monetary stance with instability in interest rate. Here, Ghana must caution on preferences and uncertainty. This is a critical concern as reducing inflation bias at the expense of global shocks and minor aggressive output shocks might create more tension than the Bank of Ghana could manage.

In Kenya, there is huge lacuna between the level of interest rates and money expansion. The economy suffers from exogenous shocks that pose inevitable cost on the monetary management. The results obtained shows that Kenya’s economy is experiencing a complex global monetary transmission shocks originating from global inflationary pressure. Two major variables explained the present frailty in the country’s monetary stance. First, the economy is consuming and not producing, as such, excessive reliance on external consumption has led to imported inflation. Second, national monetary policy does not adjust quickly to macroeconomic fundamentals.

Absolutely, global factors truly play a predominant role as integrated financial markets and global trade have enhanced bank lending and output distributions, as well as capital flow that are expected to stimulate investment. This is not to say that the international financial market has not contributed more problems to optimal monetary policy formation. One major transmission mechanism observed from the results of the parameters obtained is the liquidity leakage channel, which exposes the domestic macroeconomic indicators to exogenous shocks that are difficult to curtail by national Central Banks due to its complex channel.

We therefore, recommend autonomous monetary policy to enable these countries move to their next stage of development. We claim that rapid quest for international financial market motivated based on promising lending will further expose the economies to shocks that are beyond the purview of the national monetary authority.

The contribution of this paper is in twofold. On the one hand, the methodological approach is different from previous approaches employed by past studies. In this paper, we have interacted our DSGE model with Bayesian estimator, which allows us to validate the subjective behaviours of a rational agent under imperfect information, combined open economy with varied global factors. On the other hand, our paper has used the novelty to incorporate the intuitive framework of International Fisher effect to New Keynesian model, which enabled us to describe how unified monetary policy conduct and fixed exchange rate regime can affect the domestic monetary policy abilities to respond to their economic condition due to global shocks.

Looking ahead, additional studies can focus on exploring how global factors generate common shocks through loanable fund and international settlement framework.

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Table 1. Prior Distribution

Parameters	Description	Mean	Std	Density
Persistence in Shock				
φ_{π}	Autoregressive of technology shock	0.5	0.1	Beta
φ_{i}	Autoregressive of monetary policy shock	0.5	0.1	Beta
φ_{y}	Autoregressive of preference shock	0.5	0.1	Beta
φ_{wi}	Autoregressive ofglobal interest rate shock	0.5	0.1	Beta
φ_{yw}	Autoregressive ofglobal gap shock	0.5	0.1	Beta
$\varphi_{\pi w}$	Autoregressive of global inflation shock	0.5	0.1	Beta
Std. Dev. of Shocks				
ε_{π}	Std. Dev. of technology shock	0.3	0.5	Inverse Gamma
ε_{i}	Std. Dev. of monetary policy shock	0.2	0.3	Inverse Gamma
ε_{y}	Std. Dev. of preference shock	0.25	0.02	Inverse Gamma
ε_{wi}	Std. Dev. of global interest rate shock	0.3	0.5	Inverse Gamma
ε_{yw}	Std. Dev. of global gap shock	0.27	0.2	Inverse Gamma
$\varepsilon_{\pi w}$	Std. Dev. of global inflation shock	0.1	2.0	Inverse Gamma
Monetary Policy Rule				
i_{π}	Inflation coefficient	0.90	0.17	Gamma
i_{wi}	Global interest rate coefficient	0.5	0.15	Gamma
i_{p}	Interest rate Smoothing	0.7	0.12	Beta
i_{y}	Output gap coefficient	1.2	0.2	Gamma
$i_{w\pi}$	Global inflation	0.20	0.1	Gamma
New Keynesian				
π_{e}	Inflation expectation	0.80	0.25	Beta
π_{p}	Inflation persistence	0.9	0.24	Beta
π_{y}	Dom. output gap coefficient	0.6	0.08	Gamma
π_{yw}	Global output gap coefficient	0.2	0.09	Gamma
$\pi_{\pi w}$	Global inflation coefficient	0.09	0.04	Gamma
σ	Preference parameter	0.6	0.09	Normal
y_{p}	Output Gap smoothing	0.7	0.08	Beta

Table 2a. Model Result: Purely Forward Phillips Curve

	Prior		Posterior					
			Ghana			Kenya		
Parameters	**Mean**	**Std**	**Mean**	**90% CI**		**Mean**	**90% CI**	
Shock Persistence								
φ_{π}	0.5	0.1	0.54	0.21	0.60	0.35	0.23	0.54
φ_{i}	0.5	0.1	0.51	0.44	0.60	0.52	0.45	0.64
φ_{y}	0.5	0.1	0.52	0.41	0.71	0.44	0.32	0.61
φ_{wi}	0.5	0.1	0.31	0.27	0.44	0.28	0.21	0.38
φ_{yw}	0.5	0.1	0.41	0.38	0.49	0.50	0.38	0.67
$\varphi_{\pi w}$	0.5	0.1	0.52	0.45	0.58	0.61	0.41	0.70
Std. Dev. of Shocks								
ε_{π}	0.30	0.5	0.34	0.27	0.44	0.27	0.21	0.30
ε_{i}	0.20	0.3	0.19	0.15	0.25	0.23	0.19	0.27
ε_{y}	0.25	0.02	0.19	0.14	0.26	0.32	0.21	0.41
ε_{wi}	0.30	0.5	0.28	0.23	0.43	0.21	0.15	0.30
ε_{yw}	0.27	0.2	0.22	0.12	0.33	0.29	0.23	0.38
$\varepsilon_{\pi w}$	0.1	2.0	0.19	0.14	0.28	0.14	0.09	0.18
Monetary Policy Rule								
i_{π}	0.90	0.17	0.77	0.66	0.81	0.74	0.66	0.81
i_{wi}	0.5	0.15	0.34	0.23	0.43	0.32	0.25	0.47
i_{p}	0.7	0.12	0.59	0.41	0.60	0.55	0.41	0.60
i_{y}	1.2	0.2	1.13	0.80	1.20	1.23	1.19	1.27
$i_{w\pi}$	0.20	0.1	0.23	0.14	0.34	0.21	0.15	0.31
New Keynesian								
π_{e}	0.50	0.25	0.76	0.65	0.90	0.65	0.59	0.81
π_{y}	0.6	0.08	0.73	0.64	0.82	0.66	0.54	0.76
π_{yw}	0.2	0.09	0.34	0.27	0.55	0.26	0.21	0.39
$\pi_{\pi w}$	0.09	0.04	0.12	0.08	0.19	0.15	0.11	0.21
σ	0.6	0.09	0.56	0.43	0.62	0.55	0.48	0.67
y_{p}	0.7	0.08	0.68	0.59	0.78	0.63	0.52	0.73

Source: *Researchers' (2019)*

Table 2b. Model Result: Backward Inertia Phillips Curve

Parameters	Prior Mean	Prior Std	Ghana Mean	Ghana 90% CI		Kenya Mean	Kenya 90% C	
Shock Persistence								
φ_{π}	0.5	0.1	0.53	0.21	0.63	0.32	0.21	0.55
φ_{i}	0.5	0.1	0.49	0.42	0.62	0.50	0.42	0.66
φ_{y}	0.5	0.1	0.53	0.40	0.73	0.45	0.30	0.69
φ_{wi}	0.5	0.1	0.34	0.22	0.45	0.30	0.18	0.40
φ_{yw}	0.5	0.1	0.42	0.36	0.50	0.51	0.32	0.70
$\varphi_{\pi w}$	0.5	0.1	0.50	0.42	0.52	0.62	0.39	0.73
Std. Dev. of Shocks								
ε_{π}	0.30	0.5	0.35	0.23	0.47	0.28	0.23	0.38
ε_{i}	0.20	0.3	0.19	0.12	0.22	0.24	0.15	0.30
ε_{y}	0.25	0.02	0.20	0.13	0.28	0.33	0.18	0.42
ε_{wi}	0.30	0.5	0.27	0.24	0.42	0.22	0.12	0.33
ε_{yw}	0.27	0.2	0.25	0.10	0.34	0.28	0.22	0.36
$\varepsilon_{\pi w}$	0.1	2.0	0.21	0.13	0.30	0.15	0.07	0.20
Monetary Policy Rule								
i_{π}	0.90	0.17	0.80	0.64	0.98	0.76	0.63	0.83
i_{wi}	0.5	0.15	0.32	0.24	0.46	0.36	0.23	0.56
i_{p}	0.7	0.12	0.61	0.38	0.72	0.56	0.40	0.65
i_{y}	1.2	0.2	1.15	0.81	1.27	1.24	1.13	1.33
$i_{w\pi}$	0.20	0.1	0.23	0.13	0.31	0.22	0.12	0.32
New Keynesian								
π_{p}	0.9	0.24	0.79	0.62	0.94	0.63	0.53	0.84
π_{y}	0.6	0.08	0.71	0.63	0.81	0.63	0.52	0.75
π_{yw}	0.2	0.09	0.35	0.23	0.56	0.27	0.20	0.40
$\pi_{\pi w}$	0.09	0.04	0.15	0.09	0.21	0.19	0.10	0.23
σ	0.6	0.09	0.56	0.41	0.66	0.57	0.42	0.75
y_{p}	0.7	0.08	0.70	0.53	0.89	0.64	0.50	0.81

Source: *Researchers' (2019)*

Table 3a. Variance Decomposition

	Ghana Output Gap	Ghana Interest Rate	Ghana Inflation	Kenya Output Gap	Kenya Interest Rate	Kenya Inflation
ε_{π}	7.47	20.68	50.10	8.56	16.20	45.01
ε_{i}	5.10	30.5	7.35	7.60	28.64	8.35
ε_{y}	56.10	5.61	13.0	60.25	9.30	12.65
ε_{wi}	15.81	20.41	13.5	11.25	25.06	14.35
ε_{yw}	10.51	10.5	4.62	7.51	14.30	6.20
$\varepsilon_{\pi w}$	5.01	12.3	11.43	4.83	6.50	13.44

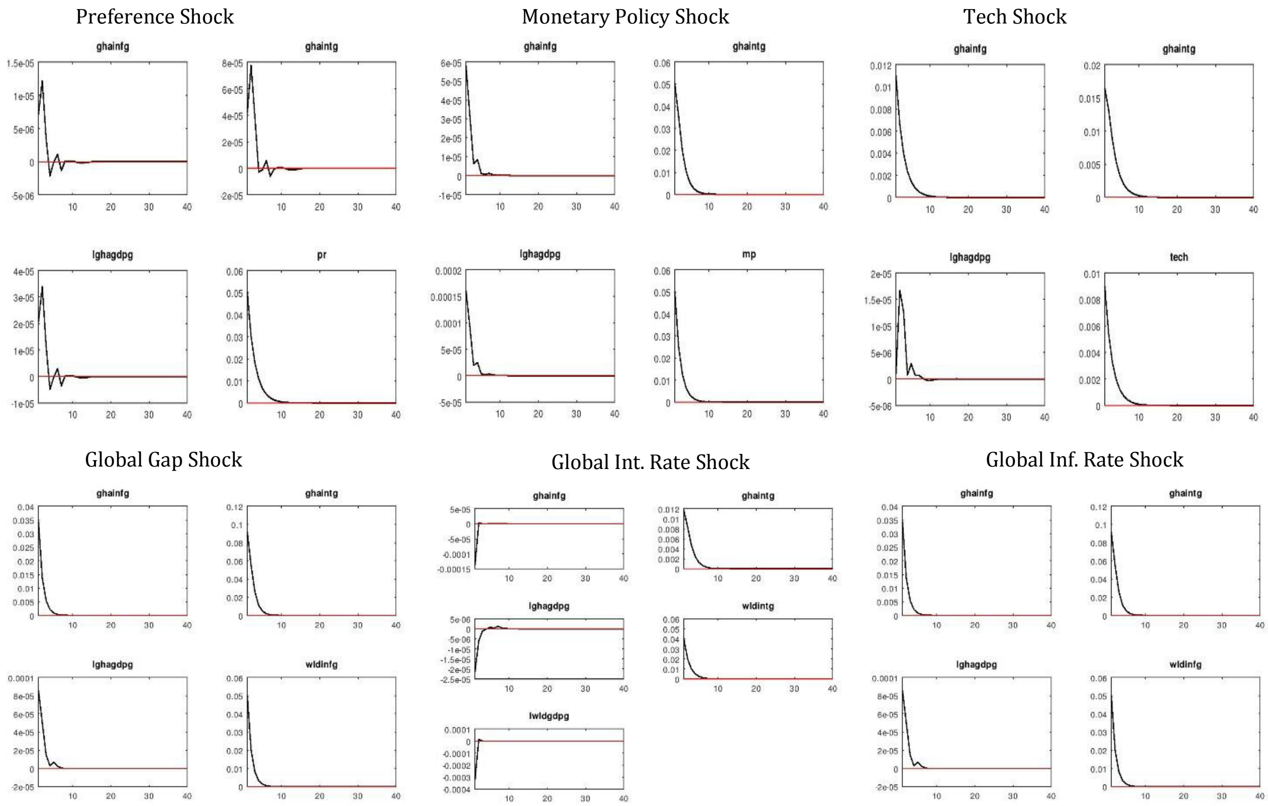
Variance decomposition simulating one shock at a time (in percent) (hp filter, lambda = 1600)
Source: *Researchers' (2019)*

Table 3b. **Variance Decomposition**

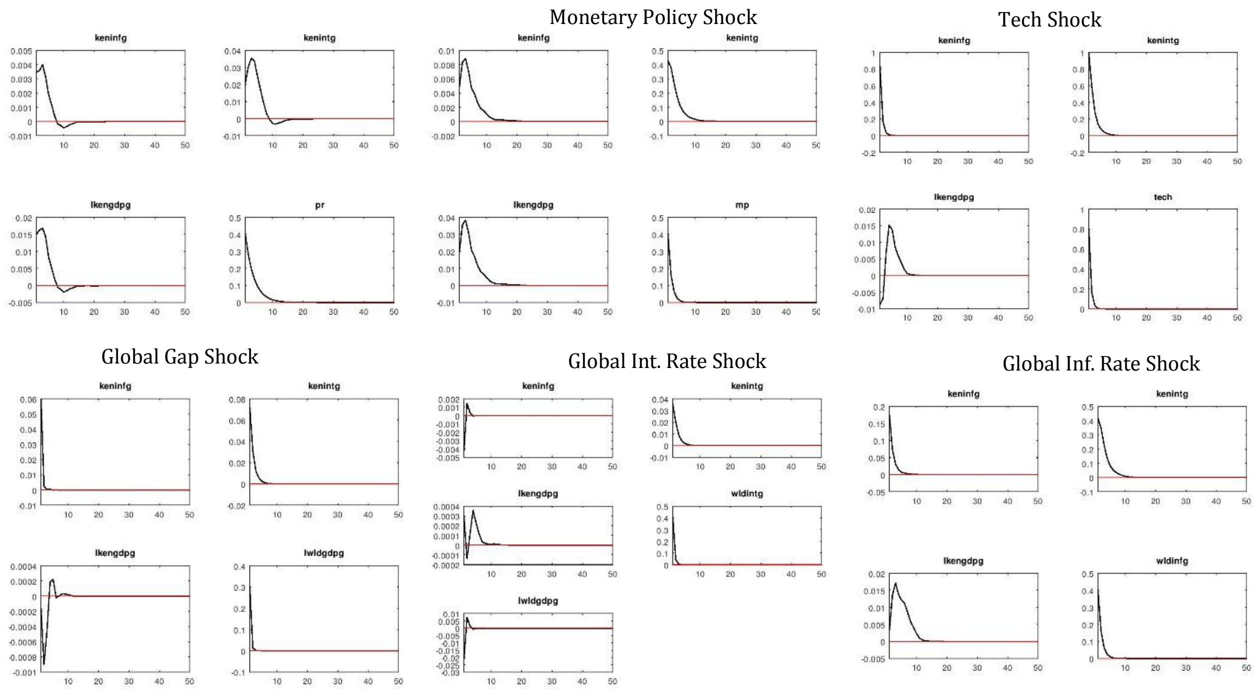
	Ghana			Kenya		
	Output Gap	Interest Rate	Inflation	Output Gap	Interest Rate	Inflation
ε_{π}	8.56	17.34	44.53	7.41	19.21	48.16
ε_{i}	6.01	29.98	9.71	5.12	26.45	8.20
ε_{y}	55.24	6.53	12.52	55.12	7.81	14.17
ε_{wi}	15.21	18.12	14.51	11.21	18.56	18.41
ε_{yw}	9.53	12.50	8.90	14.12	13.5	5.80
$\varepsilon_{\pi w}$	5.45	15.53	9.83	7.02	14.47	5.26

Variance decomposition simulating one shock at a time (in percent) (hp filter, lambda = 1600)
Source: *Researchers' (2019)*

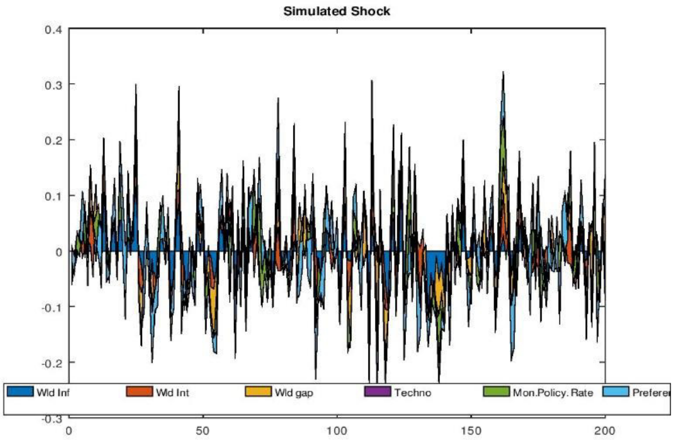
Panel 1. Ghana: Purely Forward Looking New Keynesian Phillips Curve

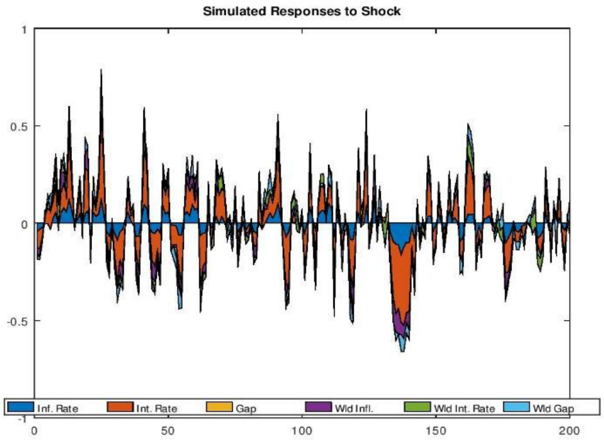


Panel 2. Kenya: Purely Forward Looking New Keynesian Phillips Curve

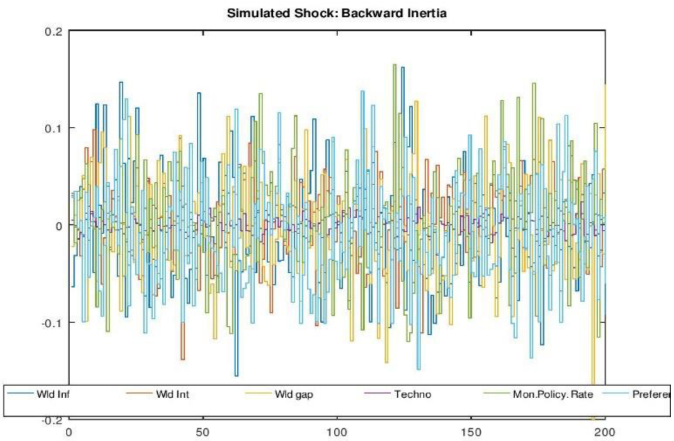


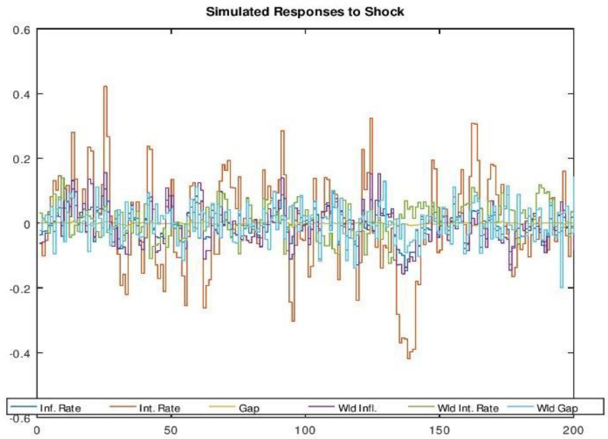
Panel 3. Ghana: Simulation



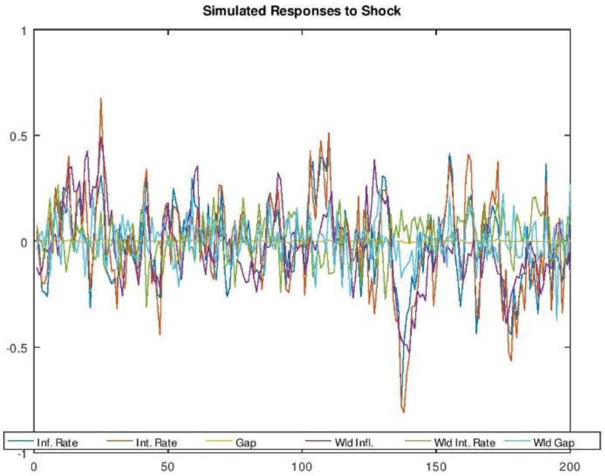


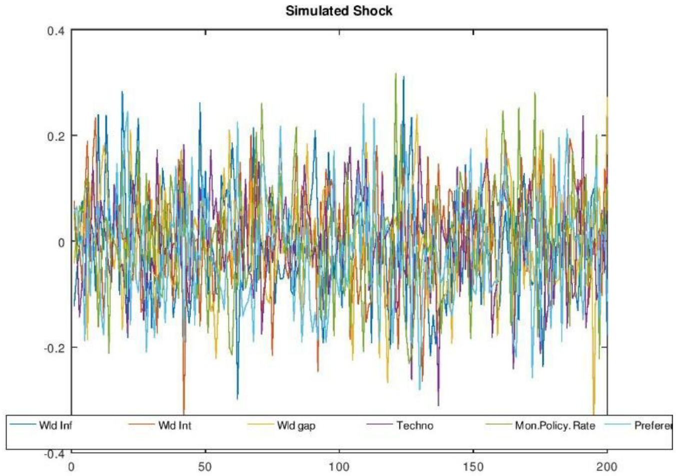
Backward Inertia





Panel 4. Kenya: Simulation





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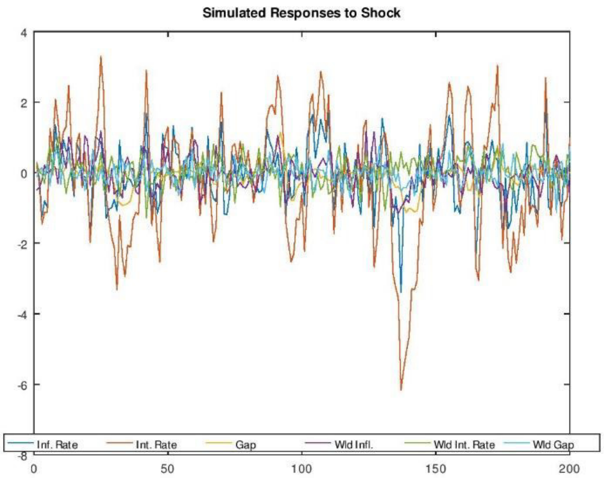
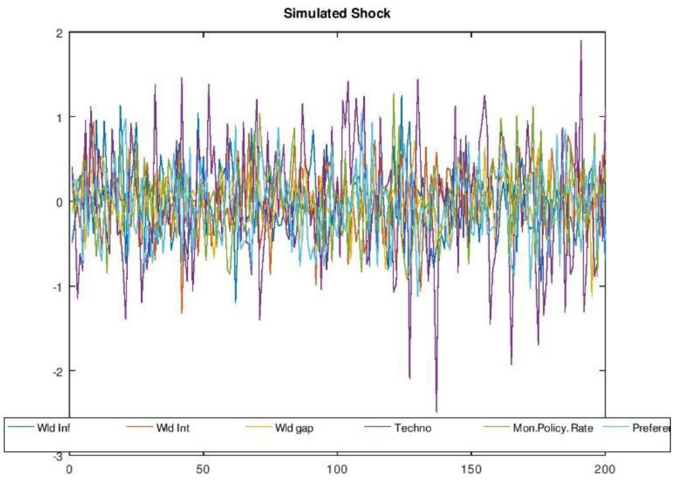
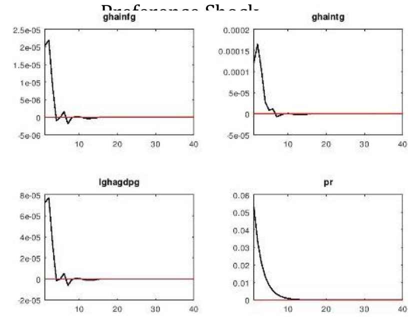


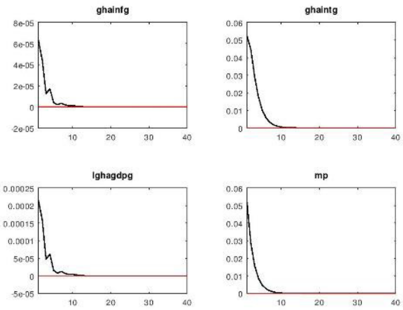


Panel 5. Ghana: Backward Inertia New Keynesian Phillips Curve

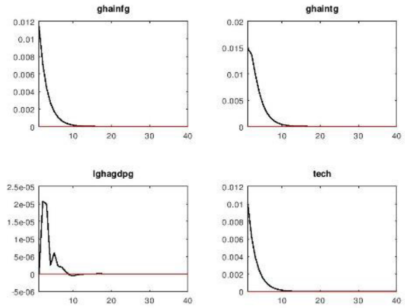
Preference Shock



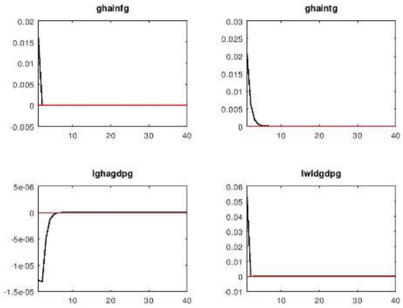
Monetary Policy Shock



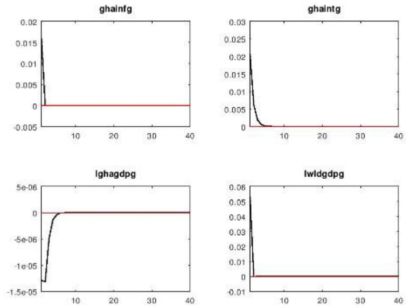
Tech Shock



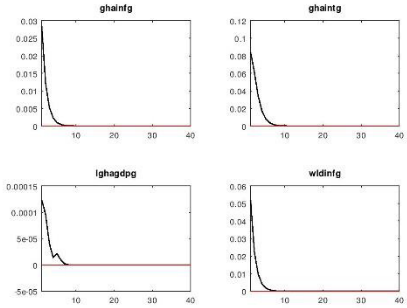
Global Gap Shock



Global Int. Rate Shock

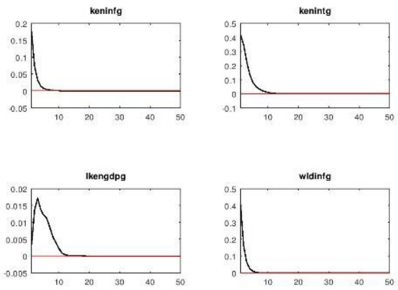


Global Inf. Rate Shock

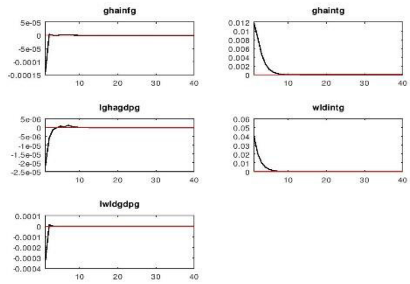


Panel 6.Kenya: Backward Inertia New Keynesian Phillips Curve

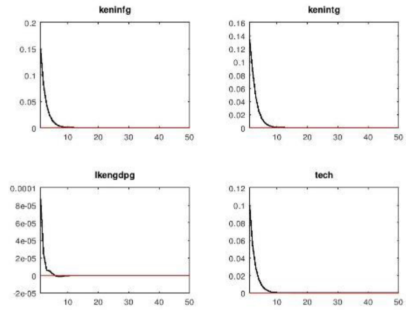
Preference Shock



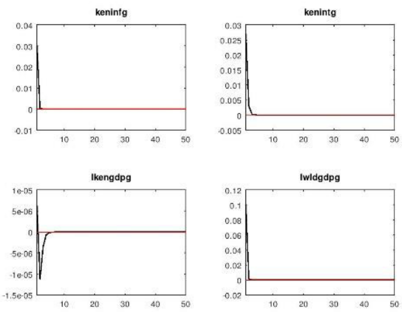
Monetary Policy Shock



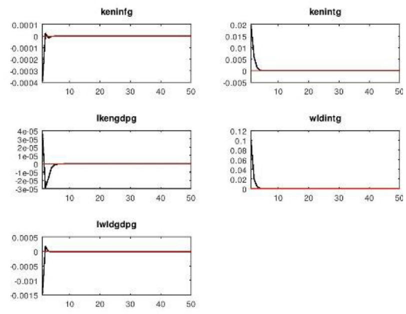
Tech Shock



Global Gap Shock



Global Int. Rate Shock



Global Inf. Rate Shock