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## Article

# Monetary policy interdependency in fisher effect: A comparative evidence

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## Monetary Policy Interdependency in Fisher Effect: A Comparative Evidence

**Abstract:** In this paper, we examine the ability of Fisher effect to describe the subjective behaviour of monetary policy responses for nations constrained by global factors. We developed and estimated a simple DSGE model for appraising the consequence of an integrated financial market predictor on national monetary policy response in Africa's largest economies – Nigeria and South Africa. The paper integrated the theoretical intuition of the famous Fisher effect on the New Keynesian DSGE model with global predictors to describe national monetary policy response as it influence domestic financial variables and macroeconomic fundamentals. Simulations show that the existence of global factors threatens the abilities of national monetary policy to predict financial variables and macroeconomic fundamentals in their economies.

**Key words:** DSGE model, Macroeconomic forecast, Monetary policy, Fisher effect, Africa

**JEL Classification:** D50, C53, E12, E44, E61

### 1. Introduction

The study examines whether Fisher effect can describe the subjective behaviour of monetary policy in the two largest economies in Africa – Nigeria and South Africa. It probes whether the impact of global output and financial market integration are responsible for the abilities of national

monetary policy to impact positively on their macroeconomic predictors. It further re-evaluates the relevance of monetary policy conducted where the future of a nation is determined by a unified monetary policy without attention to the economic conditions of these countries. This theme is particularly important because an overcited scholarship has once suggested that the extent to which a monetary policy of a nation can respond to financial and macroeconomic predictors is determined by the level of price stability and sustainable growth within the economy (Blanchard, 2018; Boianovsky, 2013; Christiano, Eichenbaum, & Trabandt, 2017; Fisher, 1919; Sibert, 1999).

In the presence of global factors, internal economic stability has become the subject of inquiry among scholars. This is because integration often leads to social cost or economic quarantine where a national monetary policy becomes subjective to unified monetary policy conduct, which exposes the majority of the poor nations to external shocks (Azariadis, 2018; Jump & Levine, 2019; Matsuyama, 2004; Twinoburyo & Odhiambo, 2018; Woodford, 2007). The negative impact affected investment and resulted in slow economic growth. As observed, the transmitted shocks on the nominal interest rate will affect the real economy through the product and financial market during policy mechanization. The economic agent living in these unlucky nations are hit by the shocks, mostly the developing world, causing adverse effect on the individual's welfare (Blanchard, 2016; Egwai-khide & Eregha, 2018; Kang, 2018; Lindé, 2018; Mankiw & Reis, 2018). In the end, the aftermath effects of these policy linkages lead to slow growth, investment breakdown and harsh economic conditions as well as a web of poverty within the system (Nyankweli, 2012). This misfortune continues as the polarization of the world economy opens the lacuna in the trade balance and the poor-affected economies with impotent monetary policy became subjected to international monetary order. Thus, they become bonded to borrowing with the harsh interest rate to meet up their national budget (Matsuyama, 2004, 2019). One possible remedy proposed by structuralism is to cut up the global link and pull out of the financial market thereby enhancing the credibility of their monetary policies (Gonçalves, Portugal, & Aragón, 2016; Gonçalves, Veiga, & Mariti, 2019; Hollander & Liu, 2016; Lewis, 1977; Matsuyama, 2004). Despite the somewhat soothing relief that this remedy promotes, there are consequence for that must also be considered by the poor economies (Myrdal, 1957).

A number of studies have attempted to examine the link between global factors and national monetary policy responses. In a famous contribution, Irving Fisher motivated the unification of international monetary policy through the popular Fisher Effect (Bayat, Kayhan, & Taşar, 2018; Fisher, 1919). This hypothesis will be re-examined using the two largest economies in Africa to see whether it de-

scribes the subjective implication of the Central Bank's policy as it depends on the global interest rate. We considered this framework because it shows the link between global factors as it affects the conduct of national monetary policy and real economic activities. We observed that despite the empirical criticism, the Fisher hypothesis remains the foundation of the evolution of international monetary order in monetary academic literature.

A distinctive feature of the Fisher effect hypothesis is that real monetary policy variable is independently quantified against inflationary expectation. Thus, these effects may be examined from five perspectives. On the first ledger, inflationary pressure has the potential to stimulate unpredictable policy response which might have an adverse effect on stabilization of the system (Balcilar & Ozdemir, 2013; Barro & Gordon, 1983; Matsuyama, 2004; Willis & Cao, 2015). On the second ledger, investigating the erosion in the exchange rate due to external shock from trade and capital flow may have complementary distortion on the growth of inflation which might cause adverse effects on the real economic activities with the Fisher effect (Ciccarone, Giuli, & Marchetti, 2019; Eregha & John, 2017; Fabris, 2018; Matsuyama, 2019; Naito, 2012; Patrick, Moura, & Pierrard, 2019). On the third ledger, the systemic asymmetric leadership monetary policy role where the conduct of national monetary policy depends on the superiority of advanced monopolistic policy in international monetary framework, which creates imbalance in the domestic financial market can be explored beyond dimension using Fisher effects (Clausen & Hayo, 2006; Fatima, 2013; Garín, Lester, & Sims, 2018; Kamin, 2010; Li, 2015; Matsuyama, 2004; Sznajderska, 2014; Tawadros, 2016). This third ledger was extended by Kamin (2010) and Fatima (2013), from two policy perspectives. First, the studies suggest plausible increase in global economic activities to create distortion in macroeconomic predictors. This might have an adverse effect on domestic output (Azariadis, 2018; Keating & Kanyama, 2015; Mankiw & Reis, 2018). Second, the aforesaid global turmoil can equally alter the setting of interest rate monetary transmission mechanism which can have adverse effects on the real economy (Moran & Queralto, 2018; Mutschler, 2018).

The fourth ledger shows the effects of real interest rate on the purchasing power of loanable proceeds which constrained the use of fiscal design to complement monetary efforts in policy mix channel (Clarida, Gali, & Gertler, 1999; Fala-giarda & Saia, 2017; Galvão, Giraitis, Kapetanios, & Petrova, 2016; Han, 2014; Kouri, 1981). The fifth ledger is the implication of the world political negotiation on trade, which has adverse effects on the proceed from trade and impact negatively on the balance of payment of other nations (Auer & Mehrotra, 2014; Kabukçuoğlu & Martínez-García, 2018; Kang, 2018; Nechio, Carvalho, & Nechio, 2018; Roy, 2017)

Certainly, interrogating how monetary policy is conditioned to global output and financial market integration, which paves way for transferring shocks from a superior nation to “unlucky ones”, needs to be urgently addressed. This is critical since national economies of countries have become dependent due to the so-called international monetary bonds (Barro & Gordon, 1983; Isola Lawal, Olukayode Somoye, Ayoopo Babajide, & Ikechukwu Nwanji, 2018). For instance, some studies have shown that domestic inflation will always depend on current and expected future monetary policy. Also, some studies suggested that this could threaten the ability of national central banks to control inflation within their borders, at least in the absence of coordination of policy with other central banks (Fatima, 2013; Woodford, 2007).

In this paper, we consider the different ways global trade and financial integration bond might likely constraint national monetary policy in Nigeria and South Africa. We describe the abilities of Fisher effects to explain the effects of the perceived exogenous shock arising from the global tension. The novelty of our work lies on the abilities of the Fisher effects to predict the effectiveness of interdependency monetary policy conduct to expose the real economic variable to macroeconomic imbalance, which has a possible transmitting factor that causes financial turmoil through the exchange rate channel. We claim that the aforesaid channel is a critical aspect of the monetary transmission mechanism that connects the conventional interest rate channel to the real sector of the economy. Understanding that the fundamental role of the Central Bank is to serve as the lender of last resort and stimulate the domestic economy requires its independence. As such the absence of its independence implies that the economy may remain stagnated. This therefore suggests that fruitless monetary policy effort might contrast credit, money mass and financial predictors.

## 2. Model

Our model is based on the above theoretical intuition and the empirical strategy of Han (2014), Christiano et al. (2018), Blanchard (2018), as well as Fujiwara and Wang (2017). We therefore present four market condition DSGE model for Nigeria and South Africa Labour market, Output market, financial market, and global market (product and financial market). Thus, baseline model for this present study is specified as:

**Household**

We consider household consumption stated as:

*Consumption setting*

$$C_{i,j,t} = 1/\theta_t - \alpha \left[ Q/P_t + \alpha G_t - \alpha T_t \right] \tag{1}$$

Where  $C_t$  = household consumption at time  $t$ ,  $1/\theta_t - \alpha$  = multiplier effect,  $T_t$  = household tax at time  $t$ .  $P_t$  = price level,  $Q$  = household spending velocity.

With preference maximization option as:

$$e(p, C_{i,j,t}) = \exp \left[ \sum_{i,j,t=0}^{\infty} \alpha, \log P_{i,j,t}, + \{ \prod_{i,j,t=0}^{\theta} P^{\beta} |\mu_t \} \right] \tag{2}$$

Where,  $\alpha_1, \dots, \alpha_n, \beta_1, \dots, \beta_n$  are utility maximization prospects.

Capital available to household is expressed as:

$$f(l_{i,j,t}, k_{i,j,t}) = l_{i,j,t}^{\varphi} k_{i,j,t}^{1-\varphi} \tag{3}$$

$$d(f(l_{i,j,t}, k_{i,j,t})) / l_{i,j,t} = \varphi l_{i,j,t}^{\varphi-1} k_{i,j,t}^{1-\varphi} \rightarrow = \varphi \left( \frac{k_{i,j,t}}{l_{i,j,t}} \right)^{1-\varphi} \tag{4}$$

$$d(f(l_{i,j,t}, k_{i,j,t})) / k_{i,j,t} = \varphi l_{i,j,t}^{\varphi} k_{i,j,t}^{-\varphi} \rightarrow = (1 - \varphi) \left( \frac{l_{i,j,t}}{k_{i,j,t}} \right)^{\varphi} \tag{5}$$

Thus, the household elasticity of substitution for capital and his labour is expressed as:

$$\begin{aligned} & d(f(l_{i,j,t}, k_{i,j,t})) / l_{i,j,t} = \\ & \frac{\Delta \left( \frac{k_{i,j,t}}{l_{i,j,t}} \right)}{\frac{k_{i,j,t}}{l_{i,j,t}}} / \frac{\Delta TRS}{TRS}, \text{ where } TRS \text{ is rate of substitution} \end{aligned} \tag{6}$$

Index of aggregate labour index  $l_{i,j,t}$  becomes:

$$l_{i,j,t} = \left( \int_0^1 a N_{i,j,t}(h)^{1/1+\theta_l} dh \right)^{1/\theta_l}, \text{ where } N \text{ is total labour force,} \tag{7}$$

and

Wage index becomes:

$$W_{i,j,t} \left( \int_0^1 a W_{i,j,t}(h)^{1/\theta} dh \right)^{-\theta_w} \tag{8}$$

Where,  $W_{i,j,t}$  denote wage,  $h$  house of work at time  $t$  and  $i, j$  or two economies under consideration.

Therefore, household maximized profit from work hour where:

$$V_{i,j,t}^l = N_t W_t - \int_0^1 W_{i,j,t} l_{i,j,t}^{-\tau/(1-\tau)} \tag{9}$$

$V_{i,j,t}^l$  denote profit and ability of labour to select best preference.

*Household financial market*

Household capital is taken to be stock where household can either invest in 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 Fisher effect.

$$M_{i,j,t}^d / P_t = f(C_{i,j,t}, i_{i,j,t}) \tag{10}$$

Where  $M_{i,j,t}^d$  is money demand at time  $t$ , in country  $i$  and  $j$  (where  $j$  is the international financial market),  $P_t$  denote price level (this obey the law of one price),  $i_{i,j,t}$  denote interest rate (that exhibit Fisher effect) and  $f$  denote household preference to invest in financial market or to consume.

**Firm**

The firm operates in a product market with two factors, cost function, profit function and competition with global output. Two factors of production at cost are stated as:

$$(L_{i,j,t}, K_{i,j,t}) = L_{i,j,t}^\vartheta K_{i,j,t}^{1-\vartheta} \geq C, \quad 0 < \vartheta < 1 \tag{11}$$

$c(w, y) = Y(L_{i,j,t}^{\rho/\rho-1} + K_{i,j,t}^{\rho/\rho-1})^{\rho-1/\rho}$  is the cost function of the firm, which exhibits a cobb Douglas features, where  $Y$  denote firm output,  $L$  firm labour,  $K$  firm capital.

### Output becomes

$$Y_{i,j,t} = \left( \int_0^1 a Y_{i,j,t}(i)^{1/\theta} di \right)^{-\theta_p} \quad (12)$$

and output is set as:

$$Y_{i,j,t}^* = C_{i,j,t} + I_{i,j,t} + G_{i,j,t} \quad (13)$$

Where,  $C_{i,j,t}$  = consumption level,  $I_{i,j,t}$  = investment level, and  $G_{i,j,t}$  = Government expenditure,  $Y_{i,j,t}^*$  global output.

### Our price setting

Where the competitive firm aggregate price with constant return to scale becomes:

$$P_t = \left[ \int_0^1 P_{j,t}^{-\tau/(1-\tau)} \right]^{\frac{-(1-\tau)}{\tau}} \quad (14)$$

Thus, the firm profit maximizing function becomes:

$$\Pi \pi_{i,j,t} = P_t Y_t - \int_0^1 P_t Y_{j,t}^\tau \quad (15)$$

Real exchange rate and Price under tradable and non-tradable

$$P_t = \phi \left[ \frac{P_v}{P_\eta} \right] \quad (16)$$

Where  $P_v$  denote price of tradable and  $P_\eta$  denote price of non-tradable, and  $\phi$  is homogenous of degree 1 (i.e. it conforms the law of one price). Thus, exchange rate becomes

$$e = EP^*/P, \quad (17)$$

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

$$\sum_{\substack{0 \leq i \leq m \\ 0 < j < n}} P(1+i) = \sum_{\substack{0 \leq i \leq m \\ 0 < j < n}} P(1+i^*) E_{t+1}^*/E_t \quad (18)$$

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



$\sum_{\substack{0 \leq i \leq m \\ 0 < j < n}} P(1 + i^*) \frac{E_{t+1}^*}{E_t}$  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.

**Global Product market**

Drawing from the work of Han (2014), the aggregate product market representing the world IS curve, which explained the gap between global output as it affects the national economies in Nigeria and south Africa is presented as:

$$y_t = \beta_y y_{t-1} + \beta_r (\mathfrak{B}_r r_t^\$ + \mathfrak{B}_{r,s} \sigma_t + \beta_{To_t} (\mathfrak{B}_r To_t + (1 - \mathfrak{B}_{To}) To_{t-1} + \omega_\tau \tau_t + \omega_y y_t^* + \varepsilon^y) \tag{19}$$

Where  $r_t$  denotes real interest rate in national currency, and  $r_t^\$$  denote global real interest rate in US dollars, we expect output gap to impact on the parameter  $\beta_r$  and idiosyncratic parameter  $\mathfrak{B}_{r,s}$  and  $\mathfrak{B}_r$ . While,  $\tau_t$  denote parameter of trade deficit relative to global output which is expressed as the trade openness among the countries.  $\varepsilon^y$  capture demand shock.

**New Keynesian Philip Curve and Fisher Effects**

Following the Philip curve presented by (Han, 2014), stated as :

$$\pi_t = \delta_\pi \pi_{t-1} + \delta_\pi E_t \pi_{t+1} + \delta_y + y_t + \delta_m (\pi_t^m + \sigma_t - \sigma_{t-1}) + e^\pi \tag{20}$$

Where  $\pi_t$  denotes inflation,  $\pi_{t-1}$  adaptive expectation,  $E_t \pi_{t+1}$  rational expectation,  $(\pi_t^m + \sigma_t - \sigma_{t-1})$  is imported inflation measured in national currency of Nigeria and South Africa, while currency variation with respect to international exchange rate erosion is denoted by  $(\sigma_t - \sigma_{t-1})$ .

**Global inflation reaction function n becomes**

The global inflation equation becomes

$$\tau_t = \forall_{\tau_t} y_t + \forall_\sigma (\sigma_t - \sigma_{t-1}) + \forall_\pi (\pi_t^* - \pi_t) + \varepsilon_t^\tau \tag{21}$$

Where,  $\pi_t^*$  denotes global inflation and  $\varepsilon_t^\tau$  denotes shock on exchange rate.

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

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

$$i_t = r_{i,j,t} + \Phi\pi_t \quad (22)$$

Where,  $i_t$  is the nominal interest rate defines as  $i_t = E_t\pi_{t+i} + r_t^r + \Phi_t^*$ ,  $\pi_t = \ln p^{t+1}/p_t$ , denote as inflation and  $r_t^r$  denote real interest rate,  $\Phi_t^*$  denote (risk premium inflation shock)

We then subtracted the inflation expectation over the eight quarters,  $\pi_{t+8}$  to determine the long run as used by, (Orphanides & Wieland, 2004).

$$r_t = i_t - \sum_t \pi_t \quad (23)$$

Thus, the Fisher effect becomes:

$$i_t = \psi i_{t-1} + \tilde{r} + \tilde{\pi} + y_\pi(\pi_t - \tilde{\pi}) + \psi_y(y_t - y_{t-1} - g_z) \quad (24)$$

Using the reduced form based on the concept of simultaneity, we have:

$$\pi_{et} = \theta_{\pi_v} v_t + \theta_{\pi_\varphi} \bar{r}_t^r, \quad (25)$$

where,  $\varphi$  = monetary shock (Nechio et al., 2018).

$$Y_{gt} = \theta_{y_v} v_t + \theta_{y_\varphi} \bar{r}_t^r, \quad (26)$$

Where,  $\theta_{\pi_v}$ ,  $\theta_{\pi_\varphi}$ ,  $\theta_{y_v}$ , and  $\theta_{y_\varphi}$  are negative coefficients.

### 3. Data

The study focuses on the two largest economies in Africa with specific focus on Nigeria and South Africa. The variables used were obtained from the International Monetary Fund's International Financial Statistics yearbook covering the period between 1980 and 2017.

We used the annual percentage change of the consumer price index (CPI) to capture our inflation data. In the New Keynesian Phillips Curve, we assume that firms import inflation from abroad, which changes the pace of price rigidity and

the fraction of firms changing prices in each period. The result of the estimation shows this evidence; that is, the international price changes affect the firm's prices and marginal cost and the conventional NKPC model. From these backdrops, we defend the inclusion of foreign inflation and the world output gap in the NKPC framework.

The monetary policy rate for Nigeria and South Africa's bank rate captures the nominal interest rate; however, we proxied the world interest rate by multiplying the quarterly US Fed fund rate by 4. We rationalize the usage of the US interest rate because the US dollar serves as a common denominator in the international monetary exchange and the impact the US plays in the trade relations with these two giant African economies. The significant role played by the US in the IMF and their spillover effect in the world economy also justify our reason to proxy the world interest rate with the US fed funds rate. In this work, we have conjectured that external shocks synchronized into the monetary policy rule in these countries, therefore, the foreign interest rate impacts the monetary policy rule in these countries. Furthermore, we also investigated the vulnerability of Nigerian and South African economies to disturbances to monetary policy rules in the United States and their big trading partners.

We estimated the real gross domestic products per capita by deflating nominal GDP per capita with the countries and the world's CPIs. We also deflated the gross capital accumulation and final consumption expenditure by the changes in the prices to arrive at the real domestic investment and household consumptions of Nigeria and South Africa.

To estimate our outward-looking New Keynesian Dynamic Stochastic General Equilibrium model, we transformed our variables to reflect their deviation from the steady states. We applied the econometric based data decomposition techniques through the Kalman and HP filtering procedure. We allowed our software used for the estimation to capture the expectation and forward inertia in inflation, output gap, and capital. Our estimation allowed us to graph the impulses from the model's state variables and the responses of the endogenous variables. Our model was able to make an 8-year out-of-sample forecast of the deviation of the observed variables to the steady states. We understand poor parameter estimates give rise to poor forecast, however, we have done the following;

We surveyed the parameter values from some leading papers in the related work; such empiric findings of Fei (2014), Egwaikhide & Eregha (2018), Vadim (2012), Iwata (2009), Zubairy (2010). We allowed Dynare on Matlab to simulate the parameters using the Metropolis-Hastings algorithm and compute the means (see

Table 1). We discover our estimated parameters fall within the range means and the estimates from the past empirics. We used these estimates to generate the impulse response function and the forecast of the deviation from the steady states of the observed variables.

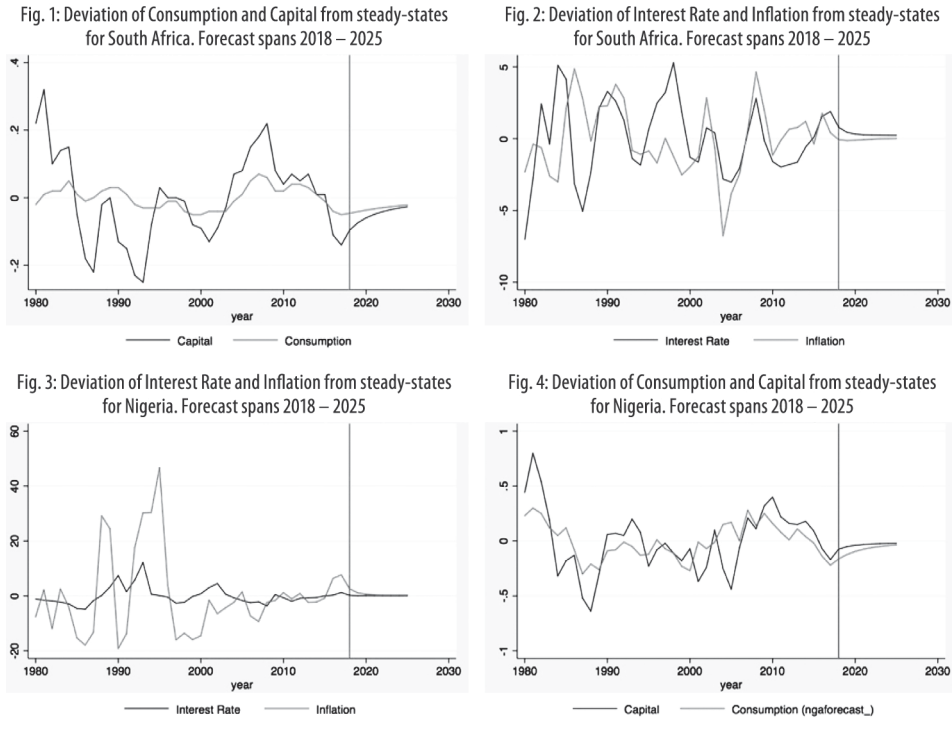
**Table 1: Parameter Values**

Parameters	Description	Mean Value
<b>Monetary Policy Rule</b>		
$m_{\pi}$	Interest rate response to inflation	1.7
$m_{i^w}$	Interest rate response to world interest rate	0.5
$m_{ip}$	Interest rate persistence	0.8
$m_y$	Response of interest to output gap	0.13
<b>New Keynesian Phillips Curve</b>		
$\pi_{\pi p}$	Inflation persistence	0.12
$\pi_y$	Inflation response to output gap	0.10
$\pi_{y^w}$	Inflation response to world output gap	0.34
$\pi_{\pi^w}$	Inflation response to world inflation	0.62
<b>Other Parameters</b>		
$c_i$	Consumption response to interest rate in consumption function	0.4
$k_p$	Capital persistence in capital accumulation	0.3
<b>Internal Shock Persistence</b>		
$\varepsilon_c$	Shock persistence in consumption	0.8
$\varepsilon_m$	Shock persistence in monetary policy rule	0.7
$\varepsilon_y$	Shock persistence in output gap	0.7
$\varepsilon_k$	Shock persistence in capital accumulation	0.7
<b>External Shock Persistence</b>		
$\varepsilon_{i^w}$	Shock persistence in world interest rate	0.7
$\varepsilon_{y^w}$	Shock persistence in world output	0.7
$\varepsilon_{\pi^w}$	Shock persistence in world inflation	0.7
<b>Other Shock Persistence</b>		
$\varepsilon_c$	Shock persistence in interest rate	0.7
$\varepsilon_c$	Shock persistence in capital (rho8)	0.7

Mean values from the findings of Fei (2014), Egwaikhide and Eregha (2018), Vadim (2012), Iwata (2009), Zubairy (2010)

Source: Researcher's (2019).

**Fig. 1-4: Depicting forecast for Nigeria and South Africa, 2018-2025.**



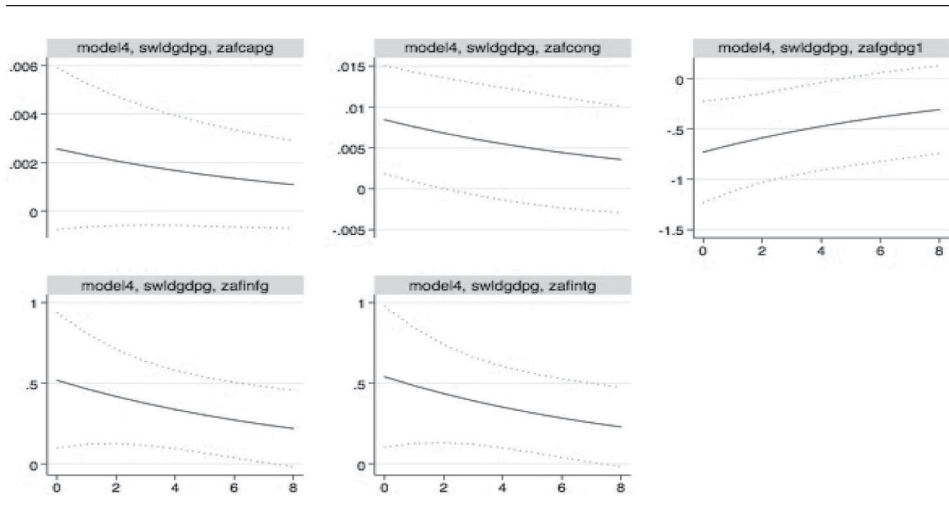
## 4. Results

In this section, we present the results and discuss the finding from our simulation DSGE model.

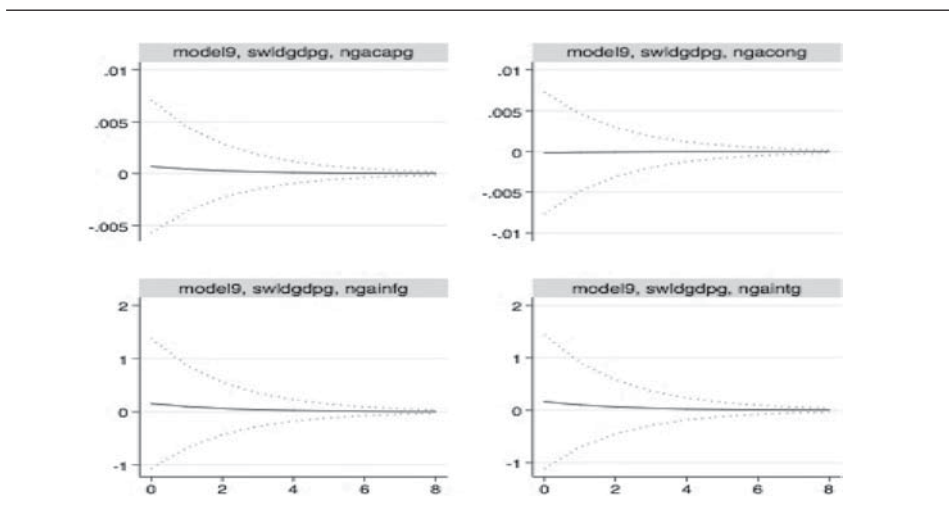
### Evidence of Impulse from Abroad

The following, from our estimated results, clarify the major channels of external shocks in our model. We have considered the world output, world inflation and world interest rate to be exogenously determined and potential mechanism through which shocks from the abroad synchronize in our outward-looking DSGE model framework.

**Fig. 5: Impulse Response Function: Shock to World Output (South Africa)**



**Fig. 6: Impulse Response Function: Shock to World Output**



**Evidence of Impulses from World Output**

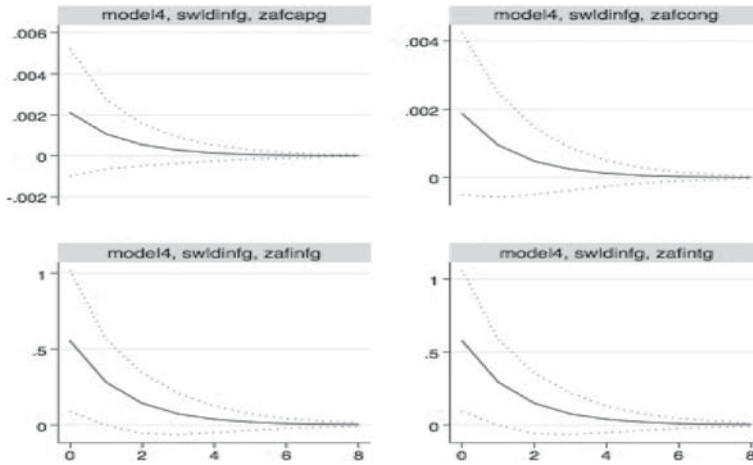
The model estimation results reveal impulses from world output. The Fig. 5-6 shows the dynamic responses of inflation, capital, output gap and monetary policy rates to the shocks from the world output. The chart shows the world output cause short-run and long-run disequilibrium to steady states. A one-percentage change

in the standard deviation in the world output impacts the South African capital formation to rise above its steady and nose-dive towards its steady state. The model predicts a long-term disequilibrium of the capital. The final consumption also rises initially above its steady state from the shock to the world output. The magnitude of consumption responses to the shock transmitted from the external is higher than capital while the rate of convergence back to its steady rate is much slower. The dynamic responses of interest rate and inflation evidently substantiate the presence of monetary policy interdependency and trade integration in South Africa. The impulses from the world output synchronize into the monetary policy rule and inflation data. The Fig. 5 shows that the inflation and interest rate deviation respond positively to shocks, however, they subsequently moved towards the equilibrium. Our model predicts long-run effect of the shocks on the domestic variables. We conclude these pieces of evidence for Nigerian data, however, we observe that the speed of adjustment to equilibrium is much faster in Nigeria than in South Africa; see Fig. 5-6. The empirics show that Nigerian data route back to the steady state before the end of the first period after a shock in world output. Our results reverberate the conclusions reached from some separate studies; see Egwaikhide & Eregha (2018). These pieces of our research evidence resonate to the economic reality of the disturbances from abroad on the real sector and the monetary policy functioning of the Nigerian and South African economies. Without much emphasis on the shock from world output, we unambiguously argue an indication of spill over effect of strong economic integration on these economies.

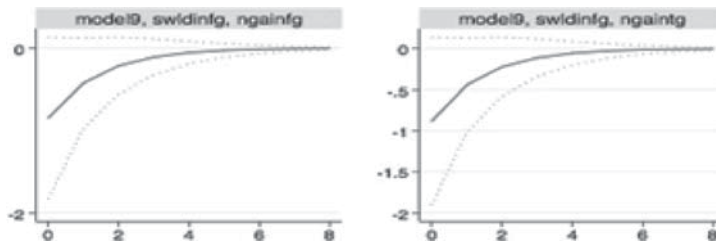
### **Evidence of Impulses from World Inflation**

In our model framework, we incorporated the world inflation into the monetary policy rule and the New Keynesian Phillips Curve to investigate foreign influence of price changes on the monetary policy reaction and the reaction of domestic inflation. Our model predicts a conspicuous interaction between world inflation and these domestic variables. In Fig. 7 & 8, we observe evidence of shocks from the world economy. The chart explains monetary policy rule and domestic inflation initially rise above their steady states, but both converge back to equilibrium before the sixth periods in South Africa. In Nigeria, the shock caused both interest rate and inflation to deviate from their steady but negatively, however, converge to the equilibrium at the sixth period. The variations in responses between these economies arise from varying consumption habit and preferences. Since our research focuses on the evidence of shocks and dynamic responses, we do not investigate further the source of variation in the socio-economic behaviour of the people in South Africa and Nigeria vis-à-vis their trade and financial relations to the global economies. However, findings thus justify our emphasis on vulnerability of the economies to the external shock in our estimation results.

**Fig. 7: Impulse Response Function: Shock to World Inflation (South Africa)**



**Fig. 8: Impulse Response Function: Shock to Inflation (Nigeria)**

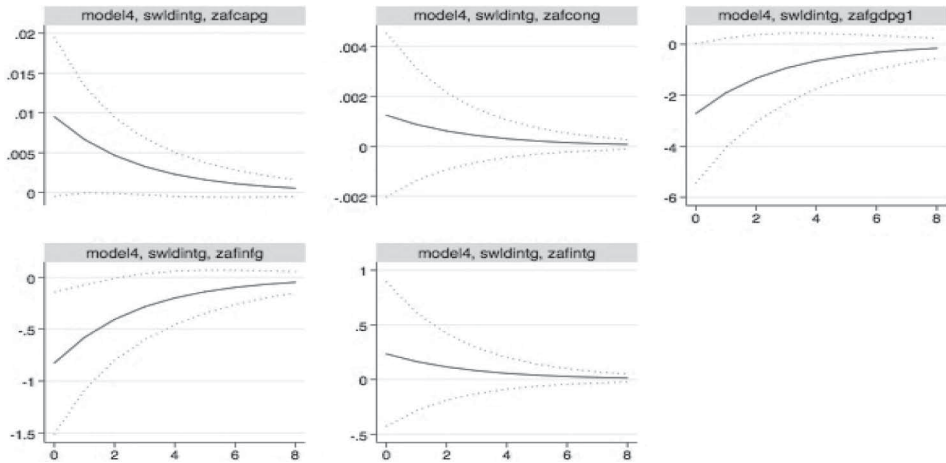


### Evidence of Impulses from Interest Rate

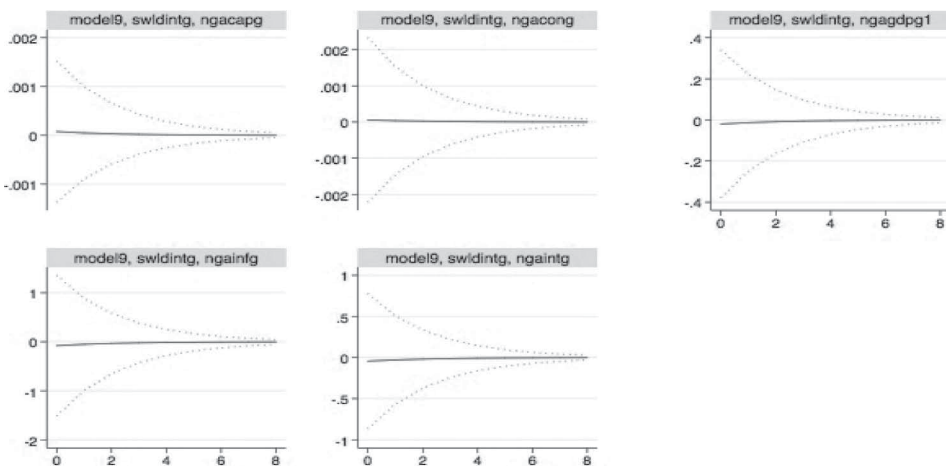
The dynamic responses to the impulses from the world interest rate are equivocally evident. The results were close to signify lack of evidence of shocks. However, the IRF graphs show sharp bends in response line. We observed quick reactions of the domestic variables against shock to the world interest rate in South Africa and Nigeria. The evidence of shock to world interest rate in dis-equilibrating the monetary policy rule and inflation is trickier than the clear evidence of world inflation and output. This finding clarifies that the major drivers of shock transmission from abroad to the Nigerian and South African economies are world inflation and output while world interest rate is secondary mechanism of shock transfer; see Fig. 9 & 10.



**Fig. 9: Impulse Response Function: Shock to World Interest Rate (South Africa)**



**Fig. 10: Impulse Response Function: Shock to Interest Rate (Nigeria)**



**Main Results**

Table 2 reports the parameter estimates of our system of equation. In the model framework, we examined the major drivers of the dynamic movement of interest rate in the monetary policy rule and the inflation in the forward-looking New Keynesian Phillip Curve, the consumption and capital accumulation. With re-

gards to shock dynamics, our model framework allows us to examine the persistence of the internal and external shocks. Since our variables are measured as deviation from their steady state, the interpretation of our results follow suit. The following are our major findings;

**Table 2: Parameter Estimates**

	Nigeria		South Africa	
	Estimates	Std	Estimates	Std
<b>Monetary Policy Rule</b>				
$m_{\pi}$	1.38***	0.45	1.2**	0.3
$m_{iw}$	0.21**	0.09	0.78**	0.33
$m_{ip}$	0.75**	0.34	0.44**	0.19
$m_y$	0.14**	0.05	0.16**	0.04
<b>New Keynesian Phillips Curve</b>				
$\pi_{\pi p}$	0.72**	0.23	0.83*	0.03
$\pi_y$	0.14**	0.03	0.09*	0.006
$\pi_{yw}$	0.28**	0.10	0.24	0.13
$\pi_{\pi w}$	0.15**	0.06	0.23**	0.11
<b>Other Parameters</b>				
$c_i$	0.04	0.03	-0.02**	0.006
$k_p$	1.00***	0.06	1.00***	0.002
<b>Internal Shock Persistence</b>				
$\varepsilon_c$	0.73**	0.14	0.87***	0.08
$\varepsilon_m$	0.33**	0.14	0.60***	0.11
$\varepsilon_y$	0.06	0.68	0.28**	0.13
$\varepsilon_k$	0.08	0.17	0.02	0.16
<b>External Shock Persistence</b>				
$\varepsilon_{iw}$	0.65***	0.15	0.70***	0.08
$\varepsilon_{yw}$	0.63***	0.12	0.89***	0.07
$\varepsilon_{\pi w}$	0.50***	0.14	0.50***	0.14
<b>Other Shock Persistence</b>				
$\varepsilon_c$	0.60***	0.12	0.38***	0.14
$\varepsilon_c$	0.68***	0.11	0.77***	0.11

Note: Robust standard error in parentheses. \*P < 0.1; \*\* P < 0.05; \*\*\*P < 0.001

Source: Researcher's (2019).

This section of our result reveals clear evidence of contemporaneous relationship between the foreign factors and the domestic economic data of Nigeria and South Africa. In the monetary policy reaction, the world interest rate parameter,  $m_{iw}$ , was significant; 0.21 & 0.78. This indicates that monetary policy responds to change in international market interest rate in these economies. This finding corresponds to the finding of Waal, Gupta & Jooste (2018). The elasticity of the dynamic response for the South African monetary policy rule is more than twice for the Nigerian. These two economies face different trade-offs between capital flight and accessibility to domestic investment funds. The Nigerian economy faces the likelihood of capital repatriation with minimum adverse effect on the cost of investment, however, the South African economy faces the likelihood of minimum capital flight while hurting the investments financed with bank loans. In any of these scenarios, the impact of foreign interest rate hurts the economies and calls for international monetary policy tightening.

The estimated parameters for world output gap,  $\pi_{yw}$ , in the inflation equation were significant for Nigeria and South Africa at 0.21 & 0.24, respectively. This implies the dynamic co-movement of domestic inflation and world's episodes of recession and expansions. The magnitude of this impact is substantially high to cause inflation persistence, indeterminate monetary policy and spiral reoccurring episode of economic expansion and contraction. The experiences of African economies have revolved around these vicious cycles of economic crises.

Our estimation reveals the evidence of imported inflation. The parameters,  $\pi_{\pi w}$ , were significant for both Nigeria and South Africa, 0.20 & 0.23, respectively. These findings are unequivocally connected to trade relation of these countries to the rest of the world. Africa is a leading import-dependent continent of which Nigerian and South African economies are the largest. The economies import inflation through loose trade and adverse incessant changes in the exchange rate with rest of the world.

Before we investigate the domestic parameters in our model, it is interesting to briefly examine the persistence of external shocks in our system of equations. Our result reports that shocks from abroad,  $\varepsilon_{iw}$ ,  $\varepsilon_{yw}$  &  $\varepsilon_{\pi w}$ , persist in the framework for Nigeria and South Africa. The estimates were significant at 1% for world output and inflation while at 10% for world interest rate. The impact of shock persistence on the domestic economies was not directly estimated in our model; however, it thus shows the vulnerability of economies to the continuity of the effect of changes in world economic situation.

We turn to the internal parameters. Our model predicts a weak inactive monetary policy response to domestic inflation. The monetary policy rules respond to inflation by,  $m_\pi$ ; 0.98 & 0.99. This result shows clear evidence of feeble monetary system to adequately control current and market projected inflation. The current monetary regime seems to struggle in maintaining price stability. However, we observed that monetary policy persists,  $m_{ip}$ ; 0.75 & 0.44, and positively responds mildly to output gap situations,  $m_y$ , 0.14 & 0.16. These findings substantiate our assumption of weak monetary regime in Africa.

The NKPC predicts our inflation data looks forward. The Nigerian inflation data show,  $\pi_{\pi p}$ ; 1.02 and 1.01 for South Africa. The result cannot be totally disconnected from the inactive policy responses. It is a common and indisputable wisdom that imprudent, inconsistent and injudicious monetary policy can give rise to large amount of unhealthy expectation in real and monetary sectors. We are speculating that incoherent dynamic inconsistency is generating inflation in these economies. Our estimation substantiates the evidence of gap on the inflation dynamics. The economies respond positively to the dynamic movement of the deviation of output from the steady states,  $\pi_y$ .

Our model predicts persistence of internally generated shocks. In Nigeria, shocks to consumption and monetary policy are revealed to persist by,  $\varepsilon_c$ ; 0.73 and  $\varepsilon_m$ ; 0.33. We confirm this evidence including persistence in shock to output gap for the South Africa,  $\varepsilon_c$ ; 0.87,  $\varepsilon_m$ ; 0.60 and  $\varepsilon_y$ ; 0.23.

## 5. Final Remarks

The aim of this paper is to develop and estimate a DSGE model for assessing the consequence of global predictors (global interest rate, global output, and global inflation) on domestic monetary policy responses as it affects the real economic variables in Nigeria and South Africa. The paper integrated the theoretical intuition of the famous Fisher effect on the New Keynesian DSGE model with global predictors to describe national monetary policy response as it influence domestic financial variables and macroeconomic fundamentals.

The finding revealed that inability of domestic policy to respond to domestic financial variables and macroeconomic fundamental was explicitly based on the interdependency of monetary policy formation attached to international order that transmits shocks on national economy through the international financial framework. The results also confirmed that the equilibrium rate of interest is influenced by price movement, income, and global predictors.

Furthermore, the paper contributed to existing literature on the subject matter by providing answers to three questions in global factors and monetary policy debates. The first concern is the pattern of national monetary policy responses to real economy variables in the contexts of trade and financial integration policy. The second is whether the current monetary policy can guarantee stability in the presence of a perceived breakdown in the traditional interest rate monetary transmission mechanism resulting from a unified monetary policy (Matsuyama, 2004). Also, the need to justify, if international bond or evolution of international economic order affect the monetary policy reaction function is also a concern to avert expected external shock on the macroeconomic variable through trade, capital flow, and the possibility of transmitting shocks to the financial market.

The research supports the finding of (O. Blanchard, 2018; Christiano et al., 2018; Fatima, 2013; Han, 2014; Kouri, 1981; Mankiw & Reis, 2018; Woodford, 2007) that existing global factors such as trade and international financial market have severe implication for domestic monetary policy formation. In particular, (Blanchard, 2018; Dilaver et al., 2018; Eregba, 2019; Kang, 2018; Woodford, 2007) have shown that global factors have desirable consequence on the traditional monetary transmission mechanism and that absence of monetary policy autonomy impedes the ability of monetary authorities to curtail inflationary pressure within and beyond their borders.

Importantly, the study contributes further by extending understanding of Fisher effect in New Keynesian DSGE model, which provides insight on the major constrain affecting the ability of monetary authorities in two major African economies from responding effectively to their macroeconomic predictors. The research provides several policy directions that indicate the urgent need to break the unified monetary policy conducts that constrained the effectiveness of monetary policy among these prominent Africa economies. To be precise, our study is advocating for monetary policy autonomy to enable these nations curtail persistent fluctuation and trigger output growth.

Finally, a number of problems emerged, offering directions for future research regarding how global shocks can be managed with the internal persistent inflation remedy in the New Keynesian output growth potential. This aspect is a huge concern as the present framework of unified monetary policy have placed a puzzle on the extent to which expansionary monetary policy could stimulate output growth without affecting the survival rate.

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