

Informal Finance And Macroeconomic Shocks In The Nigerian Economy

Jeremiah I. Ubah^{1,2}, Philip Alege^{1,2}, Adeyemi Ogundipe^{1,2}

¹Department of Economics and Development Studies, College of Business and Social Sciences, Covenant University, Ota, Ogun State, Nigeria.

²Centre for Economic Policy and Development Research (CEPDeR), Covenant University, Ota, Nigeria
DOI: 10.47750/pnr.2023.14.S03.05

Abstract

As the informal sector grows and lacks access to formal finance, unlocking its financial potential is crucial. Thus, this study examines innovative solutions for this essential portion of the economy and the interaction between informal and formal markets during economic crises in Nigeria. This study addresses these research questions: How does Nigeria's formal and informal financial markets interact? How does Nigeria's informal financial market affect growth? How does the informal banking sector react to a Nigerian economic shock? This study utilises the open economy Dynamic Stochastic General Equilibrium (DSGE) model. DSGE model parameters were calibrated and computed using Bayesian methods as well as the Dynare 4.6.4 in Matlab R2021a. The impulse response function reveals that monetary shock increased GDP but decreased government expenditure. Examining Nigeria's fiscal, monetary, and production shocks, the study finds that monetary policy shocks increased output and decreased government expenditure, while fiscal policy shocks decreased output and interest rates. The shock indicates that reduction in government spending diminishes aggregate demand as well as the real GDP. Given the informal finance's response to monetary policy shocks, the central bank should, therefore, be more hawkish, especially in times of high inflation, to achieve macroeconomic goals. Thus, the study suggests that future research should examine how the Nigerian economy reacts to shocks like oil shocks.

Keywords: Bayesian approach, Dynamic Stochastic General Equilibrium (DSGE), Informal finance, Formal finance, Macroeconomic policy.

INTRODUCTION

Informal finance, which refers to unrecorded financial activities conducted outside of official financial organizations, has gained significant attention in economic research (Boafo et al., 2022; Galdino et al., 2018). While informal sector finance is not illegal, it operates without regulation, often emerging as a response to the limitations of the traditional financial market (Hou, Hsueh & Zhang, 2020; Mutsonziwa & Fanta, 2021). The prevailing view suggests that fostering the formal financial market would absorb the customer base of the informal financial sector, as posited by McKinnon as well as Shaw in 1973, who contended that unwarranted regulation in the formal financial sector, such as ceilings on interest-rate and preferential credit distribution, fuels the evolution of informal finance (Mahdi, 2018).

However, some structuralist scholars challenge this perspective, positing that informal financial systems complement the formal system rather than compete with it (Lawhon & Truelove, 2020). Supporting this notion, Bruton, Nuhu, and Qian (2021) found that financial liberalization and inclusion efforts did not significantly enhance credit access for rural residents and small and medium-sized enterprises (SMEs), emphasising the ongoing essentiality of the financial sector in the informal economy. Similarly, the Malawian informal financial sector was found to play a vital role in alleviating economic hardships for the poor, granting them access to credit (Ngalawa, 2018).

Moreover, studies conducted in Ghana, Malawi, Nigeria, and Tanzania highlighted the essential role of informal financial institutions in mobilizing household savings and financing small businesses, which are regularly excepted from formal banking services due to high data requirements, business costs, risks, and loan defaults (Girón, Kazemikhasragh, Cicchiello, & Panetti, 2022; Nguyen & Canh, 2021; Steel, Aryeetey, Hettige & Nissanke, 1997). In contrast to commercial banks, the informal financial system provides micro- and small-sized businesses with simpler access to financing. However, the presence of a significant informal financial sector may complicate monetary policy

(Ngalawa, 2018), demanding a scientific investigation of the connection between formal and informal finance within macroeconomic models that consider the preferences of economic agents and shocks (Dawid, Leeper & Neugart, 2018).

This study aims to explore the vital role of informal finance in Nigeria's macroeconomic policies, emphasizing the need for effective policy development that accounts for the unique characteristics of the economy, especially during business cycles. Through the employment of the model of New Keynesian Dynamic Stochastic General Equilibrium (NK DSGE), this study analyses the impact of the informal finance sector on a small open economy. Previous empirical studies have examined the informal financial sector (Neuwirth, 2018; Ngalawa & Vieg, 2013; Obadeyi, 2015; Uruakpa, Kalu & Ufomadu, 2019), but the DSGE framework allows for a comprehensive understanding of the interactions between various economic agents in response to economic shocks (Fernández-Villaverde & Guerrón-Quintana, 2021). The use of dynamic stochastic general equilibrium models is backed by the microeconomic principles of limited decision making, which capture the equilibrium distributions and prices when agents optimize their objectives within resource limitations (Mukhamediyev & Khitakhunov, 2017).

Furthermore, dynamic stochastic general equilibrium models are resistant to the Lucas criticism and provide a structural framework that captures policy interventions and transmission mechanisms (Apanisile & Osinubi, 2020). These models are forward-looking and possess predictive tendencies, enabling precise and unambiguous examination of shocks (Enisan & Tolulope, 2019). Despite the extensive literature on informal finance and DSGE modelling, no study to date has employed a micro-founded DSGE framework to reconnoitre the interactions between informal and formal financial markets and their implications for Nigeria's economic activity. Therefore, this study fills this gap in the literature by examining the nexus between formal and informal finance within a macro monetary model based on a micro-founded DSGE representation.

Furthermore, unlike Ad-Hoc macroeconomic forecasting models, it is possible to escape the Lucas criticism by estimating deep parameters. According to Alege (2012) as well as Gobbi and Grazzini (2019), DSGE models should not be vulnerable to the Lucas criticism. To recapture the effects of policy interventions as well as the transmission mechanisms, dynamic stochastic general equilibrium models are, thus, structural, suggesting that there is an economic interpretation for each equation (Apanisile & Osinubi, 2020). Moreover, DSGE models are forward-looking and have predictive tendencies. Finally, shocks may be examined precisely and unambiguously using DSGE models (Enisan & Tolulope, 2019). This is due to the models' structure and assumptions. However, to the best of the researcher's knowledge, studies are yet to use a macro monetary model created within a micro-founded DSGE representation to explore the interactions of informal and formal financial markets as well as the succeeding impact on activities within the Nigerian economy.

LITERATURE REVIEW

Alege (2012) examined Nigerian business cycles using DSGE modelling. The notion included households, companies, financial intermediaries, and exporters. Productivity, monetary, and export supply shocks were considered. The study's main contribution was analysing exports' relationships to macroeconomic variables. Quarterly Bayesian algorithms calibrated and solved the model. Productivity shocks increased consumption and output but decreased price levels and loan demand. The money supply shock increased spending, output, and exports. An export supply shock decreased exports. The economy stabilised after the first quarter. The export supply shock does not affect other macroeconomic aggregates. The study met its goals, however it did not examine monetary and fiscal players, which is crucial for policy analysis. In addition, the DSGE model was not subjected to a sensitivity analysis.

To address policy research's demand for a conventional macro-econometric model, the Central Bank of Nigeria (CBN) (2013) developed a three-sector DSGE model including a household sector, a business sector, as well as a monetary authority. Total demand, supply, monetary policy, oil prices, foreign reserves, and exchange rates were all considered by the model. The estimated and calibrated model indicated that supply and demand shocks increased output and prices. Interest rates fell in reaction to monetary policy shocks, which boosted output and inflation but hurt the exchange rate, indicating imports. The economy grew when oil prices rose. The study analysed nominal and real effects on Nigeria's economy. The fiscal authority, informal economy, and informal finance were excluded from the model.

For Nigeria, Chuku (2016) created a four-sector DSGE model with households, firms, monetary agents, and fiscal agents. The study compared free-market fiscal authority monetary policy choices. Monetary policy regimes include flexible exchange rates and money growth objectives. There was an indication from the analysis of Impulse response which indicated that the monetary agent's monetary policy stance affects macroeconomic indicators' direction and amplitude. The pliable exchange rate attitude with inflation targeting was the optimal monetary policy regime because it had the lowest welfare loss. The study's monetary policy conclusions were instructive, however the assumption of flexible pricing in the business sector seems inadequate given Nigeria's macroeconomic peculiarities. Prices appear stiff due to labour unions and legislation.

Iklaga (2016) created a DSGE model of a small open economy with an oil-producing sector, oil revenue, credit-constrained individuals, pass-through for imperfect exchange rate, and foreign currency interventions as a monetary policy tool. In order to investigate the influence of foreign exchange interventions on business cycle variations, the model was calibrated and simulated using data from Nigeria. The study's overarching conclusion is that foreign exchange interventions can be utilised to help policymakers achieve their inflation and production goals.

Rasaki (2017) assessed Nigerian monetary DSGE model. Households, firms, external debt, and monetary agents dominated the model. Money supply, local interest rate, oil price, foreign debt, and international interest rate shocks are modelled. Money supply, oil price, and international inflation shocks raise production, but domestic interest rate and exchange rate shocks lower it, according to the Bayesian model. Inflation is caused by money supply, domestic interest rate, and foreign inflation shocks, but production differences are caused by external debt, foreign inflation, and nominal exchange rate shocks. However, the model's failure to include the oil sector as a producing agency makes analysing monetary policy responses to oil price shocks difficult. This method ignored informal finance.

By estimating a New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model supporting an informal economy, Adu, Alege, and Olurinola (2020) sought to gain insight into the effect that informality has on the success of macroeconomic policies in Nigeria. Using a Bayesian approach, the study estimated the DSGE model and find that the shadow economy cushions the blow of a change in monetary policy, making it less severe on the economy as a whole. The study's main conclusion was that, to reduce the shadow sector's ability to cushion the consequences of domestic economic shocks, the government should adopt market-friendly policies that facilitate the shadow sector's integration into the formal economy. However, this study neglected the role that informal finance plays in the presence of monetary policies shocks.

In their paper "Evaluating competing theories of informal sector entrepreneurship: a study of the determinants of cross-country variations in enterprises starting-up unregistered," Williams and Kedir (2018) examined what factors affect the percentage of new businesses that operate without proper registration in different nations. In the World Bank Enterprise Survey (WBES), 19.9 percent of formal sector enterprises were unlicensed, ranging from all enterprises in Pakistan to 1% in Slovakia. Four competing theories explain cross-national differences in non-registration: economic underdevelopment and poor governance (modernization theory); excessive state intervention (theory of neo-liberal); insufficient intervention from the state (theory of political economy); and a mismatch amongst formal institutions' rules and laws, and institutions' beliefs, values, and norms for the informal sector.

Ngalawa and Viegi (2013) employed the DSGE model with information asymmetry in the formal finance sector to examine the interaction between these two markets and their effect on economic activity in economies with a quasi-emerging market structure. First, they examined how the informal and formal financial sectors benefit each other, with the former resulting in more productive capacity and the latter needed to preserve equilibrium. Second, there is no universal pattern to the direction of interest rates in formal and informal financial sectors. The paper then explained how interest rates in the two sectors may move in different directions, demonstrating that the informal finance sector may defy monetary policy, with the amount to which this occurs varying with its size. It's no surprise that the shadow banking system reduces the economy's response to monetary policy. Third, the model reveals that high-risk and low-risk borrowers' risk components alter macroeconomic variables' shock responses.

Through the Bank Asset (BKA) Channel of the Monetary Transmission Mechanism, Ogbulu and Torbira (2012) analysed the empirical link and causality direction between monetary policy measures and the BKA channel. It was also looked into how the impulse response of monetary variables changed in reaction to disturbances in the monetary

system. The analysis, which used data from 1970 to 2010, found a significantly positive and considerable relationship between BKA, MNS, CRR, and MRR in the long run, as well as unidirectional Granger causation from BKA and CRR to MNS. Based on a breakdown of the variance of bank holdings in terms of shocks from the Cash Reserve Ratio, the Minimum Rediscount Rate, and the Money Supply, it is clear that shocks generated internally by banks continue to be the most important contributor to the overall volatility of these variables. In order to accomplish their economic goals, the authors advocate for well-thought-out monetary policies.

Alabi & Bada (2019) in their article investigated the relationship between Nigeria's budget deficit and short-term changes in significant macroeconomic indicators such as real production, interest rate, currency rate, inflation rate, and crude oil price. Empirical results show that the model adequately explains the government's fiscal deficit behaviour and that, while the accumulation of deficit is not inherently harmful to the economy, caution should be exercised in the financing options chosen, particularly the appropriate application of such funds to self-financing projects. It is proposed that the government increase its tax base in order to reduce rising borrowing and avoid the current fiscal issues from escalating into a full-fledged fiscal catastrophe. Finally, budgeting should not be viewed as only an accounting exercise; rather, the process should be centred on growing both physical and human capital through a well-thought-out socioeconomic development framework.

Straub (2005) developed a model of businesses' formality vs informality decisions. Businesses can partake in the official credit market if they comply with expensive registration requirements that provide them with essential public goods, such as the enforcement of property contracts and rights. Both the price of formalism as well the price of informality factor into their decision making when faced with moral hazard and credit rationing. Comparing the efficiency of formal and informal loan channels and the institutions that facilitate their respective arrangements. Current stylised data on the factors that influence informality are consistent with the concept. AFDB (2010) explained that the financial crisis showed that financial innovation may have far-reaching systemic consequences. The response of the settings of global standard and the regulation at national level has been a globally coordinated endeavour to revise and strengthen banking rules. However, at a time when stronger laws are being developed, avoiding pushback to broadening access to financial services is crucial. It is therefore proposed in this section that higher financial inclusion provides chances to improve financial stability.

In their article, Cheng & Degryse (2010) looked at how money and development are connected in a rapidly expanding economy like China's. Utilizing datasets across 27 Chinese provinces between 1995 and 2003, we examine if the development of banking and non-banking financial institutions has a (distinct) impact on regional GDP expansion. Our research indicates that the expansion of the banking sector has a statistically significant and economically more noticeable impact on GDP growth in a given area. In an article titled "Informal Finance for Private Sector Growth in Sub-Saharan Africa," Ernest Aryeetey proposed adjustments that would make microfinance and informal finance have better ability to supply what's required of the region's growing number of medium and small-sized enterprises. At first, the characteristics of informal finance were covered, with an emphasis on its scale, organisational makeup, and operational reach. The private sector has shown little interest in informal financing. Second, the piece drew attention to some recent advances in the microfinance sector. Finally, he proposed some practical measures towards a new transformation programme that will enable informal, and microfinance stay relevant to the expansion of the private sector, such as a focus on the connections between informal, semi-formal, and formal finance as well as how these links may be extended.

Fadun (2014) in his studies analyses financial inclusion as a poverty mitigation tool and wealth redistribution in emerging nations, with a focus on Nigeria. The report examines international initiatives aimed at increasing public availability of financial resources and places special emphasis on Nigeria's new strategy to accomplish the same. The research shows that increasing public availability of financial resources is a powerful device for reducing poverty and reallocating resources in emerging nations like Nigeria. To effectively alleviate poverty and promote income redistribution in developing economies, the financial sector as a whole must continue to work towards lowering the population of individuals who are prevented from accessing financial services. With a focus on the banking industry, a paper titled "assessment of the Nigerian financial sector reforms using the behavioural model" determined the impacts of these alterations on the performance of Nigeria's financial institutions. According to the results, the reforms implemented in 1986 had a considerable effect on the financial industry's long-term success.

By empirically examining the connection between growth and finance within the economy in the frame of reference to the countries in West Africa who are members of Economic Community of West African States (ECOWAS), Atindéhou, Gueyie and Amenounve's work, *Financial intermediation and economic growth: evidence from Western Africa* (2005), filled this void. There appears to be only a weakly significant causal nexus between the development of the economy and financial development on the one side, and the development of the financial sector and the development of the economy on the other side, according to the statistics. Based on these results, policymakers in West African countries should prioritise the growth of financial intermediaries as a means to boost their economies'

METHODOLOGY

Informal finance DSGE Model

The external sector and government expenditure would be included to the Ngalawa and Viegi (2013) DSGE model. Thus, enterprises, families, financial intermediaries and monetary authorities, government, and the rest of the world comprise six economic sectors. The family optimises an intertemporal utility function that includes consumption, spare time, and cash. It spends or saves its cash reserves and deposits any excess in commercial banks or lends to firms through the underground credit market. Commercial banks underpin the formal financial system (FFS), while moneylenders underpin the informal financial system (IFS). Moneylenders are usually solopreneurs, unlike commercial banks. Moneylenders rarely use agents (Sibanda, Hove-Sibanda & Shava, 2018).

The firm creates cash by converting loans from informal or formal financial sectors (Khan & Gulati, 2019). The Cobb-Douglas production function describes how the firm turns capital and manpower into a product. When seeking financial market loans, companies choose official or informal credit channels. Commercial banks in the FFS don't have the same information on their prospective borrowers' local risk profiles as lenders in the IFS. High-risk borrowers disguise themselves as moderate debtors to get FFS credit, making it impossible for commercial banks to tell them apart *ex ante*. Commercial banks prefer low-risk borrowers over high-risk borrowers because they believe low-risk consumers have a higher loan payback rate, which increases their expected profit.

According to Li, Zhang, and Hu (2021), balance can be maintained if banks ration credit. The market for informal credit absorbs the unmet demand from the legal lending market. As a result, the IFS meets both this need and the portion of total demand for credit that actively chooses to borrow money from the IFS alone. Third, since it is presumed that the population size is always the same, there is no inherent bias in counting averages as totals (Khan & Gulati, 2019). The agents considered in this study include the household, the firm, financial intermediaries, the formal financial sector, the informal financial sector, monetary authorities, the government, and market equilibrium. The following are the behaviours of each agent considered in the study.

A) Household

There is a continuous range of equivalent homes, all of which have the same resources and tastes. For a hypothetical family of fixed size, with unlimited planning horizon, the main objective is to maximise the expected sum of a discounted stream of contemporaneous satisfaction U_t , and it is defined as:

$$\text{Max } E_0 \sum_{t=0}^{\infty} \beta U_t \quad (3.1)$$

$$U_t = \ln C_t + \phi \ln(1 - N_t) + \Gamma \ln\left(\frac{M_t}{P_t}\right) \quad (3.2)$$

where $\beta \in (0,1)$ is the intertemporal discount factor that consumers place on their own preferences. It is expected that the utility function is disentangled from consumption.

Where N_t is the total time spent labouring (hours worked)

$\phi, \Gamma > 0$ (represents the significance of cash and leisure balance)

$\beta (0; 1)$ shows that consumer subjective intertemporal discount factor.

U_t It is considered that the utility function has three distinct components: leisure, consumption, and real cash.

C_t : Consumption

$(1-N_t)$: leisure

(M_t/ P_t) : real cash balances

$$C_t + L_t^i + D_t + \frac{M_t}{P_t} = (1 + R_{t-1}^{li})qL_{t-1}^i + (1 + R_{t-1}^{df})D_{t-1} + \frac{M_{t-1}}{P_{t-1}} + W_t N_t \quad (3.3)$$

Where

L_t^i : loans to firms given by households (informal finance); D_t : households deposits in commercial banks; R_{t-1}^{li} : interest rates on credit given by the households; q : the probability of repayment on loans given by the moneylender; R_{t-1}^{df} : interest rates on deposits in commercial banks; W_t : wage rate

In order to maximise the objective function given by equation (3.1), which is subject to the budget constraint given by equation (3.3), the following first order conditions are obtained in terms of the household's consumption, labour, cash balances, loans to enterprises, and deposits in commercial banks:

$$\frac{1}{C_t} = \beta(1 + R_t^{df})E_t\left(\frac{1}{C_{t+1}}\right) = 0 \quad (3.4)$$

$$N_t = 1 - \frac{\varphi C_t}{W_t} = 0 \quad (3.5)$$

$$\frac{M_t}{P_t} = \Gamma\beta E_t\left(\frac{C_{t+1}}{R_t^{df}}\right) = 0 \quad (3.6)$$

$$1 + R_t^{df} = (1 + R_t^{li}R_t^{li})q = 0 \quad (3.7)$$

(B) The Firm

The Nigerian economy benefits greatly from the Informal Sector (IS), which accounts for a sizable portion of it. Nigeria's informal sector contributed to about 50 percent of Nigeria's 2020 GDP. Based on what we know about representative firms in developing economies from the stylized facts section, we can safely assume that they are involved in agricultural operations. The company has title to the land; therefore it borrows working capital from the informal or formal banking sector at the start of the time frame and pays it back at the conclusion of the period with the proceeds from the sale of the harvest. For the sake of simplicity, let's assume that a company can't take out loans from either of these markets at the same time. In addition, it is assumed that the working capital is fixed beforehand and that there are no costs associated with making adjustments (Ambler & Paquet, 1994). The following is the capital stock's equation of motion:

$$K_{t+1} = (1 - \delta)K_{t+1} + I_t \quad (3.8)$$

where K_t represents the capital, I_t represents investment and δ is the rate of depreciation.

Since depreciation is comparable to zero when working capital is depleted in a single period, equation (3.8) is simplified to $K_{t+1} = I_t$.

It is thus assumed that the loan is converted into current investment (change in the capital) using a linear function described as

$$I_t = \vartheta_{T,t}(L_t^f + L_t^i) \quad (3.9)$$

where $\vartheta_{r,t}$ is a risk factor or probability of success, where hr denotes high risk (low probability of success) and lr stands for low risk (high probability of success); and L_t^f and L_t^i are formal and informal financial sector loans, respectively. High-risk businesses were defined as those with a lower likelihood of turning loan funds into usable capital, whereas low-risk businesses were characterised in a similar fashion but with a higher likelihood of doing so. (Dasgupta, 2005; Khan & Gulati, 2019).

This is a generic firm case. In the aggregate, a certain quantity of the firms are high-risk debtors, while the rest of the proportion are written as:

$$I_t = p\vartheta_{hr,t}(L_t^f + L_t^i) + (1 - p)\vartheta_{lr,t}(L_t^f + L_t^i) \quad (3.10a)$$

$$I_t = [p\vartheta_{hr,t} + (1 - p)\vartheta_{lr,t}](L_t^f + L_t^i) \quad (3.10b)$$

The following Cobb-Douglas form is believed to describe the firm's manufacturing technique:

$$Y_t = e^{A_t} K_t^\alpha N_t^{1-\alpha} \quad (3.11)$$

where Y_t is output and $A_t > 0$ captures technology. The technology factor is assumed to evolve according to a first-order autoregressive process given by

$$A_t = \eta A_{t-1} + \varepsilon_t^A \quad (3.12)$$

where η is independently and identically distributed (iid) with a standard deviation of " A_t ". The firms' cost minimization problem subject to satisfying market demand, therefore, is given by:

$$\min W_t N_t + (1 + R_t^{lf}) L_t^f + (1 + R_t^{lf}) q L_t^i + \varphi_t (Y_t - e^{A_t} K_t^\alpha N_t^{1-\alpha}) \quad (3.13)$$

First-order conditions on labour, formal financial sector loans, and informal financial sector loans all lead to demand functions for both labour and loans.

loans, respectively, given by:

$$W_t = \varphi_t (1 - \alpha) \frac{Y_t}{N_t} \quad (3.14)$$

$$L_t^{df} = \frac{1}{\vartheta_{tt}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf}) K_{t+1}^\alpha}{\alpha \vartheta_{tt} W_{t+1} N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.15)$$

$$L_t^{df} = \frac{1}{\vartheta_{tt}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf}) q K_{t+1}^\alpha}{\alpha \vartheta_{tt} W_{t+1} N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.16)$$

Equation (3.14) shows that wages increase with output but are inversely related to labour supply.

Financial Intermediaries

According to the study's presumptions, one of the defining characteristics of economies with low per capita income is the existence of separate official and informal finance sectors. Different types of businesses exist within the two major categories, and these businesses rarely interact with one another or share clients. When they do share clients, however, these businesses are usually able to clearly demarcate the responsibilities that each financial arrangement is responsible for (Aryeetey, 2008). We use Dasgupta's concepts as a foundation for our modelling of the two industries (Dasgupta, 2005).

(D) Formal Financial Sector

Base lending rates are set as a mark-up (ζ) over the bank rate i.e.

$R_t^{lf} = R_t^{nr} + \zeta$, where R_t^{nr} is the bank rate.

The margin is set by the commercial bank's estimation of the interest volatility of consumer demand for loan (King & Shackleton, 2003). We will assume the markup is constant for ease of discussion. Demand for loans in the FFS, as determined by borrowers' own preferences, is expressed as:

$$L_t^{adf} = \frac{P}{\vartheta_{hr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\vartheta_{hr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} + \frac{1-P}{\vartheta_{lr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\vartheta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.17)$$

Commercial banks are apprehensive about lending to high-risk customers because of the potential for default on loan repayment, which would cut into the banks' revenues. Yet, banks are unable to make an initial distinction between the two kinds of debtors since high-risk borrowers have an incentive to act in ways characteristic of low-risk debtors in order to increase their chances of qualifying for FFS loans. As a result of this activity among prospective borrowers, the FFS's aggregate disclosed loans demands is given by:

$$L_t^{adf} = \frac{P}{\vartheta_{lr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\vartheta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} + \frac{1-P}{\vartheta_{lr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\vartheta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.18a)$$

$$L_t^{adf} = \frac{1}{\vartheta_{lr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\vartheta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.18b)$$

Due to a lack of categorization criteria, financial institutions must practise credit rationing by denying loans to some borrowers despite their willingness to pay relatively high interest rates (Stiglitz & Weiss, 1981). Indeed, rationalisation of credit is the most popular strategy to minimise banks' exposure to risk when the market for formal credit are imperfect because of inaccurate information (Dasgupta, 2005). Suppose that commercial banks can meet just ϖ of the disclosed interest in FFS loans. Furthermore, we suppose that it is determined endogenously within the scope of the bank's pursuit of maximum profit. Since commercial banks can't tell what kind of borrowers would approach them without further information, they've decided to play it safe and assume that everyone who might want to borrow money is a high risk. Hence, we can express the FFS loan supply function as:

$$L_t^{sf} = \frac{\varpi}{\vartheta_{hr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\vartheta_{hr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.19)$$

Firms in the formal credit market L_t^{sf} receive loans from commercial banks using money that customers deposit with the banks (D_t) and money that the banks borrow from the central bank.

$$L_t^{sf} = D_t + L_t^{cb} \quad (3.20)$$

The commercial banks' profit maximisation problem is described by:

$$\max \varpi_t (1 + R_t^{lf}) L_t^{adf} + D_t + L_t^{cb} - \varpi_t L_t^{adf} - (1 + R_t^{df}) D_t - (1 + R_t^{nr}) L_t^{cb}$$

Subject to $L_t^{adf} < (D_t + L_t^{cb})$ which reduces to:

$$\max \varpi_t R_t^{lf} L_t^{adf} - R_t^{df} D_t - R_t^{nr} L_t^{cb} \text{ subject to } L_t^{adf} < (D_t + L_t^{cb}) \quad (3.21)$$

The first-order condition to optimise cost function derived as follows:

$$\lambda_t = \varpi_t R_t^{lf} = R_t^{nr} = R_t^{df} \quad (3.22)$$

$$\varpi_t = \frac{R_t^{df} - R_t^{nr}}{R_t^{lf} - R_t^{lf}} \quad (3.23)$$

where λ_t is a Lagrangian multiplier.

According to Equation (3.22), when the cost of borrowing money from the central bank is equal to the cost of taking money out of people's bank accounts, the cost of both is the same. It can as well be contingent from equation (3.23), that the commercial bank share of overall demand for FFS loans is determined by the ratio of the cost of funds from the two specified sources.

Informal Financial sector

The loans available in the IFS are provided by moneylenders. The self-selection demand for IFS credit is given by:

$$L_t^{adi} = \frac{\rho}{\theta_{hr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{li})qK_{t+1}^\alpha}{\alpha\theta_{hr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} + \frac{(1-\rho)}{\theta_{lr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{li})qK_{t+1}^\alpha}{\alpha\theta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.24)$$

Moneylenders, like commercial banks, deal with both high- and low-risk customers. Moneylenders, in contrast to banks, can assess the creditworthiness of prospective borrowers. This was made possible by concentrating lending activities in close geographic proximity to individual lenders, where information about the associated risks was already in the public domain. Relative to the overall self-selection demand for loans in the FFS (equation (3.17)), the proportion of revealed demand for FFS loans that is successful in obtaining loans from the commercial banks (equation (3.19)) is equal to the residual demand for credit in the FFS (equation (3.25)). The IFS must pick up the slack for this lingering demand. Assuming lenders can accurately assess the risk of each prospective borrower, the FFS residual demand for IFS loans is given by:

$$L_t^{rf} = \frac{\rho}{\theta_{hr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\theta_{hr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} + \frac{(1-\rho)}{\theta_{lr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\theta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} - \frac{\varpi_t\rho}{\theta_{hr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\theta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} - \frac{\varpi_t(1-\rho)}{\theta_{hr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha\theta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.25a)$$

$$L_t^{rf} = \left[\frac{\rho}{\theta_{hr,t}} \left(\frac{1}{\theta_{hr,t}} \right)^{\frac{1}{\alpha-1}} + \frac{(1-\rho)}{\theta_{lr,t}} \left(\frac{1}{\theta_{lr,t}} \right)^{\frac{1}{\alpha-1}} - \frac{\varpi_t\rho}{\theta_{hr,t}} \left(\frac{1}{\theta_{hr,t}} \right)^{\frac{1}{\alpha-1}} - \frac{\varpi_t(1-\rho)}{\theta_{lr,t}} \left(\frac{1}{\theta_{lr,t}} \right)^{\frac{1}{\alpha-1}} \right] E_t \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.25b)$$

$$L_t^{rf} = E_t \left[\left(\frac{1}{\theta_{hr,t}} \right)^{\frac{1}{\alpha-1}} \left(\frac{\rho(1-\varpi_t)}{\theta_{hr,t}} \right) + \left(\frac{1}{\theta_{lr,t}} \right)^{\frac{1}{\alpha-1}} \frac{(1-\rho)(1-\varpi_t)}{\theta_{lr,t}} \right] \times \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.25c)$$

The total demand for IFS loans is thus calculated as the sum of equation (3.24) and equation (3.25). It is shown that if the default probability in the IFS is included, the interest rates in the financial sectors in the informal and formal economies will be in equilibrium if and only if equation (3.25) is revised to account for the hypothesis on lenders risk, which comes from equations (3.15 and 3.16) (Basu, 1997).

$$L_t^{adi} = \frac{\rho}{\theta_{hr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{li})qK_{t+1}^\alpha}{\alpha\theta_{hr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} + \frac{(1-\rho)}{\theta_{lr,t}} E_t \left[\frac{(1-\alpha)(1+R_t^{li})qK_{t+1}^\alpha}{\alpha\theta_{lr,t}W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} + E_t \left[\left(\frac{1}{\theta_{hr,t}} \right)^{\frac{1}{\alpha-1}} \left(\frac{\rho(1-\varpi_t)}{\theta_{hr,t}} \right) + \left(\frac{1}{\theta_{lr,t}} \right)^{\frac{1}{\alpha-1}} \frac{(1-\rho)(1-\varpi_t)}{\theta_{lr,t}} \right] \times \left[\frac{(1-\alpha)(1+R_t^{lf})K_{t+1}^\alpha}{\alpha W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \quad (3.26a)$$

$$L_t^{adi} = E_t \left[\frac{(1-\alpha)(1+R_t^{li})qK_{t+1}^\alpha}{\alpha W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \times \left[\frac{\rho}{\theta_{hr,t}} \left(\frac{1}{\theta_{hr,t}} \right)^{\frac{1}{\alpha-1}} + \frac{(1-\rho)}{\theta_{lr,t}} \left(\frac{1}{\theta_{lr,t}} \right)^{\frac{1}{\alpha-1}} + \left(\frac{1}{\theta_{hr,t}} \right)^{\frac{1}{\alpha-1}} \left(\frac{\rho(1-\varpi_t)}{\theta_{hr,t}} \right) + \left(\frac{1}{\theta_{lr,t}} \right)^{\frac{1}{\alpha-1}} \frac{(1-\rho)(1-\varpi_t)}{\theta_{lr,t}} \right] \quad (3.26b)$$

$$L_t^{\text{adi}} = E_t(2 - \omega_t) \left[\frac{(1-\alpha)(1+R_t^{\text{lf}})K_{t+1}^\alpha}{\alpha W_{t+1}N_{t+1}} \right]^{\frac{1}{\alpha-1}} \left[\frac{\rho}{\theta_{hr,t}} \left(\frac{1}{\theta_{hr,t}} \right)^{\frac{1}{\alpha-1}} + \frac{(1-\rho)}{\theta_{lr,t}} \left(\frac{1}{\theta_{lr,t}} \right)^{\frac{1}{\alpha-1}} \right] \quad (3.26c)$$

(D) Monetary Authorities

Money supply targets, interest rate targets, and exchange rate benchmarks are emerging nations' main monetary policy alternatives. Most emerging economies cannot realistically target inflation. Most studies (Martins & Skott, 2021; Sturzenegger, 2019) states that QEMEs lack the criteria to develop an inflation targeting framework. With deregulation in the 1980s and 1990s, emerging economies now target money supply and interest rates rather than exchange rates. Countries can choose one or both tools. We test an optimistic monetary policy rule that employs the bank rate (R_t^{nr}) to characterise monetary authority in developing economies. The forward-looking specification allows the Federal Reserve to consider many aspects when predicting the economy's future performance (Itskhoki & Mukhin, 2021). The rule requires periodic bank rate modifications based on ROI, output, and inflation estimates.

$$R_t^{\text{nr}} = \chi_1 R_t^{\text{rr}} + \chi_2 \Delta Y^e + (1 - \chi_2) \pi^e + \phi_t \quad (3.27)$$

where R_t^{rr} is the return on investment or real rate of interest. ΔY^e is the expected change in output i.e., $\Delta Y^e = E(Y_{t+1}) - Y_t + \mathbb{J}^e$ is the predicted inflation rate, which we calculate by subtracting the current real interest rate from the current nominal interest rate in the succeeding period, and t is a stochastic term presumed to be iid. We assume that the marginal productivity of capital in the following period is equal to the rate of interest because our model operates in discrete time (Christiano et al., 2018; Mirfatah et al., 2019) as given by the following:

$$R_t^{\text{rr}} = \alpha e^{A_{t+1}} K_{t+1}^{\alpha-1} N_{t+1}^{1-\alpha} \quad (3.28)$$

(E) The Government

The Nigerian federal Government is the supposed fiscal agency, and it is expected to adhere to a rule-governed system of taxing and spending. The effect of changes in government policies is assumed to affect the real cash balance and consumption pattern of the Nigerian economy. Revenue is earned by the government from the issuance of bonds (B_t) and the receipt of taxes (TX_t). The earned revenue then utilised in the financing of good purchases (G_t) and in the making of payment transfers to households (Alege, 2019). The budget constraint entailing the real flow for the government is shown as:

$$TX_t + B_t = G_t + TP_t + B_{t-1} \quad (3.29)$$

Therefore the AR(1) process given government expenditure, tax revenue and bonds are assumed to be :

$$g_t = \rho_g g_{t-1} + \varepsilon_t^g \quad (3.30)$$

$$tx_t = \rho_{tx} tx_{t-1} + \varepsilon_t^{tx} \quad (3.31)$$

$$b_t = \rho_b b_{t-1} + \varepsilon_t^b \quad (3.32)$$

Rest of the World (ROW)

Given that Nigeria imports most of its consumption and generates most of its revenue from crude oil exporting, a complete examination of the Nigerian economy must include the external sector. The global economy has several nations. Each economy is open, therefore, its decisions have minimal impact on the world. Household choices are assumed to be uniform in local and global economies. Then, terms of trade, CPI inflation, real exchange, global risk sharing, and uncovered interest parity in an open economy are linked. This clarifies the open economy linkages needed to construct the open economy IS curve, the Phillips curve, and the goods market clearing criterion (Bernanke, 2018).

a. The Law of One Price (LOOP)

When certain conditions are met, the price of a given good, or service will be the same everywhere in the world. This economic theory is known as "the law of one price." The law of one price presumes a perfectly competitive market where there are no costs of transaction, costs of transportation, regulatory restraints, fluctuations in the value of currencies, and price-fixing behaviour on the part of either buyers or sellers. The possibility of arbitrage means that differences in asset prices in different regions can be eliminated over time, making way for a rule of one price. According to the law of one price:

$$\Psi_t = \frac{\varepsilon_t Z_t^*}{Z_{1,t}} \quad (3.33)$$

LOOP hold when $\Psi_t = 1$. This becomes:

$$Z_{1,t} = \varepsilon_t Z_t^* \quad (3.34)$$

Where;

Ψ_t is Law of one price gap; LOOP hold when $\Psi_t = 1$; ε_t is Nominal exchange rate; Z_t is Foreign price index; $Z_{1,t}$ is Domestic price of imported goods

Log-linearizing equation (3.34) we obtained:

$$\log z_{1,t} = \log \varepsilon_t + Z_t^* \quad (3.35)$$

b. Real Exchange Rate

The real exchange rate is calculated by dividing the foreign price index by the domestic price index, which is:

$$R_t = \frac{\varepsilon_t Z_t^*}{Z_{1,t}} \quad (3.36)$$

Where;

R_t : Real Exchange Rate; ε_t : Nominal Exchange Rate; Z_t : Foreign Price Index; $Z_{1,t}$: Domestic Price Index z

The log-linearisation of equation (3.36) yields:

$$r_t = \varepsilon_t Z_t^* - Z_{1,t} \quad (3.37)$$

c. Trade Agreements

The ratio of domestic prices (exports) to foreign prices (imports) is a measure of the extent to which one economy benefits from trade with another. It is a gauge of the domestic economy's competitiveness in the sense that:

$$X_t = \frac{Z_{d,t}}{Z_{f,t}} \quad (3.38)$$

Where;

X_t : Trade agreement; $Z_{d,t}$: Price of local goods; $Z_{f,t}$: Price of foreign goods

The log-linearisation of the trade agreement given in equation (3.80) will give:

$$x_t = Z_{d,t} - Z_{f,t} \quad (3.39)$$

d. Domestic and Consumer Price Index (CPI) Inflation

The Consumer Price Index (CPI) is a measure of the rate of change in the aggregate price index, which includes both local and foreign price indexes, is denoted as inflation, while the rate of change in the local price index is characterised

as local inflation. The log-linearization of the Consumer Price Index, $P_t = (P_{D,t})^{1-\alpha} + (P_{F,t})^\alpha$ a symmetric steady state in which the Purchasing Power Parity is maintained (i.e.: $P_{D,t}=P_{F,t}$) result to:

$$p_t = (1 - \alpha)p_{D,t} + \alpha p_{F,t} \tag{3.40}$$

Equation (3.40) further, this becomes:

$$p_t = p_{D,t} - \alpha(p_{D,t} - p_{F,t}) \tag{3.41}$$

Since $Z_t = p_{D,t} - p_{F,t}$ from (3.39), substitute it into equation (3.41) to get:

$$p_t = p_{D,t} - \alpha(z_t) \tag{3.42}$$

Using a one-period lag equation (3.42) becomes:

$$p_t - p_{t-1} = p_{D,t} - p_{D,t-1} - \alpha(z_t - z_{t-1}) \tag{3.43}$$

Equation (3.42) can rewritten as:

$$\pi_t = \pi_{D,t} - \alpha(\Delta z_t) \tag{3.44a}$$

Equation (3.44) relate the CPI inflation ($\pi_t = p_t - p_{t-1}$), domestic inflation ($\pi_{D,t} = p_{D,t} - p_{D,t-1}$) and the term of trade ($z_t = p_{D,t} - p_{F,t}$). (3.44b)

It demonstrates that the disparity between the two indices of price growth is related to shifts in the terms of trade. Parameter α is the coefficient of proportionality. Equation (3.42.) $z_t = p_{D,t} - p_{F,t}$ which defines the term of trade is combined with equation (3.35) $p_{F,t} = e_t + p_t^*$ that indicate the law of one price, to show the link between the term of trade and the law of one price. This is shown as:

$$z_t = e_t + p_t^* - p_{D,t} \tag{3.45a}$$

Make e_t the subject of the formula:

$$e_t = z_t + p_t^* - p_{D,t} \tag{3.45b}$$

The connexion between the term of trade as well as the real exchange rate is, thus obtained. The exchange rate in equation (3.37) is, then, substituted into equation (3.41) we have:

$$q_t = z_t - p_t^* + p_{D,t} + p_t^* - p_t$$

Simplifying, this becomes:

$q_t = z_t + p_{D,t} - p_t$ Where $p_t = p_{D,t} - \alpha(z_t)$ as shown in equation (3.42) is substituted into the preceding equation to become:

$$q_t = z_t - \alpha z_t \tag{3.46a}$$

$$q_t = (1 - \alpha)z_t \tag{3.46b}$$

(Babajide, Adegboye & Omankhanlen, 2015) and Oye (2018)

i. International Risk Sharing

It is assumed that in a fully integrated international financial market, domestic and foreign bond prices are identical, indicating perfect sharing of risks amongst households in both economies. It is hypothesised that consumers' tastes in the domestic and global economies are similar. When the first order consumption conditions in equation (3.23) are paired with the bond asset equation (3.25), the following result is obtained:

$$\left(\frac{C_{R,t+1}}{C_{R,t}}\right)^\sigma \frac{P_t}{P_{t+1}} = Q_{t,t+1} \quad (3.47)$$

With the no-arbitrage term

$$\varepsilon_t Q_t^* = \varepsilon_{t+1} Q_{t,t+1} \quad (3.48)$$

Equation (3.48) with no arbitrage both domestic and foreign bond prices are the same. Gives

$$\beta \left(\frac{C_{t+1}^*}{C_t^*}\right)^{-\sigma} \frac{P_t^*}{P_{t+1}^*} \varepsilon_t = \beta \left(\frac{C_{R,t+1}}{C_{R,t}}\right)^{-\sigma} \frac{P_t}{P_{t+1}} \varepsilon_{t+1} \quad (3.49)$$

Using equation (3.36) on real exchange rate:

$$Q_t = \frac{\varepsilon_t P_t^*}{P_{D,t}}$$

Equation (3.48) becomes:

$$\left(\frac{C_t^*}{C_{t+1}^*}\right)^{-\sigma} \frac{Q_t}{Q_{t+1}} = \left(\frac{C_{R,t+1}}{C_{R,t}}\right)^{-\sigma} \quad (3.50)$$

Rearranging equation (3.49) to introduce K, the equation becomes:

$$C_{R,t} = K C_t^* Q_t^\sigma \quad (3.51)$$

Where

$$K = \frac{C_{R,t+1}}{C_{t+1}^*} Q_{t+1}^\sigma$$

Log-linearise equation (3.51), that is:

$$c_{R,t} = c_t^* + \frac{1}{\sigma} q_t \quad (3.52)$$

Recall from equation (3.46) that $q_t = (1 - \alpha)z_t$ then equation (3.52) becomes:

$$C_{R,t} = C_t^* + \frac{1-\alpha}{\sigma} z_t \quad (3.53)$$

Because customers are expected to develop consumption habits and because the world market is clearing $y_t^* - c_t^*$ it becomes:

$$c_{R,t} - h c_{R,t-1} = y_t^* - h y_t^* + \frac{(1-h)(1-\alpha)}{\sigma} z_t \quad (3.54)$$

Equation (3.52) shows a relation that links the domestic consumption ($C_{R,t}$), world consumption C_t^* and the term of trade (z_t) (Oye, 2018).

ii. Uncovered Interest Parity

Looking at the assumption of the complete international financial market, investors are said to be indifferent when it comes to buying of foreign or domestic bonds while the interest rate is the same in both the foreign and domestic economies. That is, the returns on domestic bonds (R_t) equal to the returns on foreign bonds (R_t^*) to give:

$$R_t = R_t^* \left(\frac{\varepsilon_t}{\varepsilon_{t+1}}\right) \quad (3.55)$$

Where;

R_t : Domestic bonds; R_t^* : Foreign bonds

Equation (3.55) is further log-linearised to have:

$$r_t = r_t^* + E_t (e_t - e_{t+1}) \quad (3.56)$$

When equation (3.56) is re-arranged, it becomes:

$$r_t - r_t^* = E_t \Delta e_{t+1} \quad (3.57)$$

Combining equation (3.57) and equation (3.37), the equation becomes:

$$(i_t - \pi_{t+1}) - (i_t^* - \pi_{t+1}^*) = E_t \Delta q_{t+1} \quad (3.58)$$

This statement demonstrates how the spread between foreign and domestic interest rates affects the real exchange rate (Bhattarai & Trzeciakiewicz, 2017; Oye, Alege & Olomola, 2018).

General Equilibrium

If the market for final goods has cleared, then the sum of consumer spending, business investment, and government spending has been met:

$$Y_t = C_t + I_t + G_t + X_t$$

$$P_t C_t = M_t$$

where $I_t = K_{t+1}$.

a. Total Demand Side: Goods Market Equilibrium and IS-Curve

In order for the domestic goods market to clear, the economy's output must be equal to the sum of its domestic and overseas demands (exports) such that:

$$Y_{t(j)} C_{D,t(j)} + \int_0^1 C_{D,t(j)}^i di + G_t \quad (3.59)$$

$C_{D,t(j)}$: Domestic demand for good j produced in the domestic economy,

$C_{D,t(j)}^i$: Foreign demand by country i for good k produced in the domestic economy,

According to Gali & Monacelli (2008), $C_{D,t(j)}$ and $C_{D,t(j)}^i$ is defined as:

$$C_{d,t(j)} = \left(\frac{P_{D,t(j)}}{P_{D,t}} \right)^{-\varepsilon} C_{D,t} \text{ where } C_{D,t} = (1-\alpha) \left(\frac{P_{D,t}}{P_t} \right)^{-\eta} C_t \text{ and}$$

$$\int_0^1 C_{D,t}^i = \left(\frac{P_{D,t(j)}}{P_{D,t}} \right)^{-\varepsilon} C_{D,t}^i \text{ where } C_{D,t}^i = (\alpha) \left(\frac{P_{D,t}}{\varepsilon_{i,t} P_{F,t}} \right)^{-\gamma} \left(\frac{P_F}{P_t} \right)^{-\eta} C_t^i$$

Equation (3.106) is inserted into total domestic output in equation (3.107) to get the aggregate domestic and foreign demands (exports) for locally produced goods.

$$Y_t = \left[\int_0^1 Y_{t(j)} \frac{\varepsilon-1}{\varepsilon} dj \right]^{\frac{\varepsilon}{\varepsilon-1}} = C_{D,t} + \int_0^1 C_{D,t(j)}^i di + G_t \quad (3.60)$$

it becomes:

$$Y_t = (1 - \alpha) \left(\frac{P_{D,t}}{P_t}\right)^{-\eta} C_t + \alpha \int_0^1 \left(\frac{P_{D,t}}{\varepsilon_{i,t} P_{F,t}}\right)^{-\gamma} \left(\frac{P_{F,t}}{P_t}\right)^{-\eta} C_t^i di + G_t = \left(\frac{P_{D,t}}{P_t}\right)^{-\eta} \left[(1 - \alpha) C_t + \alpha \int_0^1 \left(\frac{\varepsilon_{i,t} P_{F,t}}{P_{D,t}}\right)^{\gamma-\eta} Q_{i,t}^\eta C_t^i di \right] + G_t \quad (3.61)$$

$$Y_t = \left(\frac{P_{D,t}}{P_t}\right)^{-\eta} \left[(1 - \alpha) C_t + \alpha \int_0^1 (Z_t^i Z_{i,t})^{\gamma-\eta} Q_{i,t}^{\eta\frac{1}{\sigma}} \right] + G_t \quad (3.62)$$

When equation (3.62) is log-linearised, it becomes:

$$y_t = c_t + \alpha y z_t + \alpha \left(\eta - \frac{1}{\sigma}\right) q_t \quad (3.63)$$

Equation (3.63) can be written as:

$$y_t = c_t + \frac{a\omega}{\sigma} z_t + g_t \quad (3.64)$$

Where ω is defined as:

$$\omega = \sigma\gamma + (1 - \alpha)(\sigma\eta - 1)$$

Goods market clearing condition for the rest of the world is:

$$y^* = c^* \quad (3.65)$$

$y^* = c^*$ are indices for world output (production) and consumption

Where

$$y_t^* = \int y_t^i di$$

$$c_t^* = \int c_t^i di$$

According to Gali & Monacelli (2008) and Bergholt (2012) the Open Economy IS Curve may be obtained by combining equation (3.11) of the goods market clearing condition with the consumption Euler equation (3.29).

$$y_t - \frac{a\omega}{\sigma} z_t = E_t (y_{t+1} - \frac{a\omega}{\sigma} z_{t+1}) - \frac{1-h}{\sigma} (i - E_t \Pi_{t+1} - \rho) y_t = E_t y_{t+1} - \frac{1-h}{\sigma} (i - E_t \Pi_{t+1} - \rho) - \frac{a\omega}{\sigma} E_t \Delta z_{t+1} = E_t y_{t+1} - \frac{1-h}{\sigma} (i - E_t (\Pi_{D,t+1} + \alpha \Delta Z_{t+1}) - \rho) - \frac{a\omega}{\sigma} E_t \Delta Z_{t+1} = E_t y_{t+1} - \frac{1-h}{\sigma} (i - E_t \Pi_{D,t+1} - \rho) - \frac{a(\omega-1)}{\sigma} E_t \Delta Z_{t+1} \quad (3.66)$$

Where $\theta = (\omega - 1)$

When we insert $y_t = y_t^* + \frac{1}{\sigma\alpha} z_t$ into equation (3.66) to get open economy IS curve

$$y_t = E_t y_{t+1} - \frac{1-h}{\sigma\alpha} (i - E_t \Pi_{D,t+1} - \rho) - \alpha \theta E_t (\Delta y_{t+1}^*) \quad (3.67)$$

The assumption of flexible prices is considered in equation (3.114) as: $y_t^1 = E_t y_{t+1}^1 - \frac{1-h}{\sigma\alpha} (r_t^1 - \rho) - \alpha \theta E_t (\Delta y_{t+1}^*)$

$$(3.68)$$

obtain the dynamic IS curve:

$$\tilde{y}_t = E_t \tilde{y}_{t+1} + \frac{1-h}{\sigma\alpha} (i - E_t \Pi_{D,t+1} - r_t^1) \quad (3.69)$$

b. Total Supply Side: Marginal Cost and Open Economy New Keynesian Phillips Curve

Recollect that the setting condition for the firm's ideal price in equation (3.56) is:

$$p_t^* - p_t = 1 - \beta\theta \sum_{k=0}^{\infty} (\beta)^k E_t [\widehat{m\bar{c}}_{t+k|t} + p_{t+k} - p_{t-1}]$$

$$\widehat{m\bar{c}}_{t+k|t} = m\bar{c}_{t+k|t} - m\bar{c}_{t+k} \tag{3.70a}$$

When equation (3.56) is simplified further we have:

$$p_t^* - p_{t-1} = \beta\theta E_t[p_{t+1}^* - p_t] + (1 - \beta\theta)\widehat{m\bar{c}}_t + \pi_t \tag{3.70b}$$

Dynamics of the total price index

The law of motion for the total price index is:

$$\underline{P}_t = [\theta(P_{t-1})^{1-\varepsilon} + (1 - \theta)(P_t^*)^{1-\varepsilon}]^{\frac{1}{1-\varepsilon}} \tag{3.71}$$

This becomes

$$(\underline{p}_t)^{1-\varepsilon} = [\theta(P_{t-1})^{1-\varepsilon} + (1 - \theta)(P_t^*)^{1-\varepsilon}] \tag{3.72}$$

Divide equation (3.72) by P_{t-1}

$$\frac{(\underline{p}_t)^{1-\varepsilon}}{p_{t-1}} = \frac{\theta(p_{t-1})^{1-\varepsilon}}{p_{t-1}} + \frac{(1-\theta)(p_t^*)^{1-\varepsilon}}{p_{t-1}} \tag{3.73}$$

to give;

$$\Pi_t^{1-\varepsilon} = \theta + 1 - \theta \left(\frac{p_t^*}{p_{t-1}}\right)^{1-\varepsilon} \tag{3.74}$$

Log-linearise equation (3.74) to get:

$$\pi_t = (1-\theta) (p_t^* - p_{t-1}) \tag{3.75}$$

As shown by Equation (3.75), re-optimisation of enterprises often selects a price that is distinct from the average cost in the economy during the prior period.

The NK Phillips curve is derived by integrating the dynamics of the overall price level (equation 3.63) with the best price setting condition (equation 3.52):

$$\pi_{D,t} = \beta E_t[\pi_{D,t+1}] + \lambda \widehat{m\bar{c}}_t \tag{3.76}$$

$$\text{Where } \lambda = \frac{(1-\theta)(1-\beta\theta)}{\theta} \tag{3.77}$$

Domestic inflation is proportional to the divergence of the marginal cost from its steady state, as shown by equation (4.65).

Shock Processes

$P_t C_t = M_t$ from the general equilibrium equation is a symbol representing a post-equilibrium state when prices reflect just real-world demand and supply. They have implicitly assumed that the labour market has cleared since they have used N_t to represent both household and corporate demand for labour. Based on equation (3.5) and equation (3.6), the

market determines the equilibrium pay (3.14). Equation describes the monetary policy response function, which in turn determines the bank rate (3.27). The interest rates on deposits and IFSs at commercial banks are set by market forces. A predetermined premium is added to the bank rate to arrive at the basic lending rates. Equations (3.15) and (3.16), respectively, describe the demand based on self-selection for FFS and IFS loans. The loans provided by the official and informal financial sectors are represented by equations (3.19) and (3.26), respectively. Spill over demand from the FFS is supplied by the supply in the IFS, and this is reflected in the simultaneous solution of the two equations, leads to equilibrium in the two markets. The rate of economic capital formation is equal to the product of (3.19) and (3.26).

It is assumed that Nigeria is a small open economy and its activities do not have a strong impact on the foreign economy with respect to inflation, output and interest rate. The foreign variables are modelled as exogenous and are assumed to follow AR (1) Processes such that:

$$\text{Foreign Inflation shock: } \pi_t^* = \rho_{\pi_t^*} \pi_{t-1}^* + \varepsilon_t^{\pi_t^*} \quad (3.78)$$

$$\text{Foreign Output shock: } y_t^* = \rho_{y_t^*} y_{t-1}^* + \varepsilon_t^{y_t^*} \quad (3.67)$$

$$\text{Interest rate shock: } r_t^* = \rho_{r_t^*} r_{t-1}^* + \varepsilon_t^{r_t^*} \quad (3.79)$$

The stochastic Processes $\varphi_i^j \sim \text{iidN}(0, \sigma_j^2)$

For $j = f^*, Y^*, R^*$. This therefore explains that the stochastic processes of foreign inflation, foreign output and foreign interest rate are independently, identically and normally distributed of zero mean and variance σ_j^2 . (Calvo, 1983; Oye et al., 2018)

Table 1: Calibrated Parameters

Parameters	Parameters Description	Distribution	Mean	Std. Dev.
val	Risk factor (probability of success) for low risk individuals	Normal	0.9	0.1
sigma	Weight on real money balances	Normal	3	0.1
Rho	The proportion of high-risk borrowers	Normal	0.35	0.1
kyu	Probability of IFS loan repayment	Normal	0.9	0.1
Phi	utility function; leisure parameter	Normal	10.38	0.1
alpha	Share of capital in the production function	Beta	0.7	0.1
beta	Discount rate	Normal	0.95	0.1
Delta	Depreciation	Beta	0.4	0.1
vah	Risk factors for high-risk borrowers	Beta	0.65	0.1
Eta	autoregressive parameter shock	Normal	0.65	0.1
Chi2	Weight of expected change in output in the monetary policy rule	Normal	0.65	0.1
Chi1	The factor of inertia in the base lending rate	Normal	0.7	0.1
zeta	Mark-up over the bank rate to obtain the base lending rate	Beta	0.65	0.1
Psi	The lagrangian multiplier in a firm's cost minimisation function	Beta	0.7	0.1
kappa	The intertemporal discount factor	Gamma	0.6	0.1
omega	Inverse elasticity of substitution between domestic and foreign goods	Normal	0.5	0.1
Kappa_alpha	The intertemporal discount factor shares of capital production	Beta	0.7	0.1
Upsilon_exr	Taylor's feedback on the exchange rate	Beta	0.4	0.1
Rho_mur	AR (1) money supply	Beta	0.7	0.1
Rho_Rdf	AR (1) Commercial bank deposit rates	Beta	0.7	0.1
Rho_a	AR (1) Technology	Beta	0.7	0.1
Rho_ge	AR (1) Government expenditure	Beta	0.7	0.1
Rho_ff	AR (1) Foreign inflation	Beta	0.7	0.1
Rho_fy	AR (1) Foreign output	Beta	0.7	0.1

Parameters	Parameters Description	Distribution	Mean	Std. Dev.
Rho_mu	AR (1) Monetary policy shock	Beta	0.7	0.1
Rho_y	AR (1) Output	Beta	0.65	0.1
Rho_df	AR (1) Domestic inflation	Beta	0.7	0.1
Rho_t	AR (1) Transfer payment	Beta	0.7	0.1
Rho_ex	AR (1) Exchange rate	Beta	0.7	0.1
st_ff	Foreign inflation shock	Inverse Gamma	0.25	∞
st_fy	Foreign output shock	Inverse Gamma	0.25	∞
st_mu	Monetary policy shock	Inverse Gamma	0.25	∞
st_y	Output shock	Inverse Gamma	0.25	∞
st_df	Domestic inflation shock	Inverse Gamma	0.25	∞
st_t	Transfer payment shock	Inverse Gamma	0.25	∞
st_a	Technology shock	Inverse Gamma	0.25	∞
st_ge	Government expenditure shock	Inverse Gamma	0.25	∞
st_ex	Exchange rate shock	Inverse Gamma	0.25	∞

Source: Author's Compilation, 2022

DISCUSSION OF RESULT

Impulse Response Analysis

In this section, the Impulse Response Analysis is illustrated through graphs of the Impulse Response Functions (IRFs). How endogenous variables fare in the face of standard deviation-sized surprises is quantified by the Impulse Response Functions. The effects of fiscal policy (government spending), monetary policy (rate of interest), and production (GDP) on dependent variables were analysed.

i. Monetary Policy Shocks

When the Apex bank (Central Bank of Nigeria) makes an abrupt shift in policy, it is called a monetary policy shock. Figure 1 shows how the interest rate changed as a result of the positive monetary policy shock, showing a rise from quarter one until it reached a steady state in quarter twenty. The positive monetary shock positively impacts output (GDP) but reacted negatively on government expenditure from quarter one to its steady state, that is, quarter twenty. The implication is that the economy will likely experience consumption and investment falls. The government now pays more in interest on its debt. If interest rates go up, the federal government will have to spend more money to make interest payments. Future tax increases may result from this. It has a similar effect on business and consumer confidence. It is common knowledge that when interest rates rise, consumers and companies alike become less willing to engage in risky spending and investing. The finding is in conformity with that of Hatmanu, Cautisanu and Ifrim (2020).

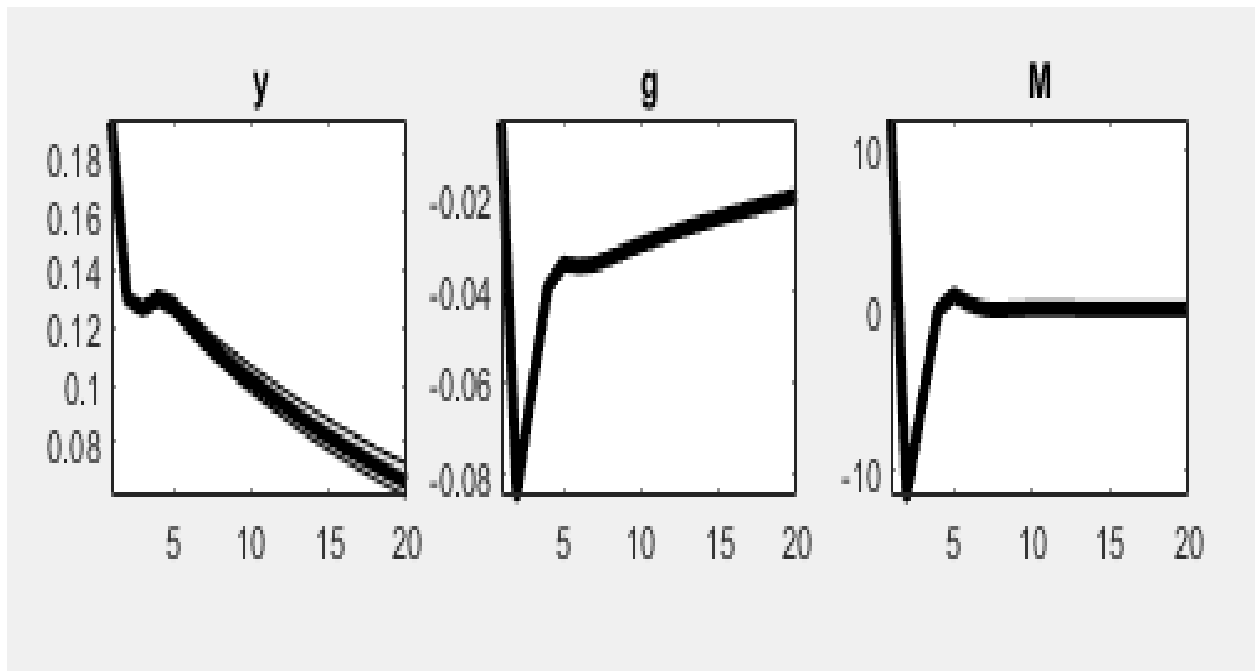


Figure 1: Monetary Policy Impulse Response
 Source: Authors' Computation using Matlab

ii. Fiscal Policy Shock

The negative fiscal policy shock in Figure 2 reacted negatively to output and interest rate. The inference here is that a decline in government spending will lead to a drop in aggregate demand and GDP. The loss of jobs and subsequent decrease in income is a direct result of the recession. Consumer spending is slowed by a drop in income, which further affects aggregate demand and leads to a further decline in real GDP. In addition, the interest rate had a depressive effect on government spending. Businesses and individuals alike will reduce spending if interest rates rise. Because of this, profits will decrease and share values will fall. Conversely, when interest rates fall drastically, stock prices rise because of higher expenditures by customers as well as businesses.

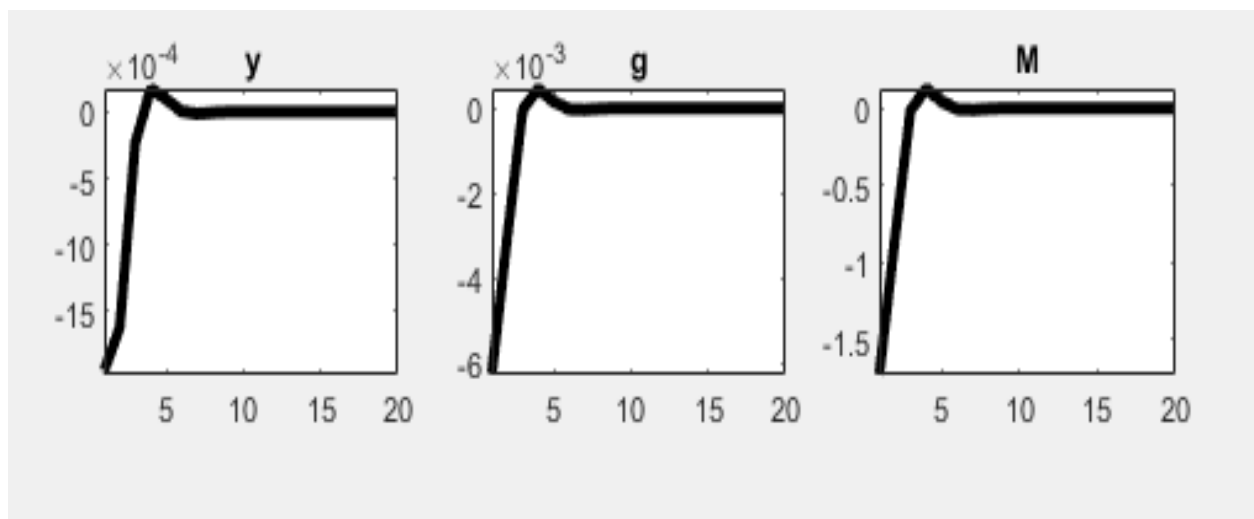


Figure 2: Fiscal Policy Impulse Response
 Source: Authors' Computation using Matlab

iii. Output Shock

As shown in Figure 3, during Q1 through Q20, domestic output is increased as a result of the positive output shock while decreasing interest rates. To keep the rising output level going, the Central Bank can lower interest rates in

reaction to a positive output shock. From the first quarter, when the shock first hit, to the twenty-fourth quarter, when things finally settled down, government spending took a hit. While an increase in public spending should lead to a rise in GDP, this is highly unlikely to occur. For instance, a reduction in inflation and continued growth can result from an increase in interest rates. There may have a chilling effect on economic expansion if interest rates are kept too high. During the expansion phase, the higher G.D.P. is a result of the lower interest rate.

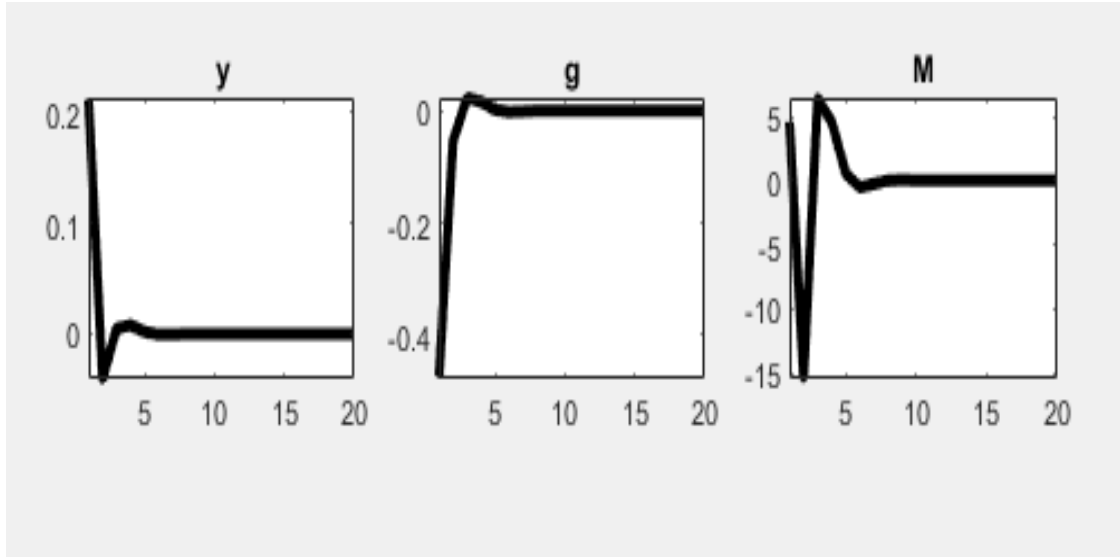


Figure 3 Impulse Response to Output
Source: Authors' Computation using Matlab

iv. Smoothed Shocks

The calculated smoothed shocks should cluster close to zero on a scatter plot. Some of the processes of the smoothed shock are centred about zero, as shown in Figure 4. This shows that the calculated model's statistics are reliable and valid.

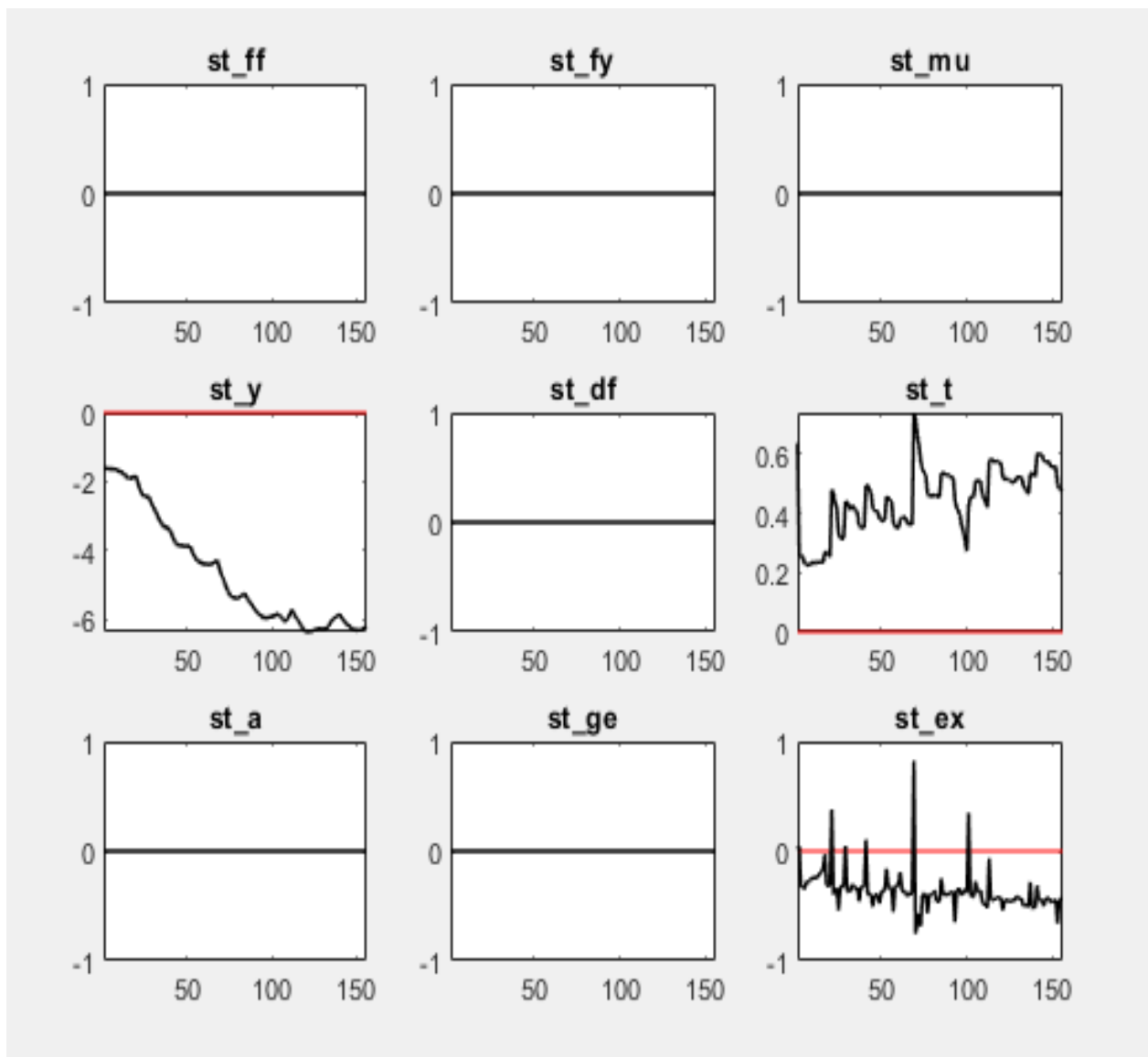


Figure 4: Smoothed Shocks

Source: Authors' Computation using Matlab

Nature of Informal Financial Sector and Macroeconomic Performance in Nigeria

This subsection deals with the connections between informal finance and macroeconomic performance in Nigeria. This involves examining the direction and magnitude of the correlation between informal financing and macroeconomic performance in Nigeria such as output (GDP growth rate) is analysed. This is accomplished through numerical simulations utilising Taylor's approximation of the system of equations at the first order. In order to do the numerical simulations, the Dynare programme is employed in a Matlab setting. Table 2 displays the matrix of covariance of exogenous shocks generated by running Dynare in a Matlab environment. This demonstrates that the shocks are not linked in any particular order.

Table 2: Matrix of Covariance of Exogenous Shocks

Shocks	St_mu	St_y	St_a	St_ge	St_ex
St_mu	0.010000				
St_y	0.000000	0.010000			

St_a	0.000000	0.000000	0.010000		
St_ge	0.000000	0.000000	0.000000	0.010000	
St_ex	0.000000	0.000000	0.000000	0.000000	0.010000

Source: Author's Computation using Matlab and Dynare 4.6.4 output

Tables 3 and 4 present the theoretical moments as well as the coefficient of autocorrelation. These statistics are necessary to inspect the results of the numerical simulations.

Table 3: Theoretical Moments

Variables	Definition	Mean	Standard Dev.	Variance
y	Output	0.0000	0.1250	0.0156
M	Interest rate	0.0000	33.0175	1090.1562
g	Government expenditure	0.0000	0.1884	0.0355

Source: Author's Computation using Matlab and Dynare 4.6.4 output

Table 4: Coefficients of Autocorrelation

Variables	Definition	1	2	3	4	5
Y	Output	-0.3216	-0.0630	0.0424	0.0186	-0.0095
M	Interest rate	-0.3843	-0.1404	0.0047	0.0135	0.0037
G	Government expenditure	0.4349	0.0560	-0.0642	-0.1044	-0.1267

Source: Author's Computation using Matlab and Dynare 4.6.4 output

The correlations matrix presented in Table 5, is a result of the dynamic simulation of the DSGE model. The result shows that interest rate indicates a positive relationship between output and government expenditure. Output revealed a positive relationship with interest rate but a negative correlation with government expenditure. Government expenditure on the other hand also indicates a negative correlation with output and a positive relationship with interest rate. It is, therefore, concluded that government expenditure in Nigeria negatively affects output.

Table 5: Correlations Matrix of Informal Financing Outcome

Variables	Interest rate (M)	Output (y)	Government expenditure (g)
Interest rate (M)	1.0000	0.9377	0.2213
Output (y)	0.9377	1.0000	-0.1031
Government expenditure (g)	0.2213	-0.1031	1.0000

Source: Author's Computation using Matlab and Dynare 4.6.4 output.

CONCLUSION AND RECOMMENDATIONS

This study presents a distinct contribution to the existing literature by incorporating fiscal policy considerations into the analysis of the effects of informal finance in Nigeria. Through a comprehensive review of the literature, it becomes evident that this research addresses three crucial areas that remain underexplored. Firstly, this study intends to fill the gap in literature by empirically examining the linkages between Nigeria's formal and informal banking sectors. Secondly, it contributes to the body of knowledge by employing the Dynamic Stochastic General Equilibrium (DSGE) approach, which has been sparingly used in Nigeria, and even fewer studies have applied it to evaluate the behaviour of the informal finance sector in response to economic shocks.

To better understand the interface between the informal and formal financial sectors in Nigeria, it is essential to distinguish between formal and informal finance. Formal finance refers to funds obtained through traditional financial institutions such as banks, while informal finance involves borrowing from acquaintances or strangers (Elston et al., 2016). This distinction provides insights into the accessibility of loans and how formal and informal sectors interact. The study's findings indicate that the risk factors (probability of success) for low-risk individuals are lower in the informal finance sector, with a posterior mean of 0.844 compared to a prior mean of 0.900.

Additionally, this study investigates the transmission effects of the informal financial market on other sectors of the economy. By modelling the informal finance sector using interest rates, the study reveals that a positive monetary policy shock leads to a gradual increase in interest rates until they stabilize after twenty quarters. This shock has a positive impact on output (GDP) but negatively affects government expenditure throughout the same period.

The third objective of the study focuses on analysing fiscal, monetary, and output shocks in the Nigerian economy. The findings show that a positive monetary policy shock has a positive effect on output and a negative impact on government expenditure (Hatmanu et al., 2020; Hossain, 2020). Conversely, a negative fiscal policy shock negatively affects output and interest rates. A reduction in government spending diminishes aggregate demand, leading to a decline in real GDP and employment. Higher interest rates resulting from increased government expenditure can also deter consumer and business spending, leading to reduced profits and stock values. The study emphasizes that government spending, when not constrained by the zero lower bound, tends to raise nominal interest rates, potentially crowding out investment and hindering future economic growth (Murphy & Walsh, 2022).

Based on the major findings of the study regarding the dynamics of Nigeria's informal finance and the estimation of the DSGE model, several policy recommendations can be made. First, the central bank should adopt a more cautious policy approach, particularly in the presence of high inflation, to enhance the effectiveness of macroeconomic policies in achieving their intended goals. Combining conventional and unconventional policy measures would offer a more nuanced approach. To better mitigate the effects of the shocks from monetary policy on the real economy, the government should adopt market-friendly measures that encourage the informal sector's incorporation into the formal sector.

To enhance the transmission mechanism of shocks from monetary policy to the real economy, The government should adopt policies that encourage economic growth and as well promote the formalisation of unregistered businesses, leading to increased tax revenues and a more robust basis for economic policy formulation. Furthermore, the study underscores the negative impact on GDP when the government reduces spending, which reduces aggregate demand and leads to job losses and decreased income. To mitigate such adverse effects and maintain economic growth, strategic and timely interventions by the government are necessary.

References

1. Adu, O., Alege, P. O., & Olurinola, O. (2020). Macroeconomic policy effectiveness and the informal economy in Nigeria: A DSGE approach. *Research in World Economy*, 11(6), 51. <https://doi.org/10.5430/rwe.v11n6p51>
2. Alabi, N. O., & Bada, O. (2019). Investigating the Causality between Unemployment Rate, Major Monetary Policy Indicators and Domestic Output using an Augmented Var Approach: A Case of Nigeria. *Global Journal of HUMAN-SOCIAL SCIENCE: E Economics*, 19(6), 11–21.
3. Alege, P. O. (2012). A business cycle model for Nigeria. *CBN Journal of Applied Statistics*, 3(1), 85–115.

4. Alege. (2019). Remittances, financial development and the effectiveness of monetary policy transmission mechanism in Nigeria: A DSGE approach (1986–2018). *Covenant University Inaugural Lecture Series*, 10(2), 1–106.
5. Ambler, S., & Paquet, A. (1994). Stochastic depreciation and the business cycle. *International Economic Review*, 35(1), 101. <https://doi.org/10.2307/2527092>
6. Apanisile, O. T., & Osinubi, T. T. (2020). Financial development and the effectiveness of monetary policy channels in Nigeria: A DSGE approach. *Journal of African Business*, 21(2), 193–214.
7. Aryeetey, E. (2008). From informal finance to formal finance in Sub-Saharan Africa: Lessons from linkage efforts. AERC/IMF African Finance for the 21st Century Unpublished Manuscript.
8. Atindéhou, R. B., Gueyie *, J. P., & Amenounve, E. K. (2005). Financial intermediation and economic growth: Evidence from Western Africa. *Applied Financial Economics*, 15(11), 777–790. <https://doi.org/10.1080/09603100500108030>
9. Basu, J. (1997). The conservatism principle and the asymmetric timeliness of earnings. *Journal of Accounting and Economics*, 24(1), 3–37. [https://doi.org/10.1016/s0165-4101\(97\)00014-1](https://doi.org/10.1016/s0165-4101(97)00014-1)
10. Bergholt, D. (2012). The basic new Keynesian model. https://bergholt.weebly.com/uploads/1/1/8/4/11843961/the_basic_new_keynesian_model_-_drago_bergholt.pdf
11. Bernanke, B. S. (2018). The real effects of disrupted credit: Evidence from the global financial crisis. *Brookings Papers on Economic Activity* 2018(2), 86(3), 1031–1065.
12. Bhattarai, K., & Trzeciakiewicz, D. (2017). Macroeconomic impacts of fiscal policy shocks in the UK: A DSGE analysis. *Economic Modelling*, 61, 321–338. <https://doi.org/10.1016/j.econmod.2016.10.012>
13. Boafo, C., Owusu, R. A., & Guiderdoni-Jourdain, K. (2022). Understanding internationalisation of informal African firms through a network perspective. *International Small Business Journal: Researching Entrepreneurship*, 40(5), 618–649. <https://doi.org/10.1177/02662426211054099>
14. Bruton, G. D., Nuhu, N., & Qian, J. J. (2021). Informal finance in settings of poverty: Establishing an agenda for future entrepreneurship research. *Journal of Developmental Entrepreneurship*, 26(2). <https://doi.org/10.1142/S1084946721500114>
15. Calvo, G. A. (1983). Staggered contracts and exchange rate policy. In *Exchange rates and international macroeconomics*. University of Chicago Press., 235–258.
16. CBN. (2013). DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM MODEL FOR MONETARY POLICY ANALYSIS IN NIGERIA. Gov.Ng. <https://www.cbn.gov.ng/out/2015/rsd/dynamic%20stochastic%20general%20equilibrium%20model%20for%20monetary%20policy%20analysis%20in%20nigeria.pdf>
17. Cheng, X., & Degryse, H. (2010). The Impact of Bank and Non-Bank Financial Institutions on Local Economic Growth in China. *Journal of Financial Services Research*, 37(2–3), 179–199. <https://doi.org/10.1007/s10693-009-0077-4>
18. Christiano, L. J., Eichenbaum, M. S., & Trabandt, M. (2018). On DSGE Models. *Journal of Economic Perspectives*, 32(3), 113–140. <https://doi.org/10.1257/jep.32.3.113>
19. Chuku, C. A. (2016). Evaluating monetary policy options for managing resource revenue shocks when fiscal policy is laissez-faire: Application to Nigeria.
20. Dasgupta, R. (2005). Microfinance in India: Empirical evidence, alternative models, and policy imperatives. *Economic and Political Weekly*, 40(12), 1229–1237.
21. Dawid, H., Leeper, P., & Neugart, M. (2018). Cohesion policy and inequality dynamics: Insights from a heterogeneous agents' macroeconomic model. *Journal of Economic Behavior & Organization*, 150, 220–255.
22. Enisan, A. A., & Tolulope, A. O. (2019). Monetary policy shocks and effectiveness of channels of transmission in nigeria: A dynamic stochastic general equilibrium approach. *Global Business Review*, 20(2), 331–353.
23. Fadun, S. O. (2014). Financial Inclusion, Tool for Poverty Alleviation and Income Redistribution in Developing Countries: Evidences from Nigeria. 5.
24. Fernández-Villaverde, J., & Guerrón-Quintana, P. A. (2021). Estimating DSGE models: Recent advances and future challenges. *Annual Review of Economics*, 13, 229–252.
25. Galdino, K. M., Kigundu, M. N., Jones, C. D., & Ro, S. (2018). The informal economy in pan Africa: Review of the literature, themes, questions, and directions for management research. *Africa Journal of Management*, 4(3), 225–258.
26. Gali, J., & Monacelli, T. (2008). Optimal monetary and fiscal policy in a currency union. *Journal of International Economics*, 76(1), 116–132. <https://doi.org/10.1016/j.jinteco.2008.02.007>
27. Girón, A., Kazemikhasragh, A., Cicchiello, A. F., & Panetti, E. (2022). Financial Inclusion Measurement in the Least Developed Countries in Asia and Africa. *Journal of the Knowledge Economy*, 13(2), 1198–1211. <https://doi.org/10.1007/s13132-021-00773-2>
28. Gobbi, A., & Grazzini, J. (2019). A basic New Keynesian DSGE model with dispersed information: An agent-based approach. *Journal of Economic Behavior & Organization*, 157, 101–116.
29. Hatmanu, M., Cautisanu, C., & Ifrim, M. (2020). The Impact of Interest Rate, Exchange Rate and European Business Climate on Economic Growth in Romania: An ARDL Approach with Structural Breaks. *Sustainability*, 12(7), 2798. <https://doi.org/10.3390/su12072798>
30. Hossain, M. (2020). Financial liberalization, financial development and economic growth: An analysis of the financial sector of Bangladesh. *Bangladesh's Macroeconomic Policy*, 395–418.
31. Hou, L., Hsueh, S. C., & Zhang, S. (2020). Does formal financial development crowd in informal financing? Evidence from Chinese private enterprises. *Economic Modelling*, 90, 288–301.
32. Iklaga, F. (2016). A DSGE Model for an Emerging Open Economy Oil-Producer: Foreign Exchange Interventions as a Policy Instrument. In *Energy Economics Emerging from the Caspian Region: Challenges and Opportunities*, 1st IAEE Eurasian Conference. International Association for Energy Economics.
33. Itskhoki, O., & Mukhin, D. (2021). Exchange rate disconnect in general equilibrium. *Journal of Political Economy*, 129(8), 2183–2232.
34. Khan, A., & Gulati, R. (2019). Assessment of efficiency and ranking of microfinance institutions in India: A two-stage bootstrap DEA analysis. *International Journal of Business Forecasting and Marketing Intelligence*, 5(1), 23. <https://doi.org/10.1504/IJBFMI.2019.099008>

35. King, A., & Shackleton, C. M. (2021). Working in poverty: Informal employment of household gardeners in Eastern Cape towns, South Africa. *Development Southern Africa*, 1–14.
36. Lawhon, M., & Truelove, Y. (2020). Disambiguating the southern urban critique: Propositions, pathways and possibilities for a more global urban studies. *Urban Studies*, 57(1), 3–20. <https://doi.org/10.1177/0042098019829412>
37. Li, J., Zhang, X., & Hu, J. (2021). Strategic co-funding in informal finance market: Evidence from China. *Journal of Applied Economics*, 24(1), 329–349. <https://doi.org/10.1080/15140326.2021.1932395>
38. Mahdi, I. (2018). Informal finance in Sierra Leone: Why and how it fits into the financial system. *Economics Department Working Paper Series, London*, 1–32.
39. Martins, G. K., & Skott, P. (2021). Sources of inflation and the effects of balanced budgets and inflation targeting in developing economies. *Industrial and Corporate Change*, 30(2), 409–444.
40. McKinnon, R. I. (1973). *Money and capital in economic development* (Washington, DC: Brookings Institution, 1973). *McKinnon Money and Capital in Economic Development 1973*.
41. Mirfatah, M., Nasrollahi, Z., Levine, P., & Gabriel, V. (2019). Money Growth Rules in an Emerging Small Open Economy with an informal sector. *International Journal of Business and Development Studies*, 11(1). <https://doi.org/10.22111/ijbds.2019.4836>
42. Mukhamediyev, B., & Khitakhunov, A. (2017). Interdependence of Real, Financial and Export Import Indicators in a DSGE Model of Multiple Countries. In *Country Experiences in Economic Development, Management and Entrepreneurship*, Springer, Cham, 5, 63–87.
43. Murphy, D., & Walsh, K. J. (2022). Government spending and interest rates. *Journal of International Money and Finance*, 123, 102598.
44. Neuwirth, R. (2018). Igbo apprenticeship system is world's largest business incubator platform Robert Neuwirth reveals. <https://www.informationng.com/2018/11/igbo-apprenticeship-system-is-worlds-largest-business-incubator-platform-robertneuwirth-reveals.html>.
45. Ngalawa, H. (2018). Informal financial transactions and monetary policy in low-income countries: Interpolated informal credit and interest rates in Malawi. *South African Journal of Economic and Management Sciences*, 21(1), 1–14.
46. Ngalawa, H., & Viegi, N. (2013). Interaction of formal and informal financial markets in quasi emerging market economies. *Economic Modelling*, 31, 614–624.
47. Nguyen, B., & Canh, N. P. (2021). Formal and informal financing decisions of small businesses. *Small Business Economics*, 57(3), 1545–1567. <https://doi.org/10.1007/s11187-020-00361-9>
48. Obadeyi, J. A. (2015). Microfinance banking and development of small business in emerging economy. *Nigerian Approach*.
49. Ogbulu, O. M., & Torbira, L. L. (2012). Monetary policy and the transmission mechanism: Evidence from Nigeria. *International Journal of Economics and Finance*, 4(11). <https://doi.org/10.5539/ijef.v4n11p122>
50. Oye, Q. R., Alege, P., & Olomola, P. (2018). Optimal fiscal and monetary policy rules in Nigeria. *Journal of Applied Economic Sciences*, 13(6), 1615–1622.
51. Rasaki, M. G. (2017). A Bayesian estimation of DSGE model for the Nigerian economy. *Euro Economica*, 36(02), 145–158.
52. Shaw, E. S. (1973). *Financial deepening in economic development*. New York: Oxford University Press.
53. Sibanda, K., Hove-Sibanda, P., & Shava, H. (2018). The impact of SME access to finance and performance on exporting behaviour at firm level: A case of furniture manufacturing SMEs in Zimbabwe. *Acta Commercii*, 18(1), 1–13.
54. Steel, W. F., Aryeetey, E., Hettige, H., & Nissanke, M. (1997). Informal Financial Markets Under Liberalization in Four African Countries. *World Development*, 25(5), 817–830.
55. Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review*, 71(3), 393–410.
56. Straub, S. (2005). Informal sector: The credit market channel. *Journal of Development Economics*, 78(2), 299–321.
57. Sturzenegger, F. (2019). Macri's Macro: The Elusive Road to Stability and Growth. *Brookings Papers on Economic Activity*, 2019(2), 339–436. <https://doi.org/10.1353/eca.2019.0016>
58. Uruakpa, N. I., Kalu, U. E., & Ufomadu, O. A. (2019). Impact of financial inclusion on economic growth of Nigeria. *Double Blind Peer Reviewed International Research Journal*, 12(2), 46–58.
59. Williams, C. C., & Kedir, A. (2018). Evaluating competing theories of informal sector entrepreneurship: A study of the determinants of cross-country variations in enterprises starting-up unregistered. *The International Journal of Entrepreneurship and Innovation*, 19(3), 155–165.