Oscar, W. A., Analo, O. V., & Jibrin, F. M. (2026). The Aggregate Demand Channel of Oil Price Shocks: Implications for Nigeria's Banking Sector. *Energy RESEARCH LETTERS*, *7*(Early View). https://doi.org/10.46557/001c.156397

Peer-reviewed research

The Aggregate Demand Channel of Oil Price Shocks: Implications for Nigeria's Banking Sector

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Keywords: Oil price, Banking sector stability, Monetary policy, New Keynesian model, Quarterly projection model

JEL Classifications: E32 Business Fluctuations - Cycles, E44 Financial Markets and the Macroeconomy, E52 Monetary Policy, E58 Central Banks and Their Policies, Q43 Energy and the Macroeconomy

https://doi.org/10.46557/001c.156397

Energy RESEARCH LETTERS

Vol. 7, Issue Early View, 2026

This paper employs a New Keynesian framework to examine the impact of oil price shocks on Nigeria's banking system through the aggregate demand channel. The findings indicate that a negative oil price shock poses a threat to banking system stability, whereas an expansionary monetary policy response from the central bank enhances stability after two quarters. The paper's identification of asymmetric behaviour represents a significant contribution to the literature.

I. Introduction

Oil price shocks have significant macroeconomic consequences, but their effects vary depending on a country's economic structure, external vulnerability, dependence on oil, and net export position (Jiménez-Rodríguez, 2022; Qin, 2020). In oil-rich economies such as Nigeria, these shocks are transmitted through multiple channels—fiscal, external, and aggregate demand. Among these, the aggregate demand channel is particularly critical, as it captures the broad impact of oil price fluctuations on government revenues, public spending, and overall economic activity (Ahmed et al., 2019; Li et al., 2023; Maghyereh & Abdoh, 2021).

Despite extensive work on the macroeconomic implications of oil shocks, limited attention has been paid to how these shocks affect banking system stability, particularly through the aggregate demand channel. This study addresses that gap by employing a semi-structural model that explicitly captures this transmission mechanism. To our knowledge, this is the first such application in the Nigerian context. The findings, therefore, should guide policymakers on how to respond to oil price shocks and their potential impact on the banking system.

Ma et al. (2021) identify two channels through which oil shocks influence the banking sector: indirectly via macroeconomic disruptions that elevate systemic risk, and directly through their effects on banks' asset portfolios. The indirect route is particularly relevant for Nigeria, where banks are deeply tied to the health of the broader economy (Lee & Lee, 2019; Odu & Sanusi, 2021). A contraction in aggregate demand—driven by falling oil prices—thus poses a substantial threat to financial stability.

Given Nigeria's high dependence on oil revenues, the aggregate demand channel offers a comprehensive lens through which to assess banking sector vulnerabilities. Recent studies confirm that oil price fluctuations directly and indirectly undermine Nigeria's macroeconomic stability, with significant spillovers to the financial system (Oscar & Kwarshak, 2024; Tumala et al., 2022). We therefore prioritise this channel over others due to its economy-wide influence on both demand-side conditions and financial sector resilience (Oladunni, 2020; Omotosho, 2019).

The rest of the paper is structured as follows: Section II describes the data and methodology. Section III presents the empirical findings. Section IV concludes with key insights and policy recommendations.

II. Data and Methodology

The paper estimates a quarterly projection model within the New Keynesian framework using a Bayesian approach. The model comprises behavioural equations for aggregate demand, the Phillips curve, Taylor's rule, banking stability, and a modified uncovered interest rate parity, as summarised in Equations (1) to (5).

Quarterly series on real GDP, consumer price index (CPI), interest rate, exchange rate, and inflation target are obtained from the National Bureau of Statistics and the Central Bank of Nigeria for the period 2010 Q1 to 2024 Q4. The foreign variables, including the output gap, CPI, and interest rates, are sourced from the IMF database, except for the

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output gap, which is obtained from the U.S. Bureau of Economic Analysis.

$$\tilde{y}_t = \beta_1 \tilde{y}_{t-1} - \beta_2 MCI_t + \beta_3 \tilde{y}_t^* + \beta_4 Oil_t + \epsilon_t^{\tilde{y}} \quad (1)$$

In Equation (1), aggregate demand $\tilde{y}_t$ is a function of its lagged value $\tilde{y}_{t-1}$, monetary conditions MCI_t, foreign output gap ($\tilde{y}_t^*$), oil price changes (Oil_t) and the shock to aggregate demand $\epsilon_t^{\tilde{y}}$.

The inflation Equation (2) follows a hybrid version of the new Keynesian Phillips Curve (HNKPC):

$$\pi_t = \alpha_1 \pi_{t-1} + (1-\alpha_1)\,\mathbb{E}_t\left[\pi_{t+1}\right] + \alpha_2 RMC + \epsilon_t^{\pi} \quad (2)$$

Where inflation π_t is sensitive to its lagged (π_{t-1}) and expected ($\mathbb{E}_t\left[\pi_{t+1}\right]$) values as well as the real marginal cost (RMC).

The Taylor's rule used in the paper follows a simple rule where the central bank considers the behaviour of aggregate demand and the deviation of inflation from its target.

$$\begin{aligned} i_t = {} & g_1 i_{t-1} \\ & + (1-g_1)\left\{i_t^n + g_2(\mathbb{E}_t[\pi_{t+n}^4] - \pi_{t+n}^T) + g_3 \tilde{y}_t\right\} \\ & + \epsilon_t^i \end{aligned} \quad (3)$$

where i_t represents the central bank policy rate in response to the neutral interest rate i_t^n, deviation of annualised inflation from its target ($\mathbb{E}_t[\pi_{t+n}^4] - \pi_{t+n}^T$), and aggregate demand $\tilde{y}_t$. The lagged value of the policy rate and its parameter, g_1, represents the smoothing in policy adjustments, which entails how much weight the central bank places on its "wait-and-see" approach to monetary policy. The monetary policy shock is represented by ϵ_t^i.

The banking system equation represents the relationship between non-performing loans of deposit money banks (BS_t), its lagged values, monetary policy rate (i_t), aggregate demand ($\tilde{y}_t$), and the shock variable (ϵ_t^{BS}) as shown in Equation (4).

$$BS_t = \rho_{BS_t} BS_{t-1} + \varphi_{i_t} i_t - \varphi_{\tilde{y}_t} \tilde{y}_t + \epsilon_t^{BS} \quad (4)$$

As oil prices are primarily determined exogenously, they are modelled alongside foreign variables, including the foreign output gap, inflation, and interest rate. These variables are restricted to an AR (1) process. The domestic trend variables are filtered using the Kalman filter, while the foreign trend variables are processed with the HP filter, supplemented by expert judgement. Specifically, certain data points for the foreign output gap are obtained from the Federal Reserve Economic Data (FRED).

As an open economy, we also specify an uncovered interest rate parity (UIP) to the dynamics in the foreign exchange market between Nigeria and the global market.

$$\begin{aligned} s_t = {} & (1-e_1)\,\mathbb{E}_t\left[s_{t+1}\right] \\ & + e_1(s_{t-1} + 0.5 * (\pi_{t+n}^T - \pi_t^{*SS} + \overline{z}_t)) \\ & + (-i_t + i_t^* + prem)/4 + \epsilon_t^s \end{aligned} \quad (5)$$

where the nominal exchange rate s_t depends on its expected ($\mathbb{E}_t\left[s_{t+1}\right]$) and lagged ($s_{t-1}$) values, the difference between the domestic inflation target, π_{t+n}^T (annualised), and the steady state of global inflation (π_t^{*SS}) as well as the trend of real exchange rate ($\overline{z}_t$). In the UIP condition we add a risk premium $prem$ to the difference between domestic nominal interest rate i_t and the foreign nominal interest rate i_t^* (Dąbrowski & Janus, 2024). We also include the risk premium variable, as Kumar (2023) demonstrated that, in the absence of a risk premium, the UIP may fail.

The calibration of the parameters (reported in Table 1) followed an empirical process informed by expert judgement, while the steady-state parameters are based on forecasts from the home country during the period, as well as multilateral institutions such as the International Monetary Fund and the World Bank.

The steady inflation target is based on a study conducted by Okoroafor et al (2018) and the average of inflation during the sample period. The steady-state values for the real exchange rate, as well as domestic and foreign real interest rates, are based on De Resende et al. (2022). Estimates for potential output and annualised foreign inflation are sourced from the IMF (2024).

III. Results

Scenario 1 analysed the effects of a 1.00 percentage point negative shock to oil prices and monetary policy, considering both weak and strong sensitivities of aggregate demand to these shocks.

The impulse response of Scenario 1 provided in Figure 1 indicates a subdued aggregate demand for at least one quarter, contributing to an increase in non-performing loans, which negatively affects the banking system over the same period. Similar findings are reported by Chin et al. (2023) and Alnabulsi et al. (2022) for Kazakhstan and MENA countries. The results further suggest that loosening monetary policy during a decline in oil prices would lead to an increase in inflation for approximately two quarters, followed by a gradual decrease. Initially, there would be a depreciation of the exchange rate and a decrease in the nominal interest rate, resulting in looser monetary conditions. These looser conditions positively impact aggregate demand and, therefore, restore banking system stability after two quarters.

Scenario 2 assessed the effects of positive shocks in oil prices and monetary policy, each by 1.00 percentage points, while considering varying degrees of sensitivity in the response of aggregate demand—weak, moderate, and strong.

The banking system index experienced a significant decline in response to the oil and monetary policy shocks; nevertheless, this effect diminishes after the second quarter as monetary policy tightens within the same period (Napari et al., 2024), which offers counterfactual evidence relevant to the ECOWAS region. Furthermore, it is revealed in Figure 2 that the oil shock has the potential to restore the economy towards recovery following a decline in aggregate demand; however, this recovery is accompanied by an immediate surge in inflation that persists for approximately two quarters.

The conditional forecast indicated that if the banking system experiences a negative shock due to falling oil prices and the monetary authorities react by lowering interest rates, this would lead to a sudden outflow of capital, resulting in a slight rise in non-performing loans (see figure 3). This increase is expected to persist over time, reflecting the degree of exposure that deposit money banks have to foreign capital. Conversely, if the government opts to increase taxes to compensate for a shortfall in oil revenue, this will likely exacerbate stress within the banking sector.

Table 1. Summary of the calibrated parameters

Symbol	Description	Priors
β_1	Persistence of output growth	0.8
β_2	Passthrough of monetary policy to the real economy	0.3
β_3	Sensitivity of output to external demand	0.5
β_4	Weight of oil price in the aggregate demand model	0.3
α_1	Inflation persistence	0.7
α_2	Passthrough of marginal costs to inflation	0.2
e_1	Weight of the backward-looking component in the UIP condition	0.4
g_1	Monetary policy persistence	0.6
g_2	Weight on inflation in the monetary policy rule	0.5
g_3	Weight on output gap in the monetary policy rule	0.5
ρ_{BS_t}	Persistence in the Banking system	0.6
φ_{i_t}	Weight of the policy rate in the banking stability equation	0.5
$\varphi_{\tilde{y}_t}$	Weight of aggregate demand in the banking stability equation	0.5
π_t^{TSS}	Steady state of inflation target	15
$\overline{r}_t^{SS}$	Steady state of domestic trend real interest rate	0.5
$\overline{z}_t^{SS}$	Steady state of the trend real exchange rate	0.5
$\overline{y}_t^{SS}$	Steady state of potential output growth	3.3
π_t^{*SS}	Steady state of annualised foreign inflation	2.0
$\overline{r}_t^{*SS}$	Steady state of foreign trend real interest rate	0.75

Note: Owing to the dearth of studies on the Nigerian economy, a significant part of the calibration is based on expert judgement.

IV. Conclusion

The banking system of resource-rich countries is often vulnerable to fluctuations in commodity prices. In Nigeria's case, most of the credit to the private sector is extended to players in the oil industry, and aggregate demand depends significantly on proceeds from the oil sector. We have therefore demonstrated, under two scenarios, that negative shocks to oil prices would escalate the ratio of non-performing loans (which aligns with the findings of Odu & Sanusi, 2021). However, an expansionary monetary policy response by the central bank could enhance banking stability after approximately two quarters. For future studies, we recommend a disaggregated analysis of the impact of oil price shocks on both small and large banks.

Submitted: May 13, 2025 AEST. Accepted: October 03, 2025 AEST. Published: July 20, 2026 AEST.

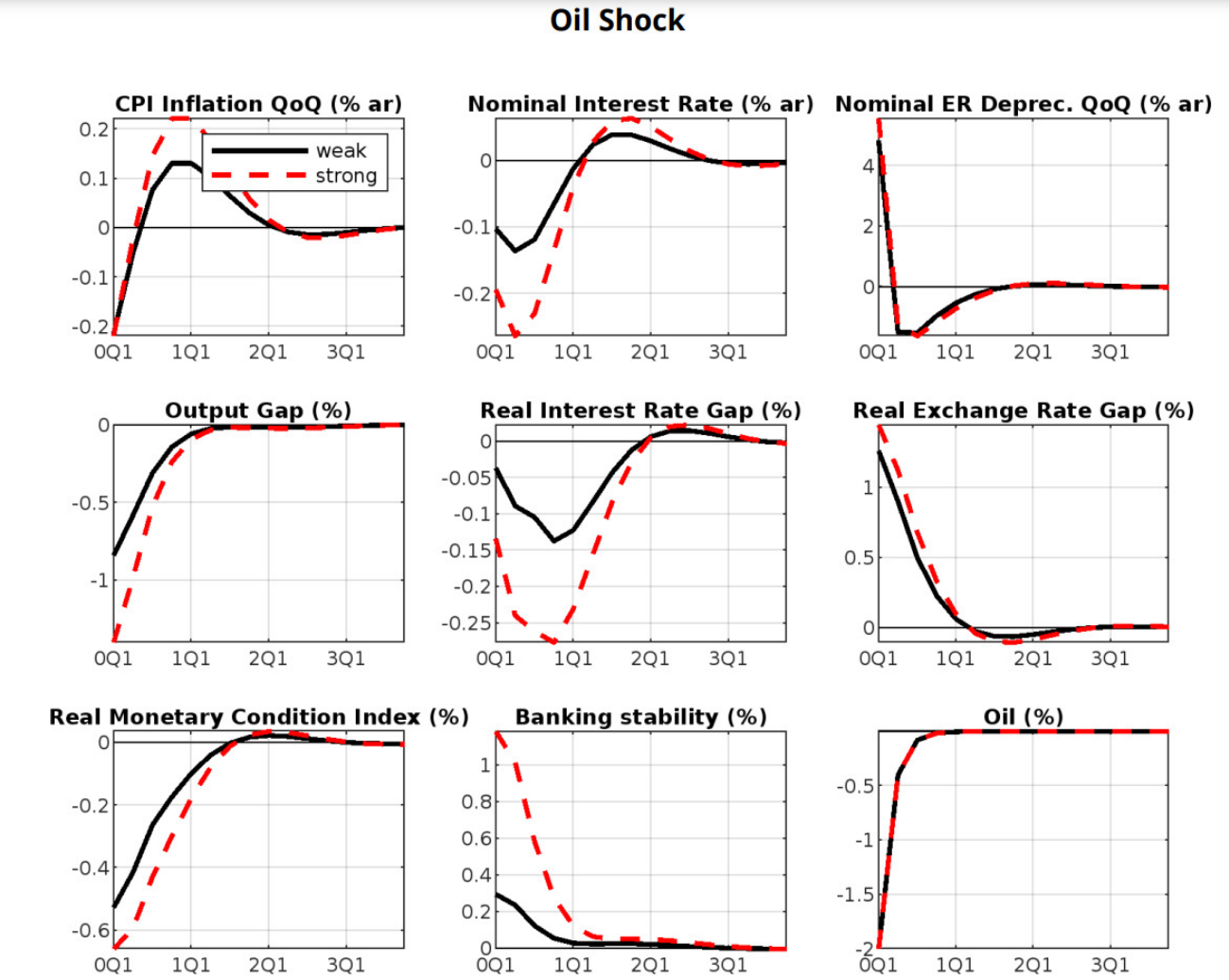

Figure 1. Impulse response function of scenario 1

Notes: Variable names are presented in their full forms; however, 'oil' refers to changes in the price of oil. The output gap is used interchangeably with aggregate demand, and 'Banking Stability' is proxied by non-performing loans. The black line, along with the dotted red and blue lines, represents the baseline and alternative responses, respectively.

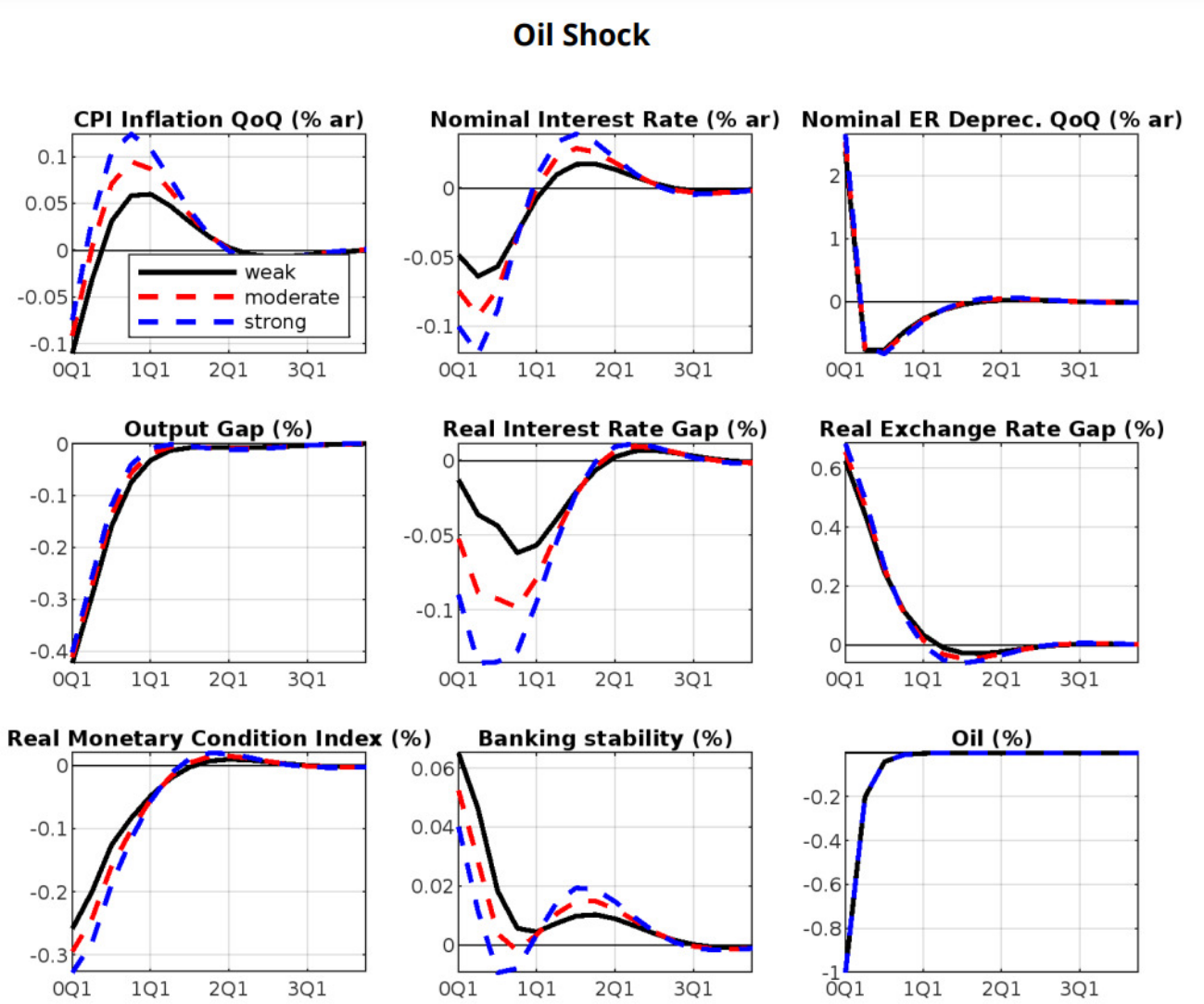

Figure 2. Impulse response function of scenario 2

Notes: Variable names are presented in their full forms; however, oil refers to changes in the price of oil, the output gap is used interchangeably with aggregate demand, and banking stability is proxied by non-performing loans. The black line, along with the dotted red and blue lines, represents the baseline and alternative responses, respectively.

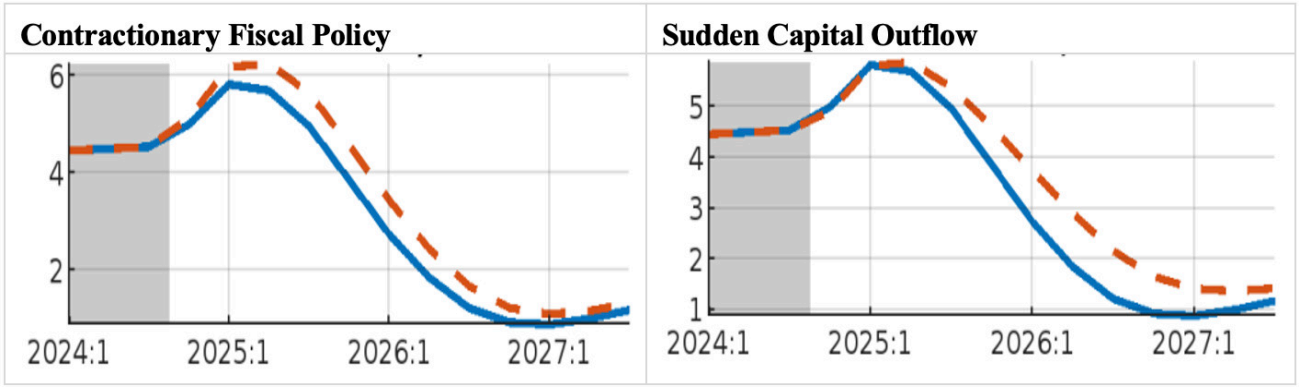

Figure 3. Conditional forecast of banking system stability index (non-performing loans)

Note: The forecasts are calibrated to ensure that the variables return to their steady state in the long run. In this instance, we calibrated the non-performing loans to remain below the industry threshold of 5 per cent.

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