External shocks and macroeconomic volatility in Nigeria: does financial development moderate the effect?

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Abstract

Purpose – Motivated by the negative effect of external shocks on the domestic economy, this study explores the role of financial sector development in absorbing the effect of external shocks on macroeconomic volatility in Nigeria.

Design/methodology/approach – Autoregressive distributed lag and fully modify ordinary least square are used to examine the moderating effect of financial development in the link between external shocks and macroeconomic volatilities in Nigeria between 1986Q1 and 2019Q4. External shock is proxy using oil price shock, and financial development is proxy by domestic credit to the private sector and market capitalisation. At the same time, macroeconomic volatility is proxy by output and inflation volatilities. Macroeconomic volatilities are generated using generalised autoregressive conditional heteroskedasticity (GARCH 1,1).

Findings – The results indicate that domestic credit to the private sector significantly reduces output and inflation volatilities in Nigeria in the short and long run. However, market capitalisation promotes macroeconomic volatility. More specifically, financial development indicators play different roles in curtaining macroeconomic volatilities. The results also reveal that external shocks stimulate macroeconomic volatility in Nigeria in the short and long run. Nevertheless, the effects of external shocks on macroeconomic volatilities are reduced when the role of financial development is incorporated.

Practical implications – This study, therefore, concludes that strong financial sector development serves as a significant shock absorber in reducing the adverse effect of external shock on the domestic economy.

Originality/value – This study contributes to the extant studies by introducing a country-specific analysis into the empirical examination of how financial development can moderate the influence of external shock on macroeconomic volatilities.

Keywords External shocks, Macroeconomic volatility, Financial development, Nigeria

Paper type Research paper

1. Introduction

The fast progress in globalisation over the past three decades has amplified the interdependency among countries worldwide regarding economic activities. The increasing global integration resulted in economic prosperity and diversification in some countries. Nonetheless, it has increased the exposure of many countries to foreign shocks.

JEL Classification — G1, O4, E3

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This susceptibility predominantly affects the developing economies due to over-reliance on the export of primary commodities as the significant source of foreign exchange earnings and government revenue, inconsistent policy mix and structural issues (Calderón *et al.*, 2005; Kousar *et al.*, 2016; Dada, 2022; Abanikanda *et al.*, 2023). External shock is described as an unanticipated shift in external factors affecting domestic economic activities. Therefore, it can be said that the magnitude of reliance of a country on external resources and foreign markets determines its vulnerability to external shocks (Abere and Akinbobola, 2020). External shocks can cause booms and bursts in an economy, engendering macroeconomic volatility. On this basis, external shock management becomes an essential element for consideration in overall macroeconomic management, particularly in less developed countries.

Over the years, the Nigerian economy has become more open and depends on the rest of the world for economic sustainability-export of primary products, import of raw materials and manufactured products (Oyelami and Olomola, 2016). Therefore, any shock in the global economy possibly engenders volatility in the macroeconomic indicators in the country. Nigeria's experience of two sharp recessions in the space of 5 years as a result of the drastic drop in global oil prices coupled with the COVID-19 pandemic after some years of solid economic performance is an evident occurrence of the extent of Nigeria's exposure to external shock. Besides, scholars in Nigeria have identified various channels through which foreign shocks surface over the years. Olomola and Adejumo (2006), Aremo *et al.* (2012), Adeniyi *et al.* (2015) , Abdulkareem and Abdulhakeem (2016) and Dada and Akinlo (2023b) have established that the Nigerian economy is vulnerable to global oil price shock, while Oyelami and Olomola (2016), Akanbi and Dada (2018), Adefabi and Rasaki (2018) and Abere and Akinbobola (2020) revealed that external financial shocks, foreign input price shocks and external debt shocks are crucial in determining the macroeconomic performances in Nigeria.

However, there is a major gap in the earlier studies in Nigeria as they failed to consider the likelihood of financial development (henceforth, FD) in propagating or diminishing the impact of external shocks on macroeconomic volatility. A more profound financial sector has been documented as a fundamental factor in alleviating the adverse influence of external shocks on macroeconomic volatility by strengthening an economy shock-absorbing capacity (Dabla-Norris and Srivisal, 2013; Kpodar *et al.*, 2018). Among other benefits, FD is believed to enhance risk-sharing, which decreases financial restrictions, boosts the capability of households and businesses to absorb shocks and enables better consumption smoothing (Sahay *et al.*, 2015; Levine, 2005; Aghion *et al.*, 2010; Anderson *et al.*, 2015; Bezooijen and Bikker, 2017; Akinlo and Dada, 2023a). As Kpodar *et al.* (2018) noted, a deeper financial sector would bring about the effectiveness of the country's policy in executing counter-cyclical policies to lessen the external shock effect. These claims suggest that a sound financial system would alleviate the effects of external shocks and improve the economy's resilience.

Though the impact of financial sector development on the economy has drawn extensive consideration in extant studies in Nigeria (Dada and Akinlo, 2023a; Olaniyi *et al.*, 2023; Ayadi, 2021; Dada and Awoleye, 2018; Ayinde and Yinusa, 2016; Ihenacho, 2016; Olushola and Makwe, 2018; Adeniyi *et al.*, 2015; Adekunle *et al.*, 2013), the link between financial sector development and macroeconomic volatility has however been understudied. Macroeconomic stability has been acknowledged as a precondition for sustainable and inclusive growth. Macroeconomic volatility is a source of business cycle uncertainty, dampening foreign and domestic investment, thus depressing an economy's growth (Kpodar *et al.*, 2018). In addition, macroeconomic indicators in Nigeria are highly volatile and vulnerable to global occurrences. Despite the various sources of external shocks, this vulnerability can be primarily attributed to the over-dependence of Nigeria's economy on the export of crude oil (Ibrahim and Alagidede, 2016).

In 2020, the oil sector contributed 51% of government revenue, 8.30% of GDP and 87% of total export earnings (CBN, 2020). Nigeria's reliance on crude oil prices exceeds many other oil-producing states. Thus, any shock in the global oil market would induce an economic disturbance in the country. For instance, the global economy experienced an oil crisis in 2014, leading to a drastic plunge in crude oil prices. Notably, between June 2014 and January 2015, the Brent price of crude oil dropped by 57% (CBN, 2018). This negative shock in oil prices portends a severe consequence for the economy of Nigeria. Following the plunge in oil prices, the growth rate of GDP slumped from 6.31% in 2014 to 2.65% in 2015 (World Development Indicator (WDI), 2020). Owing to the continuous fall in the price of crude oil, Nigeria's growth downturned from 6.31% in 2014 to −1.6 in 2016. The country's economy slipped into recession in the second quarter of 2016 and upheld a negative output growth rate in all the subsequent quarters of the year (CBN, 2018).

Also, the economy suffered another recession in the third quarter of 2020, barely five years after 2016. This is occasioned by the recorded decline in oil prices and COVID-19 global impact on the already struggling economy (CBN, 2020). Apart from the impact of oil price shock on output, it also produces inflationary pressure on the economy. Nigeria depends massively on the importation of refined petrol due to non-functional refineries. Besides, oil is a major driver of productive activities in the country due to epileptic power supply; therefore, the prices of consumables are determined by changes in oil prices. This shows that the economy is significantly exposed to oil price shocks. Based on these perspectives, it is essential to identify possibilities for expanding Nigeria's economic resilience to shock (especially oil prices).

Despite the noticeable rampant shocks, there is a dearth of empirics on the potential role of FD in the nexus between external shocks and macroeconomic volatility in Nigeria. Besides, available evidence on this subject has concentrated on either panel studies or cross-countries analysis with mixed results (Dabla-Norris and Srivisal, 2013; Kpodar *et al.*, 2018; Beck *et al.*, 2006). Due to different financial and economic structures and the degree of exposure to shock among developing countries, there is a need to examine this subject from a country-specific point of view. In addition, while a deeper financial system can help reduce the detrimental consequence of external shocks on macroeconomic volatility, a shallow financial system could propagate external shocks, intensifying macroeconomic volatility. The likelihood of these reverse associations demands empirical inquiry, necessitating the current study. Therefore, the moderating role of FD in the link between external shocks and macroeconomic volatility is examined. The remaining part of this article is sectionalised as follows. The literature review is presented in section 2, while section 3 describes the methodology. Results and discussion are presented in section 4, while section 5 concludes the paper.

2. Literature review

In theoretical literature, studies have shown that FD can absorb external shocks and thus reduce macroeconomic volatility in an economy. Financial deepening increases the prospects of risk diversification, reduces informational asymmetries and financial constraints and shields the economy against unforeseen international events (Bardhan *et al.*, 2000; Greenwald and Stiglitz, 1991). Therefore, as noted by Bernanke *et al.* (1999), FD boosts the capacity of the financial system to alleviate shock and diminish cycle amplification through the financial accelerator, reducing macroeconomic volatility. Similarly, Aghion *et al.* (1999) advance a macroeconomic model built on micro-foundations; the model relates unbalanced investment prospects' access to financial market imperfections. The model demonstrates that shallow financial systems expose economies to greater volatility and slow growth. The model suggests that an underdeveloped financial system creates a disconnection between investors and savers; thus, credit supply and demand are cyclical. The model further points out that the

financial system in less developed countries is likely to be poorly developed and is perhaps one of the reasons their economy suffers more volatility. Similarly, Aghion *et al.* (1999) postulate that volatility will occur more in an open economy with a weak level of FD. Acemoglu and Zilibotti (1997) reveal that better-developed financial systems may accelerate improved diversification, lowering investment risk and reducing instabilities.

On the empirical side, extensive studies have investigated how financial sector development influenced macroeconomic volatility. However, a smaller number of extant literature has incorporated the role of the financial sector in amplifying or dampening the impacts of external shocks on macroeconomic volatility. Dabla-Norris and Srivisal (2013) study the influence of financial depth on macroeconomic volatility. The authors analyse 110 developed and less developed countries in a dynamic panel analysis. The conclusion from the study suggests that the depth of the financial system decreases volatility in the business cycle of investment, consumption and expansion in output. In a related study, Kpodar *et al.* (2018) investigate the relationship among FD, shocks in terms of trade and volatility of output. The authors focus on low-income countries using system generalised method of moments (GMM), local projection and fixed-effect estimation procedures. The study discovers that development in the banking sector increases the ability of the economy to absorb shocks, thereby lessening the spread of shocks in terms of trade to the volatility of output. The results also remain unchanged when the sample was extended to include the developing nations; however, the moderating impact of the financial sector as a shock absorber dwindles as a nation's economic advances.

In contrast, the outcome shows that the deepening of the stock market has no significant role in moderating the effect of shock on output in most countries. Gonzalez-Aguado (2018) models the impact of external and domestic shocks on output volatility and observes that FD decreases the susceptibility of emerging economies to external shocks. Kapingura *et al.* (2022) used cross-sectionally augmented autoregressive distributed lag (CS-ARDL) to examine the impact of financial sector development on macroeconomic volatility in the case of the southern African development community between 1980 and 2018. The result of the study hints that banking variables and capital market development have significant adverse effects on growth volatilities; thus, financial development mitigates macroeconomic volatilities.

Similarly, Avom *et al.* (2021) examine the role of FD and institutions in the link between terms of trade volatility and macroeconomic volatility in 45 African countries spanning from 1997 to 2017. The authors submit that financial development and institutions in the region serve as shock absorbers in moderating the effect of the terms of trade shock on macroeconomic volatility. However, the result shows that financial institutions have more impact than the financial market. In another study, Ibrahim and Alagidede (2016) assess the impact of financial sector development in the nexus between economic volatility and shocks in 23 sub saharan african (SSA) countries from 1980 to 2014. Applying the panel cointegration estimation approach, the outcomes suggest that FD nonlinearly influences the business cycle volatility. The study's outcome further reveals that strong FD abates volatility, while monetary shocks dampen volatility in the long run. In East Africa, Olamide *et al.* (2022) used the structural vector autoregressive (S-VAR) approach to examine the dynamics between monetary policy, external shocks and economic growth. The authors' findings hint that commodity price shocks are translated into the GDP through exchange rate and monetary policy channels.

Park (2015) examines the effect of FD and fiscal policy on macroeconomic volatility using a panel of 127 nations. Applying the GMM estimation technique, findings show that FD has a non-linear effect on output volatility and that bigger public debt propagates the volatility of macroeconomic indicators. Notably, the author discovers that financial frictions significantly intensify and spread the impact of the foreign shock on an economy. Beck *et al.* (2006) investigate the effect of FD in the nexus between trade shock and output volatility terms. The study focuses on low-middle and high-income nations. The outcome reveals that the

interaction of FD and terms of trade shock is insignificant, suggesting that FD does not alleviate the negative impact of trade shock.

Focusing on the effect of FD on macroeconomic volatility, Alatrash *et al.* (2014) find a non-linear link between the size of the financial sector and output volatility in advanced economies with deeper financial systems. Mallick (2014), in a panel analysis, explores the link between FD, shocks and growth volatility. The outcomes show that financial sector development exerts an insignificant influence on output volatility; the effect is, however, significant for business cycle volatility. With cross-country panel data, Ma and Song (2017) investigated FD's influence on macroeconomic volatility from 1996 to 2012. The study employs the GMM technique and finds that FD reduces economic volatility only up to a certain point; however, beyond the threshold level of FD, additional advancement of the financial system will stimulate economic instability.

In a panel study of 10 emerging countries, Goyal *et al.* (2021) examined the impact of external shocks and cross-border flows on macroeconomic performance. Applying panel vector autoregressive, the study outcome reveals that volatility in global risk perception affects cross-border flows to emerging market economies more than the effect of the US monetary policy stance. Bezooijen and Bikker (2017) examine the influence of FD and financial structure on the macroeconomic volatility of 55 countries between 1975 and 2014. The authors conclude that financial structure insignificantly influences GDP instability and cyclical elements. The study also ascertains that an increase in the size of the stock market relative to the banking system could promote instability in the business cycle of investments. In contrast, a rise in the size of the stock market to the banking system results in an insignificant influence on volatility in the business cycle of investment.

Majeed and Noreen (2018) investigate the impact of FD on output volatility between 1961 and 2012 for 79 countries. Findings show that the development of the financial sector reduces the volatility of GDP, though its effect is low in several cases. Furthermore, the results show that financial stability is more dominant in alleviating GDP volatility when compared to other measures of FD. Similarly, Ito and Kawai (2010) show that the quality measure of FD stimulates expansion in GDP but causes an adverse influence on the volatility of output and inflation in countries with high-quality FD. Rehman and Awan (2017) study the dynamic link between output volatility and financial market development from 1998 to 2015 in 22 Asian economies. The study employs the system GMM model and finds that when the financial depth index is used as a proxy of FD, FD causes a positive impact on output volatility in Asia.

In Nigeria, Igwe-Kalu and Obasuju (2020) examine the role of FD in the link between trade shock and output volatility between 1981 and 2017. The authors employ ARDL procedure and find that FD aid trade led to shock in Nigeria, thus intensifying output volatility. Ogbuagu and Ewubare (2017) examine the link between financial depth, macroeconomic volatility and economic growth. The authors use exchange rate volatility as a proxy for macroeconomic volatility. Outcomes show that financial deepening affects exchange rate volatility in the long run. Olushola and Makwe (2018) investigate the impact of FD on economic growth in Nigeria, spanning from 1981 to 2017. The findings suggest that FD wields a positive influence on the Nigerian economy.

In contrast, Iheanacho (2016) investigates the link between FD and economic growth from 1981 to 2011. The author submits that FD reduces economic growth in the short run, whereas the effect is not statistically significant in the long run. From a non-linear perspective, Adeniyi *et al.* (2015) investigated the impact of FD on economic growth from 1960 to 2010 in Nigeria. The study's outcome reveals that FD has an adverse effect on economic growth. However, the relationship becomes positive when FD exceeds a threshold level. This result supports the findings of Ihenacho (2016).

From the above review, it is evident that study is absent on the absorptive role of FD in external shock-macroeconomic volatility in Nigeria, which has one of the leading financial

sectors in Africa. Thus, this present study contributes to the existing literature in this area. The following questions are raised to put this study in the right perspective: (1) What are the effects of FD and external shocks on macroeconomic volatility in Nigeria? (2) Does FD insulate the domestic economy from external shock using different proxy of the financial system? (3) Does the absorptive capacity of FD in mediating the effect of external shock on macroeconomic volatility vary with time?

3. Data and methodology

The core objective of this study is to assess the role of FD in mediating the effect of external shocks on macroeconomic volatilities in Nigeria between 1986Q1 and 2019Q4. The data availability for the variables justifies the selection of this time dimension. Table 1 describes the structure and sources of the data used for the study. Macroeconomic volatility is generated using the generalised autoregressive conditional heteroskedasticity (GARCH 1,1) model. This approach is advantageous to this study because it addresses the problem of constant variance encountered by the traditional measure of volatility (standard deviation) and also the issue of negative variance of autoregressive conditional heterosecdacity (ARCH) (Ibrahim and Alagidede, 2016; Dada, 2021). Thus, Bollerslev (1986) extended the ARCH model to embrace more flexible lags to overcome the aforementioned problems. The ARCH (p) model is presented in equation (1):

$$\sigma_t^2 = \partial_0 + \sum_{j=1}^{p} \chi_j e_{t-j}^2 + v_t \tag{1}$$

where σ_t^2 is macroeconomic variance and e^2 is the error term. Equation (1) can be compactly written as GARCH (1,1) model:

$$\sigma_t^2 = \delta_0 + \Psi\sigma_{t-1}^2 + \Psi e_{t-1}^2 \tag{2}$$

where σ_t^2 *is volatility*, then equation (2) becomes:

$$Vol_t = \delta_0 + \psi_1 Vol_{t-1} + \psi_2 e_{t-1}^2 \tag{3}$$

$$\delta_0 > 0, \Psi_1 > 0, \Psi_2 > 0$$

where Vol_t is output volatility.

	Variable	Source	Measurement
Macroeconomic volatility	Output	CBN	Generated using GARCH (1,1)
	Inflation		
External shock	Oil price	CBN	International oil price
Financial variables	Domestic credit to the private sector	CBN	Domestic credit to the private sector as a percentage of GDP
	Market capitalisation	CBN	Stock market capitalisation as a percentage of GDP
Control variables	Exchange rate	IFS	Real effective exchange rate
	International reserve	CBN	Total external reserve

Table 1. Data measurement and sources

Note(s): CBN signifies Central Bank of Nigeria Statistical Bulletin, while IFS represents IMF International Financial Statistic Database
Source(s): Authors' own work

For external shocks, the reaction function for which the shocks are generated is stated as:

$$\Delta EX = \phi(L)\Delta EX_{t-1} + \Gamma X_{t-1} + \varepsilon_t \tag{4}$$

where Δ is the first difference, EX is the measure of external policy, L is a lag polynomial, Φ is a vector of parameters, X_{t-1} is a vector of exogenous regressor and ε_t is the residual series (external shocks).

Having established the process of generating macroeconomic volatility and external shocks, this section specifies the empirical model for achieving the study's objective.

This study extends the theoretical model of Bernanke *et al.* (1999) inline with the empirical studies of Ibrahim and Alagidede (2016), Dabla-Norris and Srivisal (2013) and Beck *et al.* (2006) to include the interactive term of FD and external shocks, the model is stated thus:

$$MAvol_t = f(FD, EXS, (FD * EXS), Z) \tag{5}$$

where MAvol is macroeconomic volatility, FD is financial development, EXS is external shocks, (FD*EXS) is the interactive term of FD and external shocks captures the moderating role of FD in the nexus between external shocks and macroeconomic volatility. The positive coefficient of the interactive term suggests that FD fails to absorb external shock, thus magnifying macroeconomic volatility, while the negative coefficient signifies that strong financial sector development absorbs external shock, which lessens macroeconomic volatility. Z is other control variable that influences the relationship. In specific terms, equation (5) is stated as:

$$MAvol_t = \alpha + \beta FD_t + \gamma EXS_t + \eta(FD{*}EXS)_t + \kappa Z_t + \mu \tag{6}$$

To account for the short- and long-run estimates, which are essential for policy prescription, ARDL is used. ARDL is beneficial to this study due to its flexibility in accommodating I(l) and I(0) variables, unbiased estimates and allows verification of long-run relationships through the bounds test (Fabiyi and Dada, 2017; Dada and Fanowopo, 2020).

$$\begin{aligned}\Delta MAvol_t = {} & \alpha + \sum_{j=1}^{o} \rho_j \Delta MAvol_{t-j} + \sum_{j=0}^{p} \beta_j \Delta FD_{t-j} + \sum_{j=0}^{n} \gamma_j \Delta EXS_{t-j} + \sum_{j=0}^{m} \eta_j \Delta(FD{*}EXS)_{t-j} \\ & + \sum_{j=0}^{q} \kappa_j \Delta Z_{t-j} + \lambda_1 MAvol_{t-1} + \lambda_2 FD_{t-1} + \lambda_3 EXS_{t-1} + \lambda_4 (FD{*}EXS)_{t-1} + \lambda_5 Z_{t-1} \\ & + \mu_t \end{aligned} \tag{7}$$

The short-run movements are preceded with Δ, while the long-run coefficients are λ_j (j = 1, 2 . . .,5). Similarly, from equation (7), the null hypothesis of no long-run cointegration ($\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$) is tested against the alternative hypothesis of long-run cointegration ($\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$). However, to solve the problem of endogeneity due to the bidirectional relationship between external shocks and macroeconomic volatility in the literature, simultaneity and omitted variables bias (Brückner, 2013), fully modify ordinary least square (FMOLS) is used for sensitivity analysis. FMOLS addresses the above-mentioned issues and provides long-run parameters under the condition that a cointegration relationship exists among the variables (Phillips and Hansen, 1990; Adusei, 2012; Olaniyi and Oladeji, 2020; Dada *et al.*, 2022). FMOLS validates the long-run outcomes of the ARDL.

4. Results and discussion

4.1 Preliminary tests

Before examining the statistical and econometric characteristics of the data, it is imperative to establish the presence or otherwise of macroeconomic volatility in Nigeria. As described in section 3, macroeconomic volatility is generated through GARCH (1,1). Table 2 presents the GARCH result for the two variables-economic growth and inflation used as a proxy for macroeconomic variables. The result suggests the existence of volatilities since the coefficients of both the mean and variance equations in the two models are significant at 1%. Similarly, results from the variance equation reveal that macroeconomic volatility is clustering and continuous since the sum of the coefficients of the variance equation is less than one (Dada and Akanni, 2017). The diagnostic statistics of the model are also in the right direction. For instance, the models show the absence of autocorrelation and ARCH disturbances among the errors through the Box–Ljung (Q), Box–Ljung square (Q2) and Lagrange Multiplier (LM) test statistics, respectively. Thus, the mean and variance equations are well specified, and macroeconomic volatilities can be generated.

The synopsis of the descriptive statistics and correlation matrix presented in Table 3 reveals that most of the series is not normal since the measure of central tendency is far apart. This suggests evidence of volatilities and shocks in the data. The results of the correlation matrix at the lower end of the descriptive statistics reveal the absence of either exact or high multicollinearity among the variables.

Furthermore, the stationary test in Table 4 shows that the variables are stationary at first difference except for oil price shocks (OILS) that are stationary at level using augmented Dickey–Fuller (ADF) test. Since the stationarity level is less than 2, and most importantly, the dependent variables (output and inflation volatilities) are stationary at first level, then the adoption of ARDL as the estimation technique is justified.

To examine the long-run cointegration among the variables, an optimum lag length of 4 is imposed since quarterly data are used. Two key volatility variables (i.e., output volatility and inflation volatility) are utilised to measure macroeconomic volatility (dependent variable) and the private sector credit to GDP ratio, and market capitalisation is employed to measure FD (primary independent variable), while oil price shock is used as a proxy for external shock. Four models using different macroeconomic volatilities and financial indicators are presented. In model 1, domestic credit to the private sector is used as a proxy for FD; in model 2, market capitalisation is used as a proxy and interacts with oil price shock. The effect

Output model		Inflation model	
Variable	Coefficient	Variable	Coefficient
Mean equation			
C	3.144	C	0.028
GDP(−1)	1.034***	INF(−1)	1.027***
Variance equation			
C	4.348***	C	0.001
RESID(−1)^2	0.051***	RESID(−1)^2	0.232***
GARCH(−1)	0.159***	GARCH(−1)	0.676***
Diagnostic statistic			
LM	0.189	LM	0.374
Q(36)	57.274	Q(36)	96.492
Q^2(36)	103.25	Q^2(36)	27.388

Note(s): ***, **, * represent 1%, 5 and 10% respectively
Source(s): Authors' own work

Table 2. GARCH (1,1) estimate for macroeconomic (output and inflation) volatilities

	GDPVOL	INFVOL	DCP	MRK	OILS	EXC	RES
Mean	982242.8	3.145	11.792	12.397	−0.430	156.548	22.990
Median	43363.59	1.853	8.465	9.151	−0.002	175.140	23.016
Maximum	11,013,422	23.342	20.866	41.535	27.368	442.648	24.852
Minimum	25.917	0.004	5.930	3.035	−63.089	1.229	19.172
Std. dev.	2,013,445	4.449	5.372	8.926	8.573	129.535	1.437
Skewness	2.879	2.569	0.628	0.999	−2.951	0.575	−0.440
Kurtosis	11.576	9.753	1.630	3.716	24.147	2.535	1.927
GDPVOL	1	0.317	0.5102	0.534	−0.077	0.670	0.469
INFVOL		1	0.332	0.460	0.050	0.575	0.479
DCP			1	0.656	−0.115	0.259	0.529
MRK				1	0.020	0.451	0.637
OILS					1	0.016	−0.022
EXC						1	0.621
RES							1

Note(s): Where GDPVOL is output volatility, INFVOL is inflation volatility, DCP is domestic credit to private sector, MRK is market capitalisation, OILS is oil price shock, EXC is exchange rate and RES is international reserve
Source(s): Authors' own work

Table 3.
Descriptive statistics and correlation matrix

	At level			At first difference			
Variables	With constant	With constant and trend	Without constant and trend	With constant	With constant and trend	Without constant and trend	Status
GDPVOL	14.223	11.955	15.144	−8.486***	−9.806***	−7.908***	I(1)
INFVOL	−1.559	−1.123	−1.696	−10.761***	−10.717***	−10.810***	I(1)
DCP	−1.333	−1.766	−0.093	−5.215***	−5.212***	−5.229***	I(1)
MRK	−1.315	−2.843	−0.078	−5.482***	−5.460***	−5.513***	I(1)
OILS	−8.598***	−8.578***	−8.626***				I(0)
EXC	0.403	−2.210	2.113	−10.667***	−10.715***	−10.271***	I(1)
RES	−1.156	−2.158	−0.174	−8.175***	−8.146***	−8.160***	I(1)

Note(s): ***, **, * represent 1%, 5 and 10% respectively
Source(s): Authors' own work

Table 4.
Augmented Dickey–Fuller unit root test

of these interactive terms in models 1 and 2 is being examined on output volatility. However, in models 3 and 4, the impact of credit on the private sector and market capitalisation interacts with oil price shock to see the effect on inflation volatility, respectively. The outcome of the ARDL bounds test in Table 5 confirms the existence of a long-run relationship among the series in all the models. The null hypothesis of no long-run cointegration between macroeconomic volatility and other variables is being rejected.

4.2 Moderating effect of FD in the relationship between external shocks and macroeconomic volatility

This section examines the absorptive capacity of FD in moderating the effect of external shock on macroeconomic volatility in Nigeria. Having previously established the existence of cointegration among the variables, the short - and long-run effects are examined with ARDL. The outcome of the ARDL is displayed in Table 6. The results show that domestic credit

provided by the private sector significantly reduces output and inflation volatilities in Nigeria in both periods. However, market capitalisation contributes positively to macroeconomic volatilities. This outcome shows that indicators of FD play different roles in curtaining macroeconomic volatilities. One of the reasons for the effectiveness of domestic credit to the private sector is that the impact is more felt than market capitalisation, which is dominated mainly by large firms. In addition, credit provided by the private sector boosts the capability of both households and firms to absorb shocks, thus enhancing consumption smoothing in the long run (Sahay *et al.*, 2015; Yang and Liu, 2016; Bezooijen and Bikker, 2017). The result of this study supports the empirical submissions of Dabla-Norris and Srivisal (2013), Loayza and Raddatz (2007), Gonzalez-Aguado (2018), Ma and Song (2017), and Ibrahim and Alagidede (2016) who conclude that strong FD reduces the negative effect of external shock on the domestic economy. This result is expected as better financial sector development reduces aggregate shocks and output volatilities through diversification and lowering investment risk (Zilibotti, 1997). However, the amplifying role of market capitalisation in macroeconomic volatility is also obtained by Kpodar *et al.* (2018) for less developing countries.

External shock proxy by oil price shock contributes positively to macroeconomic volatilities in Nigeria both in the short and long run. The effect of external shocks on output volatility is the same as the effect on inflation volatility in terms of direction. Its coefficients are significantly positive, signifying that an increase in external shocks amplifies macroeconomic volatilities in Nigeria. This result suggests that oil price shock is one of Nigeria's significant determinants and factors responsible for macroeconomic volatility. Oil price shock significantly triggers output and inflation volatilities. The Nigerian economy is structured around the price of crude oil, so any shock from it (crude oil) is easily transmitted into the domestic economy through foreign earnings, thus making the economy susceptible to external shocks. The positive impact of external shocks on macroeconomic volatility aligns with the submission of Ibrahim and Alagidede (2016).

Concerning the moderating impact of FD in the link between external shocks and macroeconomic volatilities, the interactive term of FD and oil price shocks have different effects on macroeconomic volatilities, depending on the proxy used. Domestic credit to the private sector and market capitalisation reduces output volatilities in Nigeria when interacted with oil price shock both in the short and long run. This suggests that strong financial sector development serves as an essential shock absorber in reducing the adverse effect of external shock on the domestic economy. In other words, a strong financial sector insulates the economy from the contagious effect of external shock. Nevertheless, the interactive term of market capitalisation and external shock only reduces macroeconomic volatility in the short run but worsens it in the long run. This implies that Nigeria's present market capitalisation

Table 5.
ARDL bounds test (H_0: no long-run relationship)

	ARDL model selected	*F*-statistic			K
Model 1	(1, 1, 1, 4, 1, 3)	9.402***			5
Model 2	(1, 3, 2, 1, 1, 3)	9.840***			5
Model 3	(1, 1, 1, 1, 2, 1)	4.350***			5
Model 4	(1, 1, 2, 2, 1, 2)	3.925**			5
	Critical Values	10%	1.81	2.93	
		5%	2.14	3.34	
		2.5%	2.44	3.71	
		1%	2.82	4.21	

Note(s): ***, **, * represent 1%, 5 and 10% respectively
Source(s): Authors' own work

Table 6. ARDL estimate of the effect of financial development and external shocks on macroeconomic volatility

Variable	Model 1	Model 2	Model 3	Model 4
Dependent variable	Output volatility		Inflation volatility	
Long run				
DCP	−0.135** (−2.218)		−0.236*** (−2.958)	
MRK		0.128*** (3.548)		0.791*** (14.449)
OPS	0.160** (1.955)	−0.116 (−1.204)	0.087** (2.186)	0.041* (1.829)
DCP*OPS	−0.019* (−1.973)		−0.001 (−0.064)	
MRK*OPS		−0.001** (−2.248)		0.097*** (7.249)
EXR	0.023*** (6.393)	0.013*** (5.810)	0.025*** (2.616)	−0.093 (−1.153)
RES	0.433*** (7.705)	0.345*** (17.407)	0.082 (0.824)	0.190 (0.535)
Short run				
D(DCP)	−0.015** (−2.475)		−0.001 (−0.574)	
D(MRK)		0.0173* (1.848)		0.062*** (2.834)
D(MRK(−1))		−0.030** (−3.165)		
D(OPS)	0.097*** (3.008)	−0.002 (−1.084)	0.289*** (3.638)	3.838*** (4.540)
D(OPS(−1))		0.008*** (4.514)		0.217*** (2.785)
D(OPS(−2))		0.005*** (3.053)		
D(DCP*OPS)	−0.001*** (−5.400)		−0.003 (−0.676)	
D(DCP*OPS (−1))	−0.0004*** (−4.676)			
D(DCP*OPS (−2))	−0.0003*** (−3.361)			
D(DCP*OPS (−3))	−0.0003*** (−3.539)			
D(MRK*OPS)		−0.102* (0.055)		−0.121*** (−6.143)
D(MRK*OPS(−1))				−0.025* (−1.758)
D(EXR)	0.107** (2.068)	0.005*** (3.150)	0.097*** (8.207)	0.097*** (7.796)
D(EXR(−1))			−0.023* (−1.700)	
D(RES)	−0.011** (−2.233)	0.014 (0.279)	−0.212** (−2.274)	−0.118*** (−6.192)
D(RES(−1))	−0.065 (−0.211)	−0.053 (−1.007)		−0.274*** (−3.498)
D(RES(−2))	−0.115** (−2.158)	−0.127** (−2.376)		
CointEq(−1)*	−0.057*** (−7.672)	−0.084*** (−7.849)	−0.264*** (−5.212)	−0.208*** (−4.299)
Diagnostic statistics				
Adj. R^2	0.286	0.265	0.540	0.438
D-W	2.192	2.111	1.973	1.730
LM test (P/V)	0.364	0.445	0.890	0.875
Ramsey reset test (P/V)	0.530	0.271	0.537	0.732
Heteroscedasticity test (BPG)/*p*-value	0.784	0.214	0.302	0.232
CUMSUM	Stable	Stable	Stable	Stable
CUMSUM Sq.	Stable	Stable	Stable	Unstable

Note(s): (1) ***, **, * Indicate significance at 1%, 5 and 10%, respectively. (2). Figures in bracket "()" are *t*-value (3). In models 1 and 2, output volatility is the dependent variable. (4). Inflation volatility is the dependent variable in models 3 and 4. The CUMSUM and CUMSUM Sq graphs are available upon request

Source(s): Authors' own work

level is not enough to absorb external shocks that trigger macroeconomic volatility, especially inflation. The dampening effect of financial sector development in external shock-macroeconomic volatilities suggests the sophistication of a nation's financial system, allowing trade diversification, hedging of uncertainties, reducing information asymmetry and spurring risk diversification. This result aligns with the submission of Avom *et al.* (2021). Nevertheless, this outcome contradicts the studies of Igwe-Kalu and Obasuju (2020) and Beck *et al.* (2006), who found an insignificant interactive term between FD and terms of trade shock.

Other control variables added to the model also impact macroeconomic volatility in Nigeria. The exchange rate contributes to macroeconomic volatilities in Nigeria both in the short and long run. Specifically, output and inflation respond to movement in the exchange rate, thus resulting in macroeconomic volatilities. Studies by Yang and Liu (2016) also found a similar conclusion. However, foreign reserve lessens macroeconomic volatility in Nigeria in the short run but contributes to macroeconomic volatility in the long run. Adequate foreign reserves serve as a tool to smoothen macroeconomic volatility. The effect of foreign reserves reveals that the current stock of foreign reserves is inadequate to drive long-run macroeconomic stability. The diagnostic statistics of the model are also in the right magnitude. The error correction terms are significant and correctly signed for all the models. The coefficients of the error correction terms range between 5.7 and 26.4%. This implies that the short-run imbalance is corrected, and the models return to their equilibrium levels following a shock to the system resulting from deviation of the long-run path from its steady state. Breusch–Godfrey serial correlation test, heteroscedasticity test and Ramsey reset test suggest the absence of correlation, heteroscedasticity and the models are well specified. These diagnostic test collections show the estimated parameters' effectiveness and reliability. Furthermore, the cummulative sum (CUSUM) and CUSUM of squares in all the models are stable except for model 4, where the CUMSUM of squares is unstable.

The robustness check of the long-run ARDL estimates in Table 6 is verified using FMOLS. The results of the FMOLS in Table 7 are consistent with the baseline estimates (ARDL). The coefficients of FD have a negative and significant impact on macroeconomic volatilities. In contrast, external shocks have a positive and significant effect, suggesting that strong FD

Variable	Model 1	Model 2	Model 3	Model 4
Dependent variable	Output volatility		Inflation volatility	
C	6.465*** (13.865)	6.269*** (20.135)	−22.264*** (−3.415)	14.771*** (2.875)
DCP	−0.005** (−2.284)		−0.121* (−1.660)	
MRK		0.126*** (4.089)		0.106** (2.092)
OPS	0.076* (1.950)	0.038** (0.506)	0.036 (0.271)	0.053 (0.453)
DCP*OPS	−0.006* (−1.940)		−0.002** (−2.294)	
MRK*OPS		−0.003** (−2.469)		0.002* (1.736)
EXR	0.018*** (7.858)	0.016*** (7.328)	0.006* (1.800)	0.007** (2.019)
RES	0.061*** (3.813)	0.057*** (0.031)	0.976*** (3.176)	−0.114*** (−5.218)
Adj. R^2	0.915	0.916	0.573	0.469
Long-run variance	4.162	3.459	7.685	9.469
Mean dep. VAR	10.624	10.624	−0.067	−0.067
SE of reg.	1.053	0.993	1.418	1.582

Note(s): (1) ***, **, * indicate significance at 1%, 5 and 10%, respectively. (2). Figures in bracket "()" are *t*-value (3). In models 1 and 2, output volatility is the dependent variable. (4). Inflation volatility is the dependent variable in models 3 and 4

Source(s): Authors' own work

Table 7.
FMOLS estimates (robustness check)

abates macroeconomic volatility while external shock amplifies it. Furthermore, the coefficients of the interactive terms of FD and external shock also remain unchanged when another estimation technique is used.

5. Concluding remark

One of the core aspirations of policymakers in industrialised and underdeveloped countries is to uphold macroeconomic stability. Therefore, their aim is to protect the economy from external shocks or react to such shocks to dampen macroeconomic volatility. Financial development is an essential component to consider when striving to lessen macroeconomic volatility (Dabla-Norris and Srivisal, 2013). While studies abound on the effect of external shocks on macroeconomic performance in Nigeria, these studies fail to consider the likelihood of financial development in propagating or diminishing the influence of external shocks on macroeconomic volatility in Nigeria. This paper explores the moderating role of financial development in the link between external shocks and macroeconomic volatility between 1986Q1 and 2019Q4. To accomplish this objective, two measures of financial development, domestic credit to the private sector and market capitalisation, are employed. External shock is proxied by oil price, while macroeconomic volatility is proxied by output and inflation volatilities.

Our results clearly show that measures of FD have different impacts on macroeconomic volatilities. External shocks intensify macroeconomic volatilities, while a well-developed financial system is an important shock absorber to lessen the effect. In specific terms, findings from the study reveal that domestic credit to the private sector significantly reduces output and inflation volatilities in Nigeria in the short and long run. However, market capitalisation, also used to proxy financial sector development, promotes macroeconomic volatilities. This result suggests that financial development indicators play different roles in curtaining macroeconomic volatilities.

Furthermore, the results show that external shocks stimulate macroeconomic volatilities in Nigeria both in the short and long run. However, the effects of external shocks on macroeconomic volatilities reduce when the role of financial development is incorporated. This suggests that strong financial sector development serves as an important shock absorber in reducing the adverse effect of external shock on the domestic economy. The study concludes that macroeconomic volatility is adversely affected by external shocks. Nevertheless, a robust financial sector can help alleviate the adverse effects of external shocks.

The outcome of this study has important policy implications. First, the financial system needs to be strengthened by implementing appropriate financial sector reforms. A strong financial sector will not solely lessen macroeconomic volatilities but also build up the absorptive capability of the country against external shocks. To accomplish this, the governing body needs to restructure the regulatory framework further and reinforce the supervisory capacity to safeguard the soundness and efficiency of the system. The financial sector needs to be more innovative in its intermediation function, particularly in improving funding of the productive sector. In addition, the Central Bank should mandate higher capital requirements for banks. The system can absorb external shocks by enacting stringent rules comprising the required capital quality. Furthermore, policymakers must develop an efficient set of macroeconomic policies that can absorb the negative influence of shocks on the domestic economy. Also, policies to broaden the economy's productive base should be formulated to cushion the impact of external shocks.

Though this study investigates the moderating role of financial development in the link between external shocks and macroeconomic volatilities in Nigeria, it should still be viewed in its limitations. The study only considered oil price shock as an external shock and did not

include institutions and political variables in the model. Future studies can complement this research by exploring the moderating role of financial development using other external shocks, such as trade shocks, and incorporating institutional and political variables as part of the model. Furthermore, this empirical exercise can be replicated in other developing countries since the policy prescription of this study is limited to Nigeria. However, these limitations and recommendations do not undermine or reduce the novelty of this study.

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