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## **DYNAMICS OF GLOBALIZATION, FINANCIAL DEEPENING AND ENERGY DEMAND IN NIGERIA**

In recent times, globalization has raised issues on dynamics of economic globalization, financial deepening and energy consumption. The present study has been an attempt to explore interlinks between these variables using Toda-Yamamoto causal approach and ARDL bound cointegration approach. The results showed unidirectional causality run from globalization to financial deepening variables such as credit to private sector and market capitalization. It is also observed that unidirectional causality runs from credit to private sector to energy consumption. No causal relationship runs from broad money supply to globalization and energy consumption. The coefficient of globalization has a positive and statistically significant effect on energy consumption for both short and long-run. The results also shows that financial deepening has impact on energy consumption in Nigeria; the coefficients on the interaction between the globalization (GLS), broad money supply (BDS), credit to private sector (CPS) and market capitalization (MCP) are statistically significant at 5% level and with the positive sign in the short-run and negative sign in the long –run. Nigeria should develop its financial sector to enhance investment in energy saving equipments to reduce fossil fuel consumption.

**Key words:** Globalization, Financial development, Energy Consumption.

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### **Нигериядағы жаһандану, қаржылық тереңдету және энергияға деген сұраныс динамикасы**

Соңғы уақытта жаһандану экономиканың динамикасы, қаржылық жағдайды тереңдету және энергияны тұтыну мәселелерін көтерді. Бұл зерттеуде Toda-Ямамотоның себеп-салдарлық тәсілін және ARDL-мен байланысты коинтеграция тәсілін қолдана отырып, осы айнымалылардың өзара байланысын зерттеу әрекеті болды. Нәтижелер жаһанданудан жеке секторды несиеге және нарықты капиталдандыру сияқты қаржылық дамуды тереңдету сияқты айнымалыларға бір бағытты себеп-салдарлық байланысты көрсетті. Сондай-ақ, бір бағытты себеп-салдар байланысы жеке секторға берілетін несиеден энергияны тұтынуға дейін жүретіні байқалады. Кең ақша массасы мен жаһандану мен энергияны тұтыну арасында себеп-салдарлық байланыс жоқ. Жаһандану коэффициенті қысқа мерзімді және ұзақ мерзімді перспективада энергияны тұтынуға оң және статистикалық маңызды әсер етеді. Нәтижелер сонымен қатар қаржылық мүмкіндіктердің кеңеюі Нигериядағы энергияны тұтынуға әсер ететіндігін көрсетті; жаһандану (GLS), кең ақша массасы (BDS), жеке секторға несие (CPS) және нарықтық капиталдандыру (MCP) арасындағы өзара әрекеттесу коэффициенттері қысқа мерзімді кезеңде статистикалық тұрғыдан 5% деңгейінде оң белгімен және ұзақ мерзімді перспективада теріс белгімен маңызды. Нигерия қазба отынын тұтынуды азайту үшін энергияны үнемдейтін жабдыққа инвестицияларды ұлғайту үшін өзінің қаржы секторын дамытуы керек.

**Түйін сөздер:** жаһандану, қаржылық даму, энергияны тұтыну.

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### **Динамика глобализации, финансового углубления и спроса на энергию в Нигерии**

В последнее время глобализация подняла вопросы, касающиеся динамики экономики, углубления финансового положения и потребления энергии. Настоящее исследование было попыткой изучить взаимосвязи между этими переменными с использованием причинно-следственного подхода Toda-Ямамото и подхода коинтеграции, связанного с ARDL. Результаты

показали однонаправленную причинно-следственную связь от глобализации к таким переменным, как углубление финансового развития, кредитование частного сектора и рыночная капитализация. Также наблюдается, что однонаправленная причинно-следственная связь идет от кредита частному сектору к потреблению энергии. Не существует причинно-следственной связи между широкой денежной массой и глобализацией и потреблением энергии. Коэффициент глобализации положительно и статистически значимо влияет на потребление энергии как в краткосрочной, так и в долгосрочной перспективе. Результаты также показывают, что расширение финансовых возможностей влияет на потребление энергии в Нигерии; коэффициенты взаимодействия между глобализацией (GLS), широкой денежной массой (BDS), кредитом частному сектору (CPS) и рыночной капитализацией (MCP) статистически значимы на уровне 5% и с положительным знаком в краткосрочной и долгосрочной перспективе, и с отрицательным знаком в долгосрочной перспективе. Нигерии следует развивать свой финансовый сектор для увеличения инвестиций в энергосберегающее оборудование для сокращения потребления ископаемого топлива.

**Ключевые слова:** глобализация, финансовое развитие, энергопотребление.

## Introduction

Globalization is perceived as an amalgamation of diverse economies across the world through less-restrained bilateral and multilateral trade and financial flows (Ray, 2012; Hassan et al., 2019). Globalization generally has been conceptualized as increasing integration or interaction of national economic system through growth in international trade, investment, and capital flows; thereby leading to economic growth (Edame, 2012). Therefore, globalization increases foreign trade, foreign investments and foreign exchange; thereby improve the efficacy, effectiveness and efficiency of energy demand. Also, globalization through its impact on financial development results to an increase in investment in energy savings equipment, thus reduce energy demand. Contrary view to this postulation is that financial development through globalization increases income which enhances purchase of durables goods by consumers which in turn increase energy demand (Love & Zicchino, 2006; Cole, 2006).

The relationship between globalization and energy demand is a rigorous and extremely debated topic among international and energy economists. Yet, this issue is far from being resolved. The theoretical and empirical studies report at best a contradictory and inconclusive discussion on the relationship between globalization and energy consumption (Antweiler et al., 2001; Shahbaz et al., 2016; Murshed et al., 2018; Zaidi et al., 2019). The relationship between globalization and energy consumption can either be positive or negative. The positive relationship is observed when trade liberalisation through globalization increases energy consumption (Shahbaz et al., 2018). The inverse relationship is as a result of innovation which reduces energy consumption (McAusland, 2010; Zaidi et al., 2019).

Much has been written on globalization, energy consumption and environmental quality in advanced and industrialized countries but very few studies are from developing countries (Kilic, 2015; Shahbaz et al., 2015; Keho, 2016; Kwakwa et al., 2019; Mobolaji & Ndako, 2008; Omojolaibi et al., 2016; Ajide et al., 2019). Also, the findings from previous studies are largely influenced by the sample and econometric techniques. The previous studies used trade and foreign capital volume as index of trade and financial globalization policies which do not account for the rate of trade protections. The rate of protection is necessary to capture the severity of trade restrictions and trade volume in a country (Samimi & Jenatabadi, 2014). Thus, this problem is addressed in this study by using a comprehensive index which called KOF (Samimi et al., 2011; Hussein et al., 2020).

The literature on the relationship between financial development and energy consumption focused on Middle East, North Africa, advanced and emerging economies (Sadorsky, 2010; Shahbaz & Lean, 2012; Islam et al., 2013; Tang & Tan, 2014; Abosedra et al., 2015; Soheila & Shakouri, 2017; Danish et al., 2018). The only study from Nigeria is Ali et al. (2015), however this study suffers from omitted variable problem since it was based on bivariate relationship and this lead to erroneous causal inferences. The existing studies on the relationship between financial deepening and energy demand also produce mixed results among scholars (Ali et al., 2015; Farhani & Solarin, 2017; Kahouli, 2017; Gómez & Rodríguez, 2018). Despite the theoretical linkage, one of the most fundamental issues that have received little attention is interactive effect of globalization and financial deepening on energy consumption. Few studies that have examined tripartite relationship among these variables are the time series study of Soheila &

Shakouri (2017) in Iran and panel study of Danish et al. (2018), however these studies do not consider sub-Saharan developing economy like Nigeria and uniqueness of macroeconomic variables in each country as regard to the policy response cannot be underestimated. Also, panel study of Danish et al. (2018) is saddled with heterogeneity bias. As such, it fails to address the country-specific effects of financial deepening through globalization on energy consumption which may lead to inconsistent and misleading estimates. Thus, the main objective of this study is to examine the linkages among globalization, financial deepening and energy consumption. In attaining this objective, this study not only examined the causal relationship among globalization, financial deepening and energy consumption but also analysed the interactive effect of globalization and financial deepening on energy consumption. The remainder of the paper is organized as follows: Section two assesses the relevant literature. Methodology is contained in section three. Section four features the explanation of the obtained results of the study. Section five concludes the study.

### Literature Review

The study of impact of globalization on energy consumption, started with pioneer studies of Cole (2006) which revealed that trade liberalization increases per capita energy use. Sadorsky (2012) found causal relationship between energy consumption and trade openness for seven South American countries. Dogan & Deger (2016) applied panel Granger causality test to determine the causal correlation between energy consumption, economic growth and globalization. The findings established long run cointegrating relationships between these variables but failed to establish any long run causal association between globalization and energy consumption in BRIC member nations. Shahbaz et al. (2016) applied the ARDL approach to examine the relationship between globalization and energy consumption. The findings revealed significant relationship between globalization and energy consumption in India.

Koengkan (2017) applied the ARDL technique to investigate the relationship between globalization and energy consumption in 12 Latin American and Caribbean countries. The results showed positive and statistically significant impact of globalization index on primary energy consumption. Azam et al. (2015) investigated the determinant of energy demand in Indonesia, Malaysia, and Thailand.

The results found positive and significant effect of trade liberalization and foreign direct investment on energy consumption. Murshed et al. (2018) investigated the impact of globalization on energy consumption in Pakistan. The findings revealed that globalization had no causal relationship with energy consumption in Bangladesh. Shahbaz et al. (2015) examined the link between trade openness and energy consumption. The findings revealed positive and significant impact of trade openness on energy consumption in Malaysia. Koengkan et al. (2019) examined the impact of globalization on renewable energy consumption in Latin America. The study found a positive and significant impact of globalization on renewable energy demand. Shahbaz et al. (2019) investigated the relationship between globalization and energy consumption. The findings not only confirmed environmental kuznet's postulation but also revealed positive and significant impact of globalization on energy consumption.

Sadorsky (2010) applied generalized method of moments (GMM) technique of estimation to examine the impact of market capitalization, stock value traded to GDP and stock market turnover on energy consumption in 22 emerging countries. The result showed a positive and significant relationship between energy consumption and all the financial development variables. Abosedra et al. (2015) applied ARDL bound testing estimation technique to examine the relationship between energy consumption, financial development and economic growth in Lebanon. The finding indicated positive and significant impact of financial deepening on energy consumption. Soheila & Shakouri (2017) investigated the relationship among globalization, financial development, renewable energy and economic growth in Iran. The result shows that the overall index of globalization has a positive effect on economic growth. Granger causality reports bi-directional causality among renewable energy consumption, globalization, financial deepening and economic growth.

Coban & Topcu (2013) applied GMM to examine the nexus between financial development and energy consumption in European Union countries. The result revealed positive and significant impact of financial development on energy consumption. In Azerbaijan, Mukhtarov et al. (2018) applied Autoregressive Distributed Lags (ARDL), Gregory–Hansen (G-H) test and Johansen test to examine the effect of financial deepening on energy consumption. They found a positive and significant impact of financial development on energy consumption. In Kazakhstan, Mukhtarov

et al. (2020) applied VECM model to investigate the dynamic relationship between energy demand, price of energy, development of financial sector and economic growth. The result showed a positive and statistically significant impact of financial development and economic growth on the energy consumption. It was also revealed that energy price has a negative effect on energy consumption. Bekun et al. (2019) utilized the panel data of sixteen countries from Europe to examine the causal relationship between natural resources and energy consumption. The results showed that the causality run from natural resources abundance to renewable and non-renewable energy consumption. Kwakwa et al. (2019) examined the relationship between natural resources extraction and energy consumption and carbon emission in Ghana. The coefficient of natural resources revealed positive and significant effect on carbon emission.

The existing studies on the impact of globalization, financial development on energy consumption reveal mixed result. Also, few scholars investigated this relationship for Nigeria. Loto (2011) applied Mundel and Fleming model to investigate the effect of globalization on economic growth in Nigeria. The study revealed that globalization has insignificant impact on economic growth in Nigeria. Modolaji & Ndako (2008) examined the effect of globalization on financial development in Nigeria. The study revealed positive and significant impact of globalization on financial development in Nigeria. Omojolaibi et al. (2016) applied Error Correction Model (ECM) technique to examine the effect of globalization on financial development in Nigeria. The result showed that globalization has negative and statistically significant impact on financial development in Nigeria.

The uniqueness of the present study stands out on a number of fronts. First, in terms of contribution to existing studies, it examines the relationship among energy demand, globalization and financial deepening in Nigeria where energy demand is a serious issue due to domestic pricing energy pricing policy. Domestic energy pricing policy encourage inefficient in energy consumption which lead to fuel importation and huge fuel subsidies payment. High fuel subsidy crowds' other sector of economy including financial sector. Second, the existing study of Mobolaji &

Ndako (2008), Omojolaibi et al. (2016), Ajide et al. (2019) on globalization in Nigeria ignores interactive effect of globalization and financial deepening on energy demand. Despite her financial inclusiveness, domestic energy demand in Nigeria is perennially susceptible to shocks impetuous by global issues such as explosive world oil price volatility, trade liberalization and internet penetration.

## Methodology

This section provides causal relationship between globalization, financial deepening and energy consumption and interactive effect of globalization and financial deepening on energy consumption. The theoretical precept is uncomplicated and logical as the world becomes more globalized, total energy consumption will change. However, this change in energy consumption can be increased or decreased depending on the net impact of several factors among them is globalization. The increase in the total level of the world's economic output and the income associated with globalization and the removal of trade barriers have been perceived to be pushing energy consumption to higher levels in Nigeria. Therefore, the expansion of globalization is usually associated with an increase in energy usage.

Financial development provokes financial effectiveness in Nigeria by encouraging foreign portfolio and foreign direct investment flows which increase banking activities. This in turn reduces financial risk and costs of loans which have effect on energy demand through investment and consumption demand. The financial development influences energy consumption by providing facilities for household and firm to access energy commodities which in turn increases energy consumption.

### Model Specification

The study adopted Toda-Yamamoto approach to determine causal linkages amongst globalization (GLS), financial deepening proxies with broad money supply (BMS), credit to private sector (CPS) market capitalization (MCP), foreign direct investment (FDV) and energy consumption (ENEC). The technique produces robust results through augmented VAR estimation that ensures the asymptotic distribution of the Wald statistic. The compact form of the equations can be expressed as

$$y_t = \mu_0 + \sum_{i=1}^k \alpha_{1t} y_{t-i} + \sum_{i=k+1}^{dmax} \alpha_{2t} y_{t-i} + \sum_{i=1}^k \beta_{1t} x_{t-i} + \sum_{i=k+1}^{dmax} \beta_{2t} x_{t-i} + e_{1t} \quad (1)$$

$$x_t = \rho_0 + \sum_{i=1}^k \sigma_{1t} y_{t-i} + \sum_{i=k+1}^{dmax} \sigma_{2t} y_{t-i} + \sum_{i=1}^k \varphi_{1t} x_{t-i} + \sum_{i=k+1}^{dmax} \varphi_{2t} x_{t-i} + e_{2t} \quad (2)$$

The optimal lag is represented by k and maximum order of integration is denoted is by the symbol dmax. Furthermore, the ARDL is employed to estimate equation 2, 3 and 4 which showed that energy consumption as function of globalization, financial deepening such as broad money supply (BMS), credit to private sector (CPS), market capitalization (MCP) and foreign direct investment (FDV). Other intervening variables like economic growth, energy price, urbanization and carbon emission are included in the model. Evidence from

literature reveal that the autoregressive distributed lag model (ARDL) is one of the major workhorses in dynamic single- equation regression. The ARDL approach yields consistent estimates of the long-run coefficients that are asymptotically normal, irrespective of whether the underlying are I(1) or I(0), (Pesaran and Shin, 2001). One particularly attractive advantage to researchers is the error-correction model; which uses have increased over time (Engle and Granger, 1987). This can be expressed as:

$$\begin{aligned}
 ENEC_t = & \alpha_0 + \alpha_1 GLS_t + \alpha_2 BMS_t + \alpha_3 CPS_t + \alpha_4 MCP_t + \\
 & + \alpha_5 FDV_t + \alpha_6 ORT_t + \alpha_7 GDP_t + \alpha_8 EPR_t + \alpha_9 URB_t + e_{it}
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 \Delta ENEC_t = & \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta GLS_{t-i} + \sum_{i=1}^n \alpha_2 \Delta BMS_{t-i} + \sum_{i=1}^n \alpha_3 \Delta CPS_{t-i} + \\
 & + \sum_{i=1}^n \alpha_4 \Delta MCP_{t-i} + \sum_{i=1}^n \alpha_5 \Delta FDV_{t-i} + \sum_{i=1}^n \alpha_6 \Delta ORT_{t-i} + \\
 & + \sum_{i=1}^n \alpha_7 \Delta GDP_{t-i} + \sum_{i=1}^n \alpha_8 \Delta EPR_{t-i} + \sum_{i=1}^n \alpha_9 \Delta URB_{t-i} + \beta_1 GLS_{t-1} + \\
 & + \beta_2 BMS_{t-1} + \beta_3 CPS_{t-1} + \beta_4 MCP_{t-1} + \beta_5 FDV_{t-1} + \\
 & + \beta_6 ORT_{t-1} + \beta_7 GDP_{t-1} + \beta_8 EPR_{t-1} + \beta_9 URB_{t-1} + \varepsilon_t
 \end{aligned} \tag{3}$$

The interactive effect of globalization and financial deepening on energy consumption can be expressed as:

$$\begin{aligned}
 ENEC_t = & \alpha_0 + \alpha_1 GLS_t + \alpha_2 BMS_t + \alpha_3 CPS_t + \alpha_4 MCP_t + \\
 & + \alpha_5 (GLS_t * BMS) + \alpha_6 (GLS_t * CPS) + \alpha_7 (GLS_t * MCP) + \alpha_8 EPR_t + \\
 & + \alpha_9 ORT_t + \alpha_{10} GDP_t + \alpha_{11} EPR_t + \alpha_{12} URB_t + e_{it}
 \end{aligned} \tag{4}$$

*ENEC<sub>t</sub> = α<sub>0</sub> + The Measurements of Variables and Sources of Data*

Quarterly data over the period of 1990<sub>Q1</sub>–2018<sub>Q4</sub> on energy consumption, globalization, financial development, economic growth and energy prices were used. The key independent variables are globalization and financial development. Globalization is measure by globalization index.

Financial development is measured by domestic credit (CPS) as percentage of GDP, broad money supply (BMS), market capitalization (MCP) and foreign direct investment (FDI) as articulated in the literature (Chang, 2015; Polat et al., 2015; Shahbaz et al., 2017). Energy price is proxies by consumer price as applied in the previous studies (Sadorsky, 2010; Komal et al., 2015; Chang, 2015; Mukhtarov et al., 2020).

**Table 1** – The measurements of variables and sources of data

Variables (Symbol)	Measurements	Sources
Energy Consumption (ECN)	Per capital oil consumption measured in million tons of oil equivalent. Energy used in millions of KWH as proxy energy consumption	BP statistical Review of World Energy
Globalization (GLS)	Globalization index includes cross border investments, capital and labour flows, and low trade restrictions. It is an index which ranges from 0 to 100	KOF index of globalization approach
Carbon Emission (CEM)	Per capita carbon emission measured in millions of metrics tons CO <sub>2</sub>	WDI
Economic Growth (GDP)	GDP per capita growth, (constant 2010 international \$)	WDI
Financial development (BMS)	Broad money supply to GDP (m <sub>2</sub> ),	WDI
Financial development (CPS)	Ratio of private sector credit to gross domestic products	WDI
Financial development (MCP)	Ratio of market capitalisation to gross domestic products	WDI
Energy price (EPR)	Energy price is measured by consumer price index	WDI
Urbanization (URB)	Percent of population living in urban areas of the country.	WDI
Oil Resource (ONR)	Oil Production	BP Statistical Review of World Energy
Foreign Direct Investment (FDI)	Foreign Direct Investment (Net inflow as % of GDP)	World Development Indicator (WDI)

Note – compiled by authors

## Results and Discussion

In an empirical study, this study employed four estimations procedures in analyzing this data; (i) descriptive statistics (ii) unit roots tests (iii) cointegration tests (iv) estimation of short run and long run results. In testing for the stationarity properties of the series, this study employed improved and efficient tests with much better statistical properties are now Dickey-Fuller test statistic using a generalized least square (DF GLS). This modified test not only has the best overall performance in terms of small-sample size and

power, but also has substantially improved power when an unknown mean or trend is present (Stock, 1994; Elliott et al., 1996). The test unit root result in Table 1 shows that the null hypothesis of a unit root cannot be rejected for the level series of some variables using Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and DF GLS techniques. However, the null hypothesis of a unit root can be rejected for the first difference of all the series at a 5 per cent level of significance. The stationarity property of variables under consideration are mixture of I(1) and I(0), hence the ARDL technique is appropriate for estimation.

**Table 2** – Unit Root Result

	KPSS			DF GLS		
	Levels	First Difference	Remark	Levels	First Difference	Remark
<b>GLS</b>	-2.971*		I(0)	-1.692	-5.117*	I(1)
<b>BMS</b>	-0.398	-3.519*	I(1)		-3.991*	I(1)
<b>CPS</b>	-1.771	-3.418*	I(1)	-4.321*		I(0)
<b>MCP</b>	-3.421*		I(0)	-3.731*		I(0)
<b>ENEC</b>	-1.131	-5.172*	I(1)	-3.661*		I(0)
<b>CEM</b>	-1.211	-3.428*	I(1)	-1.74	-5.273*	I(1)
<b>EPR</b>	-1.821	-3.937*	I(1)	-3.191*		I(0)
<b>FDV</b>	-1.116	-4.821*	I(1)	-1.681	-3.811*	I(1)
<b>ONR</b>	-1.532	-3.811*	I(1)	-1.142	-3.911*	I(1)
<b>URB</b>	-3.870*		I(0)	-1.331	-4.318*	I(1)
<b>GDP</b>	-1.431	-3.988(1)*	I(1)	-1.221	-4.697*	I(1)

Notes: 1) \* – 5% significant level;  
2) compiled by authors

Furthermore, Toda & Yamamoto (1995) test under VAR assumptions was performed to see whether there is a causality relationship between these variables. The results of this test are given in Table 3. The results showed while unidirectional causality run from globalization to credit to private sector and market capitalization, credit to private sector

and energy consumption, no causal relationship was observed between broad money supply and globalization, between broad money supply and energy consumption. Also, bi-directional causal relationship was observed between globalization and energy consumption, market capitalization and energy consumption.

**Table 3** – Toda-Yamamoto Causality Results

Null hypothesis	Chi-square test (Prob)	Conclusion
GLS does not Granger cause BMS	3.19621 (0.7191)	Accept
BMS does not Granger cause GLS	2.01737 (0.1803)	Accept
GLS does not Granger cause CPS	28.01711 (0.0041)	Reject
CPS does not Granger cause GLS	3.00192 (0.8110)	Accept
GLS does not Granger cause MCP	79.01131 (0.0000)	Reject
MCP does not Granger cause GLS	2.91822 (0.4912)	Accept
GLS does not Granger cause ENEC	103.11831 (0.0000)	Reject
ENEC does not Granger cause GLS	87.08173 (0.0000)	Reject
BMS does not Granger cause ENEC	4.01721 (0.4198)	Accept
ENEC does not Granger cause BMS	2.07788 (0.1190)	Accept
CPS does not Granger cause ENEC	123.01761 (0.0000)	Reject
ENEC does not Granger cause CPS	3.01301 (0.2822)	Accept
MCP does not Granger cause ENEC	91.02191 (0.0000)	Reject
ENEC does not Granger cause MCP	56.11814 (0.0000)	Reject
FDV does not Granger cause ENEC	19.319704 (0.0000)	Reject
ENEC does not Granger cause FDV	25.038417 (0.0000)	Reject

Note – compiled by authors

The results of the co-integration test based on the ARDL-bounds testing method are presented in upper part of Table 4. The results indicate that the F-statistic is greater than the upper critical bound from Pesaran et al. (2001) at 5% significance level using restricted intercept and no trend. This study therefore rejects the null hypothesis of no cointegration among the variables. This shows that there is a long-run causal relationship between energy consumption, globalization and financial deepening variables. F-test results indicate that we reject the null hypothesis of no cointegration between variables, since computed value of F-statistics, 7.801, is greater than I(1) bound value at 5% level of significance. Thus, we concluded that variables are cointegrated which implies that there is a long-run relationship among the variables.

Table 3 also presents the long-run coefficients and short-run coefficients of the model estimated

using ARDL approach. The coefficient of globalization has a positive and statistically significant effect on energy consumption for both short and long-run. These findings support that of Koengkan (2017) and Shahbaz et al. (2019), however, it is disagree with what was obtained by Murshed et al. (2018) that found insignificant relationship between globalization and energy consumption. This finding is consistent with theoretical postulation that globalization increases income which enhances purchase of durables goods by consumers which in turn increase energy consumption. The coefficient of broad money supply (BMS) has positive and significant effect on energy consumption in the short run but negative statistically insignificant impact in the long run.

The long run result can be attributed to the fact that an increase in investment in energy savings equipment through financial deepening reduces energy consumption. The short run result agrees with

the findings of Shahbaz et al. (2017), Mahalik et al. (2017) but contrary to that of Farhani & Solarin (2017) and Kahouli (2017). The coefficient of credit to private sector (CPS) is positive and significant on energy consumption in both short run and long run. This finding is in line with the results of many previous studies like, Sadorsky (2010), in the case of de-

veloping countries, Sadorsky (2011) for Central and Eastern Europe, Shahbaz & Lean (2012) in Tunisian case, Coban & Topcu (2013) in case of European countries, Tang & Tan (2014) and Islam et al. (2013) in Malaysian, Mahalik et al. (2017) for the Kingdom of Saudi Arabia, Mukhtarov et al. (2018) for Azerbaijan and Mukhtarov et al. (2020) for Kazakhstan.

**Table 4** – Dynamics of globalization, financial deepening and energy consumption

Bound Cointegration Result Dependent Variable (Energy Consumption)				
Bound F-Statistics	7.8015			
Critical Value Bound		5%		
I(0)		2.45		
I(1)		3.61		
Variable	Coefficient	Std. Error	t-Statistics	P Value
GLS	0.2019	0.0901	2.2408	0.030
BMS	-0.2241	0.2971	-0.7542	0.821
CPS	0.2911	0.1381	2.1078	0.027
MCP	-0.8181	0.3913	-2.0907	0.011
GLS*BMS	-0.7321	0.5251	-1.3942	0.133
GLS*CPS	-0.5022	0.2288	-2.1949	0.011
GLS*MCP	-0.6214	0.2411	-2.5773	0.000
CEM	-0.3881	0.2691	-1.4422	0.137
EPR	-0.6697	0.2821	-2.3739	0.001
FDV	0.9282	0.3771	2.4614	0.004
ONR	0.5911	0.2180	2.7114	0.001
URB	0.3399	0.1971	1.7245	0.711
GDP	0.5732	0.2362	2.4267	0.003
Constant	0.6621	0.2901	3.1664	0.001
Short Run				
D(GLS)	0.1939	0.0941	2.0605	0.021
D(BMS)	0.5990	0.2211	2.7091	0.007
D(CPS)	0.1299	0.0371	3.5013	0.000
D(MCP)	-0.5082	0.2922	-2.3670	0.003
D(GLS*BMS)	0.1922	0.1181	1.6274	0.581
D(GLS*CPS)	0.1101	0.0515	2.1378	0.008
D(GLS*MCP)	0.0191	0.0087	2.1954	0.043
D(CEM)	-0.1721	0.0959	-1.7945	0.000
D(EPR)	-0.4291	0.1771	-2.4229	0.001
D(EPR(-1))	-0.2911	0.1421	2.0485	0.000
D(FDV)	0.6921	0.3221	2.1487	0.030
D(FDV(-1))	0.1689	0.0716	2.3589	0.038
D(ONR)	0.0817	0.0314	2.6019	0.002
D(URB)	0.0192	0.0111	0.1729	0.219
D(GDP)	0.4901	0.2107	2.3260	0.038



Table continuation

D(GDP(-1))	0.2101	0.1011	-2.444	0.035
ECT <sub>t-1</sub>	-0.6141	0.2911	2.1095	0.010
R-squared	0.691			
		F-statistics	3.182	0.000
Diagnostic Tests				
F –Statistics		Prob.		
Serial Correlation	1.421	0.198		
Functional form	0.811	0.203		
Normality	0.791	0.133		
Heteroscedasticity	0.722	0.921		
Note – compiled by authors				

The coefficient of market capitalization (MCP) is negative and significant on energy consumption in both the short run and long run. This is consistent with the findings of Ali et al. (2015). An increase in capitalization enables households and business to invest in energy saving equipment which will reduce energy consumption. The coefficients on the interaction between the globalization (GLS), broad money supply (BDS), credit to private sector (CPS), market capitalization (MCP) are statistically significant at 5% level and with the positive sign in the short-run and negative sign in the long –run. This finding indicates that economic globalization not only directly influence energy demand but also indirectly does through complementary reforms in financial sector. On the other hand, the effect of economic globalization can be significantly enhanced if some complementary reforms in financial development are undertaken. The obtained results supported by previous studies in relative to globalization, financial deepening and energy consumption such as Ali et al. (2015), Khan et al. (2017), Saud & Baloch (2018).

Foreign Direct Investment (FDI) has positive and significant impact on energy consumption in both short-run and long-run. This shows that rising FDI inflows lead to rising imports of capital goods which increase energy consumption. The coefficient of energy price (EPR) proxies by consumer price is negative and statistically significant on energy consumption. This is in line with a priori expectation that there is inverse relationship between energy price and energy consumption. This result is in conformity with the findings of Sadorsky (2010), Komal et al. (2015), Chang (2015) and Mukhtarov et al. (2020). Also, the impact of economic growth on energy consumption is positive and statistically

significant at the 5% level. It means that an increase in economic growth raises energy consumption. An oil resource extraction has positive and significant impact on energy consumption in both short and long run. This finding is consistent with that of Bekun et al. (2019) for European countries and Kwakwa et al. (2019) for Ghana.

The rate of adjustment to the long-run position is high, as evidenced by the size of the error correction coefficient (ECM) of 0.641. The Jarque-Bera test suggests that the residuals are normally distributed since the probability value is greater than the 5% significance level. Hence, the hypothesis of normal distribution for the residuals cannot be rejected. Confirming the absence of serial correlation among the residuals, the Breusch-Pagan serial correlation (LM) test result suggests the non-rejection of the null hypothesis at the 5% level of significance. Also, The ARCH and Ramsey-Reset results whose probability values are greater than 5% indicate that there is neither heteroscedasticity nor functional misspecification in the estimated model. Thus, the hypotheses of constant variance and linear relationship cannot be rejected. Since these assumptions have not been violated, it therefore follows that the results of the model presented in Table 3 are consistent, efficient and feasible for forecast and policy making.

### Conclusion

Globalization has always remained a topical issue among academia and researchers due to lack of consensus on this subject. A potential unresolved issue is not only the causal relationship among these variables but also the effect of globalization

and financial deepening interactions on energy consumption. The present study has been an attempt to explore interlinks between these variables using Toda-Yamamoto causal approach and ARDL bound cointegration approach on quarterly time series data spanning from 1980 to 2018. The results showed unidirectional causality run from globalization to financial deepening variables such as credit to private sector and market capitalization. It is also observed that unidirectional causality runs from credit to private sector to energy consumption. No causal relationship runs from broad money supply to globalization and energy consumption. Also, there is feedback relationship between globalization and energy consumption, market capitalization

and energy consumption. ARDL Result showed that globalization has positive and statistically significant effect on financial deepening and energy consumption. This has been found consistent with the finding of Shahbaz et al. (2019). The result also revealed that the interactive term of globalization and financial development has negative and significant impact on energy consumption. This implied that economic globalization not only directly influenced energy consumption but also impacted through complementary reforms in financial sector. On the other hand, this study concludes that the globalization can be meaningful in Nigeria if there are complementary positive reforms in the financial sector.

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