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Output Volatility in Nigeria: Does Financial Development Absorb Trade-Led Shocks?

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Abstract:

Purpose: *The aim of this paper is to empirically determine the stance of the Nigerian financial sector in absorbing or intensifying trade shocks.*
Design/Methodology/Approach: *Towards achieving this objective, the study uses Auto-Regressive Distributed Lag (ARDL) technique to analyse annual data from 1981 to 2017. Data used in this study were sourced from Central Bank of Nigeria Statistical Bulletin and Statista.*
Findings: *Major finding from the long-run result shows that financial development intensifies trade-led shocks, there by yielding to output volatility.*
Practical implication: *Based on findings, the study recommends the Nigerian government to focus on the achievement of greater and more inclusive financial development. This can be achieved through; increasing the availability and affordability of financial services, easing access to loans, improving soundness of banks and fostering legal traditions that protect creditors and investors.*
Originality/Value: *In addition to the lack of available literature with focus on this subject in the Nigerian sphere, understanding the role of Nigerian financial sector in absorbing trade-led shocks is fundamental in optimizing Nigeria's benefits from trade. This is of utmost importance, particularly in a time where the nation just signed the Africa Continental Free Trade Agreement.*

Keywords: *Financial development, trade shocks, output volatility, Nigeria, ARDL.*

JEL Classification: *G00, F40, O1.*

Paper Type: *Research study.*

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1. Introduction

In determining macroeconomic outcomes, fluctuations in output over a period of time is vital. These fluctuations show the form (frequency and size) of shocks being transmitted in an economy and how the economy responds to these shocks Easterly, Roumeen and Stiglitz (2001). Again, the existence of economic linkages permit output volatility to have a trickle-down effect on; consumption, welfare, planning and ultimately development. Arising from the uncertainties it creates, volatility of output is capable of reducing growth or all the same, yielding higher growth due to increase in precautionary savings and creative destruction. Driving from these, understanding the determinants of output volatility from the Nigerian perspective is imperative for the achievement of her Economic Recovery and Growth Plan (ERGP), which aims at restoring economic growth and competitiveness through bolstering local content.

Determining factors that cause output volatility, existing literature focus on the global component of output volatility through international business cycles and the explanatory power of country specific characteristic. With respect to the global component of output volatility, World Bank (2017) classifies trade-led shocks to be the most important source of external shock. According to them, trade-led shock is persistent in small open and resource endowed economics such as Nigeria which is characterised by an undiversified external economy.

In conjunction with the explanative power of country specific characteristics, Acemoglu, Johnson and Thaicharoen (2003), Otrok, and Whiteman (2003), Kose, Prasad, and Terrones (2003), Kpodar, Goff, and Singh (2019) highlight the role of domestic institutions (including financial institutions) in dampening the transmission of shocks. This dampening effect is caused by increased depth and sophistication of a nation's financial system which allows trade diversification, hedging of uncertainties, reduction of information asymmetry and spurring risk diversification. In consequence, financial intermediaries are able to stimulate demand and supply, and inhibit related shocks. However, arguing that the unwarranted size of financial systems in developed economies was a contributory factor behind the global financial crisis, Smaghi (2010) objects to the stabilising role of developed financial systems. This nexus between financial development, trade-led shocks and output volatility follow the presumptuous argument of Briguglio, Cordina, Farrugia, and Vella (2009) and Briguglio (2016) in assessing the possibility of shocks in an economy, with regards to factors that spurn and lessen economic vulnerability.

Notwithstanding the increasing levels of economic integration particularly with emergence of Africa Continental Free Trade Agreement (ACTFA) and studies by Di Giovanni and Levchenko (2007) which finds an identical change in trade openness to cause volatility that is five times higher in developing economies compared to developed ones. The difference in financial system development is pivotal in explaining why US recovered faster than Europe from the global financial crisis of

2007-2009 (Van Bezooijen and Bikker, 2017). Bearing these in mind, this work aims at examining the relevance of financial development in reducing vulnerability of the Nigerian economy to trade-led shocks.

2. Literature Review

2.1 Financial Development and Output Volatility

Development of a nation's financial system refers to its depth and sophistication with respect to providing better services. Regardless of the potentials of economic growth to be a driver of financial development (Rousseau and Vuthipadadorn, 2005 and Adamopoulos (2010), it plays a fundamental role in spurring growth and has strong predictive power in determining future growth rates (King and Levine, 1993). Supporting this narrative, Tobin (1984) agrees with the investment financing role of financial intermediaries which plays a vital role in growing the real sector. This growth spurring role exists as a result of the financial sector's ability to; spread risk, control volatility, insure against unexpected circumstances and make monetary policy more effective.

The existence of financially constrained firms whose access to finance is limited by financial market imperfections is the link between financial development and output volatility (Wei and Kong, 2016). This link operates successfully through financial accelerator effect, which is evident in the shock propagating and shock transmitting characteristic of the sector. That is, the financial sector through macro-financial linkages can effectively propagate its own shock to the real economy or transmit shocks generated by the real economy.

According to Bernanke, Gertler and Gilchrist (1999), the shock propagating characteristic of the financial sector operates through credit channel and arises due to information asymmetry in the financial market. Owing to the influence of credit channel in determining the availability and cost of funds necessary for investment and production (Dabla-Norris and Srivisal, 2013), a reduction in firms' net worth reduces her ability to finance her activities through retained earnings. Thus, increases her dependency on external finance and place the firm at the mercy of the credit channel in meeting her financial requirements. Additionally, in the presence adverse selection and moral hazard, credit market imperfections through rationing credit and increasing cost of finance generates macroeconomic fluctuations (Kiyotaki and Moore, 1997; Greenwald and Stiglitz, 1991; Bernanke and Gertler, 1990; Wei and Kong, 2016). However, concerns related to asymmetric information and credit channel effect only arise when firms have low retained earnings and collateral base.

Even as financial development is crucial for economic growth, the size of financial sector may inhibit its ability to create economic stability. According to Kunieda (2008), the relationship between financial development and volatility is concave. Meaning that financial sector development in its early stages can ease volatility,

while further developments in the sector can strengthen volatility. Supporting this Arcand, Berkes and Panizza (2012) sees development of financial sector to have a negative effect on growth beyond a certain size.

Consequently, there is a limit to which developed financial sector can absorb shock, beyond which the sector aggravates shocks and volatility (Dabla-Norris and Srivisal, 2013). These assertions exist because an increased development in an economy's financial sector increases its ability to delve into riskier ventures, leaving the entire economic system vulnerable. In contrast, Kunieda (2015) noted that the financial sector contributes to economic stability when it is poorly and well developed, but causes economic instability when it is in between these two extremes.

2.2 Trade Openness and Output Volatility

With respect to the role of trade openness in increasing an economy's vulnerability to risk, Easterly *et al.* (2001) perceives trade openness to reduce an economy's exposure to domestic shocks and increases her susceptibility to external shocks. Accordingly, Krebs, Krishna and Maloney (2004) opined that trade openness reduces country's exposure to shock, since domestic economic shocks are more dominant than global economic shocks. Therefore, through delinking domestic economy from external economy, trade openness help increase a country's resilience to internal demand or supply shocks. Also, through market enlargement from trade, there is an increased chance for resilience to shocks (Mekonnen and Dogruel, 2017).

Notwithstanding these assertions, Di Giovanni and Levchenko (2008; 2009) likened the specialisation effect of trade openness to be similar to the riskiness of having many eggs in one basket. Hence, in other to provide an all-inclusive understanding of the mechanism through which trade openness may cause volatility, these scholars query the exposure of industries to external demand and supply shocks, the diversification effect of trade openness and its ability to change the co-movement pattern of trading sectors from depending on domestic cycle, to depending on global cycle. Validating any of these three hypotheses will be effective in providing an explanatory narrative for trade-led volatility.

2.3 Review of Empirical Literature

Using firm level and aggregate data, studies have empirically evaluated the role financial sectors play in dampening volatility. This section provides a brief review of these studies. Supporting the stabilising role of financial sector, Larrian (2006) using firm data finds increase in financial depth to be instrumental in reducing the level of correlation between short-term debt, sale and inventory. He also finds a well-functioning stock market to be capable of reducing output volatility.

Studying low, middle and high income countries, Beck *et al.* (2006) finds weak evidence of the cushioning effect of financial development on terms of trade volatility. In a similar study, Dabla-Noris and Srivisal (2013) while examining the interaction between financial depth and terms of trade volatility in 110 economies,

these researchers find deeper banking systems to be significant in absorbing the negative effect of terms of trade on macroeconomic volatility.

Also, towards disentangling the intermediation and size effect of financial systems, Beck, Degryse and Kneer (2014) studying 77 countries from a period of 1980 to 2007 finds financial sector to increase growth and reduce growth volatility. The study also associates large growth volatility to exist in the presence of large financial sector. Studying the effect of financial development on growth volatility profile of 28 OEDC countries between 1970 and 2007, Manganelli and Popov (2015) find financial sector to reduce volatility through reallocating resources. They also find financial development to significantly increase the rate at which industrial output composition converges to target.

Adopting a spectral approach in examining the effect of financial development on volatility and the canals through which finance affects volatility in 23 sub-Saharan African economies from 1980-2014, Ibrahim and Alagidede (2017) using a newly developed panel co-integration estimation method finds financial development to have a dampening effect on volatility. Using macroeconomic data from more than 100 countries Wang, Wen and Xu (2018) reconfirms the existence of a negative relationship between financial development and output volatility. In addition, their study finds the volatility cushioning effect of financial sector to reduce as financial liberation increases. Hence, signifying a non-linear relationship between financial sector and growth volatility.

Kpodar, Goff and Signh (2019) studying 38 low-income countries from 1978-2012 find banking sector development to play an absorbing role and prevent the transmission of trade-led shocks. Additionally, expanding their study to 121 developing countries, these researchers find the shock absorbing power of the financial sector to weaken.

3. Methodology

Focusing on the shock absorbing power of the Nigerian financial sector, while considering other possible factors that may affect growth volatility, this study adapts a theoretical model by Kpodar and Imam (2016). In this model, instability in output growth rate is explained by depth of trade integration, financial development, internal and external shocks, trade openness and financial instability. Flowing from this, the model specification for the relationship between financial development, trade-led shocks and output volatility is:

$$\mathrm{VGDP}_t = \alpha_0 + \beta_1 VTOT_t + \beta_2 PTV_t + \beta_3 VFIN_t + \beta_4 OP_t + \beta_5 TO_t + \beta_6 SAC_t + u_t \quad (1)$$

Where VGDP is real GDP volatility, VTOT is terms of trade volatility, PTV is a variable that stands for the interaction between trade volatility and financial

development (metered by private sector credit ratio), VFIN is financial volatility (measured by the inflation volatility). OP is oil prices (a proxy for oil shock), TO is trade openness and SAC is the share of agriculture's contribution to GDP (a proxy for weather shocks). Subscript t represents time, while u is error term.

Notwithstanding the vast number of variables used in this study, our variable of interest is PTV (the interaction term between terms of trade volatility and financial development). To ascertain if financial development absorbs trade-led shocks, the coefficient of the interaction variable (PTV) after regression is expected to be negative, as a positive coefficient would mean that financial development intensifies trade-led shocks. Table 1 below shows the expected signs of the coefficient of other variables.

Table 1. *Other variables and their expected signs*

Variable	Symbols	Signs
Terms of Trade Volatility	VTOT	Positive
Oil Price	OP	Negative
Financial volatility	VFIN	Positive
Trade openness	TO	Positive/Negative
Share of Agriculture's contribution to GDP	SAC	Positive

Source: *Own calculations.*

From Table 1, increase in terms of trade volatility is expected to cause fluctuations in output because of the existence of an undiversified external sector in Nigeria. Accordingly, increase in oil prices (OP) which is the major contributor to Nigeria's foreign reserve and revenue is expected to reduce output volatility. Reason being that, increase in revenue and reserve increases the government's ability to use fiscal policy to stabilise the economy. Financial volatility (VFIN) and Share of Agriculture's contribution to GDP (SAC) are expected to have positive effect on growth volatility because of the increase in uncertainty they create. Trade openness (TO) is expected to have a positive effect on output volatility if trade leads to specialisation and increase vulnerability to shocks. Conversely, Trade openness will have a positive effect on output volatility if it spurs economic diversification.

In this study, the measurement and generation of volatility of variables is essential. The study adopts a modified moving average of the standard deviation by Kpodar and Imam (2016), which assumes an AR(1) process and takes into cognisance cyclical component in its volatility computation. This volatility estimation equation is given as:

$$\ln(H_t) = \alpha + \beta \ln(H_{t-1}) + \phi\, t + u_{,t} \qquad (2)$$

Here, H is a vector of variables of which their volatility is to be computed, t denotes time and u is the random error term. By fitting this equation (i.e equation 2), allows

for the estimation of the error term ($\hat{u}$) which has a cyclical component of the vector H imbibed in it. Then for each sub-period of 3 years, volatility of the variables contained in the vector H (Volatilty H) is computed using the moving average of standard deviation formula as stated below:

$$volatilityH = \sqrt{\frac{\sum_{j=1}^{3}(\hat{u}_t - \bar{\hat{u}}_t)^2}{2}} \quad (3)$$

Where $\bar{\hat{u}}$ is the moving average of $\hat{u}_t$ over a 3 year sub-period.

3.1 Data and Variables Definition

Based on data availability and consistency, the study used annual data from`1981 to 2017. This scope was chosen because it represents a time when the Nigerian economy made conscious effort to stabilise and develop her financial sector. Also, during this time frame (1981-2017), her economy has been more open to trade than ever. Contained in this study was data sourced from Central Bank of Nigeria Statistical Bulletin (2019) which include: real GDP, terms of trade, consumer price index, private sector credit ratio, trade openness and Share of Agriculture's contribution to GDP (SAC). While data for oil price was sourced from Statista (2018). It is noteworthy to state that real GDP, terms of trade, consumer price index were used to compute output volatility (VGDP), terms of trade volatility (VTOT) and financial volatility (VFIN) respectively. Also, the product of private sector credit and terms of trade volatility were used to compute the interaction term (PTV) , while Oil price (OP), trade openness (TO) and Share of Agriculture's contribution to GDP (SAC) variables were used unaltered.

4. Presentation of Results

It can be seen from Table 2 that all the variables have negative average values (means) with the exception of the Interaction Term (ln(PTV)), Terms of Trade Volatility (ln(VTOT)) and Oil Prices (ln(OP)). The low deviation of the variables from their means as shown by the standard deviation gives indication of low growth rate (fluctuation) of these variables over the period. Signifying the relevance of the data set used in this study, the maximum and minimum value of all variables are above and below their respective means. Most of the variables were positively skewed implying that the majority of the values are less than their means. Only output volatility ln(VGDP), financial volatility ln(VFIN) and trade openness ln(TO) are positively skewed which implies that their values are greater than their means. Driving from the probability value of Jarque-bera test at 5 per cent level of significance, we accept the null hypothesis that all the series except growth volatility are normally distributed, except oil price ln(OP).

Table 2. *Summary Statistics of the Variables*

	ln(VGDP)	ln(PTV)	ln(SAC)	ln(VTOT)	ln(OP)	ln(VFIN)	ln(TO)
Mean	-3.5575	2.4663	-1.5324	0.1452	3.4781	-3.0806	-2.7933
Maximum	-2.6548	3.4176	-1.3095	0.4237	4.6955	-0.8513	-0.7810
Minimum	-5.3787	1.8697	-1.7887	0.0037	2.5079	-5.7372	-6.9299
Std. Dev.	0.6383	0.4457	0.1367	0.1143	0.6958	1.2536	1.9394
Skewness	-1.0592	0.6299	0.0511	1.0101	0.4571	-0.3424	-0.8801
Kurtosis	3.7233	2.0212	1.5861	3.3272	1.8254	2.7173	2.4262
Jarque-Bera P-Value	7.0992 [0.0287]	3.6058 [0.1648]	2.8468 [0.2409]	5.9328 [0.0515]	3.1388 [0.2082]	0.7775 [0.67789]	4.8555 [0.0882]
Observations	34	34	34	34	34	34	34

Note: *Std. Dev. Represents Observations Standard Deviation*
Source: *Own calculations.*

Table 3. *Summary of ADF and PP Unit Root Test Results*

Variables	**ADF**			**Philip-Perron**		
	Level	**1st Difference**	**Order of Integration**	**Level**	**1st Difference**	**Order of Integration**
ln(VGDP)	-0.6698	-6.7620	I(1)	-0.4936	-10.6876	I(1)
ln(PTV)	1.8202	-7.7703	I(1)	1.5389	-8.0766	I(1)
ln(SAC)	-1.4851	-6.4633	I(1)	-1.4852	-6.5341	I(1)
ln(VTOT)	-1.9669	-	I(0)	-1.9669	-	I(0)
ln(OP)	0.0549	-5.8616	I(1)	0.0594	-5.5861	I(1)
ln(VFIN)	-0.9513	-6.1384	I(1)	-0.6359	-9.7027	I(1)
ln(TO)	-2.8479	-	I(0)	-2.8479		I(0)

Source: *Own calculations.*

Table 3 shows results for unit root test of the variables contained in this analysis, using Augmented Dickey-fuller and Philip-Perron tests. Result from these tests based on 5 per cent level of significance shows that all variables are integrated at order 1 excluding ln(VTOT) and ln(TO), which are stationary at level form. Based on this result, an ARDL technique is used to examine the relationship among variables.

Table 4. *ln(VGDP) Long-Run Equation and Bounds Test: ARDL(1, 2, 1, 3, 3, 1, 2)*

Significance Level	Critical bounds		Fstatistic Value	Kmax	Hypothesis Testing
	I Bound 0	I Bound 1			
10%	1.75	2.87	9.962472	6	Cointegration exist
5%	2.04	3.24	9.962472	6	Cointegration exist
2.5%	2.32	3.59	9.962472	6	Cointegration exist
1%	2.66	4.05	9.962472	6	Cointegration exist
Diagnostic			Probability	Null Hypothesis	Hypothesis Testing
Heteroskedasticity Test: Breusch-Pagan-Godfrey			0.9814	Homoskedasticity	Cannot Rejected
Breusch-Godfrey Serial Correlation			0.1791	No Serial Correlation	Cannot Rejected
Histogram-Normalilty Test			0.1262	Normally Distribution	Cannot Rejected

Source: *Own calculations.*

Table 4 shows the result for bounds test of cointegration for our model, where ln(VGDP) is the dependent variable. The lag distribution in this co-integration equation is 1, 2, 1, 3, 3, 1 and 2 for ln(VGDP) ln(PTV) ln(SAC) ln(VTOT) ln(OP) ln(VFIN) and ln(TO) respectively. The chosen optimal lag length is based on Akaike info criterion. Following the value of F-statistic (9.962472) which is greater that the lower and upper critical bounds, the result shows the existence of long-run cointegration at 1%, 2.5%, 5% and 10% level of significance.

Accordingly, the model was subjected to diagnostic tests such as; serial correlation, heteroskedasticity and normality. Using Breusch-Pagan-Godfrey test of heteroskedasticity we fail to reject the null hypothesis of homoskedasticity because the P-value of 0.9814 is greater than 0.05. Also, using Breusch-Godfrey Serial Correlation the null hypothesis of no serial correlation cannot be rejected because the P-value of 0.1791 is greater than 0.05. This rule of thumb is applicable to the result of the histogram normality test, where the P-value of 0.1262 is greater than 0.05, insinuating the existence of a normally distributed error term.

Table 5. *Long-Run Coefficients Estimates and Error Correction Term*

Variables	Coefficient	Standard Error	T-Ratio	P-value
ln(PTV) ***	3.567985	1.243026	2.870403	0.0141
ln(SAC)	0.898692	0.647487	1.387969	0.1904
ln(VTOT)	1.966410	2.192995	0.896678	0.3875
ln(OP) ***	-3.205670	0.787797	-4.069157	0.0016
ln(VFIN) ***	-0.239362	0.097320	-2.459530	0.0301
ln(TO) ***	0.290970	0.126567	2.298936	0.0403
ECM ***	-0.730957	0.071468	-10.22771	0.0000
R-Squared: 0.8927		DW-Statistic 2.1428		
R-Bar-Squared: 0. 7317				

Note: **** denote significance levels at least at 5%.*
Source: *Own calculations.*

From Table 5, the signs of the estimated coefficients of agriculture's contribution to growth (SAC), oil price (OP), and trade openness (TO) are in line with economic expectation. Nevertheless, with respect to significance, the coefficients of the interaction term between private sector credit ratio and terms of trade volatility (PTV), oil price (OP), financial volatility (VFIN) and trade openness (TO) significantly explain output volatility (VGDP) at 5 per cent level of significance.

Interpreting the effect of these significant variables on explain output volatility (VGDP) goes as follows: a one per cent increase in oil price (OP) will cause output volatility (VGDP) to change by -3.21 per cent. Also, deducing from the coefficients of financial volatility (VFIN) and trade openness (TO), a 1 per cent change in financial stability and trade openness will lead to a change in dependent variable by -0.239 per cent (decrease) and 0.291 per cent (increase) respectively. Importantly, the result shows that a one per cent change in the interaction term (PTV); which is our

variable of interest will lead to an increase in output volatility (VGDP) by approximately 3.58 per cent.

The results from the long-run estimates show that share agriculture's contribution to GDP (SAC) and terms of trade volatility (VTOT) have positive effect on output volatility (VGDP). However, these variables are insignificant in explaining output volatility in the long-run. The long-run result shows that the correction of short-run system disequilibrium. With regards to this, Error Correction Term (ECM) of this regression has a coefficient of -0.730957 and is statistically significant. Meaning that disequilibrium in the economy will be corrected to initial equilibrium at a speed of approximately 73 per cent annually.

5. Summary, Conclusion and Policy Recommendation

5.1 Summary

The use of financial intermediaries to cope with uncertainties has been an approach adopted by several economies, as the financial sector through her intermediaries has the ability to diversify trade, hedge uncertainties, reduce information asymmetry and spur risk diversification. In consequence, for Nigeria-a small open and resource endowed economy which is highly susceptible to shock due to undiversified external economy, analysing the role of her financial sector's development in reducing vulnerability to trade-led shocks is crucial to facilitate policy makers formulate finance focused policies that will reduce output volatility. Towards achieving this goal, this work makes use of Autoregressive Distributed Lag (ARDL) technique to verify the long-run effect of financial development on output volatility.

Variables used in this study were selected based on availability from Central Bank of Nigeria's Statistical Bulletin and Statista, some of which are subject to the author's computation. These variables include; real GDP volatility, terms of trade volatility, financial volatility, trade openness, oil price and share of agriculture's contribution to GDP.

Using ARDL as an estimation technique, the error-correction model shows that output volatility in Nigeria will adjust quickly to its initial equilibrium. Also, the long-run result shows that oil price and financial stability have negative and significant effect on output volatility, while trade openness has positive and significant effects on output volatility.

In general, findings from this study show that financial development (proxied by an interaction term between private sector ratio and terms of trade volatility) intensifies trade shocks in Nigeria from 1981 to 2017. Thus, facilitating output volatility.

5.2 Conclusion and Policy Recommendations

The study concludes that financial development in Nigeria does not cushion trade-led shocks. The reason is, the poor state of Nigerian financial system cannot

efficiently absorbs shocks from its highly opened economy. This is supported by a report from World Economic Forum (2014), where her financial development is ranked 137 and 122 out of 144 countries based on accessibility to loan and affordability of financial services respectively. Also, the report ranks her domestic market size (measured by the sum of GDP plus value of imported goods and services less export) to be 31 out of 144 and Foreign market size (measured by the value of goods and services) to be 37 out of 144. Thus, depicting the existence of a wide discrepancy between the nation's trade and her financial development and making the sector ill-equipped for its shock absorbing function. In addition, Nigerian financial sector and her intermediaries are ruled by adverse selection and moral hazards in their undertakings. These lapses in the financial sector, allow her escalate trade led-shocks through macro-financial linkages.

Based on findings, the study advocates for greater and more inclusive financial development effort that will reach all spheres of the financial sector. This can be achieved by; increasing the availability and affordability of financial services, easing access to loans, improving soundness of banks and fostering legal traditions that protect creditor and investors. Also, the government should try as much as possible to diversify the Nigerian economy so as to enable her reap the benefit of trade and reduce her vulnerability to domestic and external shocks.

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