ISLAMIC UNIVERSITY JOURNAL OF SOCIAL SCIENCES VOL 3, NO 1, JULY 2024

ISSN: 2709-2429(Print), 2709-2437(Online)

The Role of International Trade Channel in the Transmission of U.S. Recessions into African Countries: Evidence from Nigeria

by

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Abstract

This paper examines the role of international trade as a transmission channel of U.S. recessions into African countries, drawing inferences from Nigeria and using time series data spanning 1981 to 2019. The analysis involves investigating how the effects of U.S. recessions on Nigeria's growth spread across time, with and without Nigeria's international trade, based on an autoregressive distributed lag (ARDL) cointegration model. The main findings are: (i) When Nigeria's international trade is not controlled for in the analysis, U.S. recessions do not have statistically significant negative effects on growth in Nigeria both in the short-run and long-run. (ii) When Nigeria's international trade is controlled for, the recessions have statistically significant negative effects on growth via the trade channel, but only in the short-run and with a lapse of time. (iii) The positive effect of international trade on growth occurs in the long-run, while the recessions do not have statistically significant effects on growth in the long-run. The key policy implications of these findings is that U.S. recessions only affect the impact of international trade on growth in a typical African country in the short-run, in that in the long-run the country is resilient to the recessions and its trade is positively impactful. Therefore, to limit the effects of shocks from large economies such as the U.S. in the short-run and maximize the benefits of trade, African countries need to diversify their trade away from such economies by increasing intra-Africa trade. This requires better performance of Africa's trade blocs (e.g. ECOWAS) and the coordination of *per jure* and *de facto* trade policies within the continent generally.

Keywords: U.S. recessions, trade, Africa, Nigeria

JEL Codes: F1, F14, E32, O51, O55

Introduction

Due to its large size in a globalizing world, economic developments in the U.S. are usually transmitted largely into other countries. This is why an adage says that when the U.S. sneezes, the rest of the world catches a cold. Although countries such as China have gained increased importance in the global economy, the U.S. is still the most influential country in the world, particularly in terms of impact on other countries (Chudik & Smith, 2013). Generally, international trade has been identified as the main channel of international transmission of business cycles (Dées, Mauro, Pesaran & Smith, 2007; Baxter & Kouparitsas, 2005), which implies that the transmission of developments in the U.S. into African countries through the trade channel will likely be large because trade plays a large role in the performance of the countries.

Kose and Raymond (2001) show that African countries are trade-driven economies that export primary commodities and import intermediate inputs and capital goods, which consequently makes trade to be the main channel through which international shocks induce variations of aggregate output in the countries. Furthermore, trade between Africa and emerging countries such as China has increased in recent years (Pigato & Tang, 2015). This will likely have corresponding effects on the role of trade in the transmission of U.S. shocks into Africa, in that the shocks would be transmitted directly into African countries through their trade links with the U.S. and indirectly through second-round effects via their trade links with the emerging countries, since the emerging countries also trade with the U.S. The question then arises: "how really has international trade influenced the transmission of developments in the U.S. into Africa in recent decades"?

In line with the foregoing facts, the objective of this paper is to contribute to studies on recessions and international trade by examining the role of international trade in the transmission of U.S. recessions into African countries, drawing inferences from Nigeria's experience. This involves using an autoregressive distributed lag (ARDL) cointegration model and secondary data spanning 1981-2019. U.S. recessions usually have large impacts. For example, the U.S. recession of 2007-2009, which eventually became a global recession, led to large downturns in the U.S., other countries, and the global economy as a whole (Tapia, 2013; Schanzenbach, Nunn, Bauer, Boddy & Nantz, 2016; Amromin, Nardi & Schulze, 2018; Kose, Sugawara & Terrones, 2020).

However, findings on the effects of U.S. recessions on African countries (e.g. African Development Bank, 2009; Maswana, 2009) are inconclusive. While some studies show that the recessions usually have their greatest effects on the financial sectors of African countries, other studies show that the real sectors of the countries are usually the most affected, which implies that further studies are required on the subject. Further studies are particularly required on the role of trade in the transmission of U.S. recessions into African countries, because the countries are trade-driven economies.

Basically, a recession points to an unfavourable phase of the business cycle of an economy, characterized by large reductions of sectoral and overall economic activities, over a considerable period of time, such as two consecutive quarters (Máximo and Gonzalo, 2019; Abberger & Nierhaus, 2008; Kose & Prasad, 2010). When recessions in individual countries become synchronized, they lead to the recession of the global economy as a whole. For example, the 2007-2009 crisis originated from the U.S., spread to Europe, and eventually became a global crisis after recessions in individual countries became synchronized (Soludo, 2009).

The remaining part of the paper is structured as follows: Relevant literature is reviewed in section two. The methodology of the paper is expounded in section three. Results are presented and discussed in section four. Finally, concluding remarks are presented in section five.

Literature Review

The review of related literature for this paper is done under two divisions. The first division focuses on the theoretical framework, where theories underpinning the empirical analysis of the paper are discussed, while empirical studies that are related to the paper are examined under the second division.

Theoretical Literature

There are three main theories underpinning the empirical analysis of this paper. The first theory is the export-led growth theory which shows that exports function as an engine of growth, in that increased quantity of exports in an economy induces increased growth (World Bank, 1993; Yang, 2008; Alimi, 2012). The theory implies that factors of production such as labour, capital, knowledge and technology are not the only determinants of growth. Basically, economic openness is required for the theory to work. As shown under section one, African countries are large exporters whose growth is impacted on largely by international shocks via the trade channel. The key destinations of Africa's exports are the U.S. and China (Jones, 2017; Schneidman & Westbury, 2013). The export-led growth theory therefore explains how U.S. recessions impact on the growth of African countries.

The second theory is the theory of crisis-based shock, which shows that when there is an international crisis, such a recession, the crisis can be transmitted into another country via the trade or financial channel (Chang and Majnoni (2000). Such an international crisis can lead to a trade shock. Kose and Raymond (2001) show theoretically that the macroeconomic performance of African countries as trade-driven economies is substantially affected by such a trade shock relative to a financial shock.

The third theory underpinning the empirical analysis of this paper is the global imbalances theory, which shows that the trade deficits of the U.S. are the trade surpluses of its trade partners, such as African countries (Palley, 2011; Engeni, 2013; Eugeni, 2016). Global imbalances imply that trade imbalances will reflect in the export and import flows between the U.S. and African countries during tranquil and crisis periods, with consequent effects on the current accounts and growth performance of the exporting and importing countries, which means that the theory also explains how U.S. recessions impact on the growth of African countries.

Empirical Literature

International shocks are of various forms and may be classified as follows: (i) Crisis-based versus non-crisis-based shocks (Dornbusch, Park & Claessens, 2000; Baur, 2012; Guesmi, Kaabia & Kazi, 2013; Mendoza, 1995; Shimokawa & Kyle, 2003); and (ii) Fiscal versus monetary shocks (Weyerstrass et al., 2006; Osowski, 2016; Taylor, 1995; Boivin, Kiley & Mishkin, 2010; Endut, Morley & Tien, 2015).

Crisis-based shocks, usually called contagions, are the type of shocks that are associated with negative developments triggered by the behaviour of economic agents, such as the decision of investors to sell their assets in one country due to a crisis in another country, because of changes of their beliefs or expectations regarding the former country. Non-crisis-based shocks are the type of shocks that take place in tranquil periods when there are large and sudden changes in economic fundamentals, such as GDP and inflation. An example is a GDP shock transmitted between trade partners due to trade linkages. Furthermore, fiscal and monetary shocks are the type of shocks associated with fiscal policy variables, such as tax rates, and monetary policy variables, such as interest rates. For example, an interest rate shock in the U.S. can be transmitted into small open economies with large financial links with the country.

For example, the 2007-2009 global recession involved both agent behaviour and economic fundamentals. It was triggered by agent behaviour regarding sub-prime mortgage in the U.S. and developed into international financial and economic crisis that affected agent behaviour and economic fundamentals in all countries (Soludo, 2009). As indicated earlier, shocks that originate from the U.S. usually have significant effects on the macroeconomic performance of other countries. However, such shocks may have varying effects on individual countries based on their policies, including trade policies, and economic structures (Gurara & Ncube, 2013; De Waal, 2014). For example, countries adopting the fixed exchange rate policy may be affected by external shocks more than countries with the flexible exchange rate policy, because the flexibility of exchange rate makes it to absorb shocks effectively (Hoffmaister, 1998).

Methodology

Unit Root Tests

The model employed for the analysis of this paper is the ARDL cointegration model of Pesaran and Shin (1998) and Pesaran, Shin and Smith (2001), which is hereafter referred to as PSS. Basically, the model is a cointegration model that is appropriate when the variables under consideration do not have the same order of integration (i.e. there is a mix of I(0) and I(1) variables). Therefore, the augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root techniques were first employed to examine the stationarity properties of the

variables of the present study. Thereafter, the ARDL model was employed because the results of the unit root tests show that there is a mix of I(0) and I(1) variables.

The Autoregressive Distributed Lag Model

The ARDL of PSS involves testing for cointegration by using the F-test, based on an unrestricted error-correction model (ECM) with both the level and differenced forms of the variable of interest. The unrestricted ECM is described as unrestricted because the error-correction term that restricts by imposing short-run and long dynamics is not included in the model. If cointegration is found to exist based on the unrestricted ECM, a long-run model as well a restricted ECM that correspond to the unrestricted model are specified. Following PSS, the unrestricted ECM of this paper is

$$\Delta lrgdp_{t-1} = \varphi + \alpha lrgdp_{t-1} + \beta usrecessn_{t-1} + \pi lrtrade_{t-1} + \gamma(lrtrade * usrecessn)_{t-1} + \delta(lrexchrt)_{t-1} + \sum_{j=1}^{p-1} \omega_j \Delta lrgdp_{t-i} + \sum_{j=0}^{q-1} \psi_j \Delta usrecessn_{t-i} + \sum_{j=0}^{m-1} \mu_j \Delta ltrade_{t-i} + \sum_{j=0}^{n-1} \sigma_j \Delta(ltrade * usrecessn)_{t-i} + \sum_{j=0}^{z-1} \theta_i \Delta ltrade_{t-i} + \varepsilon_t \quad (1)$$

where rgdp, usrecessn, trade and exchrt point to Nigeria's real GDP, U.S. recession, Nigeria's real total trade as a share of GDP; l and Δ stand for natural log and difference operator; φ, α, β, π γ and δ are scalar long-run parameters; ω, ψ, μ, σ and θ are vector short-run parameters; while ε is the serially uncorrelated error-term.

The number of lags of an ARDL model, such as the one in equation (1), is usually determined by information criteria, such as Akaike and Schwarz information criteria. The cointegration test involves the long-run parameters of equation (1). The test is based on the null hypothesis of no cointegration stated as:

H_0: $\alpha = \beta = \pi = 0$.

The cointegration test involves two bounds of critical values, namely upper and lower bounds. If the calculated F value falls above the upper bound, then cointegration exists. On the other hand, cointegration does not exist if the calculated F value falls below the lower bound. The test is inconclusive if the calculated F value falls between the upper and lower bounds. Further steps are required to determine cointegration when the result of cointegration test is inconclusive.

The long-run equation of the unrestricted ECM of equation (1) is

$$lrgdp_t = \chi + \sum_{j=1}^{p-1} \xi_j lrgs_{t-j} + \sum_{j=0}^{q-1} \varsigma_j (usrecessn)_{t-j} + \sum_{j=0}^{m-1} \upsilon_j (lrtrade)_{t-j} + \sum_{j=0}^{n-1} \kappa_j (lrtrade * usrecessn)_{t-j} + \sum_{j=0}^{z-1} \varrho_j (lrexchrt)_{t-j} + \eta_t \quad (2)$$

where the variables are as defined for equation (1) and η is the serially uncorrelated error-term.

The (restricted) error correction model of the unrestricted ECM of equation (1) is

$$\Delta lrgdp_t = \tau + \sum_{j=1}^{p-1} \zeta_j \Delta lrgdp_{t-j} + \sum_{j=0}^{q-1} \kappa_j \Delta usrecession_{t-j} + \sum_{j=0}^{m-1} \rho_j \Delta(lrtrade)_{t-j} + \sum_{j=0}^{n-1} \varpi_j \Delta(lrtrade * usrecessn)_{t-j} + \sum_{j=0}^{n-1} \tau_j \Delta(lrexchrt)_{t-j} + \phi ECM_{t-1} + z_t \quad (3)$$

where the variables are as defined for equation (1); ECM is the error correction term; and z is the serially uncorrelated error term.

In order to examine how U.S. recessions impact on Nigeria's real GDP with and without trade, an ARDL model with the U.S. recession dummy as the only regressor is first estimated in the analysis. Thereafter, the impact of the trade channel is examined by estimating another ARDL model in which trade is accounted for. Therefore, the regressors of the second model are the U.S. recession dummy, Nigeria's trade, Nigeria's trade multiplicatively interacted with the recession dummy, and Nigeria's real exchange rate (control variable).

Data

The data used for the study span 1981-2019. Information on the data is provided in Table 1 below. The information covers the names of variables and sources of data.

Table 1: The Data of the Study

Variables	**Source of Data**
Nigeria's Gross Domestic Product	World Development Indicators.
U.S. recession	Dummy variable constructed by author that takes value 1 in each of the years of recession in the U.S. and zero otherwise.
Nigeria's trade as share of GDP	World Development Indicators.
Nigeria's nominal exchange rate	World Development Indicators.
Nigeria's CPI inflation	World Development Indicators.

Note: GDP, trade and exchange rate were deflated with CPI inflation; while the years of U.S. recessions are based on the recession dates provided by the country's National Bureau of Economic Research (NBER). According to NBER, within the sample period of this paper (1981 to 2019), the U.S. experienced recessions in 1981, 1982, 1990, 1991, 2001, 2007, 2008, 2009 and 2019.

Results and Discussions

The results of the unit root tests are first presented in Table 2. Thereafter, the results of the ARDL cointegration model are presented. The results of the ARDL cointegration model have three parts. The first part is for the

ARDL cointegration test, which shows whether cointegration exists or not. If there is evidence of the existence of cointegration, the second part of the results should be for the long-run equation, which shows the long-run coefficients. The third part of the results should be for the error-correction model, which shows short-run coefficients and the error-correction term that links short-run and long dynamics. If there is no evidence of cointegration, no long-run equation should be estimated, but a short-run model without the error-correction term can be estimated.

Unit Root Tests Results

Table 2 presents the results of the unit root tests. The results reveal the stationarity properties of the variables under consideration, which guide on the appropriate cointegration model.

Table 2: Unit Root Tests Results

ADF				**PP**		
Variable	ADF Test Statistic	5% Critical Value	Decision	PP Test Statistic	5% Critical Value	Decision
lnrgdp	− 0.978178	− 2.941145	NS	− 0.791306	− 2.941145	NS
D(lnrgdp)	− 6.067743	− 2.943427	I(1)	− 10.31903	− 2.943427	I(1)
lnrtrade	− 1.242459	− 1.950394	NS	− 1.877939	− 1.949856	NS
D(lnrtrade)	− 6.059702	− 1.950117	I(1)	− 11.55596	− 1.950117	I(1)
lnrexchrt	− 1.052372	−1.949856	NS	− 0.962780	− 1.949856	NS
D(lnrexchrt)	− 6.405312	− 1.950117	I(1)	− 6.560491	− 1.950117	I(1)
usrecessn	− 4.084474	− 2.941145	I(0)	− 3.736647	− 2.941145	I(0)
usrecessn*lnrtrade	− 4.039595	− 2.941145	I(0)	− 3.756426	− 2.941145	I(0)

Note: ADF stands for augmented Dickey-Fuller, PP stands for Phillip-Perron, NS stands for "not stationary"; lnrgdp, lnrtrade, lnexchrt, usrecessn and usrecessn*lntrade represent the natural log of real GDP, the natural log of real trade, the natural log of real exchange rate, U.S. recession dummy, the multiplicative interaction of U.S. recession dummy and the natural log of real trade ; while "D" is the first-difference operator.

As shown in Table 2, out of the five variables considered for unit root tests, the U.S. recession dummy and the multiplication interaction of the dummy and real trade are stationary at level form, which means they are I(1). On the other hand, real GDP, real trade and real exchange rate become stationary after they are differenced once, which means that they are I(1). Since there is a mix of I(0) and I(1) variables, the ARDL model is the appropriate model for cointegration analysis. If the variables are all I(1), the vector error-correction model (VECM) is the appropriate cointegration model.

ARDL Bounds Cointegration Test

The results of the ARDL Bounds cointegration test are presented in Table 3 for the ARDL model whose only regressor is the U.S recession dummy as well as for the extended model.

Table 3: ARDL Bounds Cointegration Test Results

Panel A: ARDL model with U.S. recession dummy as the only regressor					Panel B: Extended ARDL model				
F Stat. Value	Level of Sig.	Lower Bound: I(0) Bound	Upper Bound: I(1): Bound	Evidence of Cointegration	F Stat. Value	Level of Sig.	Lower Bound: I(0) Bound	Upper Bound I(1) Bound	Evidence Of Cointegration
1.899459	10%	5.59	6.26	No	7.466037	10%	3.47	4.45	Yes
	5%	6.56	7.3	No		5%	4.01	5.07	Yes
	2.5%	7.46	8.27	No		2.5%	4.52	5.62	Yes
	1%	8.74	9.63	No		1%	5.17	6.36	Yes

As shown in Table 3, cointegration does not exist for the ARDL model whose only regressor is U.S. recession dummy, in that the calculated F value is below the critical values of the lower bound for all levels of significance. On the other hand, cointegration exists for the extended ARDL model, because the calculated F value is above the critical values for the upper bound. This means that there is no long-run relationship between real GDP and the U.S. recession dummy when the dummy is modelled as a regressor without controlling for trade.

Short-Run Equation without Error-Correction Term

Since there is no cointegration for the ARDL model whose only regressor is U.S. recession dummy, no long-run equation that corresponds to the ARDL model could be estimated. However, a corresponding short-run model without an error-correction term was estimated. The results of this short-run model are presented in Table 4.

Table 4: Short-Run Model; dependent variable, Dlrgdp

Variable	Coefficient	Probability
D(lrgdp(-1))	0.086777	0.5822
D(lrgdp(-2))	-0.442706	0.0049***
usrecessn	-0.118792	0.6569
C	0.418289	0.0740*
trend	-0.005645	0.5628

F-statistic: 2.44928	Durbin-Watson stat: 1.968099
Prob(F-statistic): 0.066910	

Note: lnrgdp and usrecessn stand for natural log of real GDP, and the U.S. recession dummy respectively; while *** and * point to statistical significance at 1% and 10% levels respectively. Model was chosen automatically among competing models based on the Akaike information criterion.

As shown in Table 4, the U.S. recession dummy does not have a statistically significant impact on real GDP in the short run. This means that U.S. recessions by themselves do not impact on growth in Nigeria if there no channel for the impact, such as the trade channel. However, the second lag of real GDP has a negative impact of about 44% on its own current value, pointing to an inverse relationship between the second lag and current value.

Long-Run Equation of the ARDL Model

For the augmented ARDL model for which there is evidence of cointegration, it is necessary that long-run coefficients of variables are examined. Hence, the results for long-run equation are presented in Table 5 below.

Table 5: Long-Run Equation of ARDL Model; dependent variable, lrgdp

Variable	Coefficient	Probability
lrtrade	1.402747	0.0017***
lrtrade*usrecessn	-0.105428	0.6605
lrexchrt	-0.059480	0.8121
c	22.372584	0.0000***
@trend	0.176316	0.0000***

Note: usrecessn, lrtrade, and lrexchrt stand for the U.S. recession dummy, log of real trade, and log of real exchange rate respectively; while *** points to statistical significance at 1% level of significance. Model was chosen automatically among competing models based on the Akaike information criterion.

As Table 5 shows, trade has a statistically significant impact of about 140% on GDP in the long-run. The multiplicative interaction of the recession dummy and trade tends to have a negative impact on GDP in the long-run, but the impact is not statistically significant. This means that U.S. recessions tend to reduce growth through the trade channel in the long-run, but the impact is not statistically significant. This shows that trade is indeed influential on GDP in the long-run and that the impacts of U.S. recessions do not superimpose the impact of trade in the long-run. The table also shows that real GDP has an increasing trend in the long-run.

Error-Correction Model of ARDL Model

It is also necessary that the short-run coefficients and the coefficient of the error-correction term are examined for the augmented ARDL model for which there is evidence of cointegration. Hence, the results of the error-correction model are presented in Table 6.

Table 6: Error-Correction Model of ARDL Model; Dependent Variable, Dlrgdp

Variable	Coefficient	Probability
D(lrgdp(-1))	0.031173	0.8060
D(lrgdp(-2))	0.678249	0.0002***
D(lrgdp(-3))	0.226872	0.0874*
D(lrtrade)	0.514323	0.0001***
D(lrtrade(-1))	0.498705	0.0008***
D(lrtrade(-2))	-0.264055	0.0437**
D(lrtrade(-3))	-0.235838	0.1267
D(lrtrade*usrecessn)	-0.003238	0.9530
D(lrtrade*usrecessn(-1))	0.138711	0.0238**
D(lrtrade*usrecessn(-2))	0.053387	0.3975
D(lrtrade*usrecessn(-3))	-0.103892	0.0641*
D(lrexchrt)	0.285275	0.0077
D(lrexchrt(-1))	0.204167	0.1975
D(lrexchrt(-2))	-0.418386	0.0010***
D(@trend)	0.076416	0.0107**
ECM(-1)	-0.433403	0.0004***

Note: usrecessn, lrtrade, and lrexchrt stand for the U.S. recession dummy, log of real trade, and log of real exchange rate respectively; while ***, **, and * point to statistical

significance at 1%, 5% and 10% levels respectively. Model was chosen automatically among competing models based on the Akaike information criterion.

As Table 6 shows, the impact of the current value of real trade on real GDP is statistically significant and positive to the tune of about 51%, but the positive impact decreases slightly to about 50% after the first year, after which the impact becomes negative. The negative impact of U.S. recessions on real GDP via the trade channel occurs with a lapse of time in the short-run, in that it is after three years that the multiplicative interaction of the recession dummy and trade has a negative impact. Table 6 also shows that both depreciation and appreciation of the real exchange rate impact positively on real GDP in the short-run, implying that the two forms of exchange rate changes are beneficial, depending on prevailing economic conditions and policy stance.

Conclusions

The paper has reached three main conclusions regarding U.S. recessions and the role of international trade in their transmission into African countries. First, U.S. recessions do not by themselves have negative effects on the economic growth of a typical African country. That is, the recessions do not have negative effects on the growth of the country without the trade channel. Second, when the recessions have negative effects on the growth of the country via the trade channel, the effects only occur in the short-run, albeit with a lapse of time and not instantaneously. This means that the recessions only have effects on the cyclical component and not the long-term trend of the growth of the country. The long-term trend of the growth of the country is therefore driven by its economic structures.

The third conclusion is that trade is very influential in a typical African country, because it has a high and statistically significant positive effect on growth in the long-run, even in the face of U.S. recessions. The long-run is a period of time that is long enough for an economy to adjust to new developments. Hence, the positive effect of trade on growth in the long-run implies that trade has strong footing in a typical African country. This means that African countries could benefit maximally from trade if they reduce the short-run effects of negative shocks from large economies, such as the U.S., by diversifying trade away from them and increasing intra-Africa trade.

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