TRADE OPENNESS AND INFLATION: EMPIRICAL EXPLANATION OF THE NEXUS IN NIGERIA

Musa Abdullahi Sakanko[1], David Joseph[2]

[1]Department of Economics, University of Jos, Plateau State, Nigeria, [2]Economics Department, Badamasi Babangida University Lapai, Niger State, Nigeria

ABSTRACT

Purpose of the study: The study aims is to examine the effect of trade openness on inflation rate in Nigeria.

Methodology: Time series data were collected from secondary sources. EViews10 (statistical software for data analysis) ware employed to analyze the data collected.

Findings: The results revealed a cointegrating and one-way Granger causality between inflation rate, and trade openness. In addition, both the short-run and the long-run results demonstrate a significant and negative relationship between inflation rate and trade openness in Nigeria.

Application: The study is paramount to the government and policymakers in dealing and taking a decision regarding consumer price index and trade openness in Nigeria. We conclude that the government should work towards full diversification and diversion of the economy from oil export, control, and management of the degree of trade liberalization and the extent to which goods enter the country, and the control of money supplied.

Novelty/Originality: The study accorded to debate on the inflation rate, and trade openness in Nigeria looking, at both short-run and long-run effects, before few accessible studies focused on impact, and trade openness was not measured as the value of net export divided by gross domestic product. Finally, the paper contributed to the scanty of the literature.

Keywords: Trade Openness, International Trade, Inflation, ARCH, ARDL Bound Testing.

JEL Classifications: F15, F41, F43, P33, P45, E31, C22.

1. INTRODUCTION

For many decades ago, West Asia and North African peoples; from Yemen to Morocco, have been facing excruciating experience by autocratic tyrant leaderships till the first quarter of 2011 when earthquake of political revolution shaken the system (Teti and Garvasio, 2011). Likewise, dozens of Sub-Saharan African countries whose dictatorial type of their leaders turns public offices to a vacuum villa of hierarchy instead of free and fair elections, in which all citizens have equal rights to participate in forming the governments of their states. Looking at the region from the ethnic perspective, Africa as a continent contains two major divisions: The North Africa Arab and indigenous black Africans, otherwise known as Sub-Saharans. Arab-Africans are often judged as West Asia in the Arabian Peninsula.

Considering the significantly obvious celebrated benefit of international economic integration, no country can therefore afford to isolate itself from the global economy (Haile, 2017), even as the removal of trade barriers and access to the advanced markets have earned developing economies relatively higher national income and hence economic development (Ramzan, Kalsoom & Zareen, 2013). Although international trade is regarded to serve a positive role in rare case, changes in domestic price level with increased participation in international trade unfortunately spells doom for the growth of domestic economy, due to the adverse effect which inflation has on the growth of any economy (Sakanko & David, 2017; Sakanko, Obilkwu & David, 2019).

In Nigeria, it is worthy of note that with decline in trade to GDP ratio (aggregate of export and import as a percentage of GDP) as a measure of trade openness in 1981 from 48.57% in 1980, to 18.17%, there was a swift response in inflation rate, as it rose from 9.97% in 1980 to 20.81% in 1981 (World Development Indicators [WDI], 2018). Similarly, with decline in trade to GDP ratio in the years 1988, 1994, 2012 and 2016 among others from, 19.3% in 1987, 30.5% in 1993, 41.7% in 2011 and 21.2% in 2015, to 16.4%, 20.9%, 34.7% and 18.0% respectively, inflation rate responded positively from 9.7% in 1987 to 61.2% in 1988, from 61.3% in 1993 to 76.8% in 1994, from 10.3% in 2011 to 12.0% in 2012, and from 9.55% in 2015 to 18.55% in 2016 correspondingly (Central bank of Nigeria [CBN], 2017). Furthermore, apart from periods (1987, 1989, 1990, 1995, 1997, 1999, 2007, 2010, 2011 and 2017) in which the inflation rate drops with rise in trade to GDP ratio, as a measure of degree of trade openness, in certain periods a proportionate relationship was observed between trade openness and inflation rate, that is, while certain periods (1991, 1992, 2002, 2003, 2005, and 2008)

---

experienced an increase in the general price level even with the increase in the degree of trade openness, others periods (1996, 2002, 2004, 2006, and 2013) exhibits a decrease in inflation rate with fall in the degree of openness (CBN, 2017; WDI, 2018). This, however, strikes the curiosity strings of whether trade openness really influences inflation rate negatively in Nigeria.

In any economy, inflation creates obvious costs to economic, social, political and other aspects of the country (Haile, 2017). A higher rate of inflation has commonly been observed to have negative effects in any typical economy in form of wastage of substantial resources due to inefficient transactions and speculation, destruction of the basis for rational economic decisions and the damages of the credibility of most of the government policies (Ashra, 2002). It is however obvious that with higher inflation rates the economic growth process is distorted via its reducing effects on domestic propensity to save, which entails the diminishing of people's tendency to save part of their income for future consumption and domestic investments, due to the evaporation of the purchasing power of money income, which ultimately affects economic activities (Haile, 2017).

Though the associated hypothesis has been that the degree of openness of an economy to international trade has a reducing effect on inflation rate, through its celebrated benefit of boosting the level of real output (Haile, 2017), mainly through increased efficiency, better allocation of resources, improved capacity utilization, increased foreign investment (Ojoko, Adejumo, Adekanye, Victor & Obi-Egbedi, 2014), and indirectly through the availability of cheaper imports, cheaper inputs and foreign competition, which also reduce the cost of production, however, the issue which follows has cast a doubt on the possibility of trade openness changing inflation in the way it was expected (Haile, 2017), as fiscal, monetary and structural tools lose their control over inflation with increased openness of an economy to international trade (Ramzan, Kalsoom & Zareen, 2013). This is as trade openness takes different forms with inflation due to various structural and country-specific factors (Haile, 2017), such as fluctuations in exchange rate, foreign investment inflows and Balance of Payments (BoP), domestic interest rate, among others (Sakanko & David, 2017; Sakanko, Obilikwu & David, 2019). However, there is no unique agreement on the interaction between higher trade openness and inflation.

Unfortunately, in Nigeria, a study on inflation and trade openness are very scanty. The only accessible study is that of Ojoko, Adejumo, Adekanye, Okoruwa & Obi-Egbedi (2014), which used the VECM approach to investigate the effect of trade openness on inflation in Nigeria during the period 1970 – 2010. The authors discovered the presence of co-integrating (long-run) relationship between trade openness and inflation in Nigeria. In addition, and the insignificant proportionate relationship was discovered between inflation and trade openness in Nigeria in the short- and long-run.

Indisputable, considering the scanty nature of studies regarding trade openness and inflation in Nigeria, the nature of the relationship between inflation and trade openness have been hard to understand. The study of Ojoko et al. (2014) being the only accessible research on trade openness and inflation in Nigeria is unable to ascertain the exact nature of their relationship due to the use of inappropriate estimation model. The result from the VECM been statistically insignificant, it cannot be used in making an inference or make a valid judgment on the nature of the relationship. In addition, though the unit root test was conducted, important post estimation tests of autocorrelation, heteroscedasticity, normality, and stability were ignored. In essence, this study will fill the gap by estimating the relationship between trade openness and inflation in Nigeria employing the appropriate model and conducting all the important tests and diagnostics (unit roots test, autocorrelation test, stability tests, etc.). Furthermore, this study will expand the scope of the study from 1980 – 2018 in other to capture the current changes in Nigeria's general price level and trade openness.

2. LITERATURE REVIEW

This study was built on the neoclassical theoretical framework because the theory assumed absent of government intervention, rational, profit and utility maximization, and perfect information. The forces of demand and supply are treated as a driver of the economy and advocate for economic liberalization or openness which increases competition, hence economic growth and development. On the one hand, due to the absence of a universally agreed theoretical definition and measure (Kızılgöl & İpek, 2014), the concept of trade openness in economics is used to explain the extent to which countries are integrated with others, and whether inward or outward-oriented economic policies are applied intensively (Saçık, 2009, cited in Kızılgöl & İpek, 2014). In its simplest form, trade openness can be referred to as the level at which countries or economies allow or trade with other countries or economies of the world (Yakubu, 2016). According to Bowdler & Malik 2005, cited in Yakubu (2016), it entails the degrees to which countries or economies permit or have trading activities with other countries or economies, including import and export, foreign direct investment (FDI), borrowing and lending, and repatriation of funds abroad. Trade openness indicates the relative importance of international trade in the economy of a country. In essence, being the aggregate value of goods and services in international trade, and the reflection of the integration of countries into the world economy (Yakubu, 2016), trade openness may, however, be seen as an indicator of the degree of globalization of an economy.

On the other hand, inflation in economics simply implies the persistent and sustained increase in the general price level of goods and services in an economy over a time period (Wikipedia, 2019). It is also the quantitative measure of the rate at which the average price level of a selected basket of goods and services in an economy increases for a period (Chen, 2019). Likewise, as prices rise, a single unit of currency loses value as it buys fewer goods and services.

Furthermore, the high rates of inflation caused by an excessive growth of the money supply (Barro & Grilli, 1994), through excess demand to supply (demand-pull), increased prices of production (cost-push), which may lead to an increased in labour wage due to increase in price of goods and services (Chen, 2019), usually has both negative and positive effects on economies, in form of hoarding, social unrest and revolts, hyperinflation (Wikipedia, 2019), inefficiency in resource allocation, reduction of unemployment due to nominal wage rigidity (Mankiw, 2002), encouragement of loans and investment instead of money hoarding, and avoidance of the inefficiencies associated with deflation (Chen, 2019). However, the implementations of monetary policy measures, which entails the actions of monetary authorities and financial regulators of an economy in determining the size and growth on money supply, through the setting of interest rates, open market operations, and through the setting of banking reserve requirements (Taylor, 2008), has the ability to keeping the inflation rates in check (Chen, 2019), within permissible limits and keep the economy running smoothly.

Though different measures of trade openness exist due to non-availability of perfect single measure of trade openness in the literature, the ratio of trade to Gross Domestic Product (GDP) has come to be used by most researchers as the best proxy for trade openness (see Salimifar, Razmi & Taghizadegan, 2015; Ramzan, Kalsoon & Zaren, 2013, Haile, 2017; Ojoko, et al, 2014; Yakubu, 2016; Saçık, 2009, cited in Kızılgöl & İpek, 2014). The trade to GDP ratio measure entails the dividing of the aggregate value (sum) of imports and exports over a period of time by the gross domestic product for the same period. Although called a ratio, it is actually expressed as a percentage. The measure is given as:

$$\text{Trade Openness} = \frac{\text{Export+Import}}{\text{Gross Domestic Product (GDP)}} \qquad [1]$$

Similarly, Inflation is measured in several ways depending upon the types of goods and services considered. The inflation rate, the percentage change of a price index over time is most widely computed by calculating the movement or change in a price index, typically the Consumer Price Index (CPI). Although GDP implicit deflator is also used to measure inflation, it is less preferable because it excludes the prices of imported goods, which the CPI captures (Yakubu, 2016).

Empirically, numerous studies have been conducted from a different perspective, including, regional, spatial, level of development, and indebtedness, in other to determine the nature of the correlation between trade openness and inflation.

Certain studies have studied the relationship between trade openness and inflation from cross-country perspectives. For example, Salimifar, Razmi & Taghizadegan (2015) employed the Autoregressive Distributed Lagged (ARDL) model to determine the relationship between trade openness size and inflation in Iran during the period 1973 – 2010. The authors discovered the presence of a significant negative relationship between the openness of the Iranian's economy and inflation rate. Although the authors employed the data for non-oil income, as against oil income, due to the dependence of Iran's economy on receipts from oil export, which has tendencies to induce inflation. Similarly, Ramzan, Kalsoom & Zareen (2013) employed Pearson's correlation and OLS to examine the relationship between inflation and trade openness in Pakistan during the period 1970 – 1971 and 2008 – 2009. The result indicates the presence of a negative relationship between trade openness and inflation. In Pakistan, Mukhtar (2010) used multivariate co-integration and Vector Error Correction Model (VECM) to empirical investigates the validity of Romer's hypothesis, within the period 1960 – 2007. From the results, the author discovered the presence of a negative long-run relationship between trade openness and inflation in Pakistan, which confirms the existence of Romer's hypothesis in Pakistan. The study of Rangkakulnuwat & Thurner (2017) for Thailand also corroborates with this finding.

In contrast, Sahu & Sharma (2018) used Autoregressive Distributed Lag (ARDL) bounds testing approach in India and found a significant positive relationship between inflation and trade openness, both in the short- and long-run. Similarly, Zombe, Daka, Phiri, Kaonga, Chibwe & Seshamani (2017) employed the Toda-Yamamoto approach and discovered a significant positive relationship between inflation and trade openness in Zambia. In India, Kumar, Kapoor & Poddar (2014) result revealed a significant positive relationship between trade openness and inflation rate. In addition, Munir & Kiani (2011) investigation in Pakistan showed a significant and positive relationship between inflation and trade openness, which therefore rejects the existence of Romer's hypothesis in Pakistan.

Similarly, few studies also considered countries within the same region such as developed and developing, Africa, Asia, OECD, America, Caribbean, etc. For instance, Syed (2012) employed GMM to examine the relationship between openness and inflation in 158 countries (23 industrially developed and 135 developing countries). The results show that increased trade openness has a negative impact on the inflation rate in developed countries, and a significant positive relationship in developing countries. In addition, the author also discovered the presence of a significant inverse relationship between inflation and trade openness in Europe, Latin America and Asia & Pacific, and a proportionate relationship in Africa. Similarly, Sachsida and Mendonça (2015) found a negative relationship between inflation and trade openness in 7 distinct groups (Africa, North and Central America, South America, Asia, Europe, Oceania, countries pertaining to the OECD) using modern panel data techniques. The result obtained gave empirical support to Romer (1993) hypothesis, due to the significant and negative relationship between inflation and trade openness. Lin (2010) also established an inverse relationship between trade openness and inflation for 106 countries for the period 1970 – 2007.

Furthermore, Lin, Mei, Wang and Yao (2017) investigated the effect of trade openness on inflation with panel data from Sub-Saharan African countries. Employing Instrumental Variable (IV) techniques, the authors observed the presence of a robust and strong inverse relationship between inflation and trade openness in Sub-Sahara Africa. Examining the nature of relationship based on the independence of the central bank, the authors discovered the presence of a positive relationship between trade openness and inflation in countries with high Central Bank independence, as against countries with low central bank dependence in which a robust inverse relationship was discovered. This is however in contrasts with the findings from the study of Lotfalipour, Montazeri, and Sedighi (2013) on the economy of the Middle East and North Africa (MENA) countries, during the period 1990 – 2010, in which significant positive relationship between inflation and trade openness was observed.

Equally, Kurihara (2013) examined the relationship between the inflation rate and trade openness in Asian and OECD countries. The author discovered the presence of a significant proportionate relationship between inflation and trade openness in Asian and OECD countries and an inverse relationship in Japan. Similarly, Munir, Hasan and Muhammad (2015) empirically examine the relation¬ship between inflation and trade openness for selected Asian (5 South Asian and 3 South East Asian) economies using panel data for the period of 1976 to 2010. The results show the presence of an insignificant positive relationship between inflation and trade openness in the selected Asian countries in the given time period. Sepehrivand and Azizi (2016) investigate the effect of trade openness on inflation in D-8 Member countries with emphasis on Romer theory. Results from the panel regression model indicate the presence of a significant positive relationship between trade openness and inflation in D-8 countries. Finally, in 8 Caribbean countries, Thomas (2012) as well investigated the validity of Romer (1993)'s main result, over a 30-year period. Using a modern panel data approach, the results showed that trade openness positively influences inflation, which thus and invalidates the Romer (1993) hypothesis in Caribbean countries. This thus entails that Caribbean countries are vulnerable to external shocks.

3. METHODOLOGY

This study employs annual time series data from 1980 – 2017 to examine the relationship between trade openness and inflation rate in Nigeria. Data for inflation rate (measured by annual change in Consumer Price Index), Trade openness (measured by the ratio of aggregate trade to GDP), Oil Price (measured by annual price of Bonny light crude oil), Money supply (measured by growth of money supply), and exchange rate (measured by annual Naira to Dollar exchange rate) were sourced from the Central Bank of Nigeria (CBN)'s Annual Statistical Bulletin (ASB), while data on Per capita income (measured by annual change in real per capita income) was sourced from World Bank's World Development Indicators (WDI).

Due to the scanty nature of study on trade openness and inflation rate in Nigeria, coupled with the absence of universal conformity in the nature in which trade openness impact inflation rate, this study will start by assuming the presence of a negative relationship between trade openness and inflation rate. Empirically, this can be expressed as:

$$lnP_t = a_0 - \delta_1 OPEN_t + \mu_t \qquad [1]$$

Where; lnP denotes the natural logarithm of the change in the domestic price level (inflation rate); $OPEN$ denotes trade openness, which is measured by dividing aggregate trade (sum of export and import) in a period by nominal GDP in same period i.e. $\left(\frac{x+m}{y}\right)$; and a_0, δ, μ and t denotes the intercept, slope coefficient, error term and the number of time series observation. Furthermore, from literature, factors such as money supply,

exchange rate, output growth, and oil prices are assumed to also influence the changes in the price level. In essence, **Equation (2)** transforms to;

$$lnP_t = a_0 - \delta_1 OPEN_t + \delta_2 OilP_t + \delta_3 M_{2_t} + \delta_4 EXCH_t + \delta_5 PcY_t + \mu_t \qquad [2]$$

Where; $OilP$ denotes oil price (the price of Nigerian bonny light crude oil); M_2 is aggregate money supply; $EXCH$ denotes nominal Naira to Dollar exchange rate; PcY is the annual change in real per capita income; and other identities as previously stated.

To empirically estimate the nature of the relationship between trade openness and inflation rate in Nigeria, the Autoregressive Distributed Lagged (ARDL) bound testing technique for co-integration will be employed. The choice of this model is guided by the numerous advantages which it has over other co-integration methods, such as its ability to examine co-integrating relationships regardless of the order of integration of the series, and its use of single reduce form equation which simultaneously estimate the long run and short run parameters of the model coupled with its ability to allow variables have different optimal lags which are not obtainable in other methods (Abu, 2017). The ARDL model to be estimated is specified as follows:

$$\Delta lnP_t = a_0 - \delta_1 \sum_{i=0}^n \Delta OPEN_{t-1} + \delta_2 \sum_{i=0}^n \Delta OilP_{t-1} + \delta_3 \sum_{i=0}^n \Delta M_{2_{t-1}} + \delta_4 \sum_{i=0}^n \Delta EXCH_{t-1} +$$

$$\delta_5 \sum_{i=0}^n \Delta PcY_{t-1} + \gamma_0 lnP_{t-1} + \gamma_1 OPEN_{t-1} + \gamma_2 OilP_{t-1} + \gamma_3 M_{2_{t-1}} + \gamma_4 EXCH_{t-1} + \gamma_5 PcY_{t-1} + \mu_t \qquad [3]$$

Where; Δ is differentiation identity; POV_{t-1} is the lag of the dependent variables; and $\gamma_0 - \gamma_5$ are the coefficient of the lagged undifferentiated (levels) variables in the model, from which the f-statistics used to compare the critical values of the bound test are obtained.

The ARDL technique for co-integrating (long-run) relationship requires that the series used in the model to be integrated of order not more than one (I(1)), as the existence of a second-order integration (i.e., I(2)) of any series (variable) invalidates the use of the ARDL technique, which will as well produce a nonsensical results. The ARDL bounds test is used to test the null hypothesis that no co-integration exists against the alternative hypothesis that co-integration exists, using the computed f-statistic obtained from the levels parameter of the conditional ECM to compare the critical values provided by Pesaran, Shin and Smith (2001) and/or Narayan (2005). As such, when the comput F-statistic is greater than the upper bound (I(1)), we reject the null hypothesis that no co-integrating (long-run) relationship exists between the series. If the F-statistic is less than the lower bound (I(0)), we accept the null hypothesis that there is no co-integration between the series. Furthermore, if the F-statistic falls between I(0) and I(1), our inference would be inconclusive.

It is worthy of note that the presence of correlation between series might not entail the presence of causality among the series. in essence, the presence of correlation between inflation and trade openness (and other variables in the model) might not imply the presence of causality between them. Thus, to test for causality among the series, the Granger Causality test will be employed. To test this, the following VAR (Vector Autoregressive) model corresponding to **Equation (2)** is specified;

$$lnP_t = \alpha_0 + \theta_i \sum_{i=0}^n lnP_{t-i} + \beta_1 \sum_{i=0}^n OPEN_{t-i} + v_{t_1} \qquad [4.1]$$

$$OPEN_t = \alpha_0 + \vartheta_i \sum_{i=0}^n OPEN_{t-i} + \varphi_1 \sum_{i=0}^n lnP_{t-i} + v_{t_2} \qquad [4.2]$$

$$lnP_t = \alpha_0 + \sigma_i \sum_{i=0}^n lnP_{t-i} + \pi_1 \sum_{i=0}^n PcY_{t-i} + v_{t_9} \qquad [4.9]$$

$$PcY_t = \alpha_0 + \omega_i \sum_{i=0}^n PcY_{t-i} + \lambda_1 \sum_{i=0}^n lnP_{t-i} + v_{t_{10}} \qquad [4.10]$$

Where; $v_{t_1} - v_{t_{10}}$ are error correction terms in both model; other identities are as previously specified. In testing the pair-wise causality between the variables in the model, the null hypothesis that the parameters ($\beta_1, \varphi_1 \dots \beta_1$ and λ_1) in the models are jointly equal to zero (i.e. the absence of pair-wise Granger causality among the series) is tested against the alternative hypothesis that there exist Granger causality among the series. The f-statistics obtained from equating the parameters on the left-hand to zero with the corresponding p-value is then used to establish the presence of (non-) causality among the series. for inference, either to accept or reject the existence of Granger causality among the series. Even though the above political shaking remains true but many doubts on the golden value of these particular waves of protests. By the time protests started to pose a real challenge to Zine el-Abidine Ben Ali, few was on the opinion that the revolts may definitely spread to other nearby Arab nations. Hence, the turmoil kicked off and moved to go around across the region: Yemen to Egypt, Jordan and Syria. Of course, many presumed that Arab leaders could be well-arranged and prepared to face the riots aiming

to escape the fate of the Tunisian regime. With huge works executed by the typhoon of the protests, still, they fail to dismiss many autocratic regimes.

4. RESULTS AND DISCUSSION
A. Stationarity Test

In employing the ARDL bound testing technique for co-integrating (long-run) relationship to examine the nature of relationship between trade openness and inflation in Nigeria, it is required that the series entering the model are checked for stationarity (unit root), because series used in ARDL bound testing technique is expected to be integrated of order not more than one (i.e. I(0) or I(1)), thus the existence of a second-order integration (i.e., I(2)) of any series (variable) in estimation invalidates the use of the ARDL technique, as it will produce a nonsensical results. For this purpose, the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) were employed to conduct the unit root test for the series entering the model. The tests compare the null hypothesis of a series "has a unit root" against the alternative hypothesis that the series "does not have a unit root".

Table 1: Result of Unit Root Tests

Variables	ADF	P-P	Order of Integration
P	–5.128101*	–2.952514*	I(1)
$OPEN$	–2.714723***	–2.596581***	I(0)
$OilP$	–5.197228*	–5.197228*	I(1)
M_2	–3.492305**	–3.444046**	I(0)
$EXCH$	–3.303326**	–3.303326**	I(1)
PcY	–3.333352**	–3.498926**	I(0)

Note: * (**) [***] denotes 1% (5%) [10%] level(s) of significance

Source: Authors' computation Using E-views 10

The result presented in **Table 1** shows that while both tests are in conformity with respect to the stationarity status of some series ($OPEN, OilP, M_2, EXCH$ and PcY), there was disagreement among both tests in P. While Philips-Perron (P-P) statistics indicate that P is stationary at levels, Augmented Dickey-Fuller (ADF) statistics shows that P is stationary after first difference. Overall, the series ($P, OPEN, OilP, M_2, EXCH$ and PcY) are a mixture of I(0) and I(1), that is, while $OPEN, M_2$ and PcY are stationary at levels (I(0)), others are stationary after first differencing (I(1)). This, therefore, validates the use of the ARDL bound testing technique to estimate the relationship between the variables.

B. ARDL Bound Testing for Co-integration

From the bound testing results presented in **Table 2**, it is shown that the computed f-statistics (10.61233) exceeds the upper bound (I(1)) at 1%, 5% and even 10% level. This, therefore, indicates that the null hypothesis of no co-integrating (long-run) relationship between inflation rates and trade openness (and oil price, money supply, exchange rate, and per capita income) can be rejected. In essence, we conclude that there exists a significant co-integrating (long-run) relationship among the series.

Table 2: Result from Bound Test

Dependent Variable	Function			$k-1$	F-Statistics
P	$f(P/OPEN, OilP, M_2, EXCH, PcY)$			5	10.61233
Asymptotic critical values					

1%		5%		10%	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
3.06	4.15	2.39	3.38	2.08	3.0

Source: Authors' Computations Using E-Views 10

C. Discussion of Long-Run and Short-Run Model

With the establishment of the presence of co-integrating (long-run) relationship between inflation rate and trade openness (and oil price, money supply, exchange rate and real per capita income), the ARDL model was

estimated. Based on the Akaike Information Criterion (AIC), the optimal lag selection was given as (1,2,2,2,1,1).

The results presented in **Table 3** and **Table 4** represents the long-run and short-run estimates respectively. From the long-run result, it is shown that trade openness impacts inflation rate negatively on a 10 percent significance level. This entails that for a percent increase in the degree of Nigeria's trade openness, the inflation rate will decrease significantly by 99.5%. This result, however, corroborates with findings of (Salimifar, Razmi & Taghizadegan; 2015; Ramzan, Kalsoom & Zareen, 2013; Mukhtar, 2010; Rangkakulnuwat & Thurner, 2017).

Similarly, considering the factors which influences the movement of the general price level (inflation rate), such as the price of crude oil (Bonny light crude oil), money supply, exchange rate, and the real per capita income, while the price of crude oil and real per capita income shows a negative and significant relationship with inflation rate in Nigeria, on a 5% and 1% significance level, growth of money supply and exchange rate poses a significant positive relation with inflation rate on a 1% significance level. In essence, a percent change in the price of crude oil (bonny light crude oil) and per capita income tend to cause the Nigerian inflation rate to decline by 1.8% and 15% respectively. In addition, changes in the growth of money supply in Nigeria and the nominal Naira to Dollar exchange rate will cause the inflation rate to fall by 4.5% and 1.5% respectively.

Furthermore, the short-run results presented in Table 4 shows that trade openness and the factors which are alleged to influence the changes in the general price level explains about 86% of changes in the Nigerian general price level (inflation rate), as shown by the R^2 value in the model. From the short-run result, it is indicated that while the degree of trade openness in current period influences inflation rate negatively and insignificantly, the degree of trade openness in Nigeria in last year (one period past) and inflation rate are positively and significantly related on a 5% significance level. In essence, a percent increase in the past year degree of Nigeria's trade openness will cause the inflation rate to increase by 129.5%. This result is, however, a clear disparity between the results obtained in the long-run estimates.

In addition, the current price of crude oil, growth of money supply in the past year, current exchange rate and current real per capita income poses a significant negative relationship with the inflation rate. This entails that for a percent change in current price of crude oil (bonny light oil), past year growth of money supply, current exchange rate and current real per capita income, inflation rate will decrease (or increase) by 2.9%, 0.4%, 2.3%, 4.5%, and 15% respectively.

The coefficient of the error correction term lagged by one period (ε_{t-1}) is negative, less than 1 and statistically significant, and, therefore meets our expectation. The sign of the coefficient indicates a fast speed of adjustment to equilibrium after a shock, and therefore indicates that approximately 87% of the deviations or disequilibrium in the inflation rate will be corrected within one year.

Though the presence of correlation between inflation rate and degree of trade openness (and oil price, exchange rate, money supply, and per capita income) might not necessarily entail the presence of causality. In essence, considering the Granger causality test, the results presented in **Table 5** shows that we can reject the null hypothesis of non-causality in **Equation (4.2, 4.5 and 4.7)** based on the resultant f-statistics and its corresponding probability values, while we fail to reject the null hypothesis of the absence of causality in other equations. The results establish the presence of one-way causality running from inflation rate to trade openness; money supply to inflation rate; and exchange rate to inflation rate, but not the other way around. This entails that it is inflation rate which Granger causes trade openness, but not trade openness Granger causing inflation rate. Similarly, the exchange rate and money supply are indicated to Granger cause inflation rate.

Table 3: Long-Run Estimates
Dependent Variable: lnP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$Constant$	5.586	1.657	3.370*	0.0036
$OPEN$	−0.995	0.529	−1.879***	0.0776
$OilP$	−0.018	0.009	2.109**	0.0500
M_2	0.045	0.017	2.606*	0.0184
$EXCH$	0.015	0.005	3.006*	0.0079
PcY	−0.1540	0.059	−2.626*	0.0177

Note: *, ** and *** indicates 1%, 5% and 10% significance level
Source: Authors' Computations Using E-Views 10

Table 4: Short-Run Estimates
Dependent Variable: ΔlnP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta OPEN$	–0.140	0.388	–0.361	0.7225
$\Delta OPEN(-1)$	1.295	0.412	3.143*	0.0059
$\Delta OilP$	–0.029	0.009	–3.161*	0.0057
$\Delta OilP(-1)$	–0.002	0.010	–0.192	0.8500
ΔM_2	0.004	0.008	0.488	0.6317
$\Delta M_2(-1)$	–0.023	0.011	–2.101**	0.0509
$\Delta EXCH$	–0.045	0.006	–7.089*	0.0000
ΔPcY	–0.152	0.033	–4.630*	0.0002
ε_{t-1}	–0.872	0.087	–10.025*	0.0000
R^2	0.855			
Durbin-Watson stat	1.93			

Note: *(**) indicates 1% (5%) level of significance; Δ is the first difference operator
Source: Authors' Computations Using E-Views 10

Table 5: Granger Causality Test

Null Hypothesis:	Lags	Obs.	F-Statistic	Prob.
$OPEN$ does not Granger Cause P	2	31	0.32594	0.7248
P does not Granger Cause $OPEN$			3.53071	0.0440
$OilP$ does not Granger Cause P	2	31	0.86920	0.4311
P does not Granger Cause $OilP$			0.14260	0.8678
M_2 does not Granger Cause P	2	31	2.83573	0.0769
P does not Granger Cause M_2			0.63421	0.5384
$EXCH$ does not Granger Cause P	2	31	2.20242	0.1307
P does not Granger Cause $EXCH$			0.45810	0.6375
PcY does not Granger Cause P	2	31	0.84632	0.4405
P does not Granger Cause PcY			0.55478	0.5808

Source: Authors' Computations Using E-Views 10

Results of Diagnostics Tests

The diagnostics results reported in **Table 6** shows that the ARDL model employed passes the diagnostic tests including serial correlation (Breusch-Godfrey & Durbin-Watson stat.), normality (Jaque-Bera), functional form (Ramsey RESET) and heteroscedasticity. In addition, the plot of the Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) (see Figure 1 & 2 in appendix) which lies within the 5% significant lines/critical boundaries, therefore confirms the stability of the model, then mean the model is suited for policy recommendation.

Table 6: Diagnostic Tests

Test Statistics	Result
Autocorrelation: Chi-Sqr(2)	2.150546 (0.3412)
Heteroscedasticity: Chi-Sqr(14)	13.74806 (0.4686)
Normality: Jaque-Bera	0.827994 (0.661003)
Functional Form: Ramsey RESET F-stat (1,16)	5.844515 (0.0279)

Source: Authors' Computations Using E-Views 10

5. CONCLUSION AND POLICY IMPLICATION

This study employed the Autoregressive Distributed Lagged (ARDL) bound testing technique and Granger causality test to examine the nature of the relationship between inflation rate and trade openness in Nigeria from 1980 – 2018 and considering the effect of oil price, money supply, exchange rate and per capita income on the inflation rate. The result from the study indicates the presence of co-integrating (long-run) relationship between inflation rate and trade openness)and oil price, money supply, exchange rate, and per capita income), coupled with the existence of one-way Granger causality running from inflation rate to trade openness; exchange rate to inflation rate; and from money supply to inflation rate. Furthermore, while the long-run result shows that inflation rate is significantly and negatively related to trade openness, oil price, exchange rate, money supply and per capita income, the short-run result therefore indicates the incidence of significant positive relationship

between inflation rate and past year degree of Nigeria's trade openness, coupled with the presence of a significant negative relationship between inflation rate and current crude oil price, past year growth of money supply, current exchange rate, and current per capita income.

With the degree of trade openness influencing inflation rate positively in the short-run by more than 100%, and trade openness impacting on inflation rate by more than 99%, it therefore entails that with more degree of openness of the Nigerian economy in the short-run, without inflationary control measures in place, the domestic price level will rise, due to the behavior of Nigerian towards foreign products at the expense of locally produced products. In addition, the changes in money supply and exchange rate posing a significant negative relationship with inflation in the short-run, and otherwise in the long-run therefore explains the evils of fluctuations in the exchange rate and increase in money supply in an economy.

In essence, the management of the degree of Nigeria's trade openness and the control of the extent to which goods and services move into the control is therefore recommended of the monetary authorities and the central government. To improve the appreciation and worth of the Naira in foreign trade, the central government is charged with the diversification of the Nigerian economy from the archaic crude oil contribution of more than 90% of the Nigerian export basket. In addition, monetary authorities are advised to control the supply of money in the economy as it poses fuels the rise of the general price level.

6. LIMITATION OF THE STUDY

Accessing existing current literature in Nigeria that discusses the correlation between the two studied variables was one of the limitations of this study. The second limitation was in the aspect of data collection, especially the trade openness so stressful and time-consuming.

7. RECOMMENDATION FOR FURTHER STUDY

1. Knowledge is not vacuumed. Therefore, the following are recommended for future study:
2. Effect of trade openness on domestic agricultural out in Nigeria
3. Relationship between trade openness, exchange rate and household final expenditure in Nigeria

REFERENCE

Abu, N. (2017). Does Okun's law exist in Nigeria? Evidence from the ARDL bounds testing approach. *Contemporary Economics,* 11(2), 131-144. doi: 10.5709/ce.1897- 9254.232

Ashra, S. (2002). Inflation and Openness: A Study of Selected Developing Economies Indian Council for Research on International Economic Relations, Working Paper No. 84

Barro, R.J., & David B.G. (1983). A Positive Theory of Monetary Policy in a Natural Rate Model. *Journal of Political Economy*, 9(1), 589-610.

Barro, R. & Grilli, V. (1994). *European Macroeconomics.* London: Macmillan, ISBN 0-333-57764-7.

Central Bank of Nigeria (2017). Central Bank of Nigeria statistical bulletin (Volume 28, December 2016). Abuja: Nigeria

Chen, J. (2019, March 26). Inflation. Retrieved from https://www.investopedia.com/terms/i/nflation.asp

Haile, M.A. (2017). Does Trade Openness Reduce Inflation? Empirical evidence from Ethiopia. Global Journal of Management and Business Research: Economics and Commerce, 17(1), 239 - 249

Jin, J.C. (2006). Openness, growth and inflation - Evidence from south Korean before the Economic crisis. *Journal of Asian Economics, Elsevier,* 17(4), 738-757

Kızılgöl, Ö.A., & İpek, E. (2014). An Empirical Evaluation of the Relationship between Trade Openness and External Debt: Turkish Case. *International Econometric Review,* (IER), 42 – 58

Kumar, N., Kapoor, V., & Poddar, S. (2014). Openness And Inflation: Empirical Evidence From India. *Journal of Business Management & Social Sciences Research* (JBM&SSR). 3(9), 47 – 53

Kurihara, Y. (2013). International Trade Openness and Inflation in Asia. *Research in World Economy, 4(1),* 70 – 75. doi:10.5430/rwe.v4n1p70

Lin, F., Mei, D., Wang, H., & Yao, X. (2017) Romer Was Right on Openness and Inflation: Evidence from Sub-Saharan Africa. *Journal of Applied Economics, 2*0(1), 121-140. DOI: 10.1016/S1514-0326(17)30006-5

Lin, H. (2010). Openness and Inflation Revisited. *International Research Journal of Finance and Economics, 1(37)*, 40 – 45

Lotfalipour, M.R., Montazeri, S. & Sedighi, S. (2013). Trade Openness and Inflation. Evidence from MENA Region Countries. *Economic Insights Trends and Challenges,* II(LXV), 1 – 11.

Mankiw, N.G. (2002). *Macroeconomics (5th ed.)*. Money growth & Inflation. Chicago: University of Chicago Press.

Meyer, T. (2003). The Fallacy of Composition: A Review of the Literature, Discussion Paper of the United Nations Conference on Trade and Development, No. 166.

Mukhtar, T. (2010). Does Trade Openness Reduce Inflation? Empirical evidence from Pakistan. *The Lahore Journal of Economics,* 15(2), 35-50

Munir, S. & Kiani, A.K. (2011). Relationship between Trade Openness and Inflation: Empirical Evidences from Pakistan (1976–2010). *The Pakistan Development Review*, 50(4), 853– 876

Munir, S., Hasan, H., & Muhammad, M. (2015). The Effect of Trade Openness on Inflation: Panel Data Estimates from Selected Asian Economies (1976-2010). *Southeast Asian Journal of Economics, 3(2),* 23-42

Narayan, P. K. (2005). The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics, 37(17),* 1979-1990.

Ojoko, E.A., Adejumo, O., Odunayo, A.J., Okoruwa, V.O., & Obi-Egbedi, O. (2014). Trade Openness and Inflation in Nigerian Economy: A Vector Error Correction Model (VECM) Approach. *Research Journal of Finance and Accounting, 5(21),* 74 – 85

Ramzan, Kalsoom, F., & Zareen, Y. (2013), An Analysis of the relationship between Inflation and Trade Openness. *Interdisciplinary Journal of Contemporary Research in Business, 5(3),* 215 – 229

Rangkakulnuwat, P. & Thurner, P (2017). Trade Openness and Inflation: An Empirical Evidence of Thailand. Proceedings of 76th IRES International Conference, Osaka, Japan, 8th-9th August 2017

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relation¬ships. *Journal of Applied Econometrics, 16(3)*, 289- 326.

Romer, D. (1993). Openness and Inflation: Theory and Evidence. *The Quarterly Journal of Economics, CVIII(4)*, 861 – 903.

Sachsida, A., & de Mendonça, M.J.C. (2015). Inflation and Trade Openness Revised: An Analysis Using Panel Data. Institute for Applied Economic Research – IPEA discussion paper 162.

Sahu, P., & Sharma, N.K. (2018). Impact of Trade Openness on Inflation in India: An Autoregressive Distributed Lag (ARDL) Approach. *The Empirical Economics Letters*, 17(1), 21 – 32

Sakanko, M.A., & David, J. (2017). An Econometrics Analysis of the Determinants of Exchange Rate in Nigeria (1980 - 2016). *European Journal of Business and Management, 9(34),* 22-29.

Sakanko, M.A., Obilikwu, J. & David, J. (2019). Oil Price Volatility and Balance of Payments (BOP): Evidence of Nigeria. *Bingham Journal of Economics and Allied Studies (BJEAS*), 2(3). 69 - 82

Salimifar, M., Razmi, M.J., & Taghizadegan, Z. (2015). A survey of the effect of Trade Openness size on Inflation rate in Iran using ARDL. *Theoretical and Applied Economics,* 22(3), 143 – 154

Sepehrivand, A., Azizi, J. (2016). The Effect of Trade Openness on Inflation in D-8 Member Countries with an Emphasis on Romer Theory. *Asian Journal of Economic Modelling,* 4(4): 162-167

Syed, S.A.S. (2012). Does Greater Economic Openness Grasp The Elements Of Inflation 'Surprise'? New evidence using panel data techniques. *International Economics, 2(130)* 40 – 54.

Thomas, C. (2012). Trade Openness and Inflation: Panel Data Evidence for the Caribbean. International Business & Economics Research Journal, 11(5), 507 – 616.

Taylor, T. (2008). Principles of Economics . Freeload Press. ISBN 1-930789-05-X.

Wikipedia (2019, April 9th). *Inflation*. Retrieved from https://www.en.m.wikipedia.com/wiki/Inflation

Yakubu, M.M. (2016). Impact of Trade Openness on Inflation and Unemployment in Nigeria: 1986-2015 (An unpublished M.Sc. Thesis submitted to Department of Economics, Ahmadu Bello University, Zaria)

Zombe, C., Daka, L., Phiri, C., Kaonga, O., Chibwe, F., & Seshamani, V. (2017). Investigating the Causal Relationship between Inflation and Trade Openness using Toda–Yamamoto Approach: Evidence from Zambia. Mediterranean Journal of Social Sciences, 8(6), 171 – 182. Doi: 10.1515/mjss-2017-0054. https://www.iemed.org/observatori-en/arees-danalisi/arxius-adjunts/anuari/med.2011/Gervasio_en.pdf

Appendix

Figure 1: Plots of the Cumulative Sum (CUSUM) of Recursive Residuals
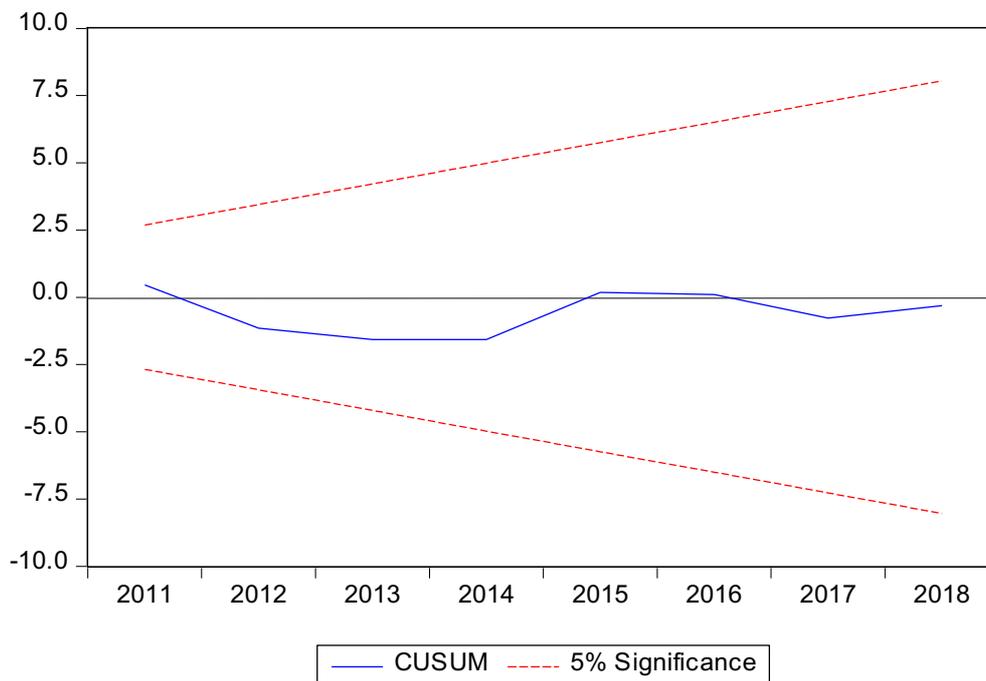
Figure 2: Plots of the Cumulative Sum (CUSUM) of squares of recursive residuals