Research Journal of Finance and Accounting
ISSN 2222-1697 (Paper) ISSN 2222-2847 (Online)
Vol.5, No.21, 2014

Trade Openness and Inflation in Nigerian Economy: A Vector Error Correction Model (VECM) Approach

Ojoko Emmanuel Ada[1*], Adejumo Oyeronke[2], Adekanye James Odunayo[2], Victor Olusegun Okoruwa[2] and Ogheneruemu Obi-Egbedi[2]

1. Department of Agricultural Economics and Extension, Federal University, Dutsinma, Katsina State
2. Department of Agricultural Economics, University of Ibadan, Nigeria

*Email of corresponding author: eojoko@fudutsinma.edu.ng

Abstract
Trade between countries of the world is a vital economic index to be considered. Opening up the economy of a country will not only improve the trade of such a country, but will also affect its inflation rate, which is an important factor for policy decision makers. This study therefore used the VECM approach to investigate the effect of trade openness on the inflation of the Nigerian economy using annual data from 1970 to 2010. A multivariate cointegration test developed by Johansen was used to determine the existence of a long-run relationship among the variables. The results indicate two cointegrating equations at 5% level of significance and one cointegrating equation at 1% level. With the existence of at least one cointegrating vector, the VEC model was applied, which indicates a negative relationship between inflation and trade openness (-1.58) for the Nigerian economy, while the coefficient of the Error Correction Term (-0.91) of the model was significant and negative, which imply that the system corrects its previous period disequilibrium at a speed of approximately 91 percent annually. The results of the Impulse-Response Function (IRF) indicate that the response of inflation to openness shock was significant and positive for only two periods, but negative after the second period and all through the rest of the periods, thereby validating the negative relationship between inflation and trade openness in Nigerian economy.
Keywords: Trade openness, inflation, VECM, Error Correction Term, Impulse-response function, Nigerian.

1. INTRODUCTION

International transactions constitute a substantial fraction of Nigeria's aggregate output. The Nigerian economy in recent years has been characterized by trends towards increased liberalization, greater openness to world trade, higher degree of financial integration, and greater financial development. The increased liberalization and openness have motivated high rate of increases in cross-border capital and direct investment flows (Udegbunam, 2002). According to Afaha *et al* (2012), Nigeria's economic development depends on the prospects of her export trade with other nations. In recent times, the meaning of ''openness'' has become similar to the notion of ''free trade'', that is a trade system where all trade distortions are eliminated (Yanikkaya, 2003). Trade Openness affects economic growth, exports, imports, foreign direct investment (FDI) and remittance of a country.

According to new growth theory, openness reduces inflation through its positive influence on output, mainly through increased efficiency, better allocation of resources, improved capacity utilization, and increased foreign investment (Jin, 2000). A continuous and persistent increase in the general level of prices (inflation) has in several times been characterized by an upsetting impact on economic well-being, since it causes the cost of living to rise and the value of investments to fall (Greenidge and Dacosta, 2009). Inflation which is an important factor for consideration in policy decision making can negatively affects economic development and also creates insecurity in the economy. The behavior of inflation dynamics is a longstanding issue in economics. Imported inflation arises from international trade where inflation is transmitted from one country to the other, particularly, during periods of rising price all over the world (Anyanwu, 1992).

As stated by Afzal *et al*. (2013), two different theoretical views exist as to the effect of openness on inflation. Openness slows down the rate of Inflation according to spillover hypothesis while according to the cost push hypothesis; openness causes a faster rate of inflation. Opening the economy not only improves the trade but it also helps to control the inflation. Bowdler *et al*. (2005) propose two mechanisms through which openness may restrict inflation volatility. The first relates to the collection of seigniorage while the second mechanism relates to the set of markets in which countries participate. They argued that the extent to which governments choose to resolve transitory deficits through temporary changes in seigniorage, as opposed to changes in spending or other tax rates, will affect the volatility of the growth rate of the money supply and hence the volatility of inflation and also that trade can support industrialization through provision of access to larger markets. Burger and Krueger (2003) revealed that trade openness causes an increase in aggregate incomes and thus leads to increase economic growth rates.

However, the effects of trade openness on inflation remain uncertain. This has created a considerable debate both theoretically and empirically. Some studies such as Sachsida *et al.,* (2003), Romer (1993), Gruben and McLeod (2004) proposed a negative relation between trade openness and inflation. The second strand of literature found a positive relationship between trade openness and inflation (Alfaro, 2005; Kim and Beladi, 2005). In spite of various studies both for developing and developed countries, the literature on openness and inflation in Nigeria is almost nonexistent. The rationale of this paper is therefore to empirically examine the effect of trade openness on inflation in Nigeria.

Money and quasi money (M2): Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is frequently called M2;

Official exchange rate (LCU per US$): Official exchange rate refers to the actual, principal exchange rate and is an annual average based on monthly averages (local currency units relative to U.S. dollars) determined by country authorities or on rates determined largely by market forces in the legally sanctioned exchange market.

Trade (% of GDP): Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.

Inflation, consumer prices (annual %): Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a fixed basket of goods and services.

2. A REVIEW OF LITERATURE

The openness of an economy can be defined in various ways, for example, in terms of trade to GDP ratio, lower average tariff barriers, pruned import quotas, export subsidies, no barriers to foreign investment, government procurement policies et cetera. The mechanisms through which openness can affect the inflation outcome could be many; one of these ways is as follows:

According to the 'new growth theory', by Jin (2000), openness is likely to affect inflation through its positive influence on the output, which is likely to ease the pressure on the price. This link could be operating mainly through:

i) Increased efficiency which is likely to reduce costs through changes in the composition of inputs procured domestically and internationally;
ii) Better allocation of resources;
iii) Improved capacity utilization; and
iv) Also increased openness could bring in foreign investment, which if channelled properly could stimulate output growth and correspondingly take further pressure off the price level.

The relationship between inflation and openness are well known and has been discussed widely in the literature. (Okun, 1981; Iyoha, 1973; Kirkpatrick and Nixon, 1977; Romer, 1993; Terra, 1998; Triffin and Grudel, 1962;). However little studies has been carried out in Nigeria on this topic (Okun, 1981; Adelowokan and Maku, 2013;). Okun (1981) postulates that the shocks to the domestic price level due to domestic output fluctuation are likely to ease as the economy opens up.

Ashra (2002) In an empirical analysis of 15 developing economies using panel data for the 1980s and the 1990s, finds that openness variables such as export-to-GDP and import-to-GDP ratio in addition to the usual variables like the rate of growth of money and agricultural output have significant influence on the domestic rate of inflation. He also finds that the impact of openness on inflation is affected by whether an economy is experiencing hyper-inflation and/or whether it is a large economy. However, as the economy opens up, the fiscal and monetary authorities tend to lose their ability to control inflation through fiscal and monetary policies. Fluctuations in the exchange rate, balance of payments (BoPs), and foreign investment inflows tend to have influence on the price and quantity dynamics in the economy in various ways.
Romer (1993) used a Barro-Gorden type of model for a cross section of 114 countries and shows that rate of inflation is inversely related to the degree of openness of the economy. He attributes this finding to the fact that the benefits of a monetary surprise in terms of the gain in real output are smaller the more trade oriented, i.e. open, the economy is. He further argues that openness puts a check on the government's incentive to engage in unanticipated inflation, because of induced exchange rate depreciation. He explained that average inflation rate is lower for smaller and relatively more open economies. In addition, he finds this relationship to be significant,

quantitatively large, and robust. According to him, this is supposed to be because the more open an economy is, the higher the possibility of her prices to come in alignment with the international prices.

Hanif and Batool (2006) modelled the behaviour of inflation by focusing on how more integration with the rest of the world affects inflation in Pakistan economy. While controlling for all the standard theoretical determinants of inflation they find that openness has significant negative impact on the domestic price growth. These results buttressed the Romer (1993) hypotheses that inflation is lower in small and open economies.

Guender and McCaw (1999) show that under discretion the inflationary bias bears an inverse relationship to the elasticity of output supplied with respect to the real exchange rate. The study which highlights the importance of aggregate supply effects on the size of the inflationary bias under discretionary policy-making used a simple model of an open economy that imports a foreign resource input. This theoretical finding is consistent with Romer's (1993) empirical results that point to the existence of a negative association between openness and inflation.

Lane (1997) using the same data set as Romer (1993) also found support for the proposition of negative relationship between inflation and openness. An interesting finding was that the openness effect was stronger when country size was included as the control variable. This, in the author's opinion, suggests that openness is not just working through a terms of trade effect. He argues that the existence of nominal price rigidity and imperfect competition in the non-traded goods sector – and not the terms of trade effect suggested by Romer - account for the inverse relationship between inflation and openness.

Terra (1998) also observed similar evidence in her paper written in response to Romer (1993) but she found the negative relationship between inflation and openness to be significantly influenced by the extent of indebtedness of the country. The paper divided the countries into 4 broad groups according to their level of indebtedness. In her opinion, this was because the 'over-borrowed' countries have less pre-commitment in monetary policy due to which the negative relationship is stronger between inflation and openness among these countries than the others. The argument forwarded by the paper is that consider two countries with the same debt burden, therefore needing the same trade surplus to make the external transfer. Assuming identical price elasticities, the less open economy will need a larger exchange rate devaluation to generate the trade surplus. The devaluation, in turn, further tightens the internal constraint by raising the value of external liabilities in domestic currency; more resources will have to be transferred from private to the public sector. When inflation tax is the major mechanism for this transfer, a higher inflation rate will result. Hence, the less open a country is, the higher its inflation will be during a debt crisis.

Al Nasser *et al.*(2009) On their critical examination of "The Openness-Inflation Puzzle: Panel Data Evidence'' stated that; In models in which the absence of pre-commitment in monetary policy leads to inefficiently high inflation, an important prediction is that more open economies should have lower inflation rates. Their study explores the relationship between trade openness and inflation for 152 countries during the period of 1950-1992. They check the validity of Romer's (1993) main result, that there is a negative link between trade openness and inflation. Their study also tests the Terra's (1998) criticism that the negative relationship between openness and inflation is due to severely indebted countries in the debt crisis period. Their analysis shows that the principal result of Romer still holds in the 1990s, however, Terra's criticism fails to hold in the 1990s as the negative relationship between inflation and openness remains unrestrictive to a subset of countries or specific time period.

Jin (2000) in his analysis of East Asian economies found openness to be an important variable for growth but fiscal policy and foreign price shocks were coming out to be even more important in his analysis, which was based on the time series data for these economies using Vector Auto Regression (VAR) framework.
Several recent studies have presented models in which trade openness can lower inflation by bolstering productivity. Aron and Muellbauer (2002) were of the opinion that evolving trade policy represents a structural break, whose omission can bias the determinants of inflation and output. For instance, the degree of openness is likely to lower the rate of inflation and may alter the influence of the real exchange rate on growth, via the impact on the demand for exports and leakage of demand into imports. According to Cox (2007), greater trade openness and higher trade growth promote more specialization in producing goods with comparative advantage, thus inducing reallocation of resources toward more efficient sectors. Furthermore, Keller (2004) iterated that increasing trade–coupled with rising foreign direct investment–can facilitate international technology diffusion, which fosters productivity growth.

Aron and Muellbauer (2007) observed that the negative effects on the mark-up of increased openness have been

substantially offset by a more depreciated real exchange rate, by lower inflation rates, and more recently, the improvement in the terms of trade. In the short-run, even more important has been the fact that increased trade openness has dramatically lowered import prices and unit labour costs. Given the evidence for remarkably slow adjustment of output prices, this means that in the short-run, increased openness actually raises the mark-up before the longer-term effects of increased competition feed through.

Zakaria (2010) indicated that there was a positive relationship between openness of the economy and inflation in Pakistan. Lartey (2012) showed that openness causes sensitive response in non-tradable goods inflation, and that optimal financial policy changes along with the degree of openness. Evans (2012) indicated that inflationary bias of openness was reduced by the degree of imperfect competition in the domestic market. Kim *et al*. (2012) showed that international trade caused economic growth in high-income, low-inflation, and nonagricultural countries, but had an unfavorable impact on economic growth in countries with opposite attributes.

Manni and Ibne Afzal (2012) shows the relationship between openness and inflation (percentage change of the GDP deflator). It shows that low levels of openness have been identified with high rates of inflation. Between openness levels of about 50% to 150%, the rate of inflation is quite static, but beyond about 190%, the inflation rate increases markedly. As openness increases, the inflationary situation in a country could be reduced or increased. The higher imports to a country consequent to greater openness could reduce the price level in a country as the international price level is expected to be lower than domestic price level for a country like Bangladesh. On the other hand, increased imports could adversely affect the current account balance and consequently depreciate the value of the domestic currency, which could lead to inflation.

Very recently, Adelowokan and Maku (2013) analysed the effect of trade openness and foreign investment on economic growth in Nigeria between 1970 and 2010 that span across the period of Pre-Structural Adjustment Programme (SAP), Structural Adjustment Programme (SAP), Post- Structural Adjustment Programme (SAP) and also the present era of National Economic Empowerment Development Strategy (NEEDS). The study revealed that trade openness, growth rate, previous growth rate, and inflation rate have significant influence on economic growth in Nigeria. The study concludes that trade openness and foreign investments have significant effect on the Nigerian economic growth.

3. MATERIAL AND METHOD

In this study which examines the effect of Trade Openness on Inflation for the Nigerian economy using annual data for 1970-2010. The variables that take place in the model are ordered as: “inf” stands for the inflation, “open” stands for trade openness to foreign trade, “rgdp” stands for the Real Gross Domestic Product, “bd” stands for Budget Deficit, “M2” stands for Money Supply, and “exr” stands for exchange rate. In calculating the trade openness to foreign trade, ((import + export)/GDP) is used. The data used in this research work was gathered from various issues of the Central Bank of Nigeria covering the period from 1970 to 2010 (annual data).

3.1 MODEL SPECIFICATION

In order to test the hypothesis of effect of the degree of openness on the inflation, the following model was estimated:

$$\mathbf{logY} = \beta_0 + \beta_1 [\mathbf{logX_1}] + \beta_2 [\mathbf{logX_2}] + \beta_3 [\mathbf{X_3}] + \beta_4 [\mathbf{logX_4}] + \beta_5 [\mathbf{logX_5}] + \varepsilon$$

Where

Y = Inflation rate (based on Consumer Price Index).

$\boldsymbol{\beta_0}$ = intercept

$\boldsymbol{\beta_1}$ **to** $\boldsymbol{\beta_5}$ = estimation coefficient

$\mathbf{X_1}$ = **OPEN**, this refers to **Openness** of an economy and is captured as Exports and Imports of goods and services as proportion of **percent of** GDP.

$$\textbf{Trade Openness} = \frac{\text{Import + Export}}{\text{GDP}}$$

(As used by Daniels (2006) in his paper “Openness, Centralized Wage Bargaining, and Inflation”).

$\mathbf{X_2}$ = **RGDP** (Real Gross Domestic Product)

$\mathbf{X_3}$ = **BD** (Budget Deficit/ Fiscal Deficit)

$\mathbf{X_4}$ **= M2** (Money Supply)
$\mathbf{X_5}$ **= EXR** (Exchange rate)
$\mathbf{\mathcal{E}}$ = error term

According to Fadli Fizari Abu Hassan Asari*, et al (2011),* Stationarity test, Johansen and Juselius Cointegration test and Vector Error Correction Model (VECM) are stated as:

Stationarity Test: Stationarity of a series is an important phenomenon because it can influence its behaviour. If *x* and *y* series are non-stationary random processes (integrated), then modelling the *x* and *y* relationship as a simple OLS relationship as in equation 2 will only generate a spurious regression.

$$Y_t = \alpha + \beta X_t + \mathcal{E}_t \qquad \textbf{(1)}$$

Time series stationarity is the statistical characteristics of a series such as its mean and variance over time. If both are constant over time, then the series is said to be a stationary process (i.e. is not a random walk/has no unit root), otherwise, the series is described as being a non-stationary process (i.e. a random walk/has unit root). Differencing a series using differencing operations produces other sets of observations such as the first-differenced values, the second-differenced values and so on.

x level	x_t
x 1st – difference value	$x_t - x_{t-1}$
x 2nd – difference value	$x_t - x_{t-2}$

If a series is stationary without any differencing it is designated as I (0), or integrated of order 0. On the other hand, a series that has stationary first differences is designated I (1), or integrated of order one (1). Augmented Dickey-Fuller test suggested by Dickey and Fuller (1979) and the Phillips-Perron test recommended by Phillips and Perron (1988) have been used to test the stationarity of the variables.

Johansen and Juselius Cointegration Test: Johansen and Juselius (1990) procedures uses two tests to determine the number of cointegration vectors: the Maximum Eigenvalue test and the Trace test. The Maximum Eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of r+1 cointegrating relations for r = 0, 1, 2…n-1. This test statistics are computed as:

$$LR_{\max}(r/n+1) = -T * \log(1-\lambda) \qquad \textbf{(2)}$$

Where λ is the Maximum Eigenvalue and T is the sample size. Trace statistics investigate the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variables in the system for r = 0, 1, 2…n-1. Its equation is computed according to the following formula:

$$LR_{tr}(r/n) = -T * \sum_{i=r+1}^{n} \log(1-\lambda) \qquad \textbf{(3)}$$

In some cases Trace and Maximum Eigenvalue statistics may yield different results and Alexander (2001) indicates that in this case the results of trace test should be preferred.

Vector Error Correction Model (VECM): If cointegration has been detected between series we know that there exists a long-term equilibrium relationship between them so we apply VECM in order to evaluate the short run properties of the cointegrated series. In case of no cointegration VECM is no longer required and we directly precede to Granger causality tests to establish causal links between variables. The regression equation form for VECM is as follows:

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{p} \psi_{1i} \Delta X_{t-i} + \sum_{i=1}^{p} \gamma_{1i} Z_{t-i} \qquad \textbf{(4)}$$

$$\Delta X_t = \alpha_2 + \sum_{i=1}^{p} \beta_{2i} \Delta Y_{t-i} + \sum_{i=1}^{p} \psi_{2i} \Delta X_{t-i} + \sum_{i=1}^{p} \gamma_{2i} Z_{t-i} \quad \textbf{(5)}$$

In VECM the cointegration rank shows the number of cointegrating vectors. For instance a rank of two indicates that two linearly independent combinations of the non-stationary variables will be stationary. A negative and significant coefficient of the ECM indicates that any short-term fluctuations between the independent variables and the dependant variable will give rise to a stable long run relationship between the variables. From the VECM equations above, Y_t represents the dependent variable (Inflation), while X_t are the independent variables. Δ is the difference operator, α_1 and α_2 are constants, ψ_1 and ψ_2 are the short-run coefficients, while γ_1 and γ_2 are the error-correction instrument measuring the speed of adjustment from the short-run state of disequilibrium to the long-run steady-state equilibrium.

4. RESULTS AND DISCUSSION:

Table 1: ADF and PP UNIT ROOT TEST RESULTS

Variable	AT LEVEL				AT FIRST DIFFERENCE				Order of Integration
	ADF†	PP†	ADF‡	PP‡	ADF†	PP†	ADF‡	PP‡	
Loginf	-5.4216	-5.4216	-5.3244	-5.3244	-6.4851	-14.1429	-6.4558	-14.4392	I (0)
Logopen	-0.1643	-0.1775	-1.7001	-1.6970	-6.1820	-6.1835	-6.2958	-6.2958	I (1)
Logrgdp	-2.3296	-5.4376	-2.0661	-1.8965	-5.8298	-5.8454	-6.1308	-6.9168	I (1)
Bd	-7.0069	-6.9594	-7.1171	-7.0967	-14.4767	-17.9348	-14.2785	-17.7199	I (0)
logM2	0.1749	0.1071	-2.7591	-1.6574	-4.2730	-4.2451	-4.1614	-4.1291	I (1)
Logexr	0.0272	-0.0784	-2.0714	-2.1851	-5.1070	-5.1038	-5.0513	-5.0506	I (1)

ADF† and PP† = Unit root tests with constant
ADF‡ and PP‡ = Unit root tests with constant and trend
*, ** and *** denote statistical significance levels at 1%, 5% and 10% respectively.

Table 1 above shows the results of the Unit Root test. We considered two different tests: (i) Augmented Dickey Fuller (Dickey and Fuller, 1979) test with the lag length determined by the Schwartz criterion, and (ii) Phillips-Perron (Phillips and Perron, 1988). For both methods, we considered two sets of models, one with constant and the other with constant and trend. The results indicate that Inflation Rate (loginf) and Budget Deficit (bd) were stationary at levels, I(0), while Openness (logopen), Real Gross Domestic Product (logrgdp), Money Supply (logM2) and Exchange rate (logexr) were all stationary at First Difference, I(1).

Table 2: LAG LENGTH SELECTION CRITERION

VAR Lag Order Selection Criteria
Endogenous variables: LOGINF LOGOPEN LOGRGDP BD LOGM2 LOGEXR
Exogenous variables: C
Date: 04/30/14 Time: 12:56
Sample: 1970 2010
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-300.7060	NA	0.412810	16.14242	16.40099	16.23442
1	-96.61540	332.9899*	6.09e-05*	7.295548*	9.105511*	7.939519*
2	-68.98340	36.35790	0.000110	7.735968	11.09733	8.931915

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

We determined the lag length of the unrestricted VAR model consisting of six (6) different lag selection criterions which include Likelihood Ratio (LR), Final Prediction Error Criterion (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). To do this,

we fit an autoregressive model of order 2 (AR 2), generating the above results in table 2, all the lag selection criteria suggest a maximum of 1 lag orders, which was been used for this study.

Table 3: MULTIVARIATE COINTEGRATION TEST RESULTS

Panel A: Trace Statistics					
Null Hypothesis	**Alternative Hypothesis**	**Eigenvalue**	**Trace Statistics** (λ_{trace})	**Critical values**	
				5%	**1%**
Ho : r = 0**	Hi : r = 1	0.763510	150.1174	114.90	124.75
Ho : r = 1*	Hi : r = 2	0.644052	95.32719	87.31	96.58
Ho : r = 2	Hi : r = 3	0.433750	56.07436	62.99	70.05
Ho : r = 3	Hi : r = 4	0.354039	34.46300	42.44	48.45
Panel B: Max-Eigenvalue statistics					
		Eigenvalue	**Maximum Eigen Statistics** (λ_{max})	**5%**	**1%**
Ho : r = 0**	Hi : r > 1	0.763510	54.79025	43.97	49.51
Ho : r ≤ 1*	Hi : r > 2	0.644052	39.25283	37.52	42.36
Ho : r ≤ 2	Hi : r > 3	0.433750	21.61135	31.46	36.65
Ho : r ≤ 3	Hi : r > 4	0.354039	16.60663	25.54	30.34

*(**) denotes rejection of the hypothesis at the 5% (1%) level. Both the trace and maximum eigenvalue test indicate 2 cointegrating equation(s) at the 5% level and 1 cointegrating equation(s) at the 1% level.

We used the Johansen (1991, 1995) test for cointegration which uses two tests to determine the number of cointegration vector: the Maximum Eigenvalue test and the Trace test. Cointegration implies the existence of a long-run or equilibrium relationship between a set of variables. The results of the cointegration test are reported in table 3 above. From the results, both the Maximum eigenvalue, λ_{max} , test and the Trace Statistics, λ_{trace} , tests indicate two (2) cointegrating relation at 5% level and one (1) cointegrating relation at 1% level. We conclude that the existence of at least one cointegrating vector indicates a long-run or equilibrium relationship exists among the variables. Therefore, we will proceed to estimate the VECM model.

Table 4: Vector Error Correction Model (VECM) Estimation Results

The presence of cointegrating vectors between variables indicates a long-run relationship among the variables; therefore, the VEC model can be applied. Structural short and long-run relationships are indicated in VECM estimation (Bulent, 2013).

Cointegrating Eq:	CointEq1
LOGINF(-1)	1.000000
LOGOPEN(-1)	-1.585332 (0.40742) [-3.89116]
LOGRGDP(-1)	-4.014184 (0.50595) [-7.93400]
BD(-1)	0.183367 (0.02845) [6.44451]
LOGM2(-1)	11.33737 (0.93378) [12.1413]
LOGEXR(-1)	-5.742644 (0.91177) [-6.29837]

C	-6.635764					
Error Correction:	D(LOGINF)	D(LOGOPEN)	D(LOGRGDP)	D(BD)	D(LOGM2)	D(LOGEXR)
ECT (-1)	- 0.906810	-0.238168	0.145767	-4.284464	-0.026767	-0.079473
	(0.27671)	(0.09278)	(0.07696)	(2.02926)	(0.01318)	(0.03198)
	[3.27708]	[-2.56704]	[1.89405]	[-2.11134]	[-2.03078]	[-2.48493]
D(LOGINF(-1))	-1.768488	0.216376	-0.121863	2.399229	0.024540	0.061688
	(0.41514)	(0.13919)	(0.11546)	(3.04445)	(0.01977)	(0.04798)
	[-4.25993]	[1.55449]	[-1.05544]	[0.78807]	[1.24098]	[1.28567]
D(LOGINF(-2))	-1.067348	-0.000614	-0.039599	0.286718	0.017061	0.017099
	(0.37443)	(0.12554)	(0.10414)	(2.74585)	(0.01784)	(0.04328)
	[-2.85061]	[-0.00489]	[-0.38026]	[0.10442]	[0.95661]	[0.39513]
D(LOGINF(-3))	-0.353672	0.043020	-0.048994	-1.250891	-0.000372	-0.000463
	(0.24666)	(0.08270)	(0.06860)	(1.80889)	(0.01175)	(0.02851)
	[-1.43383]	[0.52016]	[-0.71416]	[-0.69152]	[-0.03165]	[-0.01624]
D(LOGOPEN(-1))	2.189557	-0.690342	0.428957	-12.76369	-0.035430	-0.240241
	(0.88844)	(0.29789)	(0.24710)	(6.51535)	(0.04232)	(0.10268)
	[2.46450]	[-2.31747]	[1.73599]	[-1.95902]	[-0.83720]	[-2.33961]
D(LOGOPEN(-2))	1.646122	-0.435372	0.236298	-9.183462	-0.056715	-0.184919
	(0.87269)	(0.29260)	(0.24272)	(6.39984)	(0.04157)	(0.10086)
	[1.88626]	[-1.48792]	[0.97356]	[-1.43495]	[-1.36437]	[-1.83335]
D(LOGOPEN(-3))	1.590552	-0.407120	0.145799	-8.696680	0.014855	-0.241387
	(0.82014)	(0.27498)	(0.22810)	(6.01445)	(0.03907)	(0.09479)
	[1.93937]	[-1.48052]	[0.63919]	[-1.44596]	[0.38026]	[-2.54655]
D(LOGRGDP(-1))	4.661299	-1.126694	0.593845	-16.96637	-0.069632	-0.409534
	(1.49358)	(0.50078)	(0.41540)	(10.9531)	(0.07114)	(0.17263)
	[3.12089]	[-2.24986]	[1.42957]	[-1.54900]	[-0.97876]	[-2.37239]
D(LOGRGDP(-2))	3.389502	-0.634419	0.379747	-14.92373	-0.083169	-0.247829
	(1.27775)	(0.42842)	(0.35537)	(9.37036)	(0.06086)	(0.14768)
	[2.65271]	[-1.48084]	[1.06858]	[-1.59265]	[-1.36648]	[-1.67815]
D(LOGRGDP(-3))	2.964028	-0.554525	0.101777	-12.41279	-0.016814	-0.351255
	(1.15445)	(0.38708)	(0.32108)	(8.46610)	(0.05499)	(0.13343)
	[2.56749]	[-1.43260]	[0.31699]	[-1.46618]	[-0.30577]	[-2.63253]
D(BD(-1))	-0.125417	0.013370	-0.019033	0.045385	0.003630	0.008384
	(0.06052)	(0.02029)	(0.01683)	(0.44379)	(0.00288)	(0.00699)
	[-2.07246]	[0.65893]	[-1.13083]	[0.10227]	[1.25923]	[1.19865]
D(BD(-2))	-0.067598	-0.008930	-0.006225	0.067122	0.002614	0.007375
	(0.04088)	(0.01371)	(0.01137)	(0.29982)	(0.00195)	(0.00473)
	[-1.65342]	[-0.65143]	[-0.54750]	[0.22387]	[1.34246]	[1.56068]
D(BD(-3))	-0.037441	-0.015045	-0.003738	-0.011719	0.000814	0.003609
	(0.02605)	(0.00873)	(0.00724)	(0.19103)	(0.00124)	(0.00301)
	[-1.43732]	[-1.72255]	[-0.51597]	[-0.06135]	[0.65643]	[1.19876]
D(LOGM2(-1))	7.117643	-0.103908	0.899107	21.55062	0.515869	0.034647
	(4.43863)	(1.48823)	(1.23449)	(32.5506)	(0.21142)	(0.51301)
	[1.60357]	[-0.06982]	[0.72832]	[0.66207]	[2.43996]	[0.06754]

D(LOGM2(-2))	-9.433698	3.143381	-0.749794	11.02703	0.116670	0.886940
	(5.61091)	(1.88129)	(1.56053)	(41.1475)	(0.26726)	(0.64850)
	[-1.68131]	[1.67087]	[-0.48047]	[0.26799]	[0.43654]	[1.36768]
D(LOGM2(-3))	-4.612728	3.585692	-3.433879	30.69523	-0.068586	-0.377562
	(4.98274)	(1.67067)	(1.38582)	(36.5408)	(0.23734)	(0.57590)
	[-0.92574]	[2.14626]	[-2.47786]	[0.84003]	[-0.28897]	[-0.65561]
D(LOGEXR(-1))	8.406298	0.641471	0.303008	-60.59484	-0.087428	-0.406986
	(2.70243)	(0.90610)	(0.75161)	(19.8182)	(0.12872)	(0.31234)
	[3.11065]	[0.70795]	[0.40314]	[-3.05754]	[-0.67919]	[-1.30302]
D(LOGEXR(-2))	8.425695	-1.317849	0.201711	24.67766	-0.203948	-0.676996
	(2.86662)	(0.96115)	(0.79728)	(21.0223)	(0.13655)	(0.33132)
	[2.93924]	[-1.37111]	[0.25300]	[1.17388]	[-1.49363]	[-2.04334]
D(LOGEXR(-3))	4.976507	1.306789	0.043869	-31.17922	-0.087696	0.134524
	(3.62093)	(1.21406)	(1.00707)	(26.5540)	(0.17248)	(0.41850)
	[1.37437]	[1.07637]	[0.04356]	[-1.17418]	[-0.50845]	[0.32144]
C	-2.649284	-0.165578	0.190424	6.787014	0.096393	0.270771
	(0.87442)	(0.29319)	(0.24320)	(6.41257)	(0.04165)	(0.10106)
	[-3.02975]	[-0.56475]	[0.78300]	[1.05839]	[2.31428]	[2.67920]
R-squared	0.736219	0.715490	0.525915	0.823528	0.591739	0.523630
Adj. R-squared	0.422980	0.377634	-0.037060	0.613968	0.106928	-0.042059
Sum sq. resids	21.63280	2.431961	1.673366	1163.408	0.049083	0.288978
S.E. equation	1.162777	0.389869	0.323397	8.527193	0.055387	0.134392
F-statistic	2.350340	2.117735	0.934171	3.929797	1.220557	0.925649
Log likelihood	-41.91424	-2.575008	4.154488	-113.6424	67.67805	35.76685
Akaike AIC	3.439680	1.254167	0.880306	7.424579	-2.648781	-0.875936
Schwarz SC	4.319413	2.133900	1.760039	8.304311	-1.769048	0.003796
Mean dependent	0.010170	0.109705	0.107939	-0.031065	0.102505	0.066047
S.D. dependent	1.530738	0.494191	0.317566	13.72444	0.058609	0.131652

Determinant resid covariance (dof adj.)	4.33E-06
Determinant resid covariance	3.33E-08
Log likelihood	3.406213
Akaike information criterion	6.810766
Schwarz criterion	12.35308

Note: Standard errors in ( ) & t-statistics in [ ]

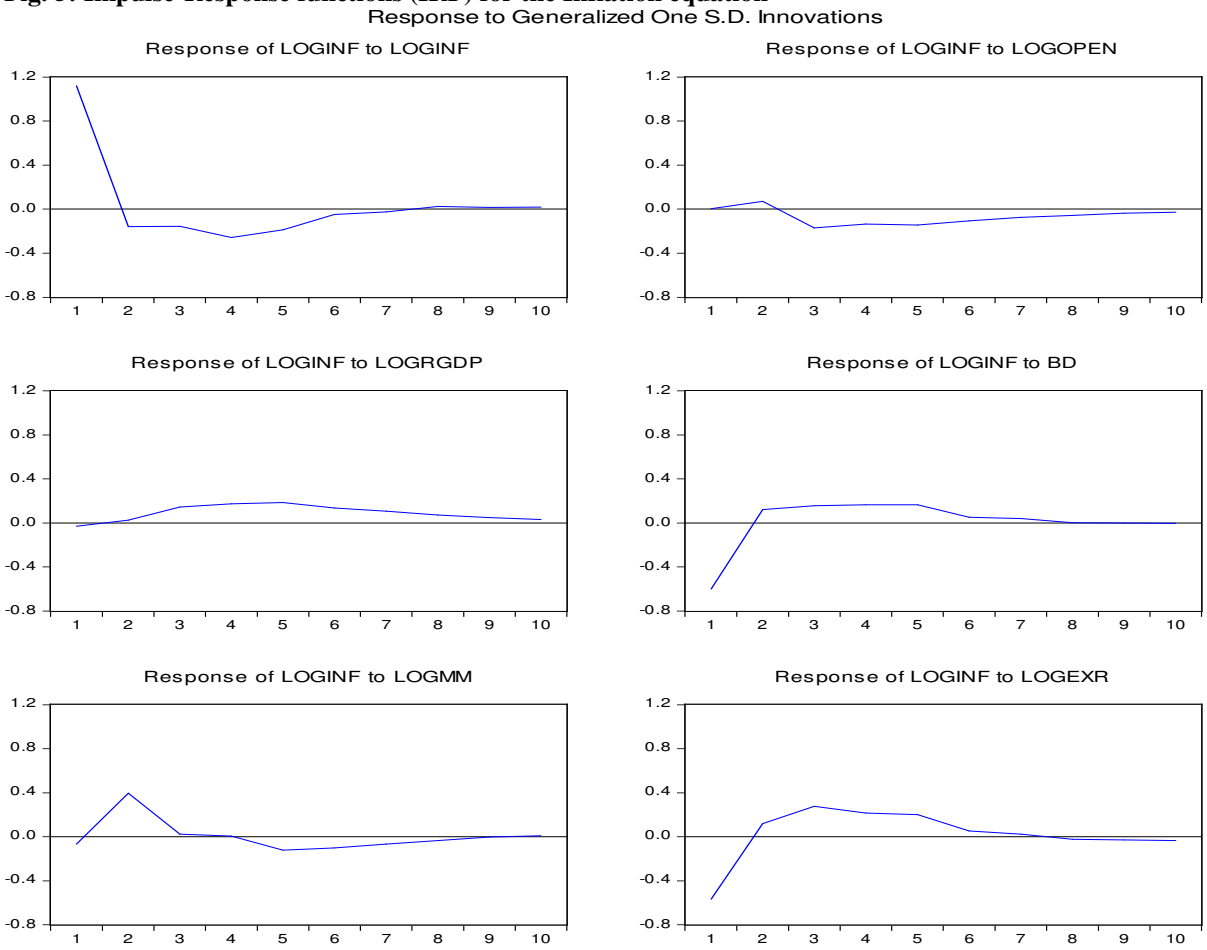
VECM estimation result with two lagged is presented in Table 4 above. The coefficient of the Error Correction Term (ECT (-1)) of the model is -0.91, this implies that the system corrects its previous period disequilibrium at a speed of approximately 91 percent annually. It also implies that almost 91 percent of deviation from the long run equilibrium is smoothed in one year. In line with a prior expectation, the sign of ECT (-1) coefficient is significant and negative, indicating there is a long-run causality from Openness, Real GDP, Money supply, Budget deficit and Exchange rate to Inflation.

The estimation result of the cointegration equation (long-run relationship) at the top of Table 4 indicates that there is a significant long-run relationship between inflation and openness. The result indicates that one percent increase in openness is associated with a 1.58 percent decrease in inflation rate. The relationship between real GDP and inflation is also significant, but the coefficient appears to be large. A one percent increase in real GDP is associated with a 4.01 percent decrease in inflation rate and this is also same for exchange rate with 5.74 percent decrease in inflation rate, while the results for budget deficit (0.18) and money supply (11.34) indicate that one percent increase in budget deficit and money supply is associated with 0.18 percent and 11.34 percent increase in inflation rate respectively.

Our result agrees with the new growth theory which states that openness reduces inflation through its positive influence on output, mainly through increased efficiency, better allocation of resources, improved capacity utilization, and increased foreign investment (Jin, 2000). It also agrees with studies of Sachsida *et al.,* (2003),

Romer (1993), Gruben and McLeod (2004) which proposed a negative relation between trade openness and inflation and that of Aron and Muellbauer (2007), and Kim *et al.* (2012), but disagrees with the studies of Alfaro (2005); Kim and Beladi (2005) and Zakaria (2010) which found a positive relationship between trade openness and inflation.

Fig. 5: Impulse-Response functions (IRF) for the Inflation equation



The Impulse response function shows the responsiveness of the dependent variables in the VAR to shocks in INF, OPEN, RGDP, BD M2 and EXR on each other after one period up to a limit of 10 periods. The solid lines in the figure above represent the Impulse response function in this analysis. Consider for instance, the response of inflation to itself; the initial shock to INF indicates a significant and positive impact on itself up to the second period and then becomes insignificant. After the seventh period the impact changes to positive up to the eighth period and then becomes neutral for the remaining periods. For the response of inflation to openness shock, the impulse was significant and positive only up to the second period and became negative immediately after and all through the rest of the periods.

5. CONCLUSION

In this study, we looked at the effect of Trade openness on inflation for the Nigerian economy using annual time series data for the period 1970 to 2010. We determined the cointegrating vectors, the Vector Error Correction Model (VECM) as well as the Impulse-Response Function (IRF) to find the long run relationship between the variables and the effect of a shock from the endogenous variables to the dependent variable respectively.

Results from this study are in line with the new growth theory which states that openness reduces inflation through its positive influence on output, mainly through increased efficiency, better allocation of resources, improved capacity utilization, and increased foreign investment (Jin, 2000). It also agrees with studies of Sachsida *et al.,* (2003), Romer (1993), Gruben and McLeod (2004), Aron and Muellbauer (2007), and that of Kim *et al.* (2012) which proposed a negative relation between trade openness and inflation. And this was revealed in the Impulse Response Function (IRF), where the response of inflation to openness shock was significant and positive only up to the second period and became negative all through the rest of the periods. We

therefore recommend that the policy makers in Nigeria should allow for more trade openness, so as to reduce the country's inflation over time and also boost the economy for better productivity.

REFERENCES

Adelowokan, O. A. and A.O Maku (2013) Trade Openness, Foreign Investment and Economic Growth in Nigeria: A Long-Run Analysis . *European Journal of Globalization and Development Research, Vol. 7, No. 1, 2013*

Afaha, J. S. and Njogo, B. O. (2012)*:* Trade Openness and its Effect on the Nigerian Economy (1970 -2010). *Arabian Journal of Business and Management Review (Oman chapter) Vol. 2, No.1; Aug 2012*

Afzal, M., Malik, M. E., Butt, A. R., and Fatima, K. (2013): Openness, Inflation and Growth Relationships in Pakistan: An Application of ARDL Bounds Testing Approach. *Pakistan Economic and Social Review*, *51*(1), 13-53.

Alexander, C., 2001. Market models: A guide to financial data analysis. John Wiley & Sons Ltd.

Al Nasser, O. M., Sachsida A and Mario Jorge Cardoso de Mendonca (2009). The openness-inflation puzzle: Panel data evidence. International Research Journal of Finance and Economics, Issue 28.

Alfaro, L. (2005): Inflation, openness and exchange-rate regimes: The quest for short-term commitment. *Journal of Development Economics*, Volume 77, Issue 1, pp. 229-249

Anyawu, J. (1992): "President Babangida's Structural Adjustment Programme and Inflation in Nigeria*"* *Journal of Social Development in Africa* 7(1): 5-24

Aron, J. and J. Muellbauer (2002). Interest rate effects on output: evidence from a GDP forecasting model for South Africa, *IMF Staff Papers* 49: November (2002), 185-213.

Aron J. and J.Muellbauer (2007). Trade Openness and Inflation. A Draft.

Ashra, S. (2002), "Inflation and Openness: A Case Study of Selected Developing Economies," Working Paper 84 of Indian Council of Research on International Economic Relations (ICRIER)

Bowdler, C., & Malik, A. (2005): Openness and inflation volatility: Panel data evidence. *University of Oxford. Working paper*.

Bulent Dogru (2013). Seigniorage Revenue and Inflation Tax in Turkish Economy. Munich Personal RePEc Archive. Gumushane University, Turkey. http://mpra.ub.uni-muenchen.de/45538/

Burger, J. M., and Krueger, M. (2003): A Balanced Approach to High-Stakes Achievement Testing: An Analysis of the Literature With Policy Implications, 7 (4). *IEJLL: International Electronic Journal for Leadership in Learning*, *7*.

Cox, W. M.(2007). Globalization, aggregate productivity, and inflation, Federal Reserve Bank of Dallas Staff Papers, No. 1, 1-24.

Daniels, J. P., Nourzad, F., & van House, D. D. (2006). Openness, centralized wage bargaining, and inflation. *European Journal of Political Economy*, 2284, 969-988. http://dx.doi.org/10.1016/j.ejpoleco.2005.09.001

Dickey, D. A. and Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, Vol. 74, pp. 427-431.

Evans, R.W. (2012). Is openness inflationary? Policy commitment and imperfect competition. *Journal of Macroeconomics*, *34*(4), 1095-1110. http://dx.doi.org/10.1016/j.jmacro.2012.05.002

Fadli Fizari Abu Hassan Asari, Nurul Syuhada Baharuddin, Nurmadihah Jusoh, Zuraida Mohamad, Norazidah Shamsudin and Kamaruzaman Jusoff (2011). A Vector Error Correction Model (VECM) Approach in Explaining the Relationship Between Interest Rate and Inflation Towards Exchange Rate Volatility in Malaysia. World Applied Sciences Journal 12 (Special Issue on Bolstering Economic Sustainability): 49-56, 2011 ISSN 1818-4952.

Greenidge, K., & DaCosta, D. (2009): Determinants of Inflation in Selected Caribbean Countries. *Journal of Business, Finance & Economics in Emerging Economies*, *4*(2).

Gruben, William and Darryl McLeod (2004): The Openness-In.ation Puzzle Revisited. Applied Economics Letters, 465-68.

Guender A.V. and S. McCaw (1999) The Inflationary Bias in a Model of the Open Economy. Department of Economics, University of Canterbury , Christchurch, New Zealand

Hanif, M. N., & Batool, I. (2006). Openness and Inflation: A case study of Pakistan. MPRA Paper, No.10214, University Library of Munich, Germany.

Iyoha, Milton A.(1973). 'Inflation and "Openness" in Less Developed Economies: A Cross-Country Analysis' Economic Development and Cultural Change; 22(1), Oct., p 31-38.

Jin, J. (2000). "Openness and Growth: An interpretation of Empirical Evidence from East Asian Countries," Journal of International Trade and Economic Development, 9, pp5-17.

Johansen, S.(1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Econometrica*, 59, 1551–1580.

------ (1995), *Likelihood-based Inference in Cointegrated Vector Autoregressive Models*, Oxford University Press: Oxford.

Johansen, S. and K. Juselius, 1990. Maximum likelihood estimation and inference on cointegration with application to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2): 169-210.

Keller, W.(2004). International technology diffusion, Journal of Economic Literature, 42, 752-782.

Kim, M and H. Beladi (2005), Is free trade deflationary? *Economics Letters*, Volume 89, Issue 3, pp. 343-349.

Kim, Y. K., Lin, S. C., & Suen, Y. B. (2012). The simultaneous evolution of economic growth, financial development, and trade openness. *The Journal of International Trade & Economic Development*, *21*(4), 513-537. http://dx.doi.org/10.1080/09638199.2010.497933

Kirkpatrick, C.H. and F.I. Nixon (1977). "Inflation and Openness," in Less Developed Economies: A Cross-Country Analysis: Comment' Economic Development and Cultural Change; 26(1), Oct. 1977, pp 147-52.

Lane, P. R. (1997). Inflation in open economies. *Journal of International Economics*, *42*(3-4), 327-347. http://dx.doi.org/10.1016/S0022-1996(96)01442-0

Lartey, E. (2012). Financial openness, nontradable inflation and optimal monetary policy. *Economics Letters*, *117*(3), 782-785. http://dx.doi.org/10.1016/j.econlet.2012.08.043

Manni, U.H and M. N. Ibne Afzal (2012). Effect of Trade Liberalization on Economic Growth of Developing Countries: A Case of Bangladesh Economy. Journal of Business, Economics and Finance: vol 1 issue 1

Okun, A.M. (1981). "Prices and Quantities: A Macroeconomic Analysis," The Brooking Institution, Washington, D.C.

Phillips, P. C. and Peron, P. (1988).Testing for a Unit Root in Time Series Regression. *Biometrica* Vol. 75, pp. 335-346.

Romer, D. (1993). 'Openness and Inflation: Theory and Evidence' *Quarterly Journal of Economics*; *108(4), November, pages 869-903.*

Romer, D. (1993): Openness and Infation: Theory and Evidence..Quarterly Journal of Economics, 869-903.

Sachsida, A., Carneiro, F. G., & Loureiro, P. R. (2003): Does greater trade openness reduce inflation? Further evidence using panel data techniques.*Economics Letters*, *81*(3), 315-319.

Terra, C. (1998). "Openness and Inflation: A New Assessment" The Quarterly Journal of Economics Vol.113, No.2 pp:641-648.

Triffin, R., & Grudel, H. (1962). The adjustment mechanism to differential rates of monetary expansion among the countries of the European economic community. *The Review of Economics and Statistics*, *44*(4), 486-491. http://dx.doi.org/10.2307/1926668

Udegbunam, R. I. (2002): Openness, stock market development, and industrial growth in Nigeria. *The Pakistan Development Review*, 69-92.

Yanikkaya, H. (2003): Trade openness and economic growth: a cross-country empirical investigation. *Journal of Development economics*, *72*(1), 57-89.

Zakaria, M. (2010). Openness and inflation: evidence from the time series data. *Dogus Universitesi Dergisi*, *11*(2), 313-322.