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TRANSMISSION MECHANISM FROM EXCHANGE RATE TO CONSUMER PRICES IN NIGERIA

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ABSTRACT

The paper seeks to establish the transmission mechanism from exchange rate to consumer prices in Nigeria using a recursive vector autoregression (VAR) model. It uses data from first quarter 2000 to fourth quarter 2013.The impulse response results show that exchange rate depreciation is transmitted to consumer prices through a decrease in the final goods and services that are supplied from foreign countries and through an increase in net exports and aggregate demand. The exchange rate depreciation is not transmitted to consumer prices through an increase in the price of the capital goods imported by the manufacturers as inputs. The impact of exchange rate depreciation on consumer prices will be reduced if more capital inputs are imported for the production of the final goods and services in Nigeria.

Keywords: *Transmission mechanism, Exchange rate, Consumer prices, Impulse response.*

1 Introduction

The catalogue of the structural distortions in the economy made Nigeria to embark on structural adjustment programme (SAP) in 1986. Generally, SAP emphasized a comprehensive reform process towards a market economy. With the introduction of the market- based exchange rate system in 1986, the naira exchange rate has exhibited the features of continuous instability, for most of the period, reflecting unidirectional depreciation in the official, bureau de change and parallel markets for foreign exchange (Obadan, 2006). Soludo (1993) in reference to Singh (1986) emphatically stated that even the Chicago and Cambridge Schools of Economics, though differ over their views on the functioning of economic systems, they however agreed that deliberate adjustments of exchange rate is not a suitable method of structural change since such generate inflation.

Even though there is an agreement on the positive exchange rate-inflation nexus by most economists, one is not certain of the channel through which exchange rate depreciation is transmitted to consumer prices in Nigeria. Previous studies in Nigeria indicate that exchange rate depreciation is transmitted to consumer prices only through the aggregate supply shocks. This may or may not be true because exchange rate depreciation may be transmitted to consumer prices through an increase in net exports and aggregate demand. Therefore, demand side argument may also hold. This paper seeks to establish the transmission mechanism from exchange rate to consumer prices in Nigeria.

The paper consists of seven sections. The next section is literature review. Section 3 presents the methodology. The results are discussed in section 4 and section 5 concludes. Section 6 gives an account of the strengths and weaknesses of the work and section 7 provides suggestions for further studies.

2 Literature Review

McCarthy (1999) analyzed the impact of exchange rates and import prices on domestic producer price index (PPI) and CPI in six industrialized OECD countries using data from 1976:1 to 1998:4. He used a recursive VAR framework in his analysis. From the impulse response function and variance decomposition he found that the exchange rate has a modest effect on domestic price over the post-Breton Woods era. Another finding of his paper is that the pass-through is stronger in countries with a large import share.

Mirdala (2014) analyzes exchange rate pass-through to domestic prices in the European transition economies. He estimated VAR model to investigate (1) responsiveness of exchange rate to the exogenous price shock to examine the dynamics (volatility) in the exchange rate leading path followed by the unexpected oil price shock and (2) effect of the unexpected exchange rate shift to domestic price indexes to examine its distribution along the internal pricing chain. To provide more rigorous insight into the problem of exchange rate pass-through to the domestic prices in countries with different exchange rate arrangements he estimates models for two subsequent periods 2000-2007 and 2000-2012. His result suggests that there are different patterns of exchange rate pass-through to domestic prices according to the baseline period as well as the exchange rate regime diversity.

In case of Turkish economy, Leigh and Rossi (2002) consider the time period January 1994-April 2002 and investigate the impact of exchange rate movements on domestic prices using VAR framework. They find that: (1) the impact of the exchange rate on prices is over after about a year, but is mostly felt in the first four months; (2) the pass-through to wholesale prices is more pronounced compared to the pass-through to consumer prices and (3) the estimated pass-through is complete in a shorter time period and is larger than that estimated for other key emerging market countries.

Justel and Sansone (2015) investigate the exchange rate pass-through (ERPT) to different price indices in Chile. The analysis is carried out with vector autoregressive (VAR) model with exogenous variables. Models were estimated using monthly data for Chile from January 1987 to December 2013. Average pass-through ratio to total CPI is estimated to be between 0.1 and 0.2 in the medium term. These results indicate a lower ERPT after the adoption of inflation targeting. Moreover, from 2002 onwards the effect of an exchange rate movement takes around four quarters to pass-through completely compared to one to two years for the full sample.

Frimpong and Adam (2010) examine the effect of exchange rate changes on consumer prices in Ghana using vector auto-regression (VAR) models. They estimated a four-variable VAR (domestic price level, foreign price level, nominal exchange rate and interest rate) using a data set covering the period 1990: Q1-2009:Q2. They find that the exchange rate pass-through to inflation is 'incomplete' and decreasing in Ghana. Their empirical results indicate a low but significant pass-through in the short run.

Madesha, Chidoko and Zaranmoyo (2013) look into the empirical relationship between exchange rate and inflation in Zimbabwe during the period 1980 to 2007. Using granger causality test estimated results reveal that both the exchange rate and inflation have long run relationship. Inflation and exchange rate are found to granger cause each other during the period under consideration.

Mohammed et al (2015) examine the exchange rate pass-through on producer and consumer price indexes in the Algerian economy through an empirical analysis using a vector autoregressive model upon quarterly data for the 2002-2011. The empirical findings show that the consumer price increases in response to an appreciate foreign exchange rates against the Algerian Dinar, while the pass-through of Euro against the Algeria Dinar exchange rate is 'complete' and more increasing in the time horizon compared the pass-through of US dollars/DZ exchange rate. In the contrast the exchange rate pass-through involves a negligible reaction on producer price index (PPI). In the second step of the variance decomposition estimate the magnitude contribution of demand shock to explain CPI and PPI change ranges from 50% and 17% after thirty quarterly respectively, whereas supply shock (oil price) continue to contribute largely to CPI fluctuations (30%) and quite modestly to PPI (5%).

Odusola and Akinlo (2001) apply the restricted vector autoregressive (VAR) model to demonstrate how devaluation impacted on output and prices (inflation) in Nigeria. Quarterly values of real Gross Domestic Product (GDP), broad money supply, official exchange rate, parallel exchange rate, prices (consumer price index; CPI) and lending rates were used in the study for the period 1970.1-1995.4. Quarterly GDP was interpolated through exports given that only annual GDP is published in Nigeria. Evidence from the study revealed that official exchange rate shocks were followed by increased prices, money supply and parallel exchange rate.

Imimole and Enoma (2011) examined the impact of exchange rate depreciation on inflation in Nigeria for the period 1986-2008, using Auto Regressive Distributed Lag (ARDL) Co-integration Procedure. They regressed one year lagged value of inflation rate, current nominal exchange rate of the naira in terms of US dollar, current nominal broad money supply, current government expenditure and real GDP in the current period on current inflation rate. They found that exchange rate depreciation, money supply and real gross domestic product are the main determinants of inflation in Nigeria, and that naira depreciation is positive, and has significant long-run effect on inflation in Nigeria.

Zubair, okorie and Sanusi (2013) use the impulse response from an estimated structural autoregressive model of the inflation process to estimate the dynamic exchange rate pass-through to consumer prices for

Nigeria, using quarterly data for the period 1986-2010. The results suggest that the exchange rate pass-through is incomplete, low and fairly slow. On impact, for instance, the elasticity of inflation to exchange rate changes is about 0.02, and it takes eight quarters to reach its full-impact of only 0.26. The variance decomposition analysis suggests that money supply has contributed more to Nigeria's inflation process relative to the exchange rate.

Ogundipe and Samuel (2013) state that the increasing over dependence of Nigerian economy on imports has necessitated the need to continually examine the effect of exchange rate shocks on consumer prices. They adopt a structural vector autoregressive to estimate the pass-through effect of exchange rate changes to consumer prices. Using the variance decomposition analysis, they found a substantially large exchange rate pass-through to inflation in Nigeria. Their findings show that exchange rate has been more important in explaining Nigeria's rising inflation phenomenon than the actual money supply.

The models specified by previous researchers do not include the two channels through which the impact of a change in money supply is transmitted to exchange rate. So, they could not establish whether the monetary policy shock is transmitted to exchange rate through interest rate channel or the price channel or both. Studies in Nigeria indicate that exchange rate depreciation is transmitted directly to consumer prices only through a decrease in the final goods and services that are supplied from foreign countries. This may or may not be true because exchange rate depreciation may be transmitted indirectly to consumer prices through an increase in the price of the capital goods imported by the manufacturers as input or through an increase in net exports and aggregate demand. So, previous studies in Nigeria have not investigated whether or not the depreciation of exchange rate is transmitted to consumer prices through an increase in the price of the capital goods imported by the manufacturers as inputs. Previous studies in Nigeria have also not investigated whether or not the depreciation of exchange rate is transmitted to consumer prices through an increase in net exports and aggregate demand. This paper contributes to the existing literature by establishing the channels through which the impact of monetary policy shocks are transmitted to consumer prices through the exchange rate.

3 Methodology

3.1 Theoretical Framework of the Study

The quantity theory of money, the purchasing power parity and the money supply and demand framework show how the monetary policy shocks are transmitted to exchange rate. If the money stock rises without a corresponding increase in output, the additional money supply will simply bid up prices based on the quantity theory of money. As the price level rises, the exchange rate depreciates based on the purchasing power parity theory (Chamberlin and Yueh, 2006).

Given the demand for money, the rise in money supply causes a fall in domestic interest rate. The fall in domestic interest rate leads to an increase outflow of short-term finance from the country and a reduce inflow, as depositors seek to take advantage of relatively higher interest rate abroad. The supply of the domestic currency on the foreign exchange market rises and the demand falls. This causes a depreciation of the exchange rate (assuming the authorities allow it) [Sloman, 2006].

Thus, the monetary policy shocks may be transmitted to exchange rate through the price channel or interest rate channel or both. Consequently, this study adopts an approach in which these two channels of the transmission mechanism from money supply to exchange rate are hybridized. As such, the following specification of the VAR which reveals both simultaneity and interaction among the variables that are

closely related to exchange rate and inflation can be stated as in equation (1).

(CPI, MSP, INTR, EXCHR) - - - (1)

Where: CPI = consumer price index representing the price level, MSP is money supply,

INTR = interest rate and EXCHR is exchange rate.

In order to establish the transmission mechanism from exchange rate to consumer price index, this study complements the quantity theory of money, the purchasing power parity theory and the money supply and demand framework with the demand pull and cost push theories of inflation. On demand pull theory of inflation, the depreciation of the exchange rate causes a rise in demand for exports, since they are now cheaper for people abroad to buy. It also causes a fall in demand for imports, since they are now more expensive. The rise in exports and a fall in imports will lead to an increase in net exports and aggregate demand and will cause a multiplied rise in national income (sloman, 2006). But, in a short run, faster real growth may be associated with more rapid inflation. Often, this is because strong growth is the result of a rise in aggregate demand that causes real output to increase at the same time as it bids up prices (Tabi and Ondoa, 2011). Based on the demand pull theory of inflation, the net exports (NEXP) that is also closely related to exchange rate and inflation is included in the VAR model as specified in equation (2).

(CPI, MSP, INTR, EXCHR, NEXP) - - - (2)

In the system of floating exchange rates, exchange rates fluctuations can have a strong impact on the level of prices through the aggregate demand and aggregate supply. On the aggregate supply, depreciation (devaluation) of domestic currency can affect the price level directly through imported goods that domestic consumers pay. However, this condition occurs if the country is the recipient countries of international prices (international price taker). Non direct influence from the depreciation (devaluation) of currency against the price level of a country can be seen from the price of capital goods (intermediate goods) imported by the manufacturers as inputs. The weakening of exchange rate will cause the price of inputs more expensive, thus contributing to a higher cost of production. Manufacturers will certainly increase the cost to the price of goods that will be paid by consumers. As a result, the price level aggregate in the country increases or if it continues it will cause inflation (Achani, Fauzi and Abdullah, 2010). That is as exchange rate depreciates, the import price index increases and an increase in import price index will lead to an increase in producer price index. The increase in producer price index will lead to an increase in wholesale and retail price index and an increase in wholesale and retail price index will lead to an increase in consumer price index. Based on the cost-push theory of inflation, the import price index, producer price index, and wholesale and retail price index that are related to exchange rate and consumer price index are also included in the model as follows:

(CPI, MSP, INTR, EXCHR, NEXP, IPI, PPI, WRPI) - - - (3)

Where: IPI is import price index, PPI is producer price index, WRPI is wholesale and retail price index and all other variables are as previously defined.

3.2 Model Specification

This paper uses an eight variable vector autoregression (VAR) approach following McCarthy (1999) and Leigh and Rossi (2002) to examine the pass-through of exchange rate to consumer prices. The model is summarized in the reduced-form VAR:

$$Y_t = \alpha_0 + \sum_{i=1}^{n} \beta_i Y_{t-i} + U_t \quad \text{- - - (4)}$$

Where Y_t is a 8*1 vector of variables (CPI, MSP, INTR, EXCHR, NEXP, IPI, PPI, and WRPI,); β_i are coefficient matrices of size 8x8 and u_t is the one-step ahead prediction error with variance-covariance matrix Σ, α_o is the intercept. The t is time and i is the lag length.

The VAR methodology deals with several endogenous variables together. But each endogenous variable is explained by its lagged, or past, values and the lagged values of all other endogenous variables in the model; usually, there are no exogenous variables in the model.

Since there are eight variables, the VAR technique is employed because it is very useful in dealing with multivariable causality. Forecasting is an important part of econometric analysis, for some people probably the most important. Vector autoregression has become quite popular method of forecasting economic variables.

As in any standard VAR model analysis, the way the variables enter the model is extremely important for the interpretation of the results. The most appropriate ordering is: CPI - MSP - INTR - EXCHR – NEXP - IPI - PPI - WRPI. The level of CPI has great influence on the amount of money supply. Money supply affects exchange rate indirectly through CPI channel. So, CPI or money supply should come first in the VAR. Money supply affects the exchange rate, possibly indirectly through the interest rate channel. The exchange rate may affect CPI directly. The exchange rate may also affect CPI indirectly through an increase in net exports and aggregate demand or through an increase in import price index, producer price index, and wholesale and retail price index.

3.3 Estimation Method

The VAR model is estimated using e-view 7.0. The time series properties of the data are analyzed using the Augmented Dickey-Fuller (ADF) unit root test of Dickey and Fuller (1979). Test of co-integration are carried out using the Johansen (1988) maximum likelihood procedure. The lag length is to be determined by the likelihood ratio (LR), final prediction error (FPE), Akaike information criteria (AIC), Schwarz information criteria (SC), and Hannan-Quinn information criteria (HQ). The VAR residual portmanteau tests for autocorrelations are used to verify the assumption of no autocorrelation. The inverse roots of autoregressive (AR) characteristic polynomial and VAR residual normality tests are used to verify whether the VAR model satisfy the stability and normality assumptions respectively.

3.4 Data

The empirical analysis is conducted using quarterly data. The time span covered is first quarter 2000 to fourth quarter 2013. The choice of 2000 as the base year is due to the fact that the data of import price index can only be obtained from that year.

The Consumer price index (CPI) of November 2009=100 is used as a measure of consumer prices. The quarterly data of narrow money supply (M_1) is chosen as the measure of money supply rather than broad money supply (M_2), as M_2 includes foreign currency deposits and is therefore, more difficult for monetary authorities to control. The treasury bill rates (average discount rates on 3-month instruments) is the interest rate which is used to reflect changes in the Central Bank's behaviour. Exchange rate data are weighted average nominal exchange rate of the naira per unit of U.S. dollar. The U.S. dollar is used since it is the currency of Nigeria's major trading partner. The annual data of net exports are interpolated into quarterly data series using E-view. The quadratic-match average method of data processing is selected in interpolation. The import commodity price index of January 2007=100 is used as import price index. An average implicit price deflator for agricultural and industrial goods and services is used as a measure of producer price index. Implicit price deflator for wholesale and retail trade is used as a measure of wholesale and retail price index.

The interest rate data are obtained from various publications of Central Bank of Nigeria (CBN) Statistical Bulletin. The data for other variables are obtained from CBN Statistical Bulletin (December, 2013 online edition: www.cbn.gov.ng). The data of all the variables are transformed to logarithms in order to be of the same standard. A plot of the logarithms of exchange rate and CPI is shown in Figure 1. From Figure 1, the naira/dollar exchange rate and CPI have shown a general upward trend for most of the periods.

4 Results

4.1 Unit Root Test and Co-integration Analysis

The ADF test indicates that the logs of the variables are of different order of integration (zero, one and two) at 5 % level of significance (Table 1). So, the co-integration test procedure is conducted. Table 2 reports the results of the Johansen test. Both the trace and maximum eigenvalue tests denote rejection of no co-integration at 5 % level.

4.2 Vector Autoregression (VAR) Estimation

The results of the lag length selection presented in Table 3 reveals that all the five criteria except Schwarz information criterion (SC) indicate 4 lags as the optimal model. Since the logs of the variables are co-integrated, the VAR is estimated in log level with 4 lags based on Akaike information criterion (AIC).

4.3 Diagnostic Tests

A battery of tests was conducted to evaluate the statistical properties of the model. The VAR residual portmanteau tests for autocorrelations shows that the residuals of the VAR model are not correlated. The inverse roots of autoregressive (AR) characteristic polynomial show that at least, one root is equal to 1 which indicates that the VAR model is unstable. However, the VAR model satisfies the normality condition. Having satisfied to some extent the statistical prerequisites, impulse response functions are used to examine the pass-through effects of exchange rate on consumer prices.

4.4 Impulse Response Analysis

The Figure 2 shows the response of variables to monetary policy shocks. The figure 2(a) displays the response of log consumer price index (LCPI) to log money supply. The response of CPI to money supply ranges from zero to 0.014 during the ten periods. The CPI responds positively and significantly with the change in money supply in line with the quantity theory of money that the price level changes directly and proportionately with the change in money supply. The Figure 2(b) presents the response of log interest rate to log money supply. The response of interest rate to money supply ranges from -0.094 to 0.021 during the ten periods. In line with the demand and supply of money framework, interest rate falls as money supply increases.

The Figure 3 presents the response of exchange rate to variables shocks. The Figure 3(a) presents the response of log exchange rate to LCPI. The response of exchange rate to CPI ranges from -0.007 to 0.013 during the ten periods. The positive and significant response of exchange rate to CPI is in line with the purchasing power parity that the change in the nominal exchange rate is directly proportional to the change in the price level. The positive and significant responses of CPI to money supply and exchange rate to CPI indicate that the impact of monetary policy shocks is transmitted to exchange rate through the money-price link. The Figure 3(b) shows the response of log exchange rate to log interest rate. The response of exchange rate to interest rate ranges from -0.004 to 0.003 during the ten periods. This result shows that interest rate does not have any influence on exchange rate. This is because with rising exchange rate, the monetary authority raises interest rate to prevent it depreciating further. This result indicates that the impact of monetary policy shock is not transmitted to exchange rate through the money-interest link.

The Figure 4 displays the response of variables to exchange rate. The Figure 4(a) shows the response of log net exports to log exchange rate. The response of net exports to exchange rate ranges from -0.003 to 0.167 during the ten periods. The net exports respond positively and significantly to exchange rate depreciation. This is because as exchange rate depreciates, exports become cheaper and imports become more expensive. Thus, exports rise and imports fall. The rise in exports and a fall in imports lead to an increase in net exports. The Figure 4(b) presents the response of log import price index to log exchange rate. The response of import price index to exchange rate ranges from -0.003 to 0.064 during the ten periods. The import price index responds positively and significantly to exchange rate. This is because the depreciation of exchange rate causes the price of imported capital inputs more expensive.

The Figure 5 displays the response of producer price index to import price index. The response of log producer price index to log import price index ranges from -0.006 to 0.015 during the ten periods. The producer price index responds positively and significantly with import price index. This is because in an imperfect market, producers will add the mark-ups on prices in order to maintain their profit levels when exchange rate and import price index are increasing.

The Figure 6 presents the response of wholesale and retail price index to producer price index. The response of log wholesale and retail price index to log producer price index ranges from -0.014 to 0.017 during the ten periods. The response of wholesale and retail price index to producer price index is negative. This is because many wholesalers and retailers will simply reduce their mark-ups and profit margins in order to keep the price stable in a perfectly competitive market when exchange rate and producer price index are increasing. The negative response of wholesale and retail price index to producer price index indicates that the impact of exchange rate depreciation is not transmitted to CPI through an increase in the price of the capital goods imported by the manufacturers as inputs.

The Figure 7 shows the response of CPI to variables shocks. The Figure 7(a) displays the response of LCPI to log exchange rate. The response of CPI to exchange rate ranges from -0.002 to 0.010 during the ten periods. The positive response of CPI to exchange rate shows that exchange rate depreciation is transmitted directly to CPI through a decrease in the consumer goods and services that are supplied from foreign countries. The Figure 7(b) presents the response of LCPI to log net exports. The response of CPI to net exports ranges from zero to 0.009 during the ten periods. The response of CPI to net exports is positive. This is because as net exports increase, aggregate demand increases and given aggregate supply, an increase in aggregate demand exerts an upward pressure on the price level. The positive responses of net exports to exchange rate and CPI to net exports indicate that exchange rate depreciation is also transmitted to CPI through an increase in net exports and aggregate demand. So, both the supply side and demand side arguments hold. The Figure 7(c) displays the response of LCPI to log wholesale and retail price index. The response of CPI to wholesale and retail price index ranges from -0.003 to 0.001 during the ten periods. The response of CPI to wholesale and retail price index is negative. This is because many wholesalers and retailers will simply reduce their mark-ups and profit margins in order to keep the price stable in a perfectly competitive market when exchange rate and producer price index are increasing. The negative response of CPI to wholesale and retail price index indicates that exchange rate depreciation is not transmitted to CPI through an increase in the price of capital goods imported by the manufacturers as inputs.

5 Conclusions

The impact of monetary policy shocks is transmitted to exchange rate through the money-price link. The exchange rate depreciation is transmitted directly to consumer prices through a decrease in the final goods and services that are supplied from foreign countries. The exchange rate depreciation is also transmitted to consumer prices through an increase in net exports and aggregate demand. The exchange rate depreciation is not transmitted to consumer prices through an increase in the price of the capital goods imported by the manufacturers as inputs. Thus, the monetary expansion is the main causal factor of the persistent increase in exchange rate and consumer prices in Nigeria. Therefore, if both monetary policy and fiscal policy are well coordinated to prevent excessive monetary expansion, the exchange rate and consumer prices will be stabilized. The impact of exchange rate depreciation on consumer prices will be reduced if more capital inputs are imported for the production of the final goods and services in Nigeria. If this policy is implemented, it will lead to a decrease in net exports and aggregate demand; and an increase in aggregate supply. The consumer prices will fall if aggregate demand decreases and aggregate supply increases.

6 Strengths and Weaknesses of the Work

A supply shock, demand shock and external shock together with domestic price indices are employed in a recursive VAR framework. A VAR model is useful in allowing for endogenous interactions between the exchange rate and other macroeconomic variables. With the use of VAR model, this paper was able to establish the transmission mechanism from exchange rate to consumer prices in Nigeria.

However, the data for wholesale and retail price indices used in this paper are lumped together. The unavailability of a separate data for wholesale price index and retail price index could not enable this paper to track the pass-through effect from wholesale price index to retail price index in transmitting the impact of the aggregate supply shocks to consumer prices. Furthermore, the percentage contributions of aggregate demand and aggregate supply shocks in transmitting the impact of exchange rate shocks to consumer prices in Nigeria have not been established.

7 Suggestions for Further Studies

Since forecasting is in the heart of economic models, such forecasts may be as robust as should be expected by its advocates if the necessary data are made available to implement them. The officially designated data collection and processing institutions in Nigeria should be able to collect separate data on wholesale and retail price indices. If this is done, then, this paper will be able to track the pass-through effect from wholesale price index to retail price index in transmitting the impact of the aggregate supply shocks to consumer prices in Nigeria.

Further studies should establish the percentage contributions of aggregate demand and aggregate supply shocks in transmitting the impact of exchange rate shock to consumer prices in Nigeria. In order to do this, future studies should estimate the variance decompositions of net exports to exchange rate, import price index to exchange rate, producer price index to import price index, wholesale price index to producer price index, retail price index to wholesale price index, consumer price index to retail price index, consumer price index to net exports, and consumer price index to exchange rate.

References

1. Achsani, Noer Azam; Arie Jayanthy F.A. Fauzi and Piter Abdullah (2010), "The Relationship between Inflation and Real Exchange Rate: Comparative Study between ASEAN+3, the EU and North America", *European Journal of Economics, Finance and Administrative Sciences* – Issue 18, 69 – 76.
2. Chamberlin, G. and L. Yueh (2006), *Macroeconomics*, UK: Thompson Learning.
3. Dickey, D. A. and W. A. Fuller (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root, *Journal of the American Statistical Association*, 74, p. 427-431.
4. Frimpong, S. and A. M. Adam (2010), "Exchange Rate Pass-Through in Ghana", *International Business Research, Vol. 3, No. 2*, 186 – 192, April.
5. Imimole, B. and A. Enoma (2011), "Exchange Rate Depreciation and Inflation in Nigeria(1986-2008)", *Business and Economic Journal*, Volume 2011:BEJ-28, Pp 1-12.
6. Johansen, S. (1988), "Statistical Analysis of Co-integrating Vectors", *Journal of Economic Dynamics and Control*, 12, Pp. 231-54.
7. Justel, S. and A. Sansone(2015), "Exchange Rate Pass-Through to Prices: VAR Evidence for Chile", *Working papers of the Central Bank of Chile*, No.747, February.
8. Leigh, D. and M. Rossi (2002), "Exchange Rate Pass-Through in Turkey", *IMF Working Paper, WP/02/2004*.
9. Madesha, W.; C. Chidoko and J. Zivanomoyo (2013), "Empirical Test of the Relationship Between Exchange Rate and Inflation in Zimbabwe, *Journal of Economics and Sustainable Development*, Vol. 4, No. 1.
10. McCarthy, Jonathan (1999), "Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies", *BIS Working paper No. 79*.
11. Mirdala, R. (2014), "Exchange Rate Pass-Through to Domestic Prices under Different Exchange Rate Regimes", *Williams Davidson Institute Working papers*, Number 1070, January, University of Michigan.
12. Mohammed, K. S. et al (2015), "Exchange Rate Pass-Through In Algeria", *Mediterranean Journal of Social Sciences*, Vol. 6, No. 2, March, MCSER Publishing, Rome-Italy.
13. Obadan, M. I. (2006), "Overview of Exchange Rate Management in Nigeria from 1986 to Date", *Bullion: Publication of the Central Bank of Nigeria*, Volume 30, No. 3, July – September.
14. Odusola, A. F. and A. E. Akinlo (2001), "Output, Inflation, and Exchange Rate in Developing Countries: An Application to Nigeria", The *Developing Economies*, XXXIX-2(June 2001): 199-222.
15. Ogundipe, A. A. and E. Samuel (2013), "Exchange Rate Pass-Through to Consumer Prices in Nigeria", *Scientific Papers: Journal of Business Management and Applied Economics*, Vol. II, Issue 4, July
16. Singh, A. (1986), "Tanzania and the IMF: The Analytics of Alternative Adjustment Programme", *Development and Change*, 17(3).
17. Sloman, J. (2006), *Economics*, Sixth Edition, UK: Pearson Education Limited.
18. Soludo, C. C. (1993), "Theoretical Basis for the Structural Adjustment Programme in Nigeria: Two Alternative Critiques", *The Nigerian Journal of Economic and Social Studies*, 35(1): 49-63.
19. Tabi, H. N. and H. A. Ondoa (2011), "Inflation, Money and Economic Growth in Cameroon", *International Journal of Financial Research*, Vol. 2, No. 1, March, www.sciedu.ca/ijfr.
20. Zubair, A.; G. Okorie and A. R. Sanusi (2013), "Exchange Rate Pass-Through to Domestic Prices in Nigeria: An Empirical Investigation" , *Economic and Financial Review*, Volume 51, Number 1, March.

Table 1. Augmented Dickey-Fuller Test

Variables	Levels		First Differences		Second Differences		Order of Integration
	ADF-Statistic	Prob*	ADF-Statistic	Prob*	ADF-Statistic	Prob*	
LMSP	-1.571	0.792	-8.376	0.000	-	-	I(1)
LINTR	-2.879	0.117	-7.991	0.000	-	-	I(1)
LEXCHR	-2.561	0.299	-5.399	0.000	-	-	I(1)
LNEXP	-2.482	0.335	-3.282	0.080	-8.272	0.000	I(2)
LIPI	-3.694	0.031	-9.509	0.000	-	-	I(0)
LPPI	-1.524	0.807	-2.118	0.523	-7.163	0.000	I(2)
LWRPI	-1.420	0.843	-18.544	0.000	-	-	I(1)
LCPI	-3.381	0.065	-7.405	0.000	-	-	I(1)

Test critical values: 1% -4.166
5% -3.059
10% -3.184
*MacKinnon (1996) one sided ρ-values
Source: Author's Computation.

Table 2. Johansen Test for Co-integration Vectors

Hypothesized No. of CE(s)	Trace			Maximum Eigenvalue		
	Trace Statistic	0.05 Critical Value	Prob**	Max-Eigen Statistic	0.05 critical value	Prob**
None*	393.925	159.530	0.000	139.646	52.363	0.000
At most 1*	254.279	125.615	0.000	77.574	46.231	0.000
At most 2*	176.704	95.754	0.000	49.041	40.078	0.004
At most 3*	127.663	69.819	0.000	45.499	33.877	0.001
At most 4*	82.164	47.856	0.000	33.384	27.584	0.008
At most 5*	48.780	29.797	0.000	22.253	21.132	0.035
At most 6*	26.526	15.495	0.001	19.490	14.265	0.007
At most 7*	7.036	3.841	0.008	7.036	3.841	0.008

*denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) ρ-values
Source: Author's Computation.

Table 3. VAR Lag Order Selection

Lag	LR	FPE	AIC	SC	HQ
0	NA	5.36e-12	-3.250	-2.958	-3.137
1	620.585	7.78e-17	-14.414	-11.817*	-13.397
2	127.996	3.08e-17	-15.494	-10.485	-13.562
3	107.043	1.25e-17	-16.866	-9.431	-14.007
4	105.589*	1.64e-18*	-20.081*	-10.175	-16.283*

*indicates lag order selected by the criterion
Source: Author's Computation.

Figure 1. Logarithms of Exchange Rate and CPI

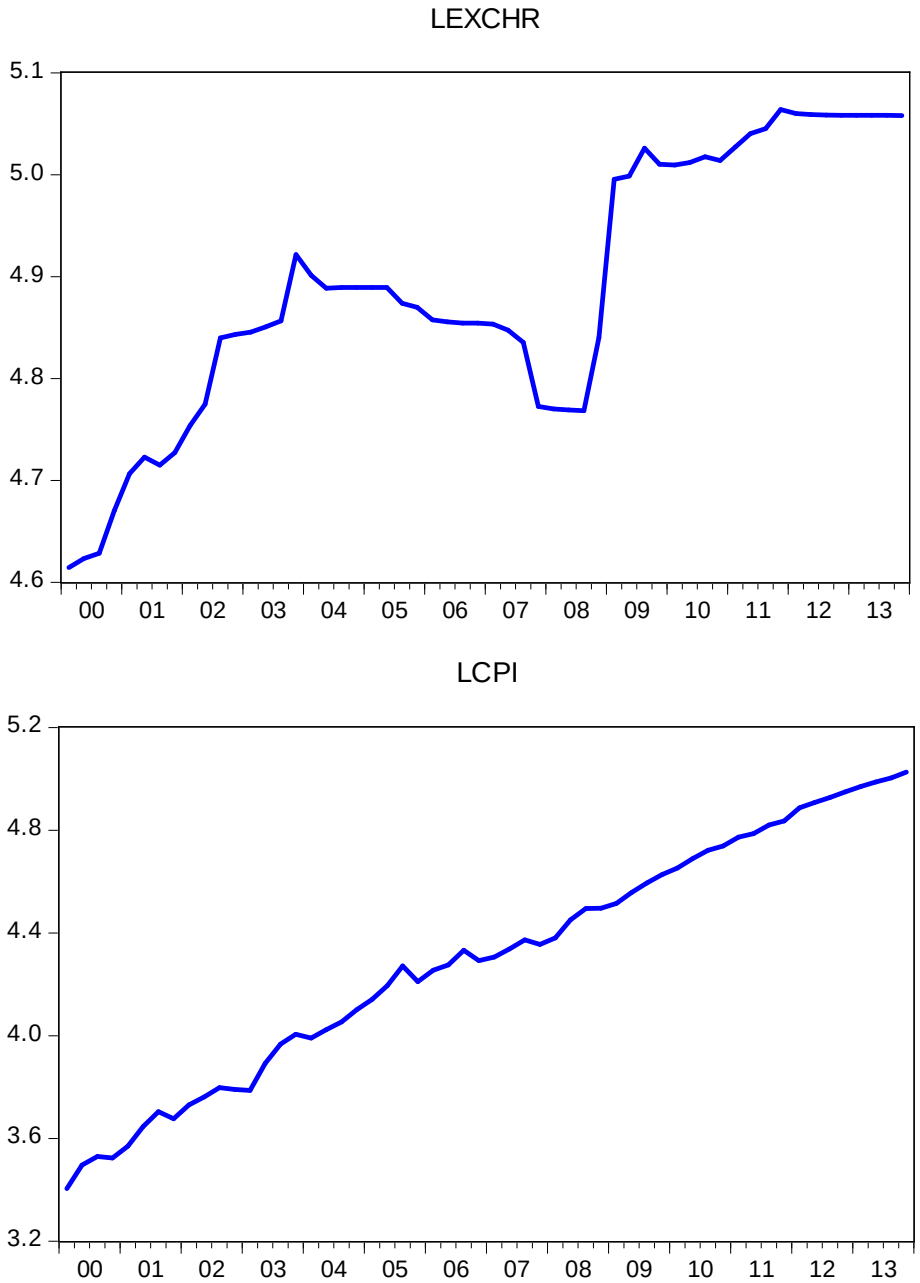


Figure 2. Response of Variables to Monetary Policy Shock

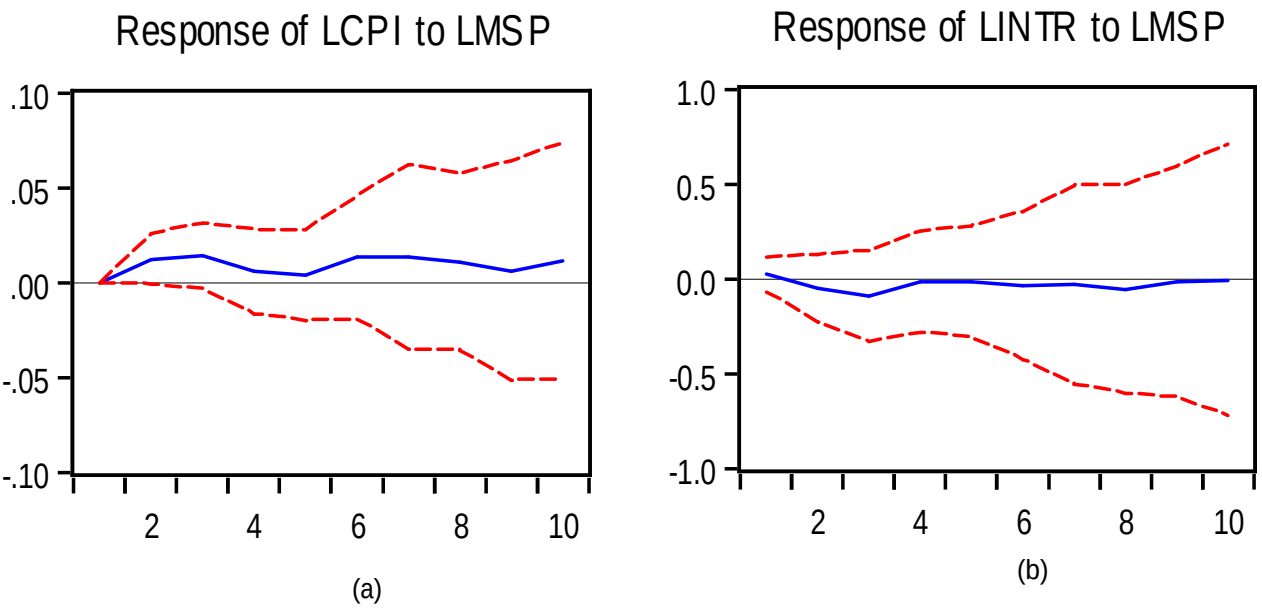


Figure 3. Response of Exchange Rate to Variables Shocks

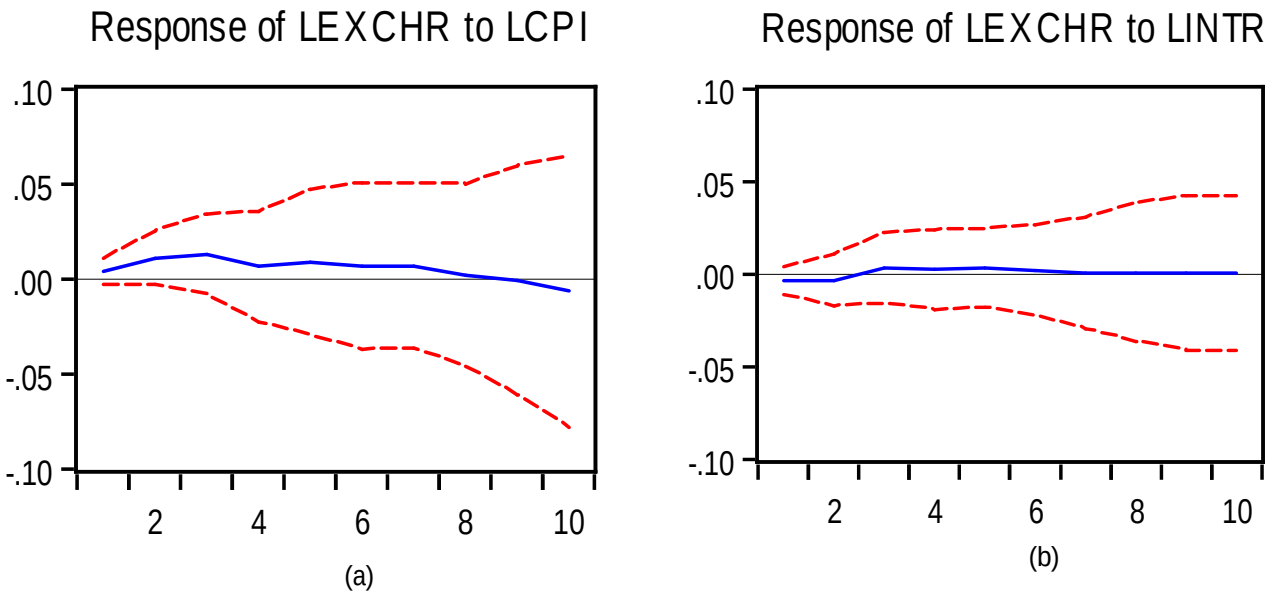


Figure 4. Response of Variables to Exchange Rate

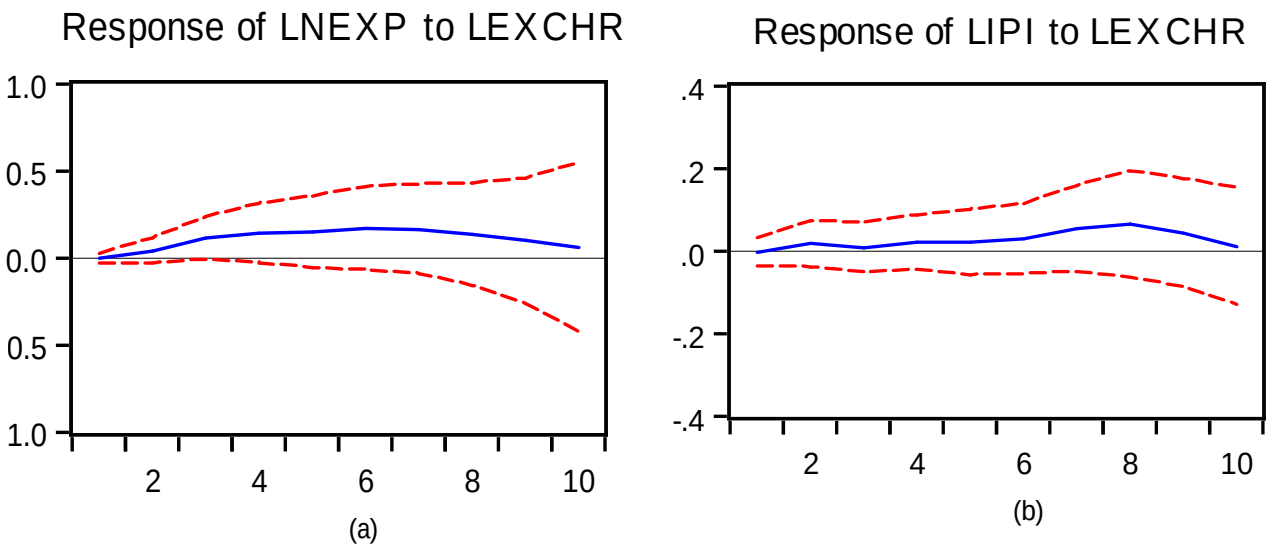


Figure 5. Response of Producer Price Index to Import Price Index

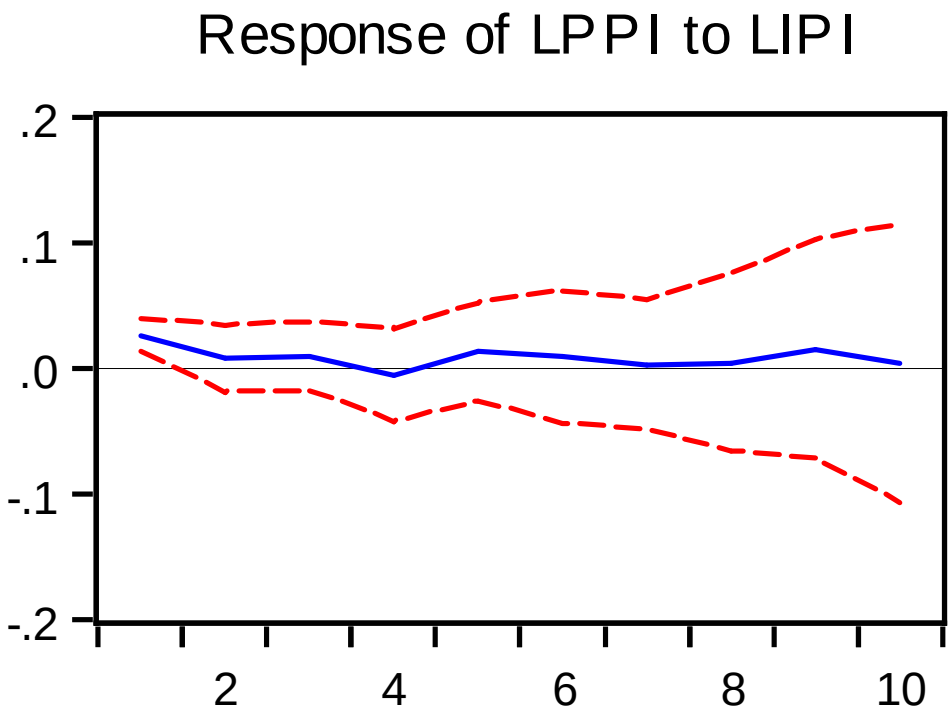


Figure 6. Response of Wholesale and Retail Price Index to Producer Price Index

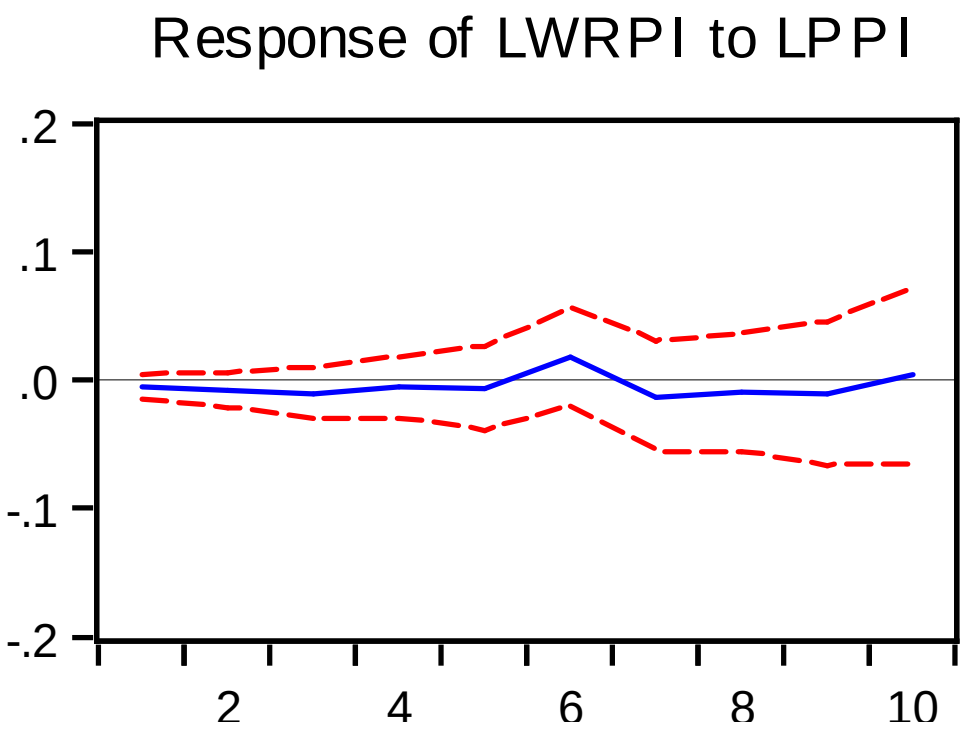
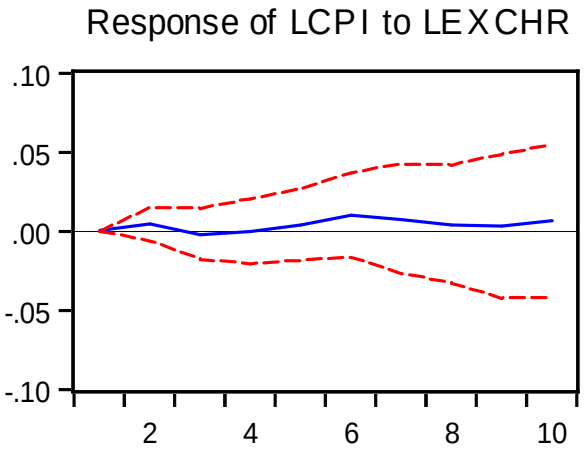
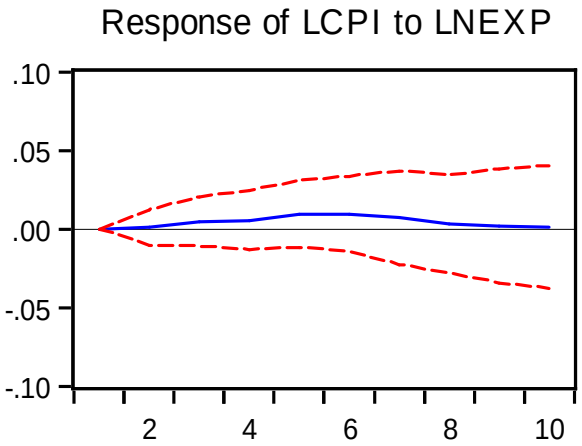


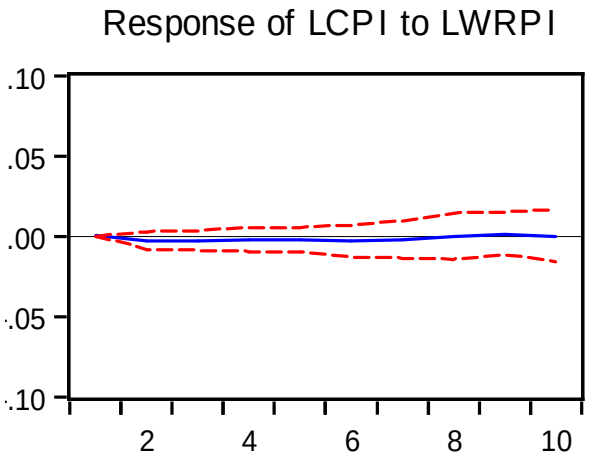
Figure 7. Response of Consumer Price Index to Variables Shocks



(a)



(b)



(c)