Exchange Rate Pass-Through to Inflation in Nigeria

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Abstract

The study examined the degree of exchange rate pass-through to domestic prices in Nigeria. The vector error correction model (VECM) methodology was applied to annual data from 1980-2010. The long and short-run results showed that exchange rate pass-through to price level in Nigeria is incomplete because the pass-through is less than 1. Further analysis revealed that the impact of the exchange rate on domestic price is more severe in the long-run than in the short-run; it impacted 76.0 and 31.0 per cent in the long and short run, respectively. This implied that shock to exchange rate ar exchange rate pass-through would translate to increase in domestic price for two consecutive periods after initial decrease. The result of the model also showed that effect of oil price pass-through to domestic price is more severe than the exchange rate, and that the pass-through from import prices to domestic prices is quite low despite its high impact in the long-run. For effective monetary policy implementation, therefore, the study recommends that in the management of the exchange rate, a sharp depreciation should be avoided due to its impact on domestic prices. Hence, exchange rate stability, and when necessory, a gradual approach to exchange rate depreciation, should be undertaken.

Key words: Exchange rate pass-through, vector error correction, inflation, Nigeria

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I. Introduction

Exchange Rate Pass-Through (ERPT) to inflation is increasingly emerging as a subject of interest for policy makers in developing countries and in the economic literature due to its relevance in designing and formulation of monetary policy. ERPT can be defined as the percentage change in domestic currency import prices, resulting from a one per cent change in exchange rate; that is, the change in domestic price that can be attributed to a

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prior change in exchange rate (Oyinlola and Babatunde, 2009). Where the pass-through is unitary (one) it is complete, and if less than one it is partial or incomplete.

The importance of ERPT lies in its significance for policy formulation for macroeconomic stability and also to monitor trade and international capital flow shocks (Campa and Goldberg, 2005). Unlike the monetary and the balance of payments models of exchange rate that assume a one-to-one relationship between exchange rate and prices, ERPT rejects this assumption, in that the impact could be less where there is significant lag in the transmission of exchange rate volatility to prices (Rowland, 2003). Notably, where pass-through is low, it results in trade flows insensitivity to changes in exchange rate even though demand may be highly elastic (Rowland, 2003).

Nigeria transited from a fixed exchange rate to a flexible regime with the introduction of the Structural Adjustment Programme (SAP) in 1986. Consequent upon this reform, was the emergence of volatility in exchange rate movement. Policy focus was therefore on the maintenance of relative stability in the exchange rate to ameliorate the pass-through effect on domestic prices. The nominal exchange rate depreciated from N3.32 per US dollar in 1986 to N97.95 per US dollar in 1999, while the inflation rate rose from 5.4 per cent and picked 72.8 per cent in 1995 before it was brought down to 6.6 per cent in 1999. In the early 2000s, the monetary authority introduced the retail Dutch Auction System (RDAS) mechanism for exchange rate management. The wholesale Dutch Auction System (WDAS) was adopted on February 20, 2006 in line with the foreign exchange market liberalization policy. This measure coupled with the increase in oil prices at the international market brought about relative stability to exchange rate prior to the global financial crisis of 2007. Notwithstanding, during 1999-2010, the average exchange rate depreciated from N97.95 per US dollar to N150.66 per US dollar while the inflation rate rose from 6.6 per cent to 17.9 per cent in 2005 and eventually settled at 11.8 per cent in 2010.

Against this background, this paper builds on earlier work of Aliyu, et al. (2009) to re-examine the exchange rate pass-through to inflation in Nigeria using the Johansen Cointegration technique. The paper, thus, extends the literature on the determination of ERPT in Nigeria by focusing on how prices such as exchange rate, import prices and oil prices pass-through to domestic price level in comparison with previous studies. The paper is divided into five sections. A brief review of the literature and empirical framework follows the introduction in Section two. Section three focuses on the data and methodology, while section four presents the results of the model. Section five concludes and proffers some policy recommendations.

II. Review of Literature

II.1 Theory of Exchange Rate Pass-through

The relationship between exchange rate and prices emanated from purchasing power parity (PPP) theory. The PPP measures the long-run or equilibrium exchange rate between two countries which is equated to the ratio of their relative price levels. The PPP argues that the law of one price holds in two different markets under the assumption of free trade and no transport cost. The theory assumed that, at equilibrium, the price of tradable goods in two different markets would remain the same. Therefore, a change in domestic currency in a market would have equal change in price in the other market, even though the markets are in two different countries. Algebraically, PPP with no transport cost and tariff can be written thus:

$$P_t^{im} = EXC_t * P_t^* \quad (1)$$

where P_t^{im} represents import prices at time t, P_t^* stands for the world import price and EXC_t is the nominal exchange rate. The proposition of PPP has been proved wrong over the years; empirical studies have shown that the law of one price failed to hold. Proportional changes in domestic prices were not identical to exchange rate for various reasons. The proponent of this argument assumed that domestic currency import price is influenced by factors such as, cost of production, exchange rate and mark-up of foreign producers. Also, the mark-up of foreign producers is a function of the exchange rate and the competitive pressures in the domestic market. It implies that long-run estimation of pass-through is a function of aggregate import prices, exchange rate, export prices of foreign producers of domestic imports and measures of domestic competition. Though, selection of variables depends on country's peculiarities.

Monetary Theory of Exchange Rate Pass-through

The monetary theory combines monetary exchange rate model by Krugman (1986) using the law of one price (LOOP) and the purchasing power parity to explain how changes in exchange rates would directly affect price levels. The theory shows that exchange rate changes affect economic factors in two stages. In the first stage, exchange rate changes distort import prices which in turn transmit to domestic inflation through import. The second level presents the changes in consumer prices dependent on import prices. The eventual impact on prices is however determined by the existence of the Pricing to Market (PTM) behaviour of exporting firms. As explained by Krugman (1986), PTM showed that exporting firms set unique prices in different destination markets due to market segmentations. The prices are set in relation to exchange rate shocks to

accommodate the additional costs incurred. Changes in exchange rate directly affect import prices other than a country's consumer price level. This is due to the fact that domestic prices comprises of non-tradable goods that a rigid in response to exchange rate shocks. The effect of exchange rate pass-through could be determined by the monetary and exchange rate policy operational in an economy. A country with a stable monetary policy and low inflation rate would likely record a lower pass-through effect. This is because overseas exporters would be less like to transfer the exchange rate-related cost to the consumers (Taylor, 2000). According to Taylor (2000), firms are more likely to pass-on additional costs incurred as a result of exchange rate fluctuations in a high inflation economy than a low one. Also, pass-through effects would be higher in a volatile exchange rate situation.

II.2 Review of Empirical Literature

There is an extensive empirical literature on exchange rate pass-through (ERPT) to domestic prices with diverse results. The diversity arises from varying methodologies and measures of domestic prices and exchange rate. Several researchers examined the sensitivity of domestic prices to exchange rate movements with their studies divided into three categories. The first focuses on examining exchange rate pass-through into disaggregated import prices (Bache, 2002 and Goldberg, 1995). The second examines exchange rate pass-through into aggregate import prices (Hooper and Mann, 1989; Campa and Goldberg, 2002; Webber, 1999). The third analyzes exchange rate pass-through into consumer price index (CPI) (Bailliu and Fujji, 2004; McCarthy, 2000; Choudri, Faruquee and Hakura, 2003). The growing research on exchange rate pass-through level is driven by the rise in the industrial organization, strategic trade theory and developments in the new open economy macroeconomic models.

Empirical work by Campa and Goldberg (2005) found that exchange rate showed higher pass-through to import prices than to consumer price. In the finding of Menon (1995), the degree of openness of the individual economies mainly drives the degree of pass-through. Goldfajn and Werlang (2000) investigated exchange rate pass-through into consumer prices in seventy-one countries using panel estimation methods on data from 1980 to 1998. They reported that the pass-through effects on consumer prices increased over time and reached a maximum after 4- quarters. The degree of pass-through was, found to be substantially higher in emerging market economies than in developed economies.

In the 1980's through 1990's, empirical studies on exchange rate pass-through were largely focused on the industriolized countries, in particular, the United

States and Japan. This was confirmed by Menon (1995) when he surveyed 48 studies on the exchange rate pass-through and found that most of the research was carried out on U.S and Japanese data. Similarly, Goldberg and Knetter (1997) observed that, in the 1980s, research on exchange rate pass-through was dominated by the analysis of pass-through in the U.S. However, pass-through literatures on developing countries are beginning to emerge (Alba and Papell (1998), Anaya (2000) and Garcia and Restrepo (2001)).

Calvo and Reinhart (2000) found that exchange rate pass-through, namely, the amount of exchange rate change that translates into changes in import prices and, hence, consumer price inflation was higher in emerging markets. They rationalized that in emerging market economies high inflation in the past promoted widespread wage and price indexation; therefore, changes in CPI resulting from exchange rate changes were consequently locked in future wages and price inflation. In addition, they posit that central banks of such countries were less credible, thus, temporary shocks to the exchange rate were accommodated and, hence, become permanent, and continuously impacted on inflation.

Kuijs (2002) studied inflation dynamics in Slovakia during 1993-2000 using a VAR model. The result showed a short term pass-through of 40.0 per cent and declining gradually as the exchange rate appreciates. Gueorguiev (2003) estimated the pass-through to consumer prices in Romania by using a first-difference VAR model for the period 1997-2002. His result indicated, a maximum pass-through to consumer prices of around 30-40 per cent with most of the impact taking place within 4 quarters.

Part of the empirical work on exchange rate pass-through on Central European countries includes the cross-country analyses by Mihaljek and Klau (2001). They estimated the exchange rate pass-through in several emerging market economies including Poland, Hungary and the Czech Republic, using a single equation estimation technique. The outcome showed, exchange rate pass-through of 6.0 per cent in the Czech Republic; Poland, 45.0 per cent; and 54.0 per cent in Hungary. However, possible endogeneity of the right-hand variables was not taken into account and, second, the pass-through was estimated over a period that comprised different exchange rate regimes and inflationary environments.

Darvas (2001) in his study of exchange rate and price dynamics for Hungary, the Czech Republic, Poland and Slovenia used a time-varying parameters framework to account for regime shifts observed in these countries during the 1990s. The results showed long run pass-through estimates ranging from 15.0 percent for the

Czech Republic; 20.0 per cent for Poland, and Hungary and Slovenia both 40 per cent. The short-term pass-through estimates were lower and ranged from 0-10 per cent.

Further research on the same countries, Coricelli, et al. (2004) used the co-integrated vector autoregressive model to estimate the long-term pass-through for four Central European countries namely Hungary, the Czech Republic, Poland and Slovenia. The results revealed a full long-term pass-through from exchange rate to domestic prices for Slovenia and Hungary, 80.0 per cent pass-through for Poland, and the Czech Republic 50.0 per cent. A major drawback of the study was that, the co-integration analysis assumed a stable long-term relationship between the variables. This assumption may not be appropriate in the context of regime shifts, so that the estimates of long-term exchange rate pass-through were less relevant in terms of providing the information for economic policy decisions due to the sluggish adjustment process.

Nkunde (2006) examined the effect of exchange rate changes on consumer prices in Tanzania using the structural vector autoregression (SVAR) models on a data set covering the period 1990-2005. Despite the depreciation of the local currency, the paper showed a decline in exchange rate pass-through to inflation in the late 1990s. This was due to the macroeconomic and structural reforms that were implemented during the period. The decline in the pass-through does not necessarily imply that exchange rate fluctuations were less significant in explaining macroeconomic fluctuations. The increase in the share of imports in the economy suggested that the pass-through could rise over the medium term. The author suggested that the policy authorities should remain vigilant in assessing the potential impact of foreign prices on the dynamics of inflation in Tanzania.

Nombulelo (2008) investigated pass-through of external shocks (exchange rate, oil price, and import price shocks) to inflation in Sri Lanka. Using vector autoregression (VAR) model that incorporates a distribution chain of pricing, the findings showed low and incomplete pass-through of external shocks to consumer inflation, reflecting a combination of factors including the existence of administered prices, high content of food in the consumption basket, as well as volatility of the exchange rate. External shocks explained about 25.0 per cent of the variation in consumer price inflation, thus, concluding that domestic policies would impact significantly on inflation.

Nicoletta (2004) examined the importance of pass-through and the impact of external shocks for Brazil, Chile, Nigeria, and South Africa by adopting VAR specification using quarterly data for the period 1990 to 2002. The result showed

that exchange rate was significant in explaining around 90.0 percent of Nigerian inflation considering 8- or 12-quarter horizons, when first differences of the exchange rate in the VAR were used. This implied that inflation in Nigeria may be highly influenced by fluctuations in the value of the naira as this translates directly albeit with long variable lags onto consumer price changes. Importantly, high pass-through also means that Nigeria would be more inclined to attempt to regularly stabilize the exchange rate by intervening in the foreign exchange market, the consequence of what Calvo and Reinhart (2000) dub "fear of floating."

Studies on exchange rate pass-through in Nigeria had been recent with results that varied along with the variables and the methodology used. A recent study on Nigeria by Omisakin (2009) submits that there was no significant impact of exchange rate variations on domestic prices and output. This was contrary to the earlier studies by Oladipo (2007) and Oyinlola and Babatunde (2009) that found a significant impact of exchange rate on domestic prices. There is a good reason to believe thus that the different outcomes of these investigations might have resulted from the different methodologies used. While Oladipo (2007) and Oyinlola and Babatunde (2009) used the Johansen multivariate estimation technique, Omisakin (2009) used the vector autoregressive model which was criticized for its inability to capture the potential long run relation among variables. Barhoumi, (2005) had argued that the exchange rate pass-through (ERPT) concept is a long run phenomenon, which supported Omisakin's outcome of no short run impact.

Examining exchange rate pass-through in Nigeria, Oladipo (2006) based on the Johansen technique, rejected full pass-through of exchange rate to import prices as a 1.0 per cent increase or change in exchange rate and exporters foreign cost of production led to a 0.86 and 0.26 per cent increase in import prices, respectively. Also, Oyinlola and Babatunde (2009) employed an unrestricted error correction model (UECM) and a Bounds Testing Analysis (BTA) to examine the extent of pass-through of exchange rate into import prices for Nigeria using data from 1980 to 2006. The result showed that export prices had a dominant effect compared to exchange rate in the short-run; they concluded that, exogenous factors largely accounted for the changes in imports prices than the country's exchange rate policy. Adetiloye (2010) adopted correlation and Granger causality analysis to test the relationship that exists between official and parallel exchange rates and import prices in Nigeria. He found that the coefficient of official exchange rate was less significant than that of the parallel exchange rate. He also discovered that import prices showed a near two-way bi-causality with the consumer price index.

Furthermore, Aliyu et al. (2009) used the Johansen cointegration method to investigate exchange pass through to import and domestic prices in Nigeria using quarterly data from 1986 to 2007. The result revealed that the pass-through during the period was incomplete. A one per cent shock to exchange rate resulted in 14.3 and -10.5 per cent pass-through to import and consumer prices by the fourth quarter, respectively.

II.3 Empirical Framework

In this study, we apply the vector error correction model. The error correction model has become popular because of its explanatory capability. The model can predict the response of related cointegrated variables as well as the speed of the change in their relationship. First, we introduce the baseline VAR model from which the VECM evolves. A standard reduced-form VAR model representation is expressed as follows:

$$Y_t = c + \sum \phi_i Y_{t-1} + \varepsilon_t \qquad (2)$$

where Y_t represents the vector of endogenous variables, c is a vector of constants, Φi denotes the matrices of autoregressive coefficients and ε_t is a vector of white noise processes. Cointegration of two or more variables implies a long-term or equilibrium relationship among them, given by their stationary linear combination (called the cointegrating equation).

Furthermore, equation (2) gives the Johansen (1991) maximum likelihood procedure. The procedure is based on a vector error correction model (VECM) and is represented in following form:

$$\Delta X_t = \mu + \sum_{i=1}^{p} \Gamma_i \Delta X_{t-i} + \Pi X_{t-p} + \varepsilon_t \qquad (2)$$

where Δ is the first difference operator, X_t is a (kx1) random vector of time series variables with order of integration equal to one, $I(1)$, μ is a (kx1) vector of constants, Γ_i are (k x k) matrices of parameters, ε_t is a sequence of zero-mean p-dimensional white noise vectors, and Π is a (k x k) matrix of parameters, the rank of which contains information about long-run relationships among the variables. If the Π - matrix has reduced rank, implying that $\Pi = a\beta'$, the variables are cointegrated, with β as the cointegrating vector. If the variables were stationary in levels, Π would have full rank. The cointegration rank in this study is conducted with the maximum eigenvalue and trace test. The asymptotic critical values are given in Johansen and Juselius (1990) and MacKinnon-Haug-Michelis (1999).

III. Data and Methodology

III.1 Data

Annual data was collected on all the series from 1980 to 2010 on the Nigerian economy. The choice of annual data was due to the use of import prices which was only available as an annual series. Five variables were used in the regression in the VECM namely exchange rate *(LEXC)*, import prices *(LIMP)*, an index for openness of the economy *(LDOP)*, oil prices *(LOIL)* and consumer price index *(LCPI)*. The average exchange rate variable was measured in nominal terms where the rate reflected the value of the naira in terms of the United States (US) dollar, data were obtained from the CBN. Openness index was measured as the ratio of total trade to gross domestic product (GDP) and this was sourced from the CBN Statistical Bulletin. Consumer price index was obtained from the CBN Statistical Bulletin and the Annual Reports and Statements of Accounts of various years. Data on LIMP was from the United Nations Conference on Trade and Development (UNCTAD).

III.2 Unit Root Tests

Table 1 presents the empirical results of the Augmented Dickey Fuller and the Phillip Perron tests. The regressions were run for all the series at both levels and first differences and, with constant and trend in the equation. While on the one hand the appropriate lag level applied in the stationarity or unit root test follows the SIC criterion, the AIC and HQ criterion were adhered to in the selection of the lag length.

Table 1: Unit Root Tests

	Level		*First Difference*		
Model	ADF Test Statistic	PP Test Statistic	ADF Test Statistic	PP Test Statistic	ADF/PP C.V
LCPI	-1.71	-0.78	-3.52*	-6.71*	-3.22
LIMP	-2.14	-2.31	-4.49*	-4.49*	-3.22
LEXC	-1.28	-1.34	-5.32*	-5.32*	-3.22
LOIL	-1.63	-1.53	-6.57*	-6.62*	-3.22
LDOP	-2.53	-2.62	-5.34*	-5.34*	-3.22

* indicates significance at 1 per cent level using MacKinnon critical values
Note: Lag length was chosen in line with the Schwarz information criterion which imposes a larger penalty for additional coefficients. It is given by $SC = 2l/T + (k \log T)/T$. where l is the log likelihood, T is the number of observations and k is the number of coefficients.

From table 1 above, the result shows that all variables were characterized by unit root. Meaning that at levels we fail to reject the null hypothesis of a unit root. At first differences, however, the result informed the rejection of the null hypothesis of a unit root in favour of the alternative, which says the variables are stationary at the one per cent level of significance. The results from the two tests, that is, the ADF and the PP tests, besides agreeing on the level at which the variables attain stationarity, yield very close *t*-statistic values for the test, sometimes the same.

III.3 Cointegration test

This work adopted the Johansen cointegration test to investigate the long-run relationship between the variables. The results suggest the existence of two cointegrating equations based on the trace and maximum eigenvalue statistics at the 5 per cent level for the model. The emergence of two cointegrating equations implies estimation of two models.

Table 2: Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.890581	124.6415	69.81889	0.0000
At most 1*	0.743732	62.68960	47.85613	0.0011
At most 2	0.390792	24.56667	29.79707	0.1775
At most 3	0.254115	10.69001	15.49471	0.2313
At most 4	0.084790	2.480852	3.841466	0.1152

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.890581	61.95189	33.87687	0.0000
At most 1	0.743732	38.12293	27.58434	0.0016
At most 2	0.390792	13.87666	21.13162	0.3752
At most 3	0.254115	8.209162	14.26460	0.3578
At most 4	0.084790	2.480852	3.841466	0.1152

III.4 Specification of Model

Theoretically, the expected signs of the vector coefficients from the VECM are expressed as:

$$LCPI = f(LIMP, LDOP, LOIL, LEXC) \quad (3)$$

$$+ \quad - \quad + \quad +$$

Higher imports prices, especially in the import dependent economy, greater openness of the economy and a rise in consumer price index would cause a depreciation of the exchange rate.

IV. Analysis of Results and Findings

This section of the paper analysis the results and policy implications. First, we conduct pairwise granger causality to test for direction of causality for different variables of interest. In addition, we also conduct granger causality/block exogeneity wald test to examine the causal effect or joint effect of other variables on the price level. The results of both long-run and short-run models and exchange rate pass-through are presented and interpreted.

Table 3: Bivariate Granger Causality Tests

Price Measure	Lags	H0 Exchange rate does not cause prices measure	lags	H0 Exchange rate does not cause prices measure
LCPI	2	5.58***	5	2.86**
LIMP	2	4.07**	5	0.49
LOIL	2	4.34**	5	2.7*

*Note: ***, **, and * stand for significance level at 1%, 5% and 10%, respectively*

Table 4: Bivariate Granger Causality Tests

Price Measure	Lags	H0 Import prices does not cause prices measure	lags	H0 Import prices does not cause prices measure
LCPI	2	4.79***	5	7.72***
LEXC	2	0.26	5	0.59
LOIL	2	2.70*	5	0.89

*Note: ***, **, and * stand for significance level at 1%, 5% and 10%, respectively*

Table 5: Bivariate Granger Causality Tests

Price Measure	Lags	H0 Inflation rate does not cause prices measure	lags	H0 Inflation rate does not cause prices measure
LIMP	2	2.09	5	0.74
LEXC	2	0.97	5	1.76
LOIL	2	3.08*	5	1.68

*Note: ***, **, and * stand for significance level at 1%, 5% and 10%, respectively*

The result of bivariate granger causality test in table 3 indicates that at 5.0 per cent level of significance exchange rate granger causes inflation rate (LCPI) both at the lower lag of 2 and at the higher lag of 5. Exchange rate also granger causes import prices (LIMP) and oil prices (LOIL) at lower lag of 2 only. However, the result in table 5 showed that inflation rate (LCPI) does not granger causes any of import prices, exchange rate and oil prices at 5.0 per cent. This result implies unidirectional causality effect from exchange rate to inflation. Further analysis also shows that import prices (LIMP) in table 4 granger causes inflation rate at 5 per cent both at the lower and the higher lags, it however shows that import price does not granger causes exchange rate. This result demonstrates that pass-through effect is from exchange rate to import prices and finally from import prices to domestic prices.

We further conduct VAR granger causality/block exogeneity wald test to confirm joint significance of exchange rate, import prices, oil prices and degree of openness on prices level. The result from table 6 shows that Chi-square statistics (15.48) for all the variables is significant at 5.0 per cent. This result implies that jointly exchange rate, import prices, oil prices and degree of openness granger causes inflation rate or price level in Nigeria.

Table 6: VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: LCPI			
Excluded	Chi-sq	df	Prob.
LDOP	0.202721	2	0.9036
LEXC	0.301075	2	0.8602
LIMP	3.171619	2	0.2048
LOIL	0.890122	2	0.6408
All	15.48232	8	0.0504

Table 7. Normalised Cointegrating Coefficients

Error Correction:	LCPI	LEXC	LIMP	LDOP	LOIL	TREND
Normalized β	1	0.76	1.26	1.84	-1.09	0.02
Error Correction						
CointEq1	-0.29	0.51	0.83	0.78	0.29	
	[-2.69]	[1.50]	[3.99]	[2.10]	[-0.87]	

Table 8. Normalised Cointegrating Coefficients

Error Correction:	LDOP	LEXC	LIMP	LCPI	LOIL	TREND
Normalized β	1	0.89	0.15	-0.65	0.79	0.07
Error Correction						
CointEq1	-2.46	0.52	-2.01	0.90	-1.52	
	[-1.90]	[0.43]	[2.78]	[2.38]	[-1.30]	

From table 7 and 8, two models were estimated incorporating both the long-run and short-run equations based on the results of the cointegration test which indicated two long-run equations. In model 1 in table 7, we normalized on domestic price level (LCPI) while in model 2 in table 8, we normalized on the degree of openness, Nigeria being a relatively opened economy. The analysis of results, however, focuses on the model 1 in table 7 which is the equation of interest. The normalized model 1, which is the model for the analysis now becomes:

$$LCPI = -7.93 + 0.76*LEXC + 1.26*LIMP - 1.09*LDOP + 0.67*LOIL - 0.02Trend$$

The result shows that a 1.0 per cent change in exchange rate leads to a 0.76 per cent change in the price level in the long-run. In the short-run, the coefficient of the error correction term of 0.29, which is the speed of adjustment, is negative and significant. The speed of adjustment of 0.29 is quite low; it implies disruption to exchange rate (depreciation) would drag to re-adjust to equilibrium level. In the short-run, a 1.0 per cent depreciation of the exchange rate in the period ago would lead to a 0.31 per cent increase in the price level in the current period. The results of both long and short-run imply that exchange rate pass-through to price level in Nigeria is, therefore, incomplete. Further analysis revealed that the impact of exchange rate on the domestic level is more severe in the long-run than in the short-run. The impact of import prices to prices is very high compared to the impact of exchange rate; a 1.0 per cent change in import prices leads to a 1.3 per cent change in the domestic price level in the long-run, while in the short-run, its impact is 0.83 per cent. Furthermore, a 1.0 per cent change in the degree of openness lead to a 1.09 per cent change (decline) in the price level in the long-run.

IV.1 Exchange Rate Pass-through to Domestic Prices

Pass-through show the predictive adjustment of domestic prices to a shock in exchange rate after accounting for the effects of other endogenous variables in the model. Following Wimalasuriya (2007) and Duma (2008) exchange rate pass-through is, therefore generated using estimates of cumulated impulse response of

each index after j years, using the cumulative response of prices to an exchange rate shock after j years. Since annual data is used for the estimation, we only consider three period horizons.

Table 10: Accumulated Effect of Exchange Rate Pass-through

Model	After		
	1 period	2 period	3 period
Import Prices	1.9	0.05	-1.5
Exchange Rate	-2.1	3.0	4.5
Oil Prices	-3.2	5.0	8.5

Source: Authors' calculation

The results from table 10 show that the effect of exchange rate pass-through to price level is relatively high. A shock to exchange rate (depreciation) would translate -2.1, 3.0 and 4.5 per cent to domestic price level in period one, two, and three, respectively. This shows a gradual but perpetual increase in the price level for the period considered. The oil prices pass-through to domestic price level is more severe than the exchange rate, as the pass-through rose from -3.2 per cent in period one to 5.0 and 8.5 per cent in period two and three, respectively. The pass-through from oil prices to domestic price level is also gradual and perpetual for the period of analysis. Surprisingly, the pass-through from import prices to domestic price level is quite low despite its high impact in the long-run. The import prices pass-through is positive for two consecutive periods and became negative in the third period. It fell from initial pass-through of 1.9 per cent in the first period to 0.05 per cent in the second period before it became negative in the third period. This reveals that import prices pass-through to domestic price level is low contrary to popular opinion of strong influence on domestic price level.

IV.2 Policy Implication

The model result has implications for policy. First, it has established that there exist exchange rate pass-through to inflation in Nigeria which implies that development in exchange rate influences the level of inflation in the economy. Second, the effect of exchange rate pass-through to domestic prices is very high. This implies that an adjustment in exchange rate impacts domestic prices very fast, as producers readily pass the burden of exchange rate adjustment to consumers in the form of higher domestic prices. Finally, the effect of oil price adjustment is more severe in Nigeria given the high import content of the fuel consumed in the economy.

V. Conclusion and Policy Recommendations

The paper examined the degree of exchange rate pass-through to inflation in Nigeria using the Johansen Cointegration method. The results of both the long and short-run imply that, exchange rate pass-through to price level in Nigeria is partial and incomplete. Further analysis revealed that, the impact of exchange rate on domestic level is more severe in the long-run than in the short-run. A positive shock to exchange rate (depreciation) would translate to a gradual and perpetual increase in the domestic price level. The effect of oil prices pass-through to domestic price level is found to be more severe than the exchange rate. Similarly, the pass-through from oil prices to domestic price level is gradual and persistent. Surprisingly, the pass-through from import prices to domestic price level was low and diminishes in subsequent periods.

In the light of these results, the study recommends that in the management of exchange rate, sharp depreciation should be avoided due to its impact on domestic prices. Hence, to maintain exchange rate and price stability, a gradual approach to exchange rate depreciation should be undertaken.

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