Modelling the Determinants of Price Level in the Nigerian Economy

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Abstract:
This paper evaluated the deterministic ability of some macroeconomic variables on the Nigeria’s price level (PL) using the Vector Error Correction Model (VECM). Review of relevant literature was thoroughly carried out. The specification of the price deterministic model was consistent with the traditional backward-looking Philips curve, quantity theory of money and the Fiscal theory of the price level. The Johansen cointegration test results provided evidence of a long run relationship among the chosen variables. The VECM results showed that the 2nd lag of PL negatively and significantly affects current PL. The second lag of Real Gross Domestic Product (RGDP) had a positive and significant effect on the current PL. Current exchange rate made a negative and significant impact on the PL whereas exchange rate at lag two made positive and significant impact. Domestic credit positively and significantly affected PL in the first period and positively but insignificantly affected it in the second period. Trade openness had significant and positive impact on PL. Money supply, government expenditure and nominal interest rate had no significant impact on PL. The outcome of all the diagnostic tests supported the acceptability of the model’s results. Based on our empirical findings, we recommend that the Nigerian monetary authority should keep tab on the variables implicated by the model of this study as significant determinants of PL.

Keywords: Modeling, Determinants, Price Level, VECM, Nigerian. JEL Classification: B22, C22, C5

1. Introduction:
Price level is a weighted average of all prices in the economy, taken as a percentage of that same average in some earlier base period. It measures the amount of money that has to be given up to buy a unit of aggregate output or a unit of the average good in the economy, therefore, price level is a measure of the buying power of money at a point in time, and captures the overall impact of individual price movements in the economy.

There are two modes of approach to the estimation of the general price level (Carl, 1928). The first is through the equation of exchange or division of total payments by a measure of trade. The other is an average of prices themselves, a weighted combination of all different types of prices. The Central Bank of Sri Lanka (2005) maintained that the general price level is measured by the Gross Domestic Product (GDP) deflator, which is the broadest measure of the general price level covering...
all goods and services included in the computation of GDP in the country and a Price Index. A price index is simply a weighted average of prices of a basket of selected goods and services and measures the overall trends in price movements at different stages of the process, from production to sales and final consumption, with respective indices as Producer Price Indices (PPIs), Wholesale Price Indices (WPIs) and, Consumer Price Indices (CPIs).

In a market economy, prices signal the prevailing demand and supply conditions and their changes and serve adequately to guarantee efficient allocation and distribution of goods and services. The experience of many countries suggests that price stability promotes economic growth, as stable prices allow everyone to make better decisions regarding what to produce, methods of production, amounts to be produced and consumed, thus, guaranteeing efficient allocation and distribution of goods and services. A stable price level contributes to financial stability; reduces the arbitrary redistribution of wealth and income that arises in inflationary and deflationary environments and increases the incentives to invest (Shostak, 2013; Amos WEB Encyclo, 2015). Crucially, it is an essential ingredient for sustainable growth in investment, output and jobs.

When stable price level is not maintained, the resulting outcome of inflation or deflation has a series of adverse impacts. According to Central Bank of Sri Lanka (2005), inflation has adverse impacts as it distorts price signals, erodes savings, discourages investment, stimulates capital flow from productive investment to non-productive investment (such as real estate), inhibits growth and makes economic planning difficult. Lucas (1972), Briault (1995), and Shostak (2013) support the earlier view that inflation leads to uncertainty about relative prices and the future price level, making it harder for firms and individuals to take appropriate decisions, thereby decreasing economic efficiency. High inflation undermines the role of money as a medium of exchange by acting as a tax on cash holdings (Frederic 2010). It also has unequal effects on the most vulnerable groups in the society such as fixed income earners, pensioners and low-income groups since they have inadequate ability to hedge against inflation. When the cost of inflation is unbearable, it can result in public unrest, causing huge economic, social and political costs. In the same way, deflation also has a number of adverse impacts, such as discouraging investment, retarding economic growth, increasing unemployment and poverty and in its severe form, leads to economic depression which could, result in economic, social and political instability in a country (The Central Bank of Sri Lanka, 2005). An unstable price level, can lead to bad forecasts of real returns to investment projects and, hence, to unprofitable borrowing and lending decisions.

The causality link between prices, output and money, exchange rate, wages, GDP, government budget and expenditure, import and export prices, real income and interest rate, have been robustly investigated using different analytical methods. For instance, while Khan et al. (2009) used Ordinary Least Square (OLS), Lim and Papi, 1997; Kemal 2006; Abidemi and Malik, 2010 applied the Johansen co-integration analysis. Kuijs, 1998; Chow and Shen, 2005; Krznar and Kunovac, 2010 on the other hand adopted the Vector autoregressive model (VAR). Furrukh et al. 2001; Sharma et al. 2010; Omanukwu, 2010 utilized the Granger causality test. In view of this, this paper evaluated the determinants of price level using the Vector Error Correction Model (VECM). This choice has been made to see if the VECM will yield the same result as the other methods already adopted in the existing studies.

2. Literature Review:

The causality link between prices and other macroeconomic variables have been vigorously investigated at different periods and for different countries. The mixed results obtained may reflect the differences in the estimation method, nature of data, variables in the estimated model and nature of country. In the light of this, the Central Bank of Nigeria (CBN) (1974) investigated the impact of changes in money supply, deficit financing, and real domestic product on price changes in Nigeria and six African countries. In the case of Nigeria, changes in money supply and domestic credit had no significant effect on the changes in the price level but real income with a 60 percent coefficient of determination. However, lagged changes in money supply produced significant regression coefficients, leading to the conclusion that changes in real income, money supply and its lags affect rates of inflation in Nigeria.

Ramachandra (1983, 1986) using annual data for the period 1951-71, found causality running from
money to real income and price level. According to him, price level causes real income and nominal income causes money. He took money stock measure as annual average of monthly values as sum of coins, currency and net demand deposits with the commercial and co-operative banks. Masih and Masih (1994) revealed that money supply was leading and price was the lagging variable for the period 1961-1990. During the period of their study prices had a feedback effect on money supply but not strong enough to be statistically significant at 5% probability level.

Osakwe (1983) investigated the relationship between changes in net current government expenditure, money wages, money supply (current and lagged) and prices using quarterly data that spanned 1970-1980. The regression analysis indicated a strong relationship between increases in net government expenditure and growth in money supply on the one hand and growth in money supply and inflation on the other hand. He concluded that the two most important factors that influenced price movement between 1970 and 1980 were increases in money wage rates and money supply. Sharma (1984) investigated the causality between price level and money supply (M1 and M2) using Granger (1969) and Sims (1972) statistical techniques for the period 1962-1980 and established bidirectional causality between M1 and price level as well as M2 and price level although he found the causality from M1 to price level to be stronger than the reverse causality between price levels and M1. Biswas and Saunders (1990) found bidirectional causality or feedback between money supply (M1, M2) and price level using quarterly data for two periods: 1962-1980 and 1957-1986. They used of Hsiao’s (1981) lag selection criteria and contradicted Sharma’s findings of comparatively weaker reverse causality from M1 to price level. Singh (1990) investigated bidirectional causality between money stock (M3) and prices (WPI) and revealed comparatively less significant causality from money supply to prices whereas Ashra, Chattopadhyay and Chaudhuri (2004) established bidirectional causality between price (GDP deflator) and M3.

Nachane and Nadkarni (1985) established unidirectional causality from money stock to prices using quarterly data that spanned the period 1960-1982. In their study the causality results between real income and money stock remained inconclusive. In a seemingly related study, Lim and Papi (1997) unearthed the determinants of domestic price level in Turkey. They adopted time series data from 1970 to 1995 and applied the Johansen Co-integration analytical technique. They concluded that money, wages, prices of exports and imports have positive influence on domestic price level whereas exchange rate exerts inverse effect on Turkey’s domestic price level.

Kuijs (1998) analyzed the relationship between three variables, namely, the price level, exchange rate and output using time series data. Vector autoregressive model was applied to investigate the relationships. The study suggested that first lag of prices, 3rd lag of prices, 1st lag of excess money supply and 1st lag of output gap are directly related to price level whereas 2nd lag of prices, 4th lag of prices and output gap are indirectly linked with price level in Nigeria. Furrulkh et al. (2001) examined the demand side and supply side determinants of inflation in Pakistan on economic and econometric criterion and investigated causal relationships among some macroeconomic variables. Time series data from 1972 to 2001 was used. Long run and short run estimates were investigated using Johansen Co-integration approach. Causal relationships were observed using Granger causality test. The findings of the study reveals that in the long run consumer price index was found to be positively influenced by money supply, gross domestic product, imports and government expenditures. They also found that government revenue reduces overall price level in Pakistan.

Chow and Shen (2005) following monetary history of the Chinese macro-economy, presented an error correction model to explain inflation from 1954 to 2002. A Vector Autoregressive model explaining the logs of price level, output and money supply yielded impulse responses that support the Friedman proposition; output reacts to money shocks first but the effect is short-lived and prices react later but the effect lasts longer. Kemal (2006) investigated whether in the long-run increase in money supply results in high rate of inflation. He applied the co-integration technique on quarterly data from 1975:Q1 to 2003-Q4. Results obtained support the quantity theory of money and also suggested that money supply works in the short run period in less than a year. Similarly, Qayyum (2006) found a strong correlation between money
growth and inflation. Excess money supply growth has been the central contributor to the rise in price in Pakistan.

Akbari and Rankaduwa (2006) explored the important determinants of the general price level in Pakistan using time series data for the period 1982-2004. The result indicated that the foreign price level of imports, money supply, and domestic output level are most important determinants of the general price level. The cost caused by the 2008 financial crisis is also a major factor in shaping the pattern of inflation in emerging economies. An exploratory study by te Velde (2008) identified some worrying signs triggered by the financial crisis to world economies. The substantial slowdown in developed economies can turn the course of economic activity in developing world. The combination of higher food and oil prices lead to the double-digit inflation in several economies. Such serious implications alert the policy makers in developing countries to reduce the magnitude of this shock through the appropriate policy responses.

Mosayed and Mohammad (2009) traced the major determinants of prices in Iran. They used time series data from 1971 to 2006 in their analysis. The study used Autoregressive and distributed lag model to discover the long run estimates. The variables considered were money supply, exchange rate, gross domestic product, change in domestic prices, change in foreign prices and Iraq war. The empirical results indicated that all the variables are positively contributing to the domestic prices in Iran. This was further reinforced by Omanukwue (2010) who used the Engle-Granger two-stage test for co-integration to examine the long-run relationship between money, prices, output and interest rate and ratio of demand deposits/time deposits (proxy for financial development) and found evidence of a long-run relationship in line with the quantity theory of money. According to him, restrictions imposed by the quantity theory of money on real output and money supply do not hold in an absolute sense. The study established the existence of “weakening” uni-directional causality from money supply to core consumer prices in Nigeria.

Sharma et al (2010) used a bivariate methodology developed by Lemmens et al. (2008) to decompose Granger causality between money supply, prices and output in frequency-domain. They concluded that there is evidence for money-output trade-off over the short-run, but in the long-run, money supply determines prices, not output. In another study, Krznar and Kunovac (2010) reported that changes in external factors (for example world prices) generate significant spillover effects on producer and consumer price indices in domestic economy of Croatia. The study employed the seasonally adjusted quarterly data from 2000 (Q2) to 2010 (Q1). The variance decomposition analysis applying VAR model revealed that external shocks must be taken into account in theoretical modeling of domestic prices and economic activity. Another study by Saleem (2010) pointed out that in Pakistan price stability can be achieved through the interest rate channel.

4.0: Theoretical framework and methodology:

4.1: Theoretical framework:

The specification of the price deterministic model is consistent with the traditional backward-looking Philips curve, Quantity theory of money and Fiscal theory of the price level.

4.2: Methodology:

The model includes measure of price level as the dependent variable and presents explanatory variables that attempt to capture the variations in the price level of the Nigerian economy. Thus, the variations in the price level are hypothesised to be a function of macroeconomic variables. The model is expressed as:

\[ PL = f(PL_{t-1}, RGDP, M2, EXR, NIR, DC, GEX, OPEN) \]  

(1)

Where

\[ PL = \text{Price Level}, \ PL_{t-1} = \text{is the immediate past value of Price Level,} \ RGDP = \text{Real Gross Domestic Product,} \ M2 = \text{Money Supply,} \ EXR = \text{Exchange Rate,} \ NIR = \text{Nominal Interest Rate,} \ GEX = \text{Government Expenditure,} \ DC = \text{Domestic Credit and OPEN = Openness of the economy.} \]

The static price level model is presented as follows:

\[ PL_t = \beta_0 + \beta_1 PL_{t-1} + \beta_2 RGDP_t + \beta_3 M2_t + \beta_4 EXR_t + \beta_5 NIR_t + \beta_6 DC_t + \beta_7 GEX_t + \beta_8 OPEN_t + \epsilon_t \]  

(2)

\[ \beta_1, \beta_5, \beta_6 < 0; \ \beta_2, \beta_3, \beta_4, \beta_7, \beta_8 > 0 \]
Equation 2 is re-specified in equation 3 to capture short-run dynamics. This compactly done as:

\[ \Delta P_l = \alpha + \sum_{i=1}^{n} \Delta P_{t-i} + \sum_{i=1}^{n} \Delta RGDP_{t-i} + \sum_{i=1}^{n} \Delta M2_{t-i} + \sum_{i=1}^{n} \Delta EXR_{t-i} + \sum_{i=1}^{n} \Delta NIR_{t-i} + \sum_{i=1}^{n} \Delta GEX_{t-i} + \sum_{i=1}^{n} \Delta OPEN_{t-i} + \psi ECM_{t-i} + \epsilon \]  

\[ \Delta \Delta P_l = \alpha + \sum_{i=1}^{n} \Delta P_{t-i} + \sum_{i=1}^{n} \Delta RGDP_{t-i} + \sum_{i=1}^{n} \Delta M2_{t-i} + \sum_{i=1}^{n} \Delta EXR_{t-i} + \sum_{i=1}^{n} \Delta NIR_{t-i} + \sum_{i=1}^{n} \Delta GEX_{t-i} + \sum_{i=1}^{n} \Delta OPEN_{t-i} + \psi ECM_{t-i} + \epsilon \]  

4.3: Estimation technique:

Unit root test was performed on the time series variables for a check of stationarity. Babatunde and Adefabi, (2005) posit that the determination of whether a variable possesses a unit root is to know if such variable exhibits certain characteristics such as mean reversion characteristics and finite variance, transitory shocks with the autocorrelations dying out with the increase in the number of lags under the alternative hypothesis of stationarity. In testing the nature of the time series, the order of integration of the variables was as well examined. This helps in determining the subsequent long-run relationship among the variables. The Augmented Dickey-Fuller (ADF) and the Philip-Perron (PP) unit root tests were used in this study to establish consistency in the results generated. While the ADF approach addresses the autocorrelation of the first differences of a series in a parametric fashion (estimating additional nuisance parameters), the PP test follows non-parametric statistical methods to account for the serial correlation in the error terms without adding lagged difference terms (see Gujarati, 2009).

Subsequently, cointegration test was carried out using the Johansen Cointegration method. Test for cointegration is believed to be a pre-test to avoid ‘spurious regression’ situations (Granger, 1986). The cointegration model helps to trace the nature of drift of the variables. The Johansen and Juselius (1990, 1992, and 1994) approach for cointegration test was employed. Unlike the Engle Granger static test procedure, the approach provides more information on cointegration analysis.

Error Correction Model (ECM) which is a category of multiple time series models was used to gauge the short-run dynamics of the variables. In specific, the model estimated the speed at which domestic price level returns to equilibrium after a change in an independent variable. The standard rule is that the ECM term must be negative and significant to ensure convergence of the dynamics to the long-run equilibrium. The regressive distributed lag technique was adopted to obtain an over-parameterized result before then applying the sequential reduction guided by the Akaike Information Criterion (AIC) to arrive at the parsimonious result. Afterwards, several diagnostic tests of model adequacy were carried out. Precisely, the Jarque-Bera (JB) Test of Normality, the Breusch-Godfrey (BG) test for serial correlation, White heteroskedasticity and Ramsey Reset Test were adopted.

5.0: Presentation and discussion of results:

5.1: Unit roots results:

The results of the ADF and the PP test of stationarity are reported in Table 1. The results of two techniques are related in terms of detecting the order of integration of the variables. All the variables are integrated of order one, I(1). Thus, the null hypothesis of non-stationarity is rejected at the 1% and 5% level of significance.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Statistic</th>
<th>Order of Integration</th>
<th>PP Statistic</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL</td>
<td>-7.207493</td>
<td>I(1)</td>
<td>-16.28071</td>
<td>I(1)</td>
</tr>
<tr>
<td>EXR</td>
<td>-5.785390</td>
<td>I(1)</td>
<td>-5.773229</td>
<td>I(1)</td>
</tr>
<tr>
<td>M2</td>
<td>-2.824172**</td>
<td>I(1)</td>
<td>-3.553401**</td>
<td>I(1)</td>
</tr>
<tr>
<td>NIR</td>
<td>-10.42813*</td>
<td>I(1)</td>
<td>-10.55311*</td>
<td>I(1)</td>
</tr>
<tr>
<td>RGDP</td>
<td>-6.108285*</td>
<td>I(1)</td>
<td>-6.115410*</td>
<td>I(1)</td>
</tr>
<tr>
<td>GEX</td>
<td>-7.634637*</td>
<td>I(1)</td>
<td>-7.584918*</td>
<td>I(1)</td>
</tr>
<tr>
<td>DC</td>
<td>-5.955014*</td>
<td>I(1)</td>
<td>-13.06068*</td>
<td>I(1)</td>
</tr>
<tr>
<td>OPEN</td>
<td>-7.690758*</td>
<td>I(1)</td>
<td>-7.630713*</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

Source: Computed by the authors using Eviews

NB: **(*) implies significant at 1%(5%) level of significance.
5.2: Johansen cointegration test results:

Table 2 presents the results of the Johansen cointegration test. Lag length of three (3) was observed as suggested by AIC and SIC. The null hypothesis of no cointegration among the variables of interest is rejected at 5% level of significance since the values of both trace statistic and max-eigen statistic do not lead to its acceptance. Thus, there is evidence of a long run relationship among the chosen variables. Specifically, Trace test indicates that there are two cointegrating equations at 5% critical level whereas Maximum Eigen test indicates only one cointegrating equation at 5% critical level. The implication is that a linear combination of all the five series was found to be stationary and thus, are said to be cointegrated. In other words, there is a stable long-run relationship among the variables and so we can avoid both the spurious and inconsistent regression problems which otherwise would occur with regression of non-stationary data series.

Table 2: Johansen cointegration test results

<table>
<thead>
<tr>
<th>H₀</th>
<th>H₁</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Max-eigen Statistic</th>
<th>0.05 Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>200.3344*</td>
<td>159.5297</td>
<td>67.81941*</td>
<td>52.36261</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>132.5149*</td>
<td>125.6154</td>
<td>44.49707</td>
<td>46.23142</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>r &gt; 2</td>
<td>88.01787</td>
<td>95.75366</td>
<td>34.39976</td>
<td>40.07757</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>r &gt; 3</td>
<td>53.61811</td>
<td>69.81889</td>
<td>24.10397</td>
<td>33.87687</td>
</tr>
<tr>
<td>r ≤ 4</td>
<td>r &gt; 4</td>
<td>29.51414</td>
<td>47.85613</td>
<td>18.90819</td>
<td>27.58434</td>
</tr>
<tr>
<td>r ≤ 5</td>
<td>r &gt; 5</td>
<td>10.60595</td>
<td>29.79707</td>
<td>7.717378</td>
<td>21.13162</td>
</tr>
<tr>
<td>r ≤ 6</td>
<td>r &gt; 6</td>
<td>2.888569</td>
<td>15.49741</td>
<td>2.722684</td>
<td>14.26460</td>
</tr>
<tr>
<td>r ≤ 7</td>
<td>r &gt; 7</td>
<td>0.165885</td>
<td>3.841466</td>
<td>0.165885</td>
<td>3.841466</td>
</tr>
</tbody>
</table>

Source: Computed by the authors using Eviews

NB: * implies rejection of the null hypothesis (H₀) at 5% level of significance. The Trace test indicates 2 cointegrating eqn(s) at the 0.05 level whereas max-eigen value test indicates 1 cointegrating equations at 5% level.

5.3: Vector error correction model:

Having identified the cointegrating vector using Johansen, the VECM was then estimated. Table 3 reports the final parsimonious estimated equation together with the short-run estimates as well as a set of commonly used diagnostic statistics. The model was chosen on the basis of the following criteria: data coherence, parameter consistency with theory, and goodness of fit. Specifically, we assume a linear trend and no intercept in the co-integrating equations.

From Table 3, it is evident that the 2nd lag of price level negatively and significantly affects current price level. As the result indicates, a 1% increase in price level in the second period leads to about 0.56% fall in the price level. A possible economic intuition could be that the increase in domestic price level in the first period led to a fall in demand for goods and services and sellers will be forced to reduce price in order to stimulate demand for their products. The result also reveals that real gross domestic product in the second lag has a positive and significant effect on the current price level while its impact at lag one is negative and insignificant. Specifically, a 1% increase in real gross domestic product generates a 0.77% increase in the price level in the second period and about 0.53% decrease at lag one. The first result supports the findings of Mosayed and Mohammad (2009) in Iran while the latter contradicts it. Money supply (M2) has negative but insignificant impact on the price level in the second period as evidenced in the result, thus, contradicting the empirical findings of the CBN (1974), Osakwe (1983), Kemal (2006) and Qayyum (2006). Current exchange rate made a negative and significant impact on the price level whereas exchange rate at lag two made positive and significant impact on the price level. Precisely, a 1% increase in the current exchange rate leads to about 0.01% fall in the price level whereas a 1% increase in exchange rate at lag two leads to 0.01% increase in the price level. The later corroborates Mosayed and Mohammad (2009).
The impact of exchange rate on price level in the first period is also positive but insignificant as revealed in the results. The parsimonious VECM result also shows that domestic credit positively and significantly affects price level in the first period; and positively but insignificantly affects it in the second period, thus, producing mixed evidence. The former contracts the empirical finding of CBN (1974) while the latter supports it. Precisely, a 1% increase in domestic credit stimulates about 0.88% increase in price level in the first period and 0.19% increase in the second period. The empirical results also reveals that a 1% increase in current government expenditure stimulates about 0.49% increase in the price level thus showing a positive although insignificant impact on the price level. Finally, trade openness has significant and positive impact on price level. Statistically, a 1% increase in trade openness leads to about 3.39% increase in price level. A possible cause of this positive and significant relationship between trade openness and price level may be imported inflation.

Another striking finding from the study is that M2, government expenditure and nominal interest rate have no significant impact on price level. Thus, suggesting that the variables are not significant determinant of price level in Nigeria within the period under study. Expectedly, the coefficient of the error correction term which measures the speed of adjustment towards long-run equilibrium is negative and significant. This implies that the rate at which variation of price level at time t, adjusts to the single long-run co-integrating relationship is different from zero. In other words, price level equation contains information about the long run relationship since the co-integrating vector does enter into this equation. The coefficient of the ECM reveals that the speed with which price level adjusts the regressors is about 9.17% in the short run. All the explanatory variables jointly explained about 74% of the variation in price level in Nigeria for the period under review.

Table 3: Parsimonious vector error correction model result (Dependent Variable: Price Level).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.404341</td>
<td>0.189976</td>
<td>-2.128386</td>
</tr>
<tr>
<td>D(LPL(-1))</td>
<td>-0.145678</td>
<td>0.122528</td>
<td>-1.188933</td>
</tr>
<tr>
<td>D(LPL(-2))</td>
<td>-0.564565</td>
<td>0.141031</td>
<td>-4.003117</td>
</tr>
<tr>
<td>D(LRGDP)</td>
<td>0.401622</td>
<td>0.248671</td>
<td>1.615076</td>
</tr>
<tr>
<td>D(LRGDP(-1))</td>
<td>-0.533935</td>
<td>0.278274</td>
<td>-1.918739</td>
</tr>
<tr>
<td>D(LRGDP(-2))</td>
<td>0.779213</td>
<td>0.294906</td>
<td>2.642239</td>
</tr>
<tr>
<td>D(LM2(-2))</td>
<td>-0.494056</td>
<td>0.360674</td>
<td>-1.369811</td>
</tr>
<tr>
<td>D(EXR)</td>
<td>-0.017389</td>
<td>0.007565</td>
<td>-2.298542</td>
</tr>
<tr>
<td>D(EXR(-1))</td>
<td>0.011272</td>
<td>0.007895</td>
<td>1.427755</td>
</tr>
<tr>
<td>D(EXR(-2))</td>
<td>0.013972</td>
<td>0.006426</td>
<td>2.174258</td>
</tr>
<tr>
<td>D(NIR(-1))</td>
<td>0.027409</td>
<td>0.028234</td>
<td>0.970805</td>
</tr>
<tr>
<td>D(NIR(-2))</td>
<td>0.024380</td>
<td>0.024014</td>
<td>1.015234</td>
</tr>
<tr>
<td>D(LDC(-1))</td>
<td>0.889677</td>
<td>0.262990</td>
<td>3.382934</td>
</tr>
<tr>
<td>D(LDC(-2))</td>
<td>0.191205</td>
<td>0.247962</td>
<td>0.771105</td>
</tr>
<tr>
<td>D(LGEX)</td>
<td>0.491414</td>
<td>0.459625</td>
<td>1.069163</td>
</tr>
<tr>
<td>D(OPM(-2))</td>
<td>3.398063</td>
<td>0.979799</td>
<td>3.468121</td>
</tr>
<tr>
<td>ECM</td>
<td>-0.917790</td>
<td>0.168899</td>
<td>-5.433957</td>
</tr>
</tbody>
</table>

R-squared: 0.749592, Mean dependent var: 0.024350, Adjusted R-squared: 0.567476, S.D. dependent var: 0.705356
S.E. of regression: 0.463888, Akaike info criterion: 1.600931
Sum squared resid: 4.734235, Schwarz criterion: 2.326073
Log likelihood: -14.21815, Hannan-Quinn criter.: 1.861105
F-statistic: 4.116029, Durbin-Watson stat: 2.241863
Prob(F-statistic): 0.001262

Source: Computed by the authors using E-views

The impact of exchange rate on price level in the first period is also positive but insignificant as revealed in the results. The parsimonious VECM result also shows that domestic credit positively and significantly affects price level in the first period; and positively but insignificantly affects it in the second period, thus, producing mixed evidence. The former contracts the empirical finding of CBN (1974) while the latter supports it. Precisely, a 1% increase in domestic credit stimulates about 0.88% increase in price level in the first period and 0.19% increase in the second period. The empirical results also reveals that a 1% increase in current government expenditure stimulates about 0.49% increase in the price level thus showing a positive although insignificant impact on the price level. Finally, trade openness has significant and positive impact on price level. Statistically, a 1% increase in trade openness leads to about 3.39% increase in price level. A possible cause of this positive and significant relationship between trade openness and price level may be imported inflation.

Another striking finding from the study is that M2, government expenditure and nominal interest rate have no significant impact on price level. Thus, suggesting that the variables are not significant determinant of price level in Nigeria within the period under study. Expectedly, the coefficient of the error correction term which measures the speed of adjustment towards long-run equilibrium is negative and significant. This implies that the rate at which variation of price level at time t, adjusts to the single long-run co-integrating relationship is different from zero. In other words, price level equation contains information about the long run relationship since the co-integrating vector does enter into this equation. The coefficient of the ECM reveals that the speed with which price level adjusts the regressors is about 9.17% in the short run. All the explanatory variables jointly explained about 74% of the variation in price level in Nigeria for the period under review.
Diagnostic test:

Several diagnostic tests of model adequacy were carried out. Precisely, the Jarque-Bera (JB) Test of Normality, the Breusch-Godfrey (BG) test for serial correlation, White heteroskedasticity and Ramsey Reset Test. The JB test of normality which is an asymptotic test is based on the OLS residuals whereas the Breusch-Godfrey test, which is also known as the Lagrange Multiplier (LM) test, tests for autocorrelation is generally considered to be more robust than the Durbin Watson test statistics. The LM test allows for: (i) higher-order schemes; (ii) non stochastic regressors such as lagged values of the regressand; and, (iii) simple or higher-order moving averages of white noise error terms. White (1980) observed that White Heteroskedasticity Test is a test of heteroskedasticity in the residuals from a least square regression. White’s test is a test of the null hypothesis of no heteroskedasticity against heteroskedasticity of some unknown general form. The Ramsey Reset Test is a general test of specification error. If the F value is highly significant, it indicates that the initial model might have been mis-specified.

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jarque-Bera Normality</td>
<td>6.69(0.03)</td>
</tr>
<tr>
<td>Breusch-Godfrey (B-G)</td>
<td>0.49(0.26)</td>
</tr>
<tr>
<td>Heteroskedasticity</td>
<td>0.45(0.39)</td>
</tr>
<tr>
<td>Ramsey Reset</td>
<td>0.57(0.44)</td>
</tr>
</tbody>
</table>

Source: Computed by the authors using Eviews

The outcome of the diagnostic tests (Table 4) is satisfactory. Under the null hypothesis that the residuals are normally distributed, the JB test for residual normality assumption is not violated. The table also shows that the error process could be described as normal for the determinants. The B-G test which is noted to have stronger statistical power indicated the absence of serial correlation. Also, the absence of white heteroskedasticity and specification error was validated. The results of the tests suggest that the model is well specified, and hence the results are plausible.

6. Conclusion and policy implications:

This paper estimated the determinants price level (PL) in the Nigerian economy using the Vector Error Correction Model (VECM). Review of relevant literature was thoroughly carried out. The specification of the price deterministic model was consistent with the traditional backward-looking Philips curve, quantity theory of money and the Fiscal theory of the price level. The results of the ADF and the PP test of stationary indicated that all the variables were integrated of order one, I(1). The Johansen cointegration test results provided evidence of a long run relationship among the chosen variables. The VECM results revealed that the 2nd lag of PL negatively and significantly affects current PL. The second lag of Real Gross Domestic Product (RGDP) had a positive and significant effect on the current PL. Current exchange rate made a negative and significant impact on the PL whereas exchange rate at lag two made positive and significant impact. Domestic credit positively and significantly affected PL in the first period and positively but insignificantly affected it in the second period. Trade openness had significant and positive impact on PL. Money supply, government expenditure and nominal interest rate had no significant impact on PL. The outcome of all the diagnostic tests supported the acceptability of the model’s results. Based on the empirical findings of this study, we recommend that the Nigerian monetary authority should keep tab on the variables implicated by the model of this study as significant determinants of PL.

References: