PRICE LEVEL, ECONOMIC GROWTH AND MACROECONOMIC PERFORMANCE IN NIGERIA: A GRANGER CAUSALITY MODELLING AND ARDL APPROACH

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ABSTRACT

The paper examines the nexus between general price level, economic growth and macroeconomic performance in Nigeria, using Granger Causality Modeling and Auto Regressive Distributed Lag (ARDL) approach on annual time series data covering the period 1987-2018. The empirical findings reveal a short-run equilibrium and long run relationship between price level, economic growth and the indicators of macroeconomic performance-investment and exchange rate. A weak speed of macroeconomic adjustment is shown by the dynamic results. Economic growth and general price level are found to have more significant (pronounced) impacts on exchange rate than on investment. Hence, the economy is likely be more susceptible to external shocks than internal shocks, particularly as crude oil price which the Nigerian economy heavily depends on is highly volatile in the international market, making the domestic economy vulnerable to internationally generated and transmitted shocks. The causality results show that economic growth granger cause investment, implying that output growth is a stimulator of investment. In the same vein, oil price granger cause exchange rate and not vice versa, an implications that oil price shocks causes exchange rate shocks/fluctuation. Based on this, sound macroeconomic policy environment, strong institutional quality and currency sterilization are required as panacea to exchange rate instability and misalignment.

Keywords*:* Price level, Economic Growth, Macroeconomic performance, Policy conflict, Institutional Structures, ARDL

International Journal of Economic Development
Volume 13, Number 2, pp. 191-221, 2020

INTRODUCTION

Price instability and economic growth are naturally incompatible in theory and policy application. This conflicting policy objectives of growth and price stability necessitates great policy caution. Economic literature posits that a certain increase in general price level-say two percent according to Keynes tenet is needed for growth to be prompted. If the yield on asset is so low, every other money issue goes into idle balance. This is the famous liquidity trap. Following the celebrated works of predicting turning points, particularly the important contribution of Patrick and Zhong which brought to a lime light the dynamics of growth and inflation parameters in model building, scholars and policy makers have advanced the course of macroeconomic policy discourse, formulation and management. Patrick and Zhong (2016) in particular, using vector auto regression (VAR) demonstrated more empirical insights into the prediction of the turning point of these parameters.

While few studies have tried to model the relationship between inflation, economic growth and macroeconomic performance (see Adrian & Vega, 2014; Cesar & Ledesma, 2014), the disaggregation of macroeconomic performance using internal measure-investment and external indicator- exchange rate have not been the focus of studies. Thus, previous studies did not consider the effect of price level and economic growth on both internal and external macro-economic performance variables. While inflation control is generally inflation within the ambit of policy makers, exchange rate control seems to somewhat out of government control. Fluctuations in exchange rate translates may precipitate business cycles and result to adverse macroeconomic disequilibria.

The current trend in the GDP calls for intense research. Macroeconomic indices are not speaking the same language. There is dwindling rate of investment. Businesses are closing down; credit squeeze has being a continuous monetary policy with high interest rate. This study, therefore intends to segregate these macroeconomic variables to be able to study their specific impact on macro-economic performance. The paper therefore seeks to empirically examine the impact of general price level and economic growth on exchange rate – a parameter used to measure external effect. It equally seeks to investigate the impact of these two variables (general price level and economic growth) on investment– a parameter used to measure internal effect. It employs granger causality test between these variables in other to determine the direction of causality and Auto-regressive Distributed Lag (ARDL) approach in order to specifically measure the effect of these two variables (i.e general price level and economic growth) on exchange rate and investment. If the direction of causality is known, policy makers can know the specific variables to target in directing the economic affairs. Thus, the findings of the paper will be critical for macroeconomic policy management and development perspective.

Following this introduction, the paper is organized as follows. Section two presents a review of the pertinent literature, which considers the key theoretical, empirical and policy issues associated with price level, economic growth and macroeconomic performance. Section three deals with the methodology, model specification and data. The empirical results and analyses are presented in Section four and Section five provides the conclusion and policy recommendations.

LITERATURE REVIEW

Theoretical and Mathematical Synthesis of Growth Dynamics

Changes in the general price level is measured by the inflation rate prevailing in a country. Economic literatures define inflation as a continuous rise in price. According to Jhingan (2010) different name has been given to inflation depending upon the rate of rise in prices. Creeping inflation (when the rise in price is very slow), working inflation (when prices rise moderately and the annual inflation rate is single digit. Running inflation (when its ranges between 10-20% per annum). Hyperinflation (prices rise very fast at double or triple digit rates from more than 20% to 100% per annum or more.

Two theories surface majorly when analyzing inflation. They are the demand- pull and cost- push inflation. The demand- pull inflation derived its name from increase in aggregate demand. In essence increase in prices is caused by increased or excess demand for goods and services. According to this theory, inflationary pressures arise because of excess demand for goods and services resulting from expansionary monetary and fiscal policies. Two major theories support demand-pull. These include the monetarist and Keynes. Bent Hansen excess demand model also come to mind here. Cost pull inflation is the rise in prices of goods and services caused by increase in the cost of factors of production and demand for more wages by workers. In this case rising production cost forces prices up.

Jhingan (2010) identifies the following causes of inflation: increase in money supply, increase in disposable income, increase in public expenditure, increase in consumer spending, cheap monetary policy, deficit financing, black money, increase in export, and shortage of factors of production, industrial disputes, natural calamities, artificial scarcities and international factors. He proposed three methods of controlling inflation. Monetary measures, which includes: credit control, demonetization of currency, issue of new currency. Fiscal measures, which include: reduction in unnecessary expenditure, increase in taxes, increase in savings, surplus budgets and public debt. Other measures include: increase in production, rational wage policy, price control and rationing.

Theories of Economic Growth/Development: The post-world war II has been dominated by four major and sometimes competing strands of thoughts (Michael and Stephen 2006). It includes the linear stage of growth, theories and patterns of structural change, the international dependence revolution, and lastly, the neoclassical free market counterrevolution.

The Linear Stage of Growth: *It* analyses the process of growth and development as steps of successive stages of economic growth which all countries must pass through before attaining economic development. An American economic historian Walt W. Rostow advocated for the above process of development. Professor W.W Rostow further distinguishes five stages of economic growth, namely: The traditional society, the pre-conditions for takeoff, the takeoff, the drive to maturity and the age of high mass consumption.

The Traditional Society: In this society regular and systemic use of modern science and technology is absent. It did not lack innovation, but lacked the tools, technology and outlook of attaining modern development. The social structure of such societies was hierarchical in which family and clan connection played a dominant role. Political power was concentrated in the regions, in the hands of the landed aristocracy supported by a large retinue of soldiers and civil servants (Jhingan 2006). Agriculture is the major occupation of such society, which serve as the major source of income.

Pre-Condition for Takeoff: Rostow was dialectical in nature. He concluded that all nations must pass through the traditional society before the second stage in which the preconditions for sustained growth are created. This stage required initial changes in three nonindustrial sectors: first, a build-up of social overhead capital, second, a technological revolution in agriculture and third, an expansion of imports.

Take Off: At this point, growth becomes its normal condition. According to Rostow, the take off period is supposed to be short, lasting for about two decades. The condition for take-off include a rise in the rate of productive instrument, the development of one or more substantial manufacturing sectors and the existence or quick emergence of a political, social and institutional framework which exploits the impulses to expansion in the modern sector.

Domestic and foreign saving are two principal strategies of economic development necessary for any takeoff. The economic mechanism by which more investment leads to more growth can be described in terms of the Harrod-Domar growth model, today often referred to as the AK model. There is always a link between the total capital stock, K and total GNP, Y. For example, If N4 of capital is always necessary to produce a N1 stream of GNP, the capital-output ration is 4 to 1, where capital output ratio is 'k' and the national saving ratio is 's'.

Therefore, S = sY where saving (s) is some proportion 's' of nation income Y; and I = ∆k, where Net investment 'I' is defined as the change in the capital stock 'k' and can be represented by '∆k'. Since 'k', has direct relationship with national income or output 'Y', as expressed by the capital output ratio 'k', it follows that:

$\frac{k}{Y} = k$ Or $\frac{\Delta k}{\Delta Y} = k$

(1)

And $\Delta k = k\Delta Y$

S = 1

(2)

$S = {}_{s}Y$ and $I = \Delta k = k\Delta Y$

$S = sY = k\Delta Y = \Delta k = 1$

$sY = k\Delta Y$

Therefore, $\frac{\Delta y}{y} = \frac{s}{k}$

(3)

The rate of growth of GNP ' $\frac{\Delta Y}{Y}$ ' is determined jointly by the national savings ration,'s' and the national capital output ration ‘k’. The point here is very simple; in order to grow economies must save and invest a certain proportion of their GNP. The more they can save and invest, the faster they can grow and the higher the macroeconomic performance. In essence, what determine microeconomic performance and indeed the economic performance is the above model is the saving ratio ‘k’. This research paper want to fill a gap here by including the overall effect of price (i.e. the general price level) and growth on macroeconomic performance.

Drive to Maturity: At this point, the society has effectively applied modern technology to the bulk of its resources. According to Rostow, it is a period of long sustained economic growth extending well over four decades. At this stage, new production techniques are developed, which naturally replace the old ones. There is high investment in the new leading sectors which are created. Noticeable changes at this stage include: the character of working force, it becomes skilled; the character of entrepreneurship changes and thirdly, the society feels bored of the miracles of industrialization and wants something new leading to further changes.

The Age of High Mass-Consumption: This is characterized by the migration to suburbia, the extensive use of the automobile, the pursuit of national policy to enhance power, to have a welfare state by more equitable distribution of national income and there are decisions to create new commercial centers and leading sectors like cheap automobiles. Thingan {2006} recorded that the United States was the first to reach the age of mass consumption in the 1920’s followed by Great Britain in the 1930’s, Japan and Western Europe in the 1950’s and the Soviet Union after the death of stallion.

Structural Change Model: Here growth is viewed in line with a complete change in the structure of the economy. There must be a complete transformation of the sector of the economy from primary sector to secondary sector. It focuses on the mechanism by which underdeveloped economies transform their domestic structure from a heavy emphasis on traditional subsistence agriculture to a more modern, more urbanized and more industrially diverse manufacturing and service economy (Michael and Stephen 2006). It employs price and resources allocation theory and modern econometrics to describe how this transformation process takes place.

The International Dependence Revolution: International dependence model, view developing countries as beset by institutional, political and economic rigidities, both domestic and international, and caught up in a dependence and dominance relationship with rich countries (Michael 2006). This theory gives three general approaches on how a country can grow/ what makes a country perpetually underdeveloped. It include: the neocolonial dependence model, the false paradigm model and the dualistic thesis. The neocolonial dependence model attributes underdevelopment to the historical evolution of a highly unequal international capitalist system of rich country – poor country relationship, false paradigm model view underdevelopment in terms of inappropriate policy application. Experts offer sophisticated, elegant theoretical structures and complex econometric models of development that often lead to inappropriate or incorrect policy (Todaro 2006). Rather than dogmatically applying econometric model that are meant for developed nations, it (policies) should be adapted to meet local needs. Dualistic talks about the increasing divergences between rich and poor nations and the widen poverty gap within a nation.

The Neoclassical counterrevolution *posits that* underdevelopment results from poor resource allocation due to incorrect pricing policies and too much state intervention.

A Point of Caution in Domar Equilibrium Point: A Mathematical Exposition

The point here is to stipulate the type of time path required if certain equilibrium desired in the economy will be attained. The economic postulation of this model state that change 'Δ' in I(t) will produce two reactions. It will affect aggregate demand as well as the production capacity of the economy. Given a natural income model, '$C+T_t+G_t$', the equilibrium position becomes '$Y^e = \propto/(1\text{-}b)$' where '$\propto = C + I_t + G$'. The multiplier ' $V=\frac{1}{s}$ where s = mps'. If we assume that I(0) according to Harrod and Domar is the only flow that affect the rate of income flow then,

$$\frac{dy}{dt}=\frac{dI}{dt}\,\frac{1}{s} \tag{4}$$

If 'p' is 'a constant capacity capital ratio' then '$p=\frac{k}{K}$'. It thus means that with capital stock k(t), the economy can produce 'k = pK naira'. 'k = pK' automatically becomes the model production function.

dk= pdK

$$\frac{dk}{dt} = p\frac{dK}{dt} = pI \tag{5}$$

In Doman's model productive capacity is fully utilized at the point where equilibrium is attained. Employing mathematical tool in explaining economic variables is great and indeed good but a point of caution is needed. Economists generally use verbal exposition to explain certain economic behavior. Econometric modeling which is an integral part of Mathematical economics give an empirical prove or backing to that verbal statement which are observe economic phenomenon. It is concerned with the discovery of relationship between deterministic variables using a rigorous argument (Clive Granger 2003). Econometrics generally contains three important parts: economic theory (micro and macroeconomics), mathematical economics and statistics (basically analysis of data).

Domar Equilibrium Point: The Ideal State of Affairs

The fact that equilibrium implies no tendency to change may tempt one to conclude that equilibrium necessarily constitutes a desirable or ideal state of affairs, on the ground that only in the ideal state would there be a lack of motivation for change (Chiang, 2005). Domar assumes among data smoothing process, an econometric exercise that can produce the only desirable state of affairs. In Doman's model productive capacity is fully utilized at the point where equilibrium is attained, such a conclusion according to Chiang (2005), is unwarranted. A constellation of selected interrelated variables so adjusted to one another that no inherent tendency to change prevails in the model which they constitute is tagged as equilibrium according to Chiang. Even though a certain equilibrium position may represent a desirable state and something to be striven for, another equilibrium position may be quite undesirable and therefore something to be avoided such as an underemployment equilibrium level of national income.

Equilibrium is attained at the point Y=K, where Y is the aggregate demand and K is the output.

Change in capacity and aggregate demand gives

$$\frac{dy}{dt} = \frac{dk}{dt} \qquad (6)$$

Next, we examine the time path of I(t) that will satisfy the equilibrium condition. Adopting Yoosoon (2003) integrating procedure,

$\frac{dI}{dt}\frac{1}{s}$ PI or $\frac{1}{I}\frac{dI}{dt} = ps$

$$\int \frac{1}{I}\frac{dI}{dt}dt = \int ps \ dt \qquad (7)$$

Applying substitution rule under integration which say that

$$\int f(u)\frac{dy}{dx}\mathrm{d}x = \int f(u)du = F(u) + c$$

Then

$\int \frac{1}{I}\frac{dI}{dt}\mathrm{d}t = \int \frac{dI}{I} = In/I/{+}C1 \; where\ I \neq 0$ (8)

And$\int ps\,\mathrm{d}t = pst + C_2 \; since\ ps\ is\ a\ constant$

It follows that:

In /I/ = pst +c where $C_1 + C_2 = C$ (9)

Since $e^{Inx} = x$

$e^{In/I/} = e^{(pst+c)}$

And by indices rule, $y^1 \times y^2 = y^{1+2}$

$e^{(pst+c)} = e^{pst}e^{c}$ then

$e^{In/I/} = e^{pst}e^{c}$

$/I/ = Ae^{pst}$ where $A = e^{c}$

If I > 0, I at a particular period becomes

$I(t) = Ae^{pst}$, if t = 0

$I(0) = Ae^{0} = A$

The required investment time path becomes

$I(t) = I(0)e^{pst}$ (10)

Where I(0) is the initial rate of investment. Production is basically a function of demand. It makes no sense after production, there is no demand and the producer keeps producing. Therefore, demand and production capacity must be maintained over time. That makes sense. That is rational enough. The above model states that the rate of investment flow must grow precisely at the exponential rate of 'ps' if the balance between capacity and demand is to be maintained. However, it follows that the larger the production capacity, the larger the required rate of growth. Given a particular rate and specific value of 'p' and's', the growth parts is known with certainty

Unpleasant Seasoning in Domar Model: The Razor-Edge Theory

If there is divergence between 'r' and 'ps' what happens? Where 'r' is the actual growth of investment and 'ps' is the required growth rate. Domar treated the 'r' and 'ps' in relation to the capacity utilization 'u', define as

$$u = \lim_{t\to\infty} \frac{y(t)}{k(t)} \tag{11}$$

U = 1 implies full utilization of capacity and u= r/ps, u>1, u = 1 and u<1 as r> ps, r = ps and r <ps. If r ≠ps, as (t→∞) there will be a shortage of capacity (u>1) or a surplus of capacity (u<1), the determinant parameter being 'r', depending on whether 'r', is greater or less than 'ps'. Using mathematical notation, it follows logically that the conclusion about capacity shortage or surplus really applies at any time t, not only as 't → ∞'. Given a growth rate 'r',

$$I(t)=I(O)e^{rt} \tag{12}$$

$$\frac{dI}{dt} = rI(0)^{rt}$$

Since $\frac{dY}{dt} = \frac{dI}{dt}\frac{I}{S}$ as established previously in Domar's model, then, $\frac{dY}{dt} = \frac{I}{S}\frac{dI}{dt} = \frac{r}{s}I(O)e^{rt}$ (13)

Domar also established that,

$$\frac{dk}{dt} = p\frac{dk}{dt} = pI$$

then, $\frac{dk}{dt} = p\frac{dk}{dt} = pI(0)e^{rt}$ (14)

if we decompose the above equation, we have:

$$\frac{dy/dt}{dk/dt} = \frac{r}{s}I(0)e^{rt} \div PI(0)e^{rt}$$

$$\frac{dy/dt}{dk/dt} = \frac{r}{s}I(0)e^{rt} \times \frac{1}{PI(0)e^{rt}}$$

$$\frac{rI(0)e^{rt}}{s} \times \frac{1}{PI(0)e^{rt}}$$

$$\frac{rI(0)e^{rt}}{SPI(0)e^{rt}} = \frac{r}{sp}$$

$$\frac{dy/dt}{dk/dt} = \frac{r}{sp} \tag{15}$$

This indicate the strength of demand i.e. the ‘demand – creating effect’ and the ‘capacity generating effect of investment’ at any time t, under the actual growth rate ‘r’. If ‘r’ (the actual rate) is more than ‘ps’ (the required rate), $dy/dt > dk/dt$, and the demand effect will be more than the capacity effect, causing a shortage of capacity. On the other hand, if $r < ps$, there will be deficiency in aggregate demand and a surplus of capacity.

The unseasoning part of the model is the razor edge of it. If investment grow at a faster rate than required ($r > ps$), there will be shortage of capacity. If the actual growth of investment lag behind, the required rate ($r < ps$), we will encounter a capacity surplus. Indeed, because of such paradoxical results, if the entrepreneur is allowed to adjust the actual growth rate ‘r’ (that is taken to be a constant) according to the prevailing capacity situations they will most certainly make the ‘wrong’ kind of adjustment(Chiang 2005, emphasis added).

Given that ‘p’ and‘s’ is constants how do we avoid high shortage and surplus of productive capacity? The only way is to guide the investment flow over so carefully along the equilibrium time path with a growth rate $r^* = Ps$. As demonstrated through mathematical equations, any deviation from such a ‘razor edge’ time part according Chiang (2005) and Wainwright (2005), will bring about a persistent failure to satisfy the norm of full utilization which Domar envisaged in his model. To Solow, this is not too cheerful a prospect to contemplate, in Solow work, certain assumption of domar model are modified to produce a more flexible result.

The Razor's Edge Theory: A Particular Case Rather Than A General Case Equilibrium Condition-Solow Proposition

I f we relax the assumption of absence of a labour input, then we can have

$Q = f(k, L)$ Where (k, L > 0) (16)

It should be noted that Harrod and Domar do not completely drop labour input as a parameter in their model building but rather, they proposed production function that carries the implication that labour is always combined with capital in a fixed proportion.

Solow goes the other way, he seeks to analyse the case where capital and labour can be combined in varying proportions. He points out that the need for delicate balancing may not arise if the above production function assumption is dropped; a phenomenon that produced the unpleasant seasoning of 'razor egde' theory. If we find Solow model as a succor, then: Q = f(k,L) and (K,L>0) (17)

$f(\frac{K}{L}, \frac{L}{L}) = f(\frac{K}{L}, 1)$= f(k, 1)

$APP_L = \frac{Q}{L} = \emptyset(k)$ (18)

The above shows that variable k and L in the original function are to be replaced by k and 1, respectively; if that is done, it then becomes a function of the capital labour ratio 'k' alone, say '∅(k)'

$$\frac{\partial k}{\partial K} = \frac{\partial}{\partial k}\left(\frac{K}{L}\right)$$

$$= \frac{1}{L} \quad (19)$$

$\frac{\partial k}{\partial L} = \frac{\partial}{\partial L}\left(\frac{K}{L}\right) = \frac{\partial}{\partial L}(L^{-1}K) = (-1)L^{-2}k = -\frac{k}{L^2}$ (Since $y = ax^n, \frac{dy}{dx} = anx^{n-1}$)

If ∅= L∅(k)

then, $MPP_K = \frac{\partial Q}{\partial k} = \frac{\partial}{\partial k}(L\emptyset(k))$ (20)

Appling Chain rule

r=f(q) and q=g(l),then,

$$\frac{dr}{dL} = \frac{dr}{dQ}\frac{dQ}{dL}$$
$$= f^1(q)g^1(L) \quad (21)$$

MPPK = $L\frac{\partial \emptyset(k)}{dk} = L\,\frac{d\emptyset(k)\partial k}{dk\ \partial k} = L\emptyset^1(k)\frac{1}{L} = \ \emptyset^1 k$ (22)

Given the isoquant function q^0 = (f(k, L), the slope of the tangent to a point on an isoquant is the rate at which k must be substituted for L (or L for K), in order to maintain the corresponding output level. The negative of the slope is defined as the rate of technical substitution (RTS).

RTS = - $\frac{dk}{dL}$ (23)

The total differential of the production function is $dq = f_1 dx_1 + f_2 dx_2$

$$dq = f_L dL + f_k dk$$

It follows from equation (17) above that;

$Q = Lf\left(\frac{k}{L}, 1\right) = L\emptyset(k)$, Where $k = \frac{K}{L}$ (24)

$$f_k = MPP_k$$
$$= \emptyset^1(k) \quad (25)$$

$f_k > 0$ Means $\emptyset^1(k) > 0$,

$f_{kk} = \frac{\partial}{\partial k}Q^1(k) = \frac{d\emptyset^1(k)}{dK}\frac{\partial k}{\partial K} = \emptyset^{11}(k)\frac{1}{L}$ (26)

Since in a normal production theory *fkk<0, then* $Q^{11}(k) < 0$, Thus the $\emptyset$ function which is the APP_L increases with k at a decreasing rate. Solow assumption if stated mathematically shows that:

$\bar{k} = \frac{dk}{dt} = sQ$ i.e. constant proportion of Q is invested. (27)

$\frac{\bar{\bar{L}}}{L} = \frac{dL/dt}{L} = \lambda(\lambda > 0)$, (28),

i.e labour force grows exponentially. Our major interest here is not how the k and L are determined but how their rates of change are. The determinant of these rate of change is the dynamic nature of the assumption, an unstable path that call for constant research on the dynamism of these variables; because they are easily influence with changes in time ‘t’. A change in the current period can influence the last year research result.

Since $Q = L\emptyset(k)$, and $\bar{k}$ = SQ, we can condense the above two equation into a single model

$$\bar{k} = SL\emptyset(k) \qquad (29)$$

Since k = K/L the K = kL, using product rule, where

$\frac{d}{dx}(f(x)g(x) = f(x)\frac{d}{dx}g(x) + \quad g(x)\frac{d}{dx}f(x)$

$= f(x)g1(x) + \quad g(x)f1\,(x)$

Then, $\bar{k} = L\bar{K} + k\bar{L}$ since: $\frac{\bar{L}}{L} = \frac{dL/dt}{L} = \lambda$, *then* $\frac{\bar{L}}{L} = \lambda$ & $\bar{L} =$ Lλ (30)

$= L\bar{K} + K\lambda L$

If we equate $K = SL\emptyset(k)$ and $L\bar{K} + K\lambda L$, the result becomes;

$$L\bar{K} + K\lambda L = SL\emptyset(k) \qquad (31)$$

Divide through by L

$$\frac{LK + K\lambda L}{L} = \frac{SL\emptyset(k)}{L}$$

$$\bar{K} + K\lambda = S\emptyset(k)$$

$$\bar{K} = S\emptyset(k) - \lambda \; (32)$$

The above differential equation in the variable k, with two parameters S and λ, is the Solow growth model using mathematical approach. What this implies is that the razor's edge theory is a particular case rather than a general equilibrium condition.

Brief Empirical Review

Adrian and Vega (2014) examine the link between inflation targeting and macroeconomic performance. The authors use VAR model. Their findings show that high inflation control through targeting enhances macroeconomic performance and investment. In their Vega analysis, monetary policy setting dynamically interacts with inflation, economic activity and the exchange rate. Using CPI to forecast inflation trend is also acceptable in economic literature. Cesar and Ledesma (2014) employ similar procedure. The Bayesian Vector Auto Regression Model (BVAR) was used by the authors. Their work outperform the benchmark random work model in previous works. The works by Livia (2016), Tony (2018) and Jeremaih (2018) adopted dynamic modelling approach into the analysis.

Livia introduced causality into the study of inflation in his methodology.

Wirkelried (2015) insists on testing a time series data for unit roots before one can use the OLS output for prediction. Fernando et al (2015) study the response of prices to exchange rate shocks in Peruvian Economy in a non-linear content. As noted early Partrick and Zhong (2016), Admix and Vega (2014), Ledesma (2014) Tony (2018), Jeremaih (2018) and others; analyze growth and general price level. These studies did not however examined the impact of these variables on macro-economic performance. It is must be stated that it is important to show how do these variables impact on macroeconomic performance Tony (2018) emphasized the role of national endowment, political economy and tax revenue in analyzing macroeconomic performance. Jeremiah (2018) emphasized that investment in technology will increase economic performance.

Michael et al (2016) use exchange rate to analyze external influence on the domestic. He sought to forecast exchange rate in an economy. He finds that development in the international market influences exchange rate movement. Maurizio (2016) investigate the impact of movement in the real exchange rate on economic growth. Unlike previous studies, Maurizio (2016) use external instrument to deal with possible reverse causality from growth to the real exchange rate. According to Kirsten et al (2016), longer-term inflation expectations can be used to model price stability objective, since they responds neither to short term inflation expectation nor to actual inflation or other macroeconomic news. Other studies that have examined the nexus between price level, economic growth and macroeconomic performance include; Tomasz et al (2016). Kyriaca Lambrias (2016), Irena Mikolajun and David Lodge (2016), Selin Ozyurt (2016) and De Michelis (2016). Livy Chitin (2016), in addition to inflation analysis, introduced moral hazard into his model. Other studies which employed VAR modelling technique and macroeconomic in the price level, economic growth and macroeconomic performance nexus include Thomas et al (2016), Alexander (2016) and Kirsten et al (2016).

METHODOLOGY

Theoretical Framework and Model Specification

Theoretically, and in the context of this study, the rate of investment represents the internal factor, while exchange rate represents the external factor. Following this, the first model captures the impact of general price level (P), economic growth (z), oil price (p^{II}), on investment (internal macroeconomic performance variable), while the second show the impact of general price level (P) and economic growth on exchange rate (ie. external macroeconomic performance variable). Thus,

$$I = f(z, p, \boldsymbol{P^{11}},) \quad (33)$$

$$I = \partial_0 + \partial_1 \boldsymbol{Z} + \partial_2 \boldsymbol{P} + \partial_2 \boldsymbol{P^{11}} \quad (34)$$

Where

I is the investment

P^{11} is the oil prices

P is the general price level

z is the economic growth.

$$Ex = f(P, z) \quad (35)$$

$$Ex = \alpha o + \alpha_1 p + \alpha_2 z \quad (36)$$

Where

Ex is the exchange rate

P is the general price level

Z is the economic growth.

That done, a Granger causality test is conducted

$$Z_t = \sum_{i=l}^{n} \lambda_i I_{t-i} + \sum_{j=1}^{n} \beta_j Z_{r-1} + u_{1t} \text{ , and;}$$

$$It = \sum_{i=l}^{n} \lambda_i I_{t-i} + \sum_{i=l}^{n} \theta_{t-j} + u_{2t} \quad (37)$$

However, based on the assumption of Grange test, Granger causality test cannot be carried out except we test for the stationarity of the data set, the research therefore, as a most, test for the stationarity of the data.

In macro modeling, analysts advise to impose penalty for adding additional regressor in model building. Hence, Akaike information criteria (AIC) is introduced in the research methodology.

$$\text{AIC} = e^{2k/n}\,\frac{\sum ui^{\lambda 2}}{n} = e^{2k/n}\,\frac{RSS}{n} \qquad (38)$$

Gujarati (2004) emphasized that the below four points must be noted when analysis Granger causality test. (i) It is assumed that two variables x and Y are stationary (ii) The number of lagged terms to be introduced in the causality tests is an important practiced questions. Similarly, the direction of causality may depend critically on the number of lagged terms included. (iii) An assumption is also inbuilt in the model; that is the error term entering the causality test are uncorrelated if this is not the case, appropriate transformation will have to be used and lastly, since our interest is in testing for causality, one need not present the estimated coefficients of model-unless otherwise specified just the results of the F test will suffice.

The test assumes that the information needed for the prediction of the respective variables, x and y is embedded solely in the time senses data on these variables.

The steps involved in implementing the Granger causality test according to Gujaranti (2004) are as follows: (i) regress x on all lagged terms and other variables, if any, but do not include the lagged y variables in this regression. This is the restricted regression analysis. From this regression, we obtain the restricted residual sum of square (RSS_R) (ii) run the regression, including the lagged y terms. This is an unrestricted regression, from this regression we obtain the unrestricted residual sum of square RSS_{UR}. (iii) The null hypothesis is H_o: $\sum ai = 0$, i.e lagged y terms do not belong in the regression, (iv) to test this hypothesis, we apply the F test given below.

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR} \;/\; (n-K)} \tag{39}$$

Which follows the F distribution with m and (n-k) degree of freedom, where m is equal to the number of lagged y terms, and k is the number of parameter estimated in the unrestricted regression (iv) if the computed F value exceeds the critical F value at the chosen level of significance, the null hypothesis is rejected, in which the lagged y terms belong in the regression. This is another way of saying y causes x (v). Steps (i) to (v) can be repeated to test whether x causes y.

Method of Estimation

This study follows the approach previously used by Maurizio (2016) and Livia Shittle (2016) who employed causality. Nevertheless, a modification is introduced into the approach by employing Granger causality modeling and Autoregressive Distributed Lag Model (ARDL) in order to bring dynamism and account for structural peculiarities of the Nigerian economy. Following Dugo Wirkelried (2016) that it is important that a model of this nature be tested for stationarity, we employ the preliminary unit roots test of staionarity so as to make the results robust and amenable for policy formulation and implementation. We introduce the Granger causality test and by extension, employ the Akaike and Schwarz criteria to choose the number of lagged terms to be introduced in the causality test. The Autoregressive Distributed Lag Model (ARDL) estimation is subsequently used to estimate the structural parameters of the model.

EMPIRICAL RESULTS AND ANALYSIS

Unit Root Test

Unit root test of stationarity is conducted on the time series in order to ensure their stationarity. According to

Engle and Granger (1987), non-stationarity time series may produce bias and inconsistent estimates which are not amenable to policy formulation. A series is non-stationary if it is time-dependent, with a non-constant variance, while a stationary series is time-invariant with a constant mean. Apart from this, non-stationary time series cannot generalize to other time periods, apart from the present. The unit test of stationarity results at levels and first- difference is presented in table 1.

Table 1
Unit Root Test Result

Levels				**Fist Difference**		
Variables	ADF Test Statistic	**5 percent Critical Value**	**Remarks**	**ADF Test Statistic**	**5 percent Critical Value**	**Remarks**
INV	-2.49757	-2.955	Non-Stationary	2.589401	2.948404	Non-Stationary
GDP	3.574918	-2.9677	Stationary	3.060315	-2.971853	Stationary
OPR	2.029012	-2.943427	Non-Stationary	-7.264860	-2.945842	Stationary
P	-2.937879	-2.943427	Non-Stationary	5.811180	-2.945842	Stationary
EXR	1.010892	-2.943427	Non-Stationary	-5.631233	-2.945842	Stationary

An examination of the unit root test results show that apart from GDP and inflation rate which were stationary at levels, all other variables were not stationary, implying that they possess unit roots. The first difference was thereafter taken in line with Box and Jenkins (1994) that non-stationary time series may be made stationary after differencing. After first differencing, all the variables except investment were stationary at first difference, implying that they are first-difference stationary. The series are therefore I(I).

Test of Cointegration

Having observed that the series are combination I(I) and (0), there is need to investigate their cointegration status. The cointegration is carried out with the use of Autoregressive Distributed Lag Model (ARDL) to examine whether there is a long run equilibrium relationship among the variables for consistent policy formulation. The cointegration test result is reported in table 2a and 2b.

Table 2

Bounds Test of Cointegration Results- Investment Model

F-Statistic	5.91
Upper bounds	5.61
Lower bounds	2.71

Table 2b

Bounds Test of Cointegration Results –Exchange Rate Model

F-Statistic	11.77
Upper bounds	6.36
Lower bounds	3.17

Source: Authors' Computation

The bounds test of cointegration result show that the F-statistic of 5.91(11.77) is greater than the upper bounds and the lower bounds value of 5.61(6.36) and 2.71(3.17), respectively, as is required in line with econometric theory. Thus, there is evidence of long-run equilibrium relationship among the variables.

Causality Test
The results of the causality is shown in table 4.

Table 4 Granger causality test

Direction of causality	F-value	Decision
I → G	2.978	Do not reject
G → I	52.378	Reject

Source: Authors' Computation

The results from the causality suggest/show that the direction of causality is from Gross Domestic Product (G) to investment {I}. This simply means that 'G' causes 'I'; since the estimated F is significant at 5% level; the critical F value is 4.08. On the other hand, there is no 'reverse causation' from investment (I) to Gross Domestic Product (G)

Direction of causality	F-value	Decision
$P^{I} \rightarrow P^{II}$	-33.128	Do not reject
$P^{II} \rightarrow P^{I}$	10.200	Reject

Source: Authors' Computation

Similarly these results show that the direction of causality is from oil price 'P^{II}' to exchange rate 'P^{I}'. It also means 'P^{II}' causes 'P^{I}', since the estimated 'F' is significant at 5% level; the critical 'F' value is 4.08, on the other hand, there is no 'reverse causality' from 'P^{I}' to 'P^{II}'.

Short Run Dynamic Results
The short run dynamic results of the ARDL which shows the short run dynamic relationship between price level, economic growth and macroeconomic performance (proxy by investment and exchange rate) in terms of the

response of investment (proxy for domestic macroeconomic performance) and exchange rate (indicator of external macroeconomic performance) is shown in table 3 and 4. A cursory observation of the results show that the R^2 of the investment model is 0.88, implying that about 88 percent of the systematic variations in macroeconomic economic performance is explained by the combine explanatory variables. After adjusting for the degrees of freedom, the model was able to explain over 83 percent of the systematic variations in investment performance (proxy for macroeconomic performance) over the period. Invariably, the model has a high predictive ability. The coefficient of one lagged investment is positive and significant at the 1 percent level. Thus, previous investment has a positive and significant effect on current investment, an implication of investment- persistence. First lagged GDP is not significant at the 5 percent level, while the second and third lagged are significant at the 10 percent and 5 percent level, respectively. Thus, past output growth has a positive and significant effect on investment performance, as investors tend to view past economic output level in making investment decisions. The coefficients of oil price and price level fails the significance test at the conventional levels of 5 percent and 1 percent in the determination of macroeconomic performance (proxied by investment).

In terms of the external performance, the second model- (i.e exchange rate) show an adjusted R^2 of 0.978, implying that over 97 percent of the systematic variations in external performance is explained by the independent variables and ECM. First lag of exchange rate is significant at the 1 percent level. Current GDP is significant at the 5 percent level and all its lag are significant at the 1 percent level, implying that the previous exchange rate, current GDP and its past values exert significant influence on external performance. Exchange rate and the price level (both current and past values) are seen to be negatively related, although this relationship is statistically not significant.

Table 3
Model 1- Investment Model

Variables	Coefficients	T-ratio	Prob.
C	2.1687	1.0177	0.3182
INV(-1)	0.6331	3.1979	0.0036
GDP	8.95E-08	1.4954	0.1468
GDP(-1)	-1.51E-07	-.16410	0.1128
GDP(-2)	2.56E-07	1.8389	0.0774
GDP(-3)	-3.52E-07	-2.8487	0.0085
OPR	0.0834	1.6072	0.1201
P	-0.0262	1.017717	0.5969
ECM (-1)	-0.4722	-4.7720	0.000
R-Squared	0.877		
Adjusted R-Squared	0.8393		
F-Statistics	23.19 [0.000]		

Table 4
Model 2-Exchange Rate Model

Variables	Coefficients	T-ratio	Prob.
C	5.221	0.56912	0.5748
EXR(-1)	0.9032	12.48215	0.0000
GDP	-4.01E-07	-2.3478	0.0279
GDP(-1)	1.43E-06	5.26943	0.0000
GDP(-2)	-1.79E-06	-4.1367	0.0004
GDP(-3)	1.66E-06	4.4077	0.0002
P	-0.0164	-0.0856	0.9326
P(-1)	-0.0665	-0.2776	0.7838
P(-2)	-0.0981	-0.3912	0.6993
P(-3)	-0.2452	-1.0479	0.3056
ECM (-1)	-0.3264	-2.2895	0.0343
R-Squared	0.984		
Adjusted R-Squared	0.978		
F-Statistics	150.9 [0.000]		

Source: Authors' Computation

CONCLUSION

The paper examines the link between price level, economic growth and macroeconomic performance (proxied by investment-internal factor and exchange rate-external factor) using granger causality modeling and Auto Regressive Distributed Lag (ARDL) approach. The theoretical-cum mathematical exposition demonstrated that equilibrium point in Domar model does not necessarily constitute a desirable or ideal state of affairs, but a 'razor edge' theory-being a particular case rather than a general equilibrium condition. The causality results show that the direction of causality is from economic growth to investment and not vice-versa. In the same vein, the direction of causality is from oil price to exchange rate and not vice-versa, implying that fluctuations in oil price is transmitted to exchange rate variability. This should be so, given the over-bearing dependence of the Nigerian economy on oil and the associated vulnerabilities. Invariably, exchange rate misalignment (persistent departure of exchange rate from its long-run competitive level (a greater problem than volatility) is provoked by oil price volatility, thus necessitating concrete policy actions. This is in line Anyaele (1990), that most less developed countries are confronted with depleting reserves (external balance positions) worsened by currency speculation, severe pressure on the exchange rate, causing misalignments.

Therefore currency sterilization policy(a process of slowing the growth of money supply by keeping the monetary base from expanding when the central bank's intervention in the foreign exchange market lead to greater holding of international reserve) can be of great help. With this, any increase in international reserve can be offset with equal open market sale of domestic securities in other to prevent the monetary base from rising. This will help control inflationary pressures and impulses due to monetary expansion. Economic growth must be sustainable in order to instigate investment. This findings of this study supported by both empirical studies and theoretical consideration indicate that, that the economic grate rate is a basic determinant of macroeconomic performance. Strong and stable macroeconomic policies that will enhance output growth, guarantee the stability of exchange rate and tame domestic inflationary pressures are also critical in this respect.

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