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Population Growth, Oil Price and Economic Growth Nexus in Nigeria

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Abstract:
This study examined the relationship between population, oil price and economic growth in Nigeria using the vector error correction model as well as impulse response and variance decomposition analysis for the period 1970 to 2013. The result of the analysis revealed that Nigeria's population has witnessed significant changes between 1960 up to the present period. The oil price data also revealed that significant changes were witnessed over the same period of study. The result further revealed that population growth and oil price, have positive effect on the real gross domestic product, thus making it conform to apriori expectation. Finally, the result of the impulse response as well as variance decomposition analysis showed clearly that both population growth and oil price have positive and stable impacts on real GDP in Nigeria over the forecasted period. The study therefore advocate that efforts should be geared towards reduction of infant and maternal mortality in Nigeria and the government should also work towards shoring up its earnings from oil sales as these would help improve the living standards of the Nigeria population.

Keywords: *Population, oil price, vector error correction, economic growth, Nigeria.*

1. Introduction

Population is a crucial determinant of energy demand and the recent upsurge in the population figures calls for concerns on the growth prospects of the world economy. Studies like (Ishola and Ejumedia, 2012) have shown that population intensifies energy consumption. It is also worthy to note that any shock in the energy sector affects the level of productivity, profitability, earnings and employment opportunity. As a result of this, alternative energy source (renewable) development is important for the required economic growth and at the same time to mitigate the adverse environmental effects of the CO2 emission from fossil energy consumption (Morgan et. al. 2013), this inadvertently link with national security, citizen safety, social order and health of the people who live in Nigeria (Uduma, 2009). Among the few studies that have been able explore the effect of population on growth include Bloom & Canning (2001), Dao (2012) and Shaari *et. al* (2013). Most of these studies, especially Bloom & Canning (2001), state the fact that it is quite possible for interaction between population dynamics and economic growth to result in a poverty trap. Dyson (2010), in a recent study claims that mortality decline (population growth) propels economic growth and therefore leads to an increase in the living standards of the people. This is owing to the facts that as people live longer, they tend to be more positive and proactive about the future, and this should definitely translate to being able to take more risk and eventually innovate. This view was supported by Bloom and Canning (2001) as well as Kalemli-Ozcan (2002) which found evidence that mortality decline raised educational attainment levels and rate of savings rates in developing countries and consequently to increase investment in physical and human capital. However, in the case of Nigeria, where the population had been rising astronomically since independence, that is, from about 56 million in 1970 to about 170 million in 2013, the real GDP has also increased, that is, from 19,793 billion US dollars in 1970 to 91,293 billion US dollars in 2011 with the exceptions of 2012 and 2013 where it dropped significantly (WDI, 2014). The reverse seems to be the case as most Nigerians live in abject poverty. Despite Nigeria's huge earnings from crude oil sales, this huge revenue has not really trickled down to the poor masses in the area of basic necessities of life such as provision of good roads, access to basic education, health facilities, and better living.

From the foregoing, is apparent that People consume energy for various activities like transportation, agriculture, industries and for domestic purposes. The big question therefore is- Nigeria with an estimated population of 160 Million people and dwindling oil revenue in the last 12 months is faced with the challenge of developing more economically viable energy source for its teeming population if growth is to be achieved. This study therefore examines the nexus between population growth oil price and economic growth in an energy dependent economy like Nigeria, where the world price of crude oil export has fallen drastically from over $120 per barrel to less than $50 per barrel within the space of nine months. Most of the study in similar area either focused on the relationship between Population and Global Warming (Birdsall, 1992; Allan, 1994), population and resources (Darmstadter, 2001), Population, Environment and Development (United Nations, 2001), population and development (World Bank, 1994), while others like Saibu & Jaiyeola (2013), Asafu-Adjaye (2000), and Dipa & Yanying (2012) focused on energy consumption and economic growth. The closest study to this is the study on relationship among population, energy consumption and economic growth of Malaysia by Shaari *et al* (2013). Since none of these studies or any other noticeable one has established the effect of population and oil price on economic growth especially, with Nigeria as a case study, this study will help to fill this noticeable gap in literature. The rest of this study is divided into the stylised facts section, empirical review, theoretical framework and research methodology, and the conclusion section.

2. Stylized Facts

2.1. Population Dynamics in Nigeria

Nigeria's population figures have in the last four decades increased astronomically. Although there have been series of arguments from various quarters as to the correctness of most population figures in Nigeria. However, the contentious nature of the figures, the fact remains that, the population of Nigeria had over blown over the years. Going down memory lane, the last population census that was held before independence between 1952 and 1953 recorded 30.4 million Nigerians of which 16.8 million were from the northern region, 6.4 million from southern region and 7.2 million from eastern region (Eniayejuni & Agoyi, 2011). The population census result was used as a basis for allocating legislative seats at the federal level among the then three regions of the country. Out of the total number of 312 seats at the Federal House of Assembly, the northern region had 174 seats based on their population, eastern region 73 seats while western region had 65 seats. Since then, Nigeria's population, either by politicization or genuinely has been on the rise. The first post-independence population census conducted in 1962 saw the country's population increased by almost 50% across the three regions. The controversy that trailed the announcement of the results led to its cancellation. This further led to the conduct of a fresh census in 1963 which puts the country's population at 55.6 million of which 29.7 million were from the northern region, 13.5 million from southern region and 12.4 million from eastern region. The 1973 exercise however put the entire population figure at 79.8 million. In 1991 Nigeria's population figure grew to 88.5 million with 47.2 million in the North, 17.6 million in the South and 23.7 million in the East. The last population census held in the country in 2006 showed that Nigeria's population has risen to 140 million (Falola, 2008). It is currently estimated that Nigeria's population is around 160 million.

Year	North (Million)	South (Million)	East (Million)	Total (Million)
1953	16.8	6.4	7.2	30.4
1963	29.7	13.5	12.4	55.6
1991	47.2	17.6	23.7	88.5
2006	72.8	27.3	39.9	140

Table 1: Nigeria's Regional Population Breakdown
Source: Nigeria Population Commission.

2.2. Population-Led Growth

This is growth based on overwhelming dependence on population explosion. As can be seen in Africa and some South East Asian countries like China and Japan, a large population can provide a stimulus for a large market through increase in effective demand (Bloom and Caning, 2001; Dao, 2012). Economists have often neglected the impact of fundamental demographic processes or population dynamics on economic growth. Bloom and Canning (2001) are among the few who explore the effect of the demographic transition on economic growth. These studies argue that that the interaction of economic growth with population dynamics can result in a poverty trap. They gave example of two clubs: one with low income and high population growth rates, while the other with high income and low population growth rates. While transition between these clubs may be rare, they are able to show that when it does happen, it does so very quickly, due to the positive feedbacks between growth and the demographic transition.

More recently, Dyson (2010) claims that mortality decline aids economic growth and therefore leads to an increase in the standard of living of the populace. As people live longer, they tend to think more about the future and are more likely to take risk and innovate. For instance, Bloom and Canning (2001) and Kalemli-Ozcan (2002) find evidence in developing countries that mortality decline has the tendency to raise educational attainment and savings rates which will in-turn translate to increased investment in both physical and human capital. Mortality decline is also accompanied by health gains that in turn enhance people's economic productivity. Strauss and Thomas (1998), for instance, show that healthier workers are likely to be more productive. In addition to mortality decline, Dyson (2010) has identified population growth, fertility and age-structural change as well as urban growth/urbanization as demographic factors that affect economic growth. However according to the 'neutralist' or 'revisionist' view, high population growth rates in developing countries since the middle of the twentieth century have had little effect on per capita GDP growth (see, for instance, Kuznets (1967), Kelley (1998), and Kelley and McGreevey (1994). Simon (1981) would go as far as suggesting that population growth may have had a positive impact on per capita GDP growth in the long run through improvement of productivity through the contribution of new ideas and the learning-by-doing resulting from increased production volume. Nevertheless, the current consensus is that, as more data become available, rapid population growth has exerted a significant negative effect on economic growth in developing countries, particularly it has resulted in lower standard of living among the majority poor. (see Birdsall and Sinding, 2001; Barro and Sala-i-Martin, 2004; Sachs, 2008; Headey and Hodge, 2009).

2.3. Empirical Review

The relationship between energy consumption, energy prices, population and economic growth has been widely discussed in past studies (Mazur, 1994; Mallick, 2008; Lau et al., 2011; Shaari et al, 2013). Mazur (1994) researched into population and environment. The contribution of American population growth to rising energy consumption was analyzed for the period 1947 to 1991. Energy consumption was disaggregated into electricity and non-electricity consumption, and by end-use sectors: residential and commercial, industrial, and transportation. Population growth was found to be relatively unimportant as a contributor to yearly fluctuations in energy price. Bretschger & Zurich (2007) looked at the channels between energy prices and economic growth. The study developed a theoretical model with different channels through which energy prices affect economic growth and the conditions for a crowding out of capital accumulation by intensive energy use were derived. Estimating a system of simultaneous equations for 37 developed countries, the study showed that rising energy prices are not a general threat to long-term economic development. Mallick (2008) examined the linkage between energy consumption and economic growth in India. Utilizing Granger causality test, the study suggested that economic growth fuelled the demand for both crude oil and electricity consumption. In contrast, the variance decomposition analysis suggested a bidirectional influence between electricity consumption and economic growth, other results remaining unchanged. Ighodaro (2010) used various types of energy consumption such as coal, electric, oil and gas consumption as determinants of economic growth. Their results disclose that electric consumption can influence economic growth. Yu and Choi (1985) employed various methods but found that no causal relationship and it is affirmed by Cheng (1996) by using Engle and Granger and the results gave the same answers. Manufacturing sector contributes to GDP, Soytas and Sari (2006) found that energy consumption influences the sector.

Hong, (2010) examined the long term equilibrium and short term dynamic between GDP and energy consumption in China with a co-integration analysis. The results submitted that energy consumption and GDP have long term equilibrium relationship. Growth was found to be connected with total of energy production and energy consumption. Ji *et al* (2011) analyzed the effect and sensitivity from the energy consumption to economic growth. Multiple linear regression was employed and found that the energy consuming indexes, total consumption of coal, gasoline, diesel oil and of power have effects on GDP in Beijing. Belke *et al* (2011) used OECD countries to analyse the relationship and discovered that energy consumption causes economic growth to increase. Narayan and Prasad (2008) did a studied in OECD countries but examined causality between electricity consumption and economic growth. Their conclusions showed that electricity consumption has an effect on economic growth in Australia, Iceland, Italy, the Slovak Republic, the Czech Republic, Korea, Portugal, and the UK. Growth does influence electricity consumption in Finland and Hungary. Lau *et al* (2011) studied energy-growth causality in seventeen selected Asian countries. The study revealed that causality runs from energy consumption to GDP in the short-run, while it runs from GDP to energy consumption in the long-run, indicating that energy is a force for economic growth in the short-run, but in the long-run, it is economic growth that drives energy consumption. Ray & Ray (2011) conducted a study on the impact of population growth on environmental degradation in India in a bid to analyse population change and its impacts on land, forest, water and energy resources. The study revealed that rapid population growth plays an important role in declining per capita agricultural land, forest and water resources and that outcome of high population growth rates are increasing population density and progressive escalation of the number of people below the poverty line. Population pressure was found to contribute to land degradation and soil erosion, thereby affecting productive resource base of the economy. Adhikari and Chen (2012) studied energy consumption and economic growth with the aim of examining the long-run relationship between energy consumption and economic growth for 80 developing countries from 1990 to 2009. The 80 countries involved were divided into three income groups, namely, upper middle income countries, lower middle income countries and low income countries and the empirical results revealed a long-run co-integrated relationship between energy consumption and growth.

Dao (2012) studied population and economic growth in developing countries by examining the economic effects of the demographic transition in developing countries. Based on World Bank data and using a sample of forty-three developing economies, the study found that the growth rate of per capita GDP is linearly dependent upon population growth, both the young and old dependency ratios, the mortality rate, and whether or not the rate of population growth is less than 1.2 percent per year. Dantama & Inuwa (2012) focused on the relationship between energy consumption and economic growth in Nigeria. They found a unidirectional causality running from energy consumption to economic growth without feedback implying that energy conservation policies will have negative repercussions on Nigeria's economic growth. They therefore advised that government should ensure reliable and sustainable supply of energy at appropriate costs and in an environmentally friendly manner, to propel national development. They also called for the diversification of energy consumption mix to reduce over dependence on non-renewable energy in order to actualize the vision 2020 dream of the country.

Similarly, Isola and Ejumedia (2012) studied the implications of population and oil production on CO_2 emissions in Nigeria within the framework of the error correction model. The study found population growth, oil production and per-capita income to be positively related to CO_2 emissions in the country. Onuonga (2012) investigated the causal relationship between energy consumption and economic growth in Kenya. Using the Granger-causality Error Correction Model, the study found that economic growth influences energy consumption in Kenya. The implication of the study is that energy conservation measures would not lead to negative effects on the country's economic growth. Shaari et. al. (2013) conducted a study on the relationship between population, energy consumption and economic growth in Malaysia. The results indicated that one co-integrating equation exists, suggesting the long-term relationship among population, energy consumption and economic growth in Malaysia. Other previous studies such as Shahiduzzaman & Alam (2012) have also suggested some policies on energy consumption in their various studies. They suggested that a policy on energy consumption should be created because of bi-directional causality between growth and energy use in Australia. However, Lise & Montfort (2006) stated that policy on energy consumption is not necessary in Turkey. Halicioglu (2009) agreed that there is no causal relationship between energy consumption and gross national product in Turkey. Hongwei (2011) examined the causality relationship between economic growth and coal consumption in China for the period of 1978 to 2008. The results showed that coal consumption and production do not influence economic growth. However, economic growth influenced coal consumption.

From the diverse scholarly works that have been reviewed in this research, it is apparent that majority of these studies have only concentrated on other countries other than Nigeria and these efforts have also been on the relationships that exist between population, energy consumption and economic growth without considering the impacts of population growth, oil price and economic growth in Nigeria. This is the gap the study sets to fill in the literature.

3. Theoretical Framework and Methodology

3.1. Theoretical Framework

The Solow neoclassical growth model was exhaustively tested in Mankiw *et al* (1992). These theorists postulated that the Solow neoclassical model fits the data better, once an additional variable - human capital - is introduced, which improves considerably the original ability to explain income disparities across countries. Investigating the limitations listed above, this paper uses another route: new econometric techniques that select a group of countries with time series that present the same stochastic properties in order to make reliable estimates of physical capital share. This procedure provides a new empirical test of the Solow growth model, which yields new evidence on income disparity behaviour across countries. Lee *et al* (1997) presented an individual *random effect* version of the model, developed by Islam (1995), introducing heterogeneities in intercepts and in slopes of the production function in a heterogeneous dynamic panel data approach. These authors have concluded that the parameter homogeneity hypothesis can definitely be rejected. Indeed, they point out that different growth rates render the notion of convergence economically meaningless, because knowledge of the convergence rate provides no insights into the evolution of the cross-country output variance over time. However, most classical econometric theory has been predicated on the assumption that observed data come from stationary processes. A preliminary glance at graphs of most economic time series or even at the historical track record of economic forecasting is enough to invalidate that assumption, since economies do evolve, grow, and change over time in both real and nominal terms. Binder and Pesaran (1999) showed that a way exists to solve this question providing that a stochastic version of the Solow model is substituted for the original one. This requires explicitly treating technology and labor as stochastic processes with unit roots, which thus provide a methodological basis for using *random effects* in the equations estimated in the panel data approach. Once these settings are taking as given, Binder and Pesaran (1999) infer that the convergence parameter estimate is interpreted purely in terms of the dynamic random components measured in the panel data model, without any further information about convergence dynamics itself. Binder and Pesaran (1999) then concluded that the stochastic neoclassical growth model developed is not necessarily a contradiction, despite the existence of unit roots in the *per capita* output time series.

3.2. Methodology

This study uses trend analysis and simple ordinary least squares (OLS), co-integration and error correction mechanism to analyse time series data from 1970 to 2013. This is necessary to avoid a spurious regression which may render our result and recommendation invalid. Going forward, this study will be anchored on the theoretical framework of Robert Solow (1956) who in his celebrated work of the core factors influencing economic growth isolated a key exogenous factor which significantly impact growth potential among economies. As noted by Adebola (2011), legion of empirical studies after Solow's work have significantly increase our understanding of the dynamic of economic growth and the key involving factors responsible for differential growth among developed and developing countries around the world. However, the Solow version of Neo classical is more suitable for this study due to its dynamism. The Solow model focuses on four variables: Output (Y), Capital (K), labour (L), and "knowledge" or the effectiveness of labour (A). At any point, the economy has some amount of capital, labour and knowledge Romer (2009). These are combined to produce output. The production function takes the form of:

$$Y(t) = f(K(t), A(t), L(t)) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y(t) = output at time t, K(t) = capital at time t, L(t) = labour at time t, A(t) = knowledge at time t. A(t) and L(t) enter the model multiplicatively, hence A(t) L(t) is effective labour.

Note that there is technology progress if the amount of knowledge (A) increases. The basic assumptions guiding this theory include (i) Constant return to scale. In its two argument, doubling the quantities of capital and effective labour (e.g doubling K and L with A held fixed) doubles the output. Multiply both variables by any non-negative constant 'C' cause the change in output by the same factor f (CK(t), CAL(t) = C f (K(t), A(t)L(t)) for C > 0 (ii) Other inputs are relatively unimportant. That is, the model neglects natural resources.

Hence, the specific example of production function is the Cobb Douglas function

$$Y = f(K(t), A(t) L(t))$$

It can be explicitly written as:

$$Y = K(t)^{\alpha} A(t) L(t)^{1-\alpha} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2) \quad 0 < \alpha < 1$$

$$Y/AL = K/AL^{\alpha} (AL/AL)^{1-\alpha} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$Y/AL = y \text{ and } K/AL = k. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$\text{Therefore, } y = k^{\alpha} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5) \quad y = f(kt)$$

From above, *y* is output per effective labour and *k* is capital per effective labour.

This production function is very useful for the framework of the research at hand and shall be adapted to incorporate the variables of analysis in this study. To see the movement of effective Labour and Capital over time;

Growth rate of Capital = $\Delta K/K$ where $\Delta K = K(t) - K(t-1)$ ……..(6)
Growth rate of Labour = $\Delta L/L$ where $\Delta L = L(t) - L(t-1)$ ……...(7)
Labour is growing at the rate **n**
Growth rate of knowledge = $\Delta A/A$ where $\Delta A = A(t) - L(t-1)$….(8)
Knowledge is growing at the rate **g**
Therefore, capital per effective labour $k = K(t) / (A(t)L(t))$ …….(9)

Using Quotient Rule to derive the fundamental Solow equation model from equation 9

We have, $$\Delta k = \frac{\Delta K(t)(A(t)L(t)) - (\Delta A(t)L(t))K(t) - (A(t)\Delta L(t))K(t)}{(A(t)L(t))2}$$

$$\Delta k(t) = \frac{\Delta K(t)}{A(t)L(t)} - \frac{\Delta A(t)K(t)}{A(t)(A(t)L(t))} - \frac{\Delta L(t))K(t)}{L(t)(A(t)L(t))}$$

Note: $\Delta K(t) = sY(t) - dK(t)$, $\Delta A(t) = \mathbf{g}$, $\Delta L(t) = \mathbf{n}$, and given that $Y/AL = f(k)A(t)L(t)$

$$\Delta k(t) = \frac{sY(t) - dK(t)}{A(t)L(t)} - k(t)\mathbf{g} - k(t)\mathbf{n} = sf(k(t)) - dk(t) - g(k(t)) - n(k(t))$$

$$\Delta k(t) = sf(k(t)) - (n+g+d)k(t) \quad \text{……………(10)}$$

Equation 10 is the fundamental Solow Model
Where $sf(k(t))$ is actual investment, and
$(n+g+d)k(t)$ is breakeven investment.
Following Asafu-Adjaye (2000), we specify the model to be estimated below:

$$GDP = f(GCF, P, EC, OP) \quad \text{…………………(11)}$$

$$GDP_t = \alpha_0 + \alpha_1 GCF_t + \alpha_2 OP_t + \alpha_3 EC_t + \alpha_4 P_t + \mu \quad \text{…...……………..(12)}$$

In this model, gross capital formation and oil price will serve as control variables.

4. Data Analysis and Interpretation

Variable	ADF Tau Statistics (Linear Trend)	Order of Integration
EC	-6.109649*(0) [-4.192337]	1
CPI	-4.342068*(1) [-4.198503]	1
GCF	-9.093810*(0) [-4.192337]	1
POP	-3.434605**(10)[-3.212361]	1
GDP	-6.721718*(0) [-4.192337]	1

Table 2: Unit Root Test Results
*Note: * significant at 1% ** significant at 10%; Mackinnon critical values and are shown in parenthesis.*
The lagged numbers shown in brackets are selected using the minimum Schwarz Information criteria.
Source: Authors' Computation, 2015.

The test result indicated that the time series variables, energy consumption, consumer price index, gross capital formation, population growth, and real gross domestic product, were found not to be stationary at levels jointly, so the study decided to report the point where they are jointly stationary. So, they are all stationary at first difference, hence, we reject the null hypothesis "*no stationary*" at first difference for linear trend test models. This indicates that those incorporated series in the dynamic regression model have no unit-root or are stationary at first difference and this implies that these series in their first difference are mean reverting and convergences towards their long-run equilibrium.

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.632158	92.48685	88.80380	0.0264
At most 1	0.373024	50.48258	63.87610	0.3926
At most 2	0.287358	30.87497	42.91525	0.4511
At most 3	0.214350	16.64639	25.87211	0.4418
At most 4	0.143670	6.514177	12.51798	0.3979

Table 3: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.632158	42.00427	38.33101	0.0181
At most 1	0.373024	19.60761	32.11832	0.6829
At most 2	0.287358	14.22858	25.82321	0.7028
At most 3	0.214350	10.13222	19.38704	0.6047
At most 4	0.143670	6.514177	12.51798	0.3979

Table 4: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Both trace statistic and Maximum-eigenvalue statistic indicates that there is 1 co-integrating equation at 5% significance level. Hence, a long-run equilibrium relationship exists between the variables and that there exist one co-integrating vector. This is also similar to the result of the study conducted by Shaari *et al* (2013).

4. Empirical Result

The result of the vector error correction model is summarised below.

Dependent Variable: D(LGDP)	Included observations: 41 after adjustments			
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
VECM(-1)	-0.753113	0.703004	-1.071278	0.2929
D(LGDP(-1))	0.591577	0.676290	0.874738	0.3889
D(LGDP(-2))	-0.641900	1.258360	-0.510108	0.6138
D(LCPI(-1))	0.193881	0.613062	0.316250	0.7541
D(LCPI(-2))	-0.337431	0.667894	-0.505217	0.6172
D(LEC(-1))	1.148807	4.110396	0.279488	0.7819
D(LEC(-2))	-0.272269	4.047997	-0.067260	0.9468
D(LGCF(-1))	0.096866	0.313367	0.309112	0.7594
D(LGCF(-2))	-0.098938	0.333733	-0.296460	0.7690
D(LPOP(-1))	16.91370	114.1427	0.148180	0.8832
D(LPOP(-2))	-16.55736	113.0624	-0.146444	0.8846
Constant	0.012198	0.634271	0.019231	0.9848
R-squared	0.703643			
Adjusted R-squared	0.636354			
Log likelihood	21.39073			
F-statistic	0.979177			
Prob(F-statistic)	0.304835			
Durbin-Watson stat	1.948371			

Table 5: Vector Error Correction Model
Source: Authors' Computation from Eviews

The coefficient of the $VECM_t(-1)$ of the first equation implies that our result conforms with expectation as it is negative but not significant probably due to the lagged values. It's value of -0.753113 implies that the error correction term or the speed of adjustment towards long run equilibrium state is 75.31%. This implies that about 75.31% divergence due to the equilibrium error in the previous year is corrected in the next period. It can be concluded that the speed of adjustment towards long run is very fast. The result shows that the variables of interest, which are energy consumption and population growth, have positive effect on the real gross domestic product. In the first case, the result shows that energy consumption in the first period (1.148807) has a positive relationship with the real GDP, which makes it conform to our apriori expectation, but has a negative relationship (-0.272269) on it in the second period. This implies that the more the energy consumed, the higher will be the growth in the economy. In the same vein, population growth in the first period (16.91370) is also found to positively impact real GDP. This also conforms to our apriori expectation as it is believed that a large or increasing population will necessitate market expansion, which should ultimately translate to higher growth of the economy. Consumer price index of coefficient of 0.193881 as well as that of gross capital formation of 0.096866 showed that all the explanatory variables in the model intensify economic growth.

4.1. Impulse-Response Analysis

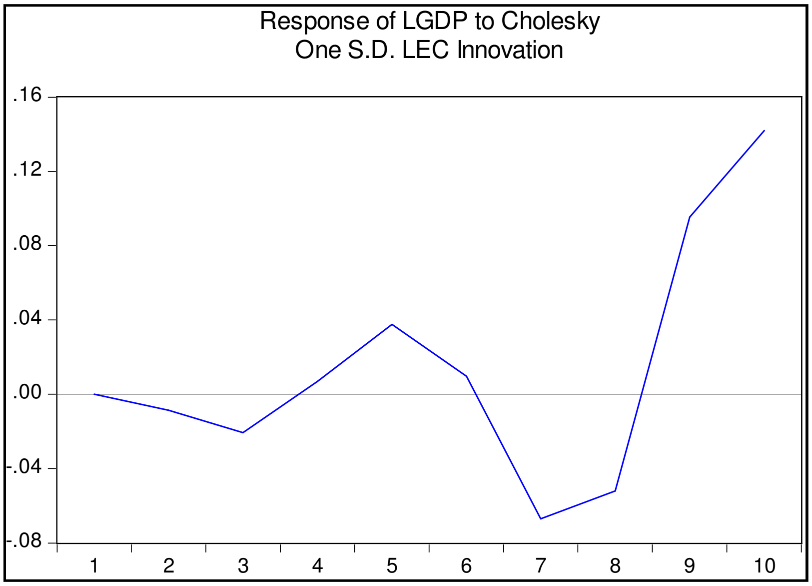

Figure 1: Impulse response of real GDP

The impulse response function above shows that over the periods, real gross domestic product has been responding positively to shocks in energy consumption. As can be observed in figure 1, its movement between positive and negative 0.04 between periods 1 to 6 signify some level of stability and it implies that the shocks to energy consumption between periods 1 to period 6 brought some level of stability to the real GDP over the period. However, the real GDP responded more negatively to energy consumption between the 6th and 8th period, the subsequent period 8th to 10th made up for this real GDP responded far more positively to shocks in energy consumption. This shows clearly that energy consumption has a very major effect in propelling the growth of Nigeria's economy over the period of study.

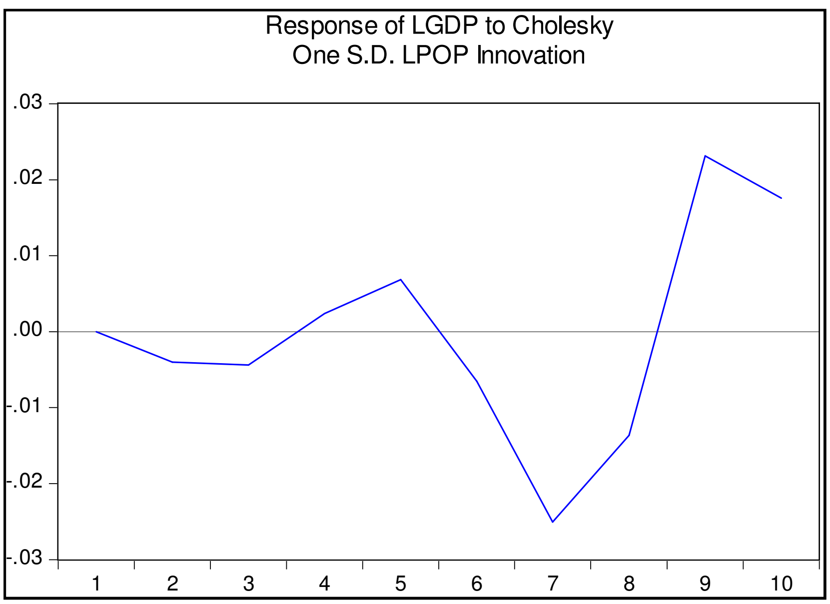

Figure 2: Impulse response of real GDP to shocks in population growth

As was the case with energy consumption, the impulse response function above shows that over the periods, real gross domestic product also responded positively to shocks in population growth. Figure 4.1 above shows that between periods 4 and 6, real GDP responded in a stable manner to the shocks in population growth. It is from the 5th to 8th period that the real GDP suffered a bit, but period 8 to 10 also witnessed a positive response from real GDP.

It is clear from this study that both energy consumption and population growth provide significant impetus for economic growth over the period of study, as the variance decomposition analysis has suggested.

4.2. Variance Decomposition Analysis

Christelle et al (2013) asserts that the Variance Decomposition (the Forecast Variance Decomposition), essentially denotes the breakdown of the forecast error variance for a particular time horizon. Explicitly, the Variance Decomposition separates the variation in an endogenous variable into the component shocks to the VAR/VECM. In essence, this analysis provides information about the relative importance of each random innovation in affecting the variables in the VAR/VECM (Ludi & Ground, 2006; Georgantopoulos, 2012). Also, the Variance Decomposition can reveal which variables in the model has short term or long term impacts on another variable of interest (http://espin086.wordpress.com/2011/04/).Therefore, the main reason to conduct the Variance Decomposition is to obtain information about the relative significance of each random innovation in affecting the variables in the estimated model. Pesaran and Shin (1998) sustained that the Variance Decomposition analysis is very sensitive to the ordering of variables.

The Variance Decomposition of real gross domestic product over 42 years computed in Eviews is shown in Table 6.

Period	S.E.	LGDP	LCPI	LEC	LGCF	LPOP
1	0.155959	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.195069	96.82277	0.263444	0.192465	2.679039	0.042284
3	0.292070	96.74412	0.152510	0.584290	2.477462	0.041618
4	0.417514	98.29298	0.146487	0.314319	1.222584	0.023634
5	0.507859	98.01733	0.099059	0.763027	1.086346	0.034238
6	0.889972	99.00452	0.306308	0.260615	0.412017	0.016537
7	0.911476	97.00639	0.617955	0.789097	1.495412	0.091143
8	1.695768	98.90059	0.216006	0.322105	0.528494	0.032802
9	1.758738	98.07415	0.428801	0.593925	0.855299	0.047829
10	3.013351	98.98041	0.178225	0.424150	0.397525	0.019691

Table 6: Variance Decomposition of real GDP

4.3. Cholesky Ordering: LGDP, LCPI, LEC, LGCF, LPOP.

From the table above, we depict the relative significance of each structural shock to the variables in the system. We then report the variance decomposition of real gross domestic product over a 10 period ahead. In terms of explaining its own shocks, 100% of real GDP variance can be explained by its own innovation in the first period. We also observe that as time goes on; its contributions are fairly tumbling till it reaches 98.98% in the last period. However, it has the highest contribution over the forecasted period compared to the other variables. This brings us to the conclusion that over the years, real GDP can be greatly explained by its own shocks.

Following real GDP itself, the 2nd up to the 9th period demonstrates the relative importance of gross capital formation (LGCF) in explaining the variation of real GDP. This result has also further buttressed the study of Solow (1956), which advocated that labour and capital are important exogenous variables that should drive economic growth. As we can see in the second year, LGCF accounts for 2.68% in the variation of real GDP, consumer price index (LCPI) accounts for 0.26%, energy consumption LEC) accounts for 0.19%, while population growth (LPOP) accounts for just 0.04%. In lieu of the above, we draw conclusion that real GDP of previous year is a major driving force of real GDP of current year.

The variance decomposition result also shows that it is only in the 10th period that oil price accounts for 0.42% to take a pole position gaining some weight over gross capital formation in the explanation of changes in real GDP.

With regard to the aforementioned interpretations, over the period considered, we can conclude that oil price and population growth have significant effect on economic growth in Nigeria. This is sequel to the fact that gross capital formation, which can result from a highly educated labour force plays a major role in the decomposition of real gross domestic product.

This study examined the relationship between population, oil price and economic growth in Nigeria using the vector error correction model as well as impulse response and variance decomposition analysis for the period 1970 to 2013. The result of the analysis revealed that Nigeria's population has witnessed significant changes between 1960 up to the present period. The oil price data also revealed that significant changes were witnessed over the same period of study. The result further revealed that population growth and oil price, have positive effect on the real gross domestic product, thus making it conform to apriori expectation. Finally, the result of the impulse response as well as variance decomposition analysis showed clearly that both population growth and oil price have positive and stable impacts on real GDP in Nigeria over the forecasted period. The study therefore advocate that efforts should be geared towards reduction of infant and maternal mortality in Nigeria and the government should also work towards shoring up its earnings from oil sales as these would help improve the living standards of the Nigeria population.

The result of the VECM model has far reaching implication on the Nigerian economy as it posits that oil price, population growth, domestic price, and gross capital formation of the current period in Nigeria will intensify positively growth of the economy, and that their values in the previous year will negatively impact the growth process of the economy. This means that effort must be geared towards enhancing the capacity of the citizenry through investment education and health infrastructures, as the result has shown that increased oil price and population growth in the country can help propel the wheels of growth.

The report of the variance decomposition of real gross domestic product over a 10 period suggests that real GDP itself provided the highest contribution over the forecasted period compared to the other variables. This made us conclude that over the years, real GDP can be greatly explained by its own shocks. The 2nd up to the 9th period demonstrates the relative importance of gross capital formation (LGCF) in explaining the variation of real GDP. This made the result confirmed the study of Solow (1956), where labour and capital are important explanatory variables in the growth model. Evidence from the variance decomposition analysis, especially from the second year, where LGCF accounted for 2.68% in the variation of real GDP, provided an impetus for the justification of capital in the growth model as a controlled variable.

5. Conclusion

The analysis of the relationship between population growth, oil price and economic growth in Nigeria between 1970 and 2013 revealed that for the Nigerian economy to be launched on the path of steady growth, population dynamism, oil price, gross capital formation, as well as consumer price index should be rising appreciably. This means that Nigeria stands a better chance to benefit immensely, from increase population if well managed. Since the result asserts a positive relationship between population and economic growth in Nigeria, it is clear that the strength of Nigeria's GDP lies in a very strong market where effective demand from a big population provides an impetus. The reason for this is not far-fetched as recent values of oil price, population or even consumer prices are expected to contribute more to economic growth of the present period than older values of the explanatory variables would do. According to Koyck (1954), given a distributed lag model, like the one used in the study, coefficients of the lags declines geometrically as we increase lags. Therefore, lag 2 of all the explanatory variables in the study has a lesser effect on economic growth compared to lag 1 and we can safely conclude that oil price and population growth have significant effect on the Nigeria's economic growth.

In addition, the result of our vector error correction model revealed the fact that all our explanatory variables are statistically insignificant in explaining economic growth in Nigeria. This is one of the shortcomings of employing the vector error correction model, and that is why the impulse response function and variance decomposition analysis had to be conducted in order to see how real GDP responds to shocks in oil price and population growth. This also necessitated the variance decomposition analysis, where the relative effectiveness of each variable in absorbing variations in economic growth was duly observed and respected. The impulse response analysis showed that there is a high degree of stability across the 10 periods in manners in which economic growth responded to Cholesky one standard deviation especially in oil price and population growth. We can then conclude that since all the variables appear to have shown positive trends and stability in influencing real GDP, oil price and population growth has positive impacts on economic growth in Nigeria.

It should be noted that, a reduction in oil price in Nigeria can hinder the country's growth, therefore any policy aimed at reducing earnings from oil should be revised as the country is highly dependent on earnings from this sector for survival. Though, this assertion is against the current public outcry in Nigeria for a downward review of oil price, it is however not in the best interest of the people to do so if growth is to be achieved in the first place. The current subsidy regime whereby the government subsidized petroleum products is also not sustainable as this subsidy does not get to the ordinary citizens to whom it is intended to empower.

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