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Growth rate and Direction of World oil price, Agricultural Growth, Food Price and Food Insecurity in Nigeria: 1970-2020

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The study analyzed the growth rate and direction of world oil price, agricultural growth, food price and food insecurity in Nigeria. Time series data on world oil price, agricultural growth, wheat price, maize price, rice price, soybean price, food insecurity , exchange rate and inflation rates spanning the period of 1970-2020, were collected on annual basis from secondary sources. The results from growth models showed that world oil price, agricultural growth, wheat price, maize price, rice price, soybean price, food insecurity fluctuated over the period though they exhibited positive instantaneous growth and compound growth rates during the period under review. However, regarding the direction of growth, food insecurity (2.441) accelerated, agricultural growth (-5.285), maize price (-3.725), wheat price (-3.722), exchange rate (-2.044) an inflation (-1.861) decelerated, while world oil price (-1.502), rice price (0.3661) and soybean price (-0.240) stagnated over the sample period, from growth models showed that world oil price, agricultural growth, wheat price, maize price, rice price, soybean price, food insecurity fluctuated over the period though they exhibited positive instantaneous growth and compound growth rates during the period under review. However, regarding the direction of growth, food insecurity (2.441) accelerated, agricultural growth (-5.285), maize price (-3.725), wheat price (-3.722), exchange rate (-2.044) an inflation (-1.861) decelerated, while world oil price (-1.502), rice price (0.3661) and soybean price (-0.240) stagnated over the sample period.

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I. INTRODUCTION

Oil sector has been one of the vital sectors in the global economy. The sector serves as a source of input and energy to almost all sectors of the economy. It also accounts for about 2.5 per cent of the World gross domestic product. The oil sector in Nigeria contributes about 10 per cent to the Nation's GDP while petroleum exports revenue represents around 86 per cent of total exports revenue (Organization of the Petroleum Exporting Countries, OPEC, 2021; Simona, 2021). Since oil was discovered in commercial quantity in Nigeria, oil has dominated the economy of the country. Thus, a small oil price changes can have a large impact on the economy. For instance, a US$1 increase in the oil price in the early 1990s increased Nigeria's foreign exchange earnings by about US$650 million (2 percent of GDP) and its public revenues by US$320 million a year (Agbede, 2013). Nigeria's reliance on oil production for income generation clearly has serious implications for its economy (Agbede, 2013).

Sharp changes in oil price affect different countries differently, depending on whether the country in question is an exporter of crude oil or an importer. For an importer or a consumer nation, rise in price of oil, an input of production, raises the cost of production, and hence can lead to (cost-push) inflation, lower economic growth, and even recession (Mordi and Adebiyi, 2010). This was the case in the US between 1948 and 1981 (Hamilton, 1983). On one hand, rise in oil price is beneficial to oil exporting countries as export receipt from a given quantity of oil increases (Blanchard, 2007). On the other hand, decline in oil price may hurt them in terms of decline in foreign revenue, economic recession, and sometimes political instability (Zhang *et al*., 2015). The relationship between oil price and food price changes, but overall, it is evident that oil prices increase causes food price to changes (Daniel *et al*., 2018)

It is evident that countries may benefit from additional income from commodity price booms; yet, the benefit may be limited due to the Dutch disease syndrome plague (DDS). Besides, removal of subsidies on petroleum products by many governments in net oil-exporting countries in pursuit of market-based efficiency is trying domestic prices of petroleum products to international crude oil prices (Baig *et al*.**,** 2007). This implies that oil price rise/shocks filters into their economies via domestic fuel prices. Thus, their economies may also be affected by oil price increase in a fashion similar to that of net oil importers.

Oil price rise is costly for the oil-importing economy, and neither does its decline benefit them (Atukeren, 2003). That is, price decline does not significantly improve the economy; whereas, oil price rise negatively impacts on the economy (Sauter and Awerbuch, 2003). This asymmetry is due to constraints placed on firms' adjustment to oil price shocks by resource reallocation effect. When oil price rises, sectors that use oil-intensive production processes decline. On the other hand, sectors that are less dependent on oil relatively expand. The engendered reallocation of resources, coupled with market imperfection constrains reverse adjustment when oil price falls. Factors of production do not readily move between sectors, despite falling oil price and declining costs of production; and consequent expansion in the energy-intensive sector. The sector could thus not fully expand in response to a unit fall in oil price - as much as they shrank when oil price had risen by a unit. This shows that oil price changes (rise and fall in price) lead to overall output loss for oil-importing countries (Jimenez-Rodriquez and Sanchez, 2003).

Price fluctuation is among the most significant source of concern for food security in both developing and developed economics (FAO, 2011). The global food market has witnessed episodes of price shock in the last three decades with their resulting effects on individual economic agent (farmers, producers, retailers and consumers), and governments. The global food price shocks of 2007/2008, the 2010/2011 resurgence of food price spikes and rising food price in 2018 have drawn the attention of international organization, policy analysts and researchers on the issues related to price fluctuations as well as the driver and trigger of food price shocks. Food prices have been quite high across many countries in the last decade (Von Branu and Tadesse 2012; Minot, 2014; Shittu *et al.*,2017).

The food price fluctuations of the past decade have also been linked to having substantial economic cost and exerted negative welfare impacts on many households especially the poor, small holder traders in Africa and other developing regions (FAO, 2011). Many factors have attributed to fluctuation in food prices in recent years including policy shocks, monetary factors, extreme weather events, demand shocks and energy price (Tadessa *et al.,* 2016). Pal and Mitra (2017, 2018), highlighted that the price of energy is the primary driver of agricultural commodity price around the globe.

Food poverty is the state of being without consistent access to enough, affordable and nutritious foods. (Fawole and Ozkan, 2018). During the 1996 world submit of November held in Rome all heads of Government of their representative at the summit pledged their support and commitments to achieving global food security and alleviation of hunger (FAO, 1996). Despite effort by international institutions, the population the undernourished people in the world still constitutes a major problem in most part of the world based on 2019 assessment of the food and agriculture organization of the United Nation (FAO, 2016).

Understanding the trend in macroeconomic variables is critical for policy recommendation and decisions. Therefore, the current study analyses the growth rate and direction of world oil price, Agricultural growth, food prices and food insecurity in Nigeria from 1970 to 2020 in a holistic manner

II. METHODOLOGY

The study used time series data from 1970 to 2020 which were obtained from World Bank and FAO. Growth model was used to ascertain direction and growth rates of variables of interest. An exponential growth model was developed for this study instead of a linear trend model because the study was interested in both absolute and relative change in the parameters of interest for this study. The exponential growth model is specified as:

$$LnY_t = \alpha + \beta t + \mu_t \quad (1)$$

where;

α = intercept;

β = coefficients of the trend variable for Agriculture growth or Food price or Food security or World oil price or Exchange rate or Inflation rate.

μ is the econometric error term.

The parameter of utmost interest in equation (1) is coefficient of β, the slope coefficient which measures the constant proportional/relative change in Y for a given absolute change in the value of the regressor t.

Firstly, multiplying β by 100, gives the instantaneous growth rate (IGR) at a point in time.

$$IGR = \beta \times 100 \quad (2)$$

where:

IGR = Instantaneous growth rate and

β = is the least-square estimate of the slope coefficient

Secondly, taking the antilog of β subtracting 1 from it and then multiplying the difference by 100 gives the compound growth rate (CGR) over a period of time. The compound growth rate (CGR) in percentage can be recovered from the equation (2) in the following manner:

$$CGR = (e^{\beta i}-1)*100 \quad (3)$$

where;
β_i = the coefficient of the trend variable in the respective cases
Further, the quadratic form of the model was estimated as:

$$lnY = \alpha + \beta_1 t + \beta_2 t^2 + u_t \quad (4)$$

If β_2 is positive and statistically significant there is acceleration in growth, if β_2 is negative and statistically significant there is deceleration in growth, if β_2 is not statistically significant there is stagnation in the growth process.

III. RESULTS AND DISCUSSION

Table 1: Growth rate and direction of Agricultural growth

The result of the trend model showing the growth rate and direction of agricultural growth is presented in Table 1. The exponential and the quadratic growth models were estimated with the agricultural growth as the dependent variable while time is the independent variable. In general, the models show good fit as indicated by the high coefficient of multiple determination and significance of the F-statistics. The coefficient of the trend (time) variable in the exponential model is positive (0.213) and this yields an instantaneous growth rate (IGR) and the compound growth rate (CGR) of 21.3% and 23.7 % respectively. In the quadratic model, the coefficient of interest is the trend squared coefficient which gives an indication of the direction of growth whether accelerating, decelerating or stagnant. The trend squared coefficient for agricultural growth model is negative(-0.000) and significant at 1%over the period under review. This implies that agricultural growth in Nigeria decelerated over the period of study. The finding is in line with Tamba (2016) who found at that agricultural growth rate in Cameroon decelerated by 0.87%.This could due to low level of infrastructure in the agricultural sector and the inability of the country to meet up with the United Nations Food and Agricultural (FAO) mandates.

Table 1: Growth Rate and Direction of Agricultural Growth

Model	**Exponential**		**Quadratic**		
Determinant	**Trend**	**Constant**	**Trend**	**Trend^2**	**Constant**
Coefficient	0.213***	7.739***	0.291***	-0.015***	7.103***
T-Stat	44.198	55.250	5.285	-5.285	43.108
Prob	0.000	0.000	0.000	0.000	0.000
R^2	0.974		0.984		
AIC	1.519		1.105		
F.Stat	1953.466		1527.543		
Prob	0.000***		0.000		
IGR%	21.300				
CGR%	23.75				

*** Indicates significance at 1% level.
Source: Author's Computation (2021).

Table 2: Growth rate and direction of exchange rate

The result of the trend model showing the growth rate and direction of exchange rate is presented in Table 2. The exponential and the quadratic form indicate a good fit of the model to the data. This is based on the high R^2values and significance of the F-statistics. The coefficient of the exponential trend model for exchange rate is0.159; this translates into the instantaneous growth rate (IGR) and the compound growth rate (CGR) of 15.9 %and 17.2 %respectively. The coefficient of the trend squared in the quadratic model is -0.000 and significant at 5% implying a deceleration in exchange rate over the study period. The findings agree with Adeoye (2014) who noted that the volatility in exchange rate could be due to changes in interest and inflation rates.

Table 2: Growth Rate and Direction of Exchange Rate

Model	Exponential		Quadratic		
	Trend	**Constant**	**Trend**	**Trend^2**	**Constant**
Coefficient	-0.002	2.707***	0.042*	-0.000*	2.336
T-Stat	-0.395	14.174	1.696	-1.861	0.56
Prob	0.694	0	0.096	0.068*	0
R^2	0.003		0.07		
AIC	2.14		2.109		
F.Stat	0.156		2.109		
			0.174		
IGR%	-0.2				
CGR%	-0.2				

***, and **, indicate significant at 1% and 5% level respectively.
Source: Author's Computation (2021).

Table 3: Growth rate and direction of inflation rate

The trend model for inflation rate is presented in Table 3. The exponential and the quadratic form indicate a good fit of the model to the data The coefficient of the exponential trend model for inflation rate has a positive value of (-0.002)when translated into the instantaneous growth rate (IGR) and the compound growth rate(CGR) are (0.2%) and(-0.2%). The coefficient of the squared trend in the quadratic model is negative (-0.000) and significant at 10%. This implies that there was deceleration in the growth of inflation rate over the period under study. The finding contrasts with Victor (2016) that noted that acceleration of inflation in Nigeria leads to increase in food and energy prices.

Table 3: Growth Rate and Direction of Inflation Rate

Model	Exponential		Quadratic		
	Trend	**Constant**	**Trend**	**Trend^2**	**Constant**
Coefficient	-0.002	2.707***	0.042*	-0.000*	2.336
T-Stat	-0.395	14.174	1.696	-1.861	0.560
Prob	0.694	0.000	0.096	0.068*	0.000
R^2	0.003		0.070		
AIC	2.140		2.109		
F.Stat	0.156		2.109		
			0.174		
IGR%	-0.2				
CGR%	-0.2				

*** and *Indicate significant at 1% and 10% level respectively.
Source: Author's Computation (2021).

Table 4:Growth rate and direction of maize price

The result of the trend model is presented in Table 4. Based on the high R^2 and F-statistics, the exponential and quadratic models indicate a good fit of the model to the data. The coefficient of the exponential trend model for maize is 0.146 and when translated into the instantaneous growth rate (IGR) and the compound growth rate (CGR) are (14.6%) and (15.7 %). The coefficient of the squared trend in the quadratic model is negative (-0.001) and significant at 1%. This implies deceleration in maize price over the period under study.

Table 4: Growth Rate and Direction of Maize Price

Model	Exponential		Quadratic		
	Trend	Constant	Trend	Trend²	Constant
Coefficient	0.146***	5.001***	0.241***	-0.001***	4.230***
T-Stat	19.579	23.001	9.199	-3.725	14.930
Prob	0.000	0.000	0.000	0.000	0.000
R^2	0.886		0.912		
AIC	2.399		2.184		
F.Stat	383.027		248.769		
IGR%	14.6				
CGR%	15.7				

Source: Author's Computation (2021).
***Indicates significant at 1% level

Table 5: Growth rate and direction of rice price

The result of the trend model for rice price is presented Table 5. The exponential and the quadratic models indicate a good fit of the model to the data. The coefficient of the exponential trend model for rice is 0.060,when translated into the instantaneous growth rate (IGR) and the compound growth rate (CGR) are (6 %) and(6.1 %). The coefficient of the squared trend in the quadratic model is negative (-0.000) but not significant. This implies that there was stagnation in the growth of in rice price over the period under study.

Table 5: Growth Rate and Direction of Rice Price

Model	Exponential		Quadratic		
	Trend	Constant	Trend	Trend²	Constant
Coefficient	0.143***	5.085***	0.152***	-0.000	5.014***
T-Stat	15.221	18.548	4.071	-0.240	12.368
Prob	0.801	0.000	0.0002	0.811	0.000
R^2	0.825		0.825		
AIC	2.863		2.901		
F.Stat	231.999		113.798		
Prob	0.000		0.000		
IGR%	14.3				
CGR%	15.3				

***Indicates significant at 1% level
Source: Author's Computation (2021).

Table 6: Growth rate and direction of soybean price

The result of trend model for soybean price is presented in Table 6. The exponential and the quadratic models indicate a good fit of the model to the data The coefficient of the exponential trend model for soybean is

0.143.This translates into the instantaneous growth rate (IGR) and the compound growth rate(CGR) of14.3% and 15.3 %) The coefficient of the squared trend in the quadratic model has a negative value of (-0.000) but not significant. This implies that soybean price stagnated over the period under study.

Table 6: Growth Rate and Direction of Soybean Price

Model	Exponential		Quadratic		
	Trend	Constant	Trend	Trend^2	Constant
Coefficient	0.149***	4.910***	0.233	-0.001***	4.220***
T-Stat	22.231	25.228	9.956	-3.722	16.638
Prob	0.000	0.000	0.000	0.000	0.000
R^2	0.909		0.930		
AIC	2.177		1.963		
F.Stat	494.229		318.875		
Prob	0.000		0.000		
IGR%	14.9				
CGR%	16				

Source: Author's Computation (2021).
*** indicates significant at 1% level.

Table 7: Growth rate and direction of wheat price

The result of trend model for wheat price is presented in Table 7. The exponential and the quadratic models indicate a good fit of the model to the data. The coefficient of the exponential trend model for wheat price has positive value of (0.149) when translated into the instantaneous growth rate (IGR) and the compound growth rate (CGR) are (14.3%) and (16%). The coefficient of the squared trend in the quadratic model has a negative value of (-0.001) which is significant at 1%. This implies that there was deceleration in the growth of wheat over the period under study.

Table 7: Growth Rate and Direction of Wheat Price

Model	Exponential		Quadratic		
	Trend	Constant	Trend	Trend^2	Constant
Coefficient	0.023***	1.675***	-0.009	0.000**	1.948
T-Stat	6.300	15.253	-0.678	2.441	12.713
Prob	0.000	0.000	0.501	0.018	0.000
R^2	0.447		0.508		
AIC	1.033		0.955		
F.Stat	39.693		24.834		
Prob	0.000		0.000		
IGR%	2.3				
CGR%	2.3				

Source: Author's Computation (2021).
***Indicates significant at 1% level

Table 8: Growth rate and direction of food insecurity

The result of trend model is presented in Table 8. The exponential and the quadratic form indicate a good fit of the model to the data. The coefficient of the exponential trend model for food insecurity has positive value of (0.023) when translated into the instantaneous growth rate (IGR) and the compound growth rate (CGR) are (2.3%) and (2.3%). The coefficient of the squared trend in the quadratic model has a positive value of (0.000) and is significant at 5%. This implies that there was acceleration in the growth of food insecurity over the period under study.

Table 8: Growth Rate and Direction of Food Insecurity

Model	Exponential		Quadratic		
	Trend	**Constant**	**Trend**	**Trend²**	**Constant**
Coefficient	0.060***	8.549***	0.068***	-0.000	8.481***
T-Stat	10.212	49.710	2.930	-0.366	33.378
Prob	0.000	0.000	0.005	0.715	0.000
R^2	0.680		0.681		
AIC	1.930		1.966		
F.Stat	104.279		51.285		
Prob	0.000		0.000		
IGR%	6				
CGR%	6.1				

Source: Author's Computation(2021).
*** and ** Indicate significant at 1% and 5% level respectively

Table 9: Growth rate and direction of world oil price

The result of trend model for world oil price is presented in Table 9. The exponential and the quadratic models indicate a good fit of the model to the data. This is based on high coefficient of the determination (R^2) and significant F-statistics. The coefficient of the exponential trend model for world oil price has positive value of (0.043). This translates into the instantaneous growth rate (IGR) and the compound growth rate (CGR) of (4.3%) and (4.39%). The coefficient of the trend square in the quadratic model is negative (-0.000) but insignificant. This implies that there was stagnation in the growth of world oil price over the period under study.

Table 9: Growth Rate and Direction of World Oil

Model	Exponential		Quadratic		
	Trend	**Constant**	**Trend**	**Trend²**	**Constant**
Coefficient	0.043	2.122***	0.071	-0.000	1.894
T-Stat	8.805	14.803	3.722	-1.502	1.940
Prob	0.000	0.0000	0.0005	0.139	0.000
R^2	0.612		0.630		
AIC	1.566		1.559		
F.Stat	77.538		40.892		
Prob	0.0000		0.000		
IGR%	4.3				
CGR%	4.39				

Source: Author's Computation(2021).
*** and ** Indicate significant at 1% and 5% level respectively

IV. CONCLUSION

1. This study was carried out to analyze the growth rate and direction of growth of global oil price, agricultural growth, food price, and food insecurity in Nigeria from 1970 to 2020. The study concluded that while the world oil price, agricultural growth, food prices, food insecurity, exchange rate and inflation fluctuated over the sample period, on the average agricultural growth, maize price, wheat price, exchange rate and inflation decelerated, food insecurity accelerated while oil price, rice price and soybean price stagnated. Nigeria must also address its dependence on food import and other structural problems, and building long –term resilience to food crises and other shocks, by focusing on increasing domestic agricultural production, promoting technologies to improve agricultural production and other foodgrain while making conscious effort to curb the effect of global oil price.

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