Global Journal of Arts, Humanities and Social Sciences
Vol.7, No. 10, pp.55-76, December 2019
Published by ECRTD-UK
Print ISSN: 2052-6350(Print), Online ISSN: 2052-6369(Online)

DEMOGRAPHIC STRUCTURE AND DYNAMICS OF MANUFACTURING OUTPUT IN NIGERIA

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ABSTRACT: *The manufacturing sector is ubiquitously seen as the pathway to economic growth and development due to its driving potentials. Modern theories present population increase in an optimistic light as opposed to the doomsday assertion of Malthus. It is in light of this foregoing that this study examines the impact of population growth on the manufacturing sector output in Nigeria for the stretch of 1981 to 2018. The population growth was ventilated into male population growth, female population growth and youth population to help examine which category of population spur or inhibit the growth of the manufacturing sector output. The test for long-run association between manufacturing output ratio to GDP and population components was done using the normalized co-integration technique. In addition, the study used the error correction mechanism (ECM) to examine the short run dynamics of the variables and the speed at which past year's disequilibrium will be corrected in the current period. The normalized co-integration showed a positive and significant relationship between male population growth and manufacturing sector contribution to GDP, while a negative and significant long run relationship was found between female population growth, youth population growth and manufacturing sector contribution to GDP respectively. The study hence recommended an aggressive entrepreneurial awareness programmes and starter packs to help draw in the active and vibrant youth population and a parity or non-dichotomy in employment, pay and other employment benefits between male and female employees.*

KEYWORDS: manufacturing output, male population growth, female population growth, youth, population growth, Nigeria.

INTRODUCTION

Over the years, the manufacturing sector has remained the epicenter of economic diversification in the global economic environment. Essentially, in most emerging economies of which Nigeria belongs to, the manufacturing sector is adjudged to be the leading sector or the sector capable of spring boarding such economy to advancement (Imoughele & Ismaila, 2014). This is because, the manufacturing sector serves or provides a medium to correct the trade imbalance of increased import over export through increase in productivity, a veritable source of foreign exchange to increase the foreign exchange capacity of the country, address the issue of unemployment by making available employment opportunities, raise the level of per capita income which translates into a drastic paradigm shift in the current pattern of consumption pervasive in the country (Onakoya, 2018).

As noted by Onakoya, et al., (2017), the share of the Nigeria manufacturing sector as a proportion of gross domestic product (GDP), over the years, has been plagued by irregularities as it was reported to be 4.8 percent to the GDP at independence. This increased to 7.4 percent a decade later following inflow of foreign direct investment (Ku, Mustapha & Goh, 2010). The manufacturing sector ratio to GDP reached a record high of 10.7 percent the following decade. Howbeit, these great feat bottomed to 6.3 percent in 1985, continuing steadily downwards to 6.3 percent and 4.21 percent in 1997 and 2009 respectively (Adenikinju & Chete, 2002). The contribution of manufacturing sector to GDP witnessed a push upward following the rebasing of the GDP to 2010 as the sector ratio to GDP rose to 6.46 percent as recorded in 2011; its share grew to 6.83 percent in 2013 and by 2016, the contribution of the manufacturing sector to GDP hit 9.2 percent (CBN, 2016; NBS, 2016).

With the commencement of the twenty-first century, global population was estimated to be about 6.1 billion people. The projection of the United Nations put the population at over 9.1 billion by the year 2050 with approximately 90 percent of such population expected to reside in developing countries (Todaro & Smith, 2011). The held belief is that population and manufacturing output (by implication economic growth) is positively correlated as more people meant and translates into a greater level of output as many argued that the current modernization and technological advancement ubiquitous in the current dispensation is drawn from centuries of rapid population growth and expansion in the manufacturing sector. At a population growth rate of about 2.8 percent per annum, Nigeria is seen as the fastest growing country population wise. Currently estimated to be over 190 million, Nigeria is seen or sits as the most populous country in Africa, accounting for one in every five persons in sub-Saharan Africa (Tartiyus, Dauda & Peter, 2015). The decomposition of the category of the population revealed that the youth constitute about 49 percent and are seen as the most vibrant, energetic, resourceful, hardworking and open to technological changes and advancement. The general belief is that with this enviable and growing population, Nigeria’s overall output will steadily and astronomically rise through time.

Howbeit, this is not the case and deviates from statutory trajectory, thus presenting a paradox. Over the past decades successive government have struggled to raise manufacturing output level and achieve inclusive growth. In 2015 to 2016, the manufacturing sector year-on-year growth for each of the quarters of the two years period were negative and this coincided with the period during which the country slipped into recession, re-echoing the catalytic role of the manufacturing sector in driving economic growth and development (NBS, 2016; Ume, et al., 2017). The Nigeria State is blessed with enormous human, mineral and natural resources which includes a growing population, coal, crude oil, among others. However, the struggle for the achievement of increase in manufacturing output has been a daunting task even in the mist of plenty labour.

In line with the foregoing, the study examined the impact of population growth on the manufacturing sector by disaggregating the entirety of population into categories of male population, female population and youth population so as to examine their individual influence on manufacturing output. The succeeding section will cover the literature review, with the estimation method covered in the third section. Section four of this paper will report the results whereas conclusion reached and proposed recommendations are reported in section five.

LITERATURE REVIEW

Theoretical Review

The postulation about population which encapsulates size and changes in population has been a burning discuss and has been a recurring topic in the economic growth and development discussion arena. Myriad of ancient philosophers like Plato, Kautilya, Confucius and contemporary economists like Smith and Ricardo, through their works, touched on the concept of population and productivity.

The attraction borne out of the complexity of association between population growth and output has given rise to plethora of population theories. As noted by Kelley (1988), these theories are broadly categorized into micro analytical theories and macro analytical theories. The micro theories focus on individual's role as it pertains to survival life span, fertility, whilst the macro theories centers around society's evaluation concerning the patterns of mortality, fertility, growth, among others. Malthus (1798) Demographic Theory falls within the latter category of population theories. As captured in his book entitled First Essay on Population, Malthus (1798) opined that population increases result mainly from the attraction that exist between individuals of opposite genders which produces a very large population which results in shortage of food. Malthus argued that owing to the veritable importance of food in the existential survival of humans and the ever growing passion and longing for it, an imbalance between available resources and people will ensue.

Malthus (1798) theory is hinged on two critical proposition being that population would increase at geometric progression (that is 1, 2, 4, 8, …) caused mainly by the absence of conscious restraint on fertility, while food production will increase at an arithmetic series (that is 1, 2, 3, 4, …) and this is occasioned by the presence of diminishing return following continuous use of scarce land. In the thought process of Malthus, the gap between food production and population growth will increase on a continuous basis through time resulting in starvation, food shortage and death in the short run. The central theme of the Malthusian hypothesis is that population growth is limited or impeded by means of subsistence and where the means of subsistence increases without some form of prevention or checks, population is bound to increase.

In controlling or checking growth in population, Malthus (1798) proposed two means – the positive and negative means. The positive means includes natural solutions to population growth such as diseases, war, famine, and pestilence; whilst the negative means touches on use of artificial solutions such as birth control. Preventive measures like refraining from giving birth, late marriage and chasity were advanced as the non-adherence or non-adoption of such means will invariably bring about hunger, poverty and misery. Howbeit, the postulations of Malthus as it relates to the association between population growth and productive capacity have been subjected to criticism on the grounds that it lacks empirical support (Piketty, 2014). Malthus in his hypothesis claimed that due to fixed supply of land and increasing population, individuals living continuously at a subsistent level will witness diminishing marginal productivity. Boserup (1981) posited that, this constitute a reverse causation as diminishing returns to labour is unattainable in the long run as increased population may bring about efficiency in division of labour and improved agrarian practices.

The theory of Malthus was expanded by neo-malthusians such as Kaplan and Fraser to energy resource. Their postulation was that, civil unrest or violence and wars will continuously be on the increase as food, fuel, suitable farmland and clean air become more scarce.

Malthus postulation of the natural order of population increase was jettisoned by Marx as contained in the surplus theory of population. Marx posited that capitalism is the major driver of population growth as it increases the army of the reserved which leads to cheap labour. As seen from the argument of Marx, population growth is to be seen in the context of capitalism since such system is capable of producing food and provide other basic necessities (McIntyre, 2011).

The 20th century birthed a new and positive line of thought on the relationship between population growth and productive capacity or output growth. This reasoning is seen in the Kuznets-Simon-Boserup hypothesis. Kuznets (1967) and Simon (2019) examined the effect of population in a different light by postulating that with higher population, the better the chances of having another Einstein or Mozart, the consequence of which will be an increase in the stock of ideas or knowledge. Given that ideas are transmitted or shared at zero cost, there is bound to be an effective deployment or use of such new ideas in a large population as opposed to small populations.

Boserup (1981) posited that growth in population accelerates or speeds up technological advancement or innovation as it puts pressure on scarce resources. Boserup (1981) opined that, necessitated by the threat of starvation and the challenge of providing for more persons, individuals are motivated to improve on their farming methods and process and invent new technologies capable of producing increasing number of goods. This is what is described as ‘agricultural intensification'. The logic behind Boserup (1981) hypothesis is easy to script. As population increases, the pressure to produce goods to feed the growing population drive individuals to improve on their method of production, build irrigation canal to improve crop fertility, develop machinery, intend to increase manufacturing output.

REVIEW OF EMPIRICAL LITERATURE

The manufacturing sector is an important sector in the macroeconomic space or environment as it is the most important driver of economic growth, development and the basis on which global trade is based which fuels global economic power. A plethora of empirical studies has been undertaken in a bid to decipher the variant factors – social, economic, political and environmental that causes the sector to accelerate or deteriorate. This section provides empirical investigations on the subject matter.

In uncovering the factor that affect manufacturing sector output, the following empirical studies were reviewed.

The empirical investigation of Onakoya, Ogundajo & Johnson (2017) which focused on the impact of monetary policy in the drive to achieving sustainable manufacturing sector growth in Nigeria found the existence of positive and significant relationship between monetary policy and the performance of the Nigerian manufacturing sector. The study adopted the vector error correction model of estimation in its analytical approach, utilizing secondary data covering 1981 to 2915.

Enu & Havi (2014) using a multivariate time series approach showed the existence of inverse relationship between real gross domestic product per capita and the manufacturing production in Ghana. They are revealed that, in the long term, manufacturing sector production reduces following increases in private sector credit, real exchange rate and labour. Their study utilized the vector autoregressive (VAR) approach and the outcome of the short run analysis disclosed that real exchange rate and consumer price index significantly deteriorates manufacturing sector value addition.

The investigation of Imoughele & Ismaila (2014) centered on the impact of monetary policy on the performance of the Nigerian manufacturing sector. The study employed the Vector Autoregressive (VAR) model of estimation to analyze secondary data sourced from the statistical bulletin and annual abstracts of statistics of the Central Bank of Nigeria and National Bureau of Statistics for the dictum extending from 1986 to 2012. The study examined the influence of key variables such as broad money supply, exchange rate, inflation rate, external reserves and interest rate on manufacturing gross domestic product. The empirical findings revealed that the variables drift identically in the long run. The outcome of the VAR estimation revealed that manufacturing sector GDP reduces following increases in interest rate, exchange rate and external reserves and manufacturing sector GDP is unresponsive to fluctuation or variations in broad money supply.

Onakoya (2018) study concentrated on the impact of variations in certain macroeconomic factors on manufacturing output in Nigeria from 1981 to 2015. The macroeconomic variables or factors selected for study included previous period gross domestic product, interest rate, money supply, unemployment rate and real exchange rate. The study adopted the Vector Error Correction Model (VECM) estimation tool to analyze possible short term behaviour between the variables. This was closely followed by the conduct of certain post-estimation test to verify the suitability of the model for prediction purposes. The result of the Johansen cointegration test carried out showed that there exist long run relationship between manufacturing output, previous period gross domestic product, interest rate, money supply, unemployment rate and real exchange rate. The result of the VECM revealed that unemployment and previous period level of gross domestic product significantly and positively impact on manufacturing output as no significant relationship was found to exist between manufacturing output and the individual macroeconomic variables of inflation rate, exchange rate, and broad money supply.

The paper by Judith & Chijindu (2016) centered on the nexus between inflation and the performance of the manufacturing sector in Nigeria. The study utilized the Vector Error Correction Model (VECM) econometrics technique in analyzing secondary data sources from the World Bank national accounts and the OECD national data file for a period covering from 1982 to 2014. The study examined the impact of three major variables namely inflation, exchange rate and interest on the annual growth rate of manufacturing value added in a bid to understand the causality between identified variables. The outcome of the Johansen cointegration test conducted revealed the variables move together in the long-run or a long-run relationship exists between the four variables of the model. Upon estimation of the vector error correction model, it was revealed that inflation and interest exhibit negative and insignificant relationship with the predictor variable respectively, whilst exchange rate was shown to be a critical factor determining manufacturing sector growth as its impact is positive and significant. The result of the granger causality revealed the presence of a unidirectional causality running from exchange rate to manufacturing output growth.

The effect of population change on economic growth in Kenya was probed by Thuku, Paul & Almadi (2013). The study used the Cobb-Douglas production function with time series data traversing from 1963 to 2009 to comprehend the effect of current and one period lag of population change on economic growth rate of Kenya. The paper utilized the Vector Autoregressive (VAR) estimation approach, with granger causality test undertaken to see if a causality runs from population to economic growth and vice versa. The findings of this paper indicated that, population growth propels Kenya’s economic growth as both, the result of the VAR estimation disclosed, are positively correlated. Bi-directional causation exists between economic growth and population, the outcome of the granger causality test revealed. The paper therefore proposed a proper management of the population expansion in Kenya so as to complement its rising total output.

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Print ISSN: 2052-6350(Print), Online ISSN: 2052-6369(Online)

Using the method of ordinary least squares with the Error correction mechanism (ECM) to examine short run behavioural tendencies of employed variables, the study conducted by Tartiyus, Dauda & Peter (2015) examined the link between population growth and economic growth in Nigeria. Their study utilized secondary data covering from 1980 to 2010 and sourced from World Development Indicators. GDP was used as index of economic growth, with population growth rate used as proxy for population. Following the result of the Johansen co-integration test administered, a long run equilibrium relationship is present between population and economic growth. The static regression result showed a positive relationship between population and economic growth in Nigeria, though population is not a significant variable in varying GDP the study exposed. The sustenance of the population growth rate was recommended by the paper in addition to the pursuit of the diversification of the Nigerian economy.

Aidi, Chisom & Ngwudiobu (2018) undertook a research to empirical understand the causality between population and economic growth in Nigeria. To proper ensure the object for which the investigation was set out to accomplish, the paper adopted the granger-causality technique to analyze time series data of forty-three years (43) traversing from 1970 to 2013. Population growth rate was chosen as index of population as growth rate of real GDP was used as measure of economic growth. Empirical discoveries of the enquiry publicized the lack of causation between population and economic growth during the time scope of the study.

Nwosu, Dike & Okwara (2014) in their study examined the how economic growth in Nigeria is affected by population growth. The paper adopted the method of ordinary least squares to estimate secondary data that stretched from 1960 to 2008. In addition, the paper employed the granger causality estimation method to uncover if a causation is present between economic growth and population growth. The real gross domestic product was utilized as index of economic growth as total population was used to measured population growth. The following were observed from the result (i) total population and real GDP move together in the long run. (ii) A uni-directional causality runs from total population to real GDP. (iii) The OLS result indicated that total population is critical in spurring Nigeria's real GDP. The paper suggested an increase in the level of per capital technology to ensure efficient utilization of uncommon resources.

Ogunleye, Owolabi & Mubarak (2018) launched an enquiry into the connection between population growth and economic growth in Nigeria. To achieve the mandate of the paper, the ordinary least squares method of estimation was used to analyze time series data over the period of 1981 to 2015. The study was anchored on the endogenous growth theory with the model specified to include population growth rate as index of population, while controlling for variables like exchange rate, fertility rate and crude death rate. Economic growth in the study was index by real gross domestic product (RGDP). Generally, the result revealed that population is linked to

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economic growth index as its effect is positive and significant. Contrarily, economic growth in Nigeria is slowed by fertility as the latter impact on the former is negative and significant.

As reasoned or deciphered from the above reviewed empirical studies, the examination of the population growth on the manufacturing sector in Nigeria is an unchartered ground as no empirical work has been undertaken on the subject. Empirical works that examined the influence of population growth concentrated majorly on economic growth for which gross domestic product was used as proxy. Also, the consideration of the population variable is in lump sum. This study fills this gap by disaggregating the composition of total population into male, female and youth population so as to ascertain the variant of the population composition that could or might propel or inhibit the performance of the Nigeria manufacturing sector.

MATERIALS AND METHODS

This section provides the methodology employed in the inquest of the influence of population growth on manufacturing sector output in Nigeria. It also lay out the research design, the nature and source of data, model specification adopted; method utilized in analyzing the sourced data; and the econometric tests conducted in the course of the investigation.

Research Design

As a quantitative investigation, this paper adopted the ex-post facto research method. As opined by Onwumere (2009), the ex-post facto research design deals with events that have previously or hitherto occurred. The preference of this research design stems from the lack of control the research exercises over the variables primarily because such distributions have already occurred. The choice of this method is also due to the leverage it allows for retrospective study of the predictor variables and their causal effect on the explained variable.

Data Source and Nature

The paper utilized secondary or time series data sourced from the World Bank Development Indicators (2018) and the Statistical Bulletin of the Central Bank of Nigeria (2018) covering a period from 1981 through 2018.

Method of Data Analysis

The econometric estimation technique used form the paper aggregates both descriptive and analytical approach. With reference to the descriptive approach, the paper provides statistics on the central tendency, measure of dispersion and measure of normality for the individual series, including the use of tables and figures to report the outcome of the various test carried out. On the other hand, the analytical tool tools employed for this investigation include the Ordinary Least

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Square (OLS) estimation technique and error correction model (ECM). Certain second order test were carried out which include: unit root test and co-integration test.

Model Specification

The critical focus of this study is basically to examine the effect of population growth on the performance of the Nigeria manufacturing sector. To achieve this, it is imperative to first engineer an econometric investigative procedure and design a functional model that incorporates variables of interest. The model for this paper is based on the Kuznets-Simon-Boserup hypothesis and follows the empirical works of Imoughele & Ismaila (2014) and Ogunleye, Owolabi & Mubarak (2018), with modification made to reflect the study interest. The following relationship model was derived;

$$MANR = f(MPG, FPG, YPG) \qquad (1)$$

Where:

$$MANR = Manufactutring\ Output\ as\ ratio\ of\ Gross\ Domestic\ Product;$$

$$MPG = \ Male\ Population\ Growth;$$

$$FPG = \ Female\ Population\ Growth;$$

$$YPG = Youth\ Population\ Growth$$

The log-linear expression of equation (1) is given thus;

$InMANR = q_0 + q_1InMPG + q_2InFPG + q_3InYPG + V_t$ (2)

Where:

q_0 = drift component or intercept

$q_1 – q_3$ = the parameter estimates of the model, and

V_t = the stochastic term.

The apriori expectations:

$q_0 > 0$, $q_1 – q_3 > 0$.

Estimation Procedure

The cradle of the estimation undertaken is the conduct of descriptive analysis wherein the central tendency (mean, median, mode), measure of dispersion (range, variance and standard deviation) and measure of normality (skewness and kurtosis) for individual series were provided. Annual variables or variables that flow through time usually possess the attributes of inherent shocks and lack of stability in them and for the avoidance of a spurious regression whereby a non-stationary variable is regressed on another or multivariate stationary variables, it is imperative to known for certain the stationarity of the variables. To achieve this, a unit root test was carried out and the paper favoured the Augmented Dickey-Fuller (ADF) approach to stationarity test and determination of the order of integration of the variables that are captured in the model of the study. The paper then proceeded to the conducted of co-integration test. The co-integration test was carried out to verify whether the variables under examination move together over time or if there exists long-run relationship among the variables. A core prerequisite for the choice of a cointegration test approach is the determination of the order of integration of the variables. Following the confirmation that all the variables under investigation are integrated of order one I(1), the study adopted the Johansen test approach as prescribed by Johansen & Juselius (1990). The estimation path then extended to the estimation of the error correction model. As opined by Brooks (2019), the equilibrium correction model, which can be used in place of error correction model is employed to assess the short run dynamics of the variables and the long run reversion to equilibrium.

The error correction mechanism employed is captured thus;

$$\Delta InMANR = r_0 + \sum_{i=1}^{n} r_1 \, \Delta InMANR_{t-i} + \sum_{i=1}^{m} r_2 \, \Delta InMPG_{t-i} + \sum_{i=1}^{m} r_3 \, \Delta InFPG_{t-i} + \sum_{i=1}^{m} r_4 \, \Delta InYPG_{t-i} + qECM_{t-1} + V_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where In is the log of the variables, MANR, MPG, FPG, and YPG are as previously defined. Δ connotes the first difference operator.

$r_1 - r_4$ represent the short run coefficients of the variables

r_0 represents the constant term, q represents the coefficient of the lagged error correction term, n and m connotes the lag length for the dependent and independent variables of the model respectively and V_t represents the stochastic or white noise error term.

RESULTS AND DISCUSSION

Descriptive Statistics

The mean, skewness, kurtosis, maximum and minimum values for each considered variables are reported in table 4.1 below;

Table 4.1 Descriptive Statistics for individual variables.

	MANR	MPG	FPG	YPG
Mean	8.0790	63608110	62427927	38.3150
Median	8.1722	60876812	59895145	38.1885
Maximum	11.7776	99237756	96636984	40.1799
Minimum	6.0489	37927809	37512693	36.4760
Std. Dev.	1.4801	18241374	17553740	1.1934
Skewness	0.2695	0.3686	0.3582	-0.0141
Kurtosis	2.1423	1.9583	1.9561	1.8164
Jarque-Bera	1.6247	2.5787	2.5378	2.2192
Probability	0.4437	0.2754	0.2811	0.3296
Observations	38	38	38	38

Source: Author's computation using E-Views 10

The table above gives the outcome of the descriptive statistics for each individual variable showing the central tendency which encapsulates the mean, median and mode), the measure of dispersion (which details the range, variance, and standard deviation) and measure of normality (giving the statistics for kurtosis and skewness) for each individual variable included in the study model. For the thirty-eight years of investigation the average manufacturing output as ratio of GDP, male population growth, female population growth and youth population growth was 8.079092 percent, 63,608,110, 62,427,927 and 38.31500 percent respectively. The maximum and minimum values as displayed in the table above reports the highest and lowest variables points for the length of the study period. As reported in table 1, the maximum manufacturing output as ratio of GDP was 11.77 percent and the minimum being 6.04 percent. The highest and lowest value of male population was 99,237,756 and 37,927,809 respectively. Similarly, the maximum and minimum female population was 96,636,984 and 37,512,693 respectively. The highest and lowest youth population growth during the dictum of the study was 40.17999 percent and 36.47608 percent respectively. The result of the standard deviation revealed that the highest variability is for male population with 18,241,374 followed closely by female population with 17,553,740 with the least being youth population with 1.193. From the results of the skewness, it was found that MPG, MANR and FPG is positively skewed indicating that the mean and median of the series of the aforementioned variables is greater than the mode of the distribution. Only YPG was found to be negatively skewed implying that the mean and median of the distribution of the series is less than its mode. The result of the measure of normality shows that all four variables such as MANR, MPG, FPG and YPG are platykurtic as their kurtosis which are 2.142371, 1.9583380, 1.956186 and 1.816421 are below the kurtosis of 3. The descriptive statistics also reported the Jarque-Bera test statistics which informs on the normality of the series. From table 1 above, the ratio of manufacturing output to GDP is normally distributed because the probability value of 0.4437 is greater than 0.05 level of significance, thus resulting in the acceptance of the null hypothesis that the variable is normally distributed. Similarly, the probability value of the Jarque-Bera statistics for MPG of 0.2754 is greater than 0.05, revealing that the variable is normally distributed. Further examination shows that the series FPG and YPG are normally distributed as the probability value of each series is greater than 0.05 level of significance, resulting in we accepting the null hypothesis that the variables are normally distributed.

Static Regression Analysis

From the descriptive statistics we moved unto the static regression estimation, from which the justification of the conduct of second order test was carried out. The result of the static estimation conducted using the ordinary least squares method of estimation is reported in table 4.2 below;

Table 4.2 Result of Long Run Estimation

Dependent variable: InMANR

Variable	**Coefficient**	**P-value**
InMPG	-31.9608	0.2637
InFPG	32.6359	0.2634
InYPG	-5.2965***	0.0000
C	9.8389	0.2236
R-square = 0.608		
Prob. (f.stat) = 0.0000, Durbin-Watson statistic = 0.6986		

Source: Author's computation using E-Views 10
*** indicates rejection of null hypothesis at 1% level

The table above shows the outcome of the multiple regression estimated using the ordinary least squares method. From the above output, the intercept of the model denoted by the constant (C) calculated to be 9.8389, signifies that in the event that the independent variables being male population growth, female population growth and youth population growth are kept at zero or assumes the value of zero, the dependent variable being manufacturing output as ratio of gross domestic product (GDP) will increase by 9.8389 units.

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From the regression result above, the R^2 of 0.608 indicates that about 60% of the total variation in the dependent variable (manufacturing output as ratio of GDP) from 1981 -2018 is largely explained or attributed to the independent variables (InMPG, InFPG, InYPG) in the model, which underscore the model goodness of fit. While, the remaining 40% is accounted for by exogenous factors not included in the model but have been taken care of by the error term. More so, in testing for the overall significance of the model or the joint impact of independent variable(s) on the dependent variable, the F-statistics was utilized. The decision rule stipulates that we fail to accept the null hypothesis of no significant relationship when the probability value of the F-statistic is less than 0.05. From the table above, the F- Stat of 17.63419 indicates that the entire model is adequately specified and statistically significant at 5% probability level given the probability value of 0.00000 which is below the 0.05 level of significance, thus leading to the rejection of the null hypothesis and acceptance of the alternative which signifies that the model is significant.

The result of the serial correlation test conducted using the Durbin-Watson statistics or inferred from the Durbin-Watson statistics showed that D.W stat value of 0.6986 is quite far from 2 which depict the presence of serial autocorrelation. Further examination of the coefficient of the parameter estimates drawing from the outcome of the multiple regression captured in table 2 above indicates that the coefficient of male population growth (InMPG) is negative and statistically insignificant. Meaning that one percent change in male population growth will lead to 31.96 percent decrease in manufacturing output as ratio of GDP or a reduction in manufacturing output. This shows that changes in male population growth are statistically insignificant in influencing manufacturing output in Nigeria. The result of the static analysis in table 2 depicts a positive and insignificant relationship between female population growth and manufacturing output or manufacturing output as ratio of GDP in Nigeria. This implies that one percentage change in female population growth will cause the ratio of manufacturing output to GDP to increase by 32.63 percent. Howbeit, the revelation of statistically insignificant relationship points to the fact that female population growth is not a key determinant of fluctuations in manufacturing output in Nigeria. Lastly, the coefficient of youth population growth as reported in the table appears with its wrong sign of negative, which is not in sync with the underlying a priori economic assertion. Also, the probability value of youth population growth is statistically significant which implies the rejection of H_0 and the acceptance of H_1, meaning that one percent change in youth population growth leads to over 5.29 percent reduction in the ratio of manufacturing output to GDP. However, from the x-rayed static multiple regression carried out using the ordinary least squares method which forms the basis of most economic theories or the validation of most economic theories, it is evidence that there exists serial autocorrelation and the lack of significance of most dependent variables in explaining the dependent variable. As such, the model is assumed to be spurious and misleading as vital information needed for policy recommendations might be missing. Hence, the

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need to ascertain the stationarity level of the variables included in the model, a test of the presence or absence of long run relationship between the variables or a long run analysis using Johansen co-integration test.

Unit Root Test Results

Following the revelations of the static regression analysis carried out, we move to address the issue of stationarity. This is fundamental as the regression of non-stationary series or regression of a stationary series on another non-stationary series results in a spurious result, making the conduct of a stationarity test essential. For this paper, the augmented Dickey-Fuller test was adopted. The result of the augmented Dickey-Fuller test of stationarity at level and first difference are presented in table 4.3 and 4.4 below respectively.

Table 4.3 ADF Result at Level

Variables	ADF test Statistic	Critical Value at 5% level	Remark
LogMANR	-1.834144	-2.943427	Not Stationary
LogMPG	0.633159	-2.971853	Not Stationary
LogFPG	1.843773	-2.954021	Not Stationary
LogYPG	-1.730723	-2.960411	Not Stationary

Source: Own Computation using Eviews 10

The results of the ADF unit root test reported in table 4.3 showed that none of the variables were stationary at level as their respective ADF test statistic fell below their corresponding critical value. Thus we fail to reject the null hypothesis of unit root and proceeding to utilizing the first difference approach.

Table 4.4 ADF Result at 1st Difference

Variables	ADF test Statistic	Critical Value at 5% level	Order of Integration	Remark
LogMANR	-6.537591	-2.945842	I(1)	Stationary
LogMPG	-5.851456	-2.971853	I(1)	Stationary
LogFPG	-3.437482	-2.957110	I(1)	Stationary
LogYPG	-15.20005	-2.960411	I(1)	Stationary

Source: Author's computation using Eviews 10

Table 4.4 above revealed that LogMANR, LogMPG, LogFPG, and LogYPG upon differencing the series once became stationary. Thus, the variables can be said to be integrated of similar order being order one I(1). As opined by Nkoro & Uko (2016), the Johansen cointegration technique is appropriate when determining the long run relationship between series of order one I(1).

Johansen Co-integration Test Result

This test was conducted to quiz whether or not the four variables included in the model have long-run relationship. The paper made use of the Johansen & Juselius (1990) approach to cointegration test to ascertain the said relationship. The result of the Johansen cointegration test is reported in table 4.5 below;

Table 4.5: Result of Johansen Cointegration Test

Series: INMANR INMPG INFPG INYPG			
Hypothesized	Trace	0.05	
No. of CE(s)	Statistics	Critical Value	Prob. **
None *	119.3843	47.85613	0.0000
At most 1 *	41.50988	29.79707	0.0015
At most 2	10.61826	15.49471	0.2361
At most 3	0.467983	3.84166	0.4939
Hypothesized	Max-Eigen	0.05	
No. of CE(s)	Statistic	Critical Value	Prob. **
None *	77.87441	27.58434	0.0000
At most 1 *	30.89162	21.13162	0.0016
At most 2	10.15028	14.26460	0.2022
At most 3	0.467983	3.841466	0.4939

Source: Author's Computation using EViews 10

The table above reports the outcome of the Johansen cointegration conducted to ascertain if all the variables expressed as a functional relationship in the model move together in the long run.

As deduced from the outcome of the Johansen cointegration test documented in table 4.4, two tests were conducted namely the trace test and Maximum Eigenvalue test, with the result of each test analyzed separately. The result of the trace test points to the existence of two cointegrating equations. The implication of this is that, the ratio of manufacturing sector output to GDP (MANR), male population growth (MPG), female population growth (FPG) and youth population growth (YPG) have identical drift in the long run or there is a long run relationship between the series. Put differently, the result of the trace test shows the existence of long run equilibrium among the series. Similarly, the outcome of the Max-Eigen test revealed identical findings as the test shows that there exist two cointegrating equations cementing or affirming the discoveries as spelt out by the outcome of the trace test carried out. The validation of cointegration between MANR, MPG, FPG, and YPG using the Johansen cointegration test approach, the model can be reparameterized into the Error Correction Model (ECM) to ascertain the short-run dynamics of the series and the speed of adjustment of the model following disequilibrium brought about by fluctuations in one or all the endogenous variables.

Normalized Co-integration Equation Result

Table 4.6: Result of Normalized Cointegration Coefficients

Cointegrating Equations(s):	**Log likelihood**		**975.4322**
Normalized cointegrating coefficients (Standard error in parentheses) [t statistics in brackets]			
$\boldsymbol{InMANR}$	$InMPG$	$InFPG$	$InYPG$
1.000000	-434.2098	441.5091	40.52954
	(155.994)	(159.130)	(4.15125)
	[-2.7835]	[2.7745]	[9.7632]
Adjustment Coefficients (standard error in parentheses)			
$\boldsymbol{D}(\boldsymbol{InMANR})$	0.007963		
	(0.06421)		
$\boldsymbol{D}(\boldsymbol{InMPG})$	9.00E-05		
	(2.0E-05)		
$\boldsymbol{D}(\boldsymbol{InFPG})$	2.55E-05		
	(1.7E-05)		
$\boldsymbol{D}(\boldsymbol{InYPG})$	-0.001919		
	(0.00142)		

Source: **Author's Computation using EViews 10**

Following the identification of existence of cointegration, the result of the normalized cointegration equation is analyzed. With specific reference to the normalization process, the signs of the parameter estimates are reversed for interpretation purposes. From the table above, it can be deduced that InMPG has a positive impact on ratio of manufacturing sector output to GDP in the long run and its impact is significant owing to the value of the t-statistics. On the other hand, InFPG and InYPG impact negatively on the ratio of manufacturing sector output to GDP in the long run, on average, ceteris paribus. Their individual impacts are significant following the value of their corresponding t-statistics.

Parsimonious Error Correction Model Result

This section reports the reparameterized Error Correction Model (ECM) which gives the short run dynamics of the variables. The behaviour of the variables in the short run and the speed of adjustment or convergence to long run equilibrium was estimated using the error correction model and the outcome of such estimation presented in the table below;

Global Journal of Arts, Humanities and Social Sciences
Vol.7, No. 10, pp.55-76, December 2019
Published by ECRTD-UK
Print ISSN: 2052-6350(Print), Online ISSN: 2052-6369(Online)

Table 4.7: Parsimonious ECM

$Regressor$	$Coefficient$	$Std, Error$	$T - Stats$	$Prob.$
$D(InMANR_{t-2})$	-0.3359	0.1342	-2.5015	0.0193
$D(InMPG_t)$	2097.935	2097.935	2.0053	0.0559
$D(InMPG_{t-1})$	-3307.104	1572.588	-2.1029	0.0457
$D(InMPG_{t-2})$	1447.680	733.6615	1.9732	0.0596
$D(InFPG_t)$	-3453.991	1460.319	-2.3652	0.0261
$D(InFPG_{t-1})$	5535.753	2418.791	2.2888	0.0308
$D(InFPG_{t-2})$	-2328.318	1144.877	-2.0336	0.0527
$D(InYPG_t)$	-4.2703	8.1632	-0.5231	0.6055
C	0.0873	1.4176	0.0616	0.9514
ECM_{t-1}	-0.6534	0.1925	-3.3939	0.0023

R^2 = 0.8752; Adjusted R^2 = 0.8039; D-W Stats = 2.4836.

The output of the equilibrium correction model (ECM) estimated and reported in table 4.7 above revealed that the explanatory power as 0.5920. This by inference means that, 59.20 percent variation in the dependent variable MANR is brought about or accounted for by the independent variables (MPG, FPG, YPG), with the residual of 40.8 percent accounted for by variables not included in the model captured by the error term. As observed from the aforementioned table, the ratio of manufacturing output to gross domestic product (GDP) at lag 2 has a significant and negative impact on current ratio of manufacturing output to gross domestic product (MANR), pointing to the presence of control or influence on current level of the ratio of manufacturing output to GDP. The behaviour of male population growth in the short run as reported in the above table shows that current, period lag 1, and period lag 2 influence ratio of manufacturing output to gross domestic product positively, negatively, and positively impact on current level of ratio of manufacturing sector output to gross domestic product respectively. However, their impact is insignificant with the exception of period lag 1 whose impact on current level of ratio of manufacturing sector output to GDP is significant at 5 percent level of significance. On one hand, the short run dynamics of female population growth shows that current female population growth and previous year female population growth (period lag 1) exert a negative and positive significant impact on current level of manufacturing output as ratio of GDP. Contrarily, the second lag of female population growth or the population of female two years ago was found to exert a negative and insignificant impact on current manufacturing sector output as ratio of gross domestic product. The result as reported in the table above shows that current youth population growth exerts a negative and insignificant impact on current manufacturing output as ratio of GDP. The empirical results reveal the error correction term which evidences long run reversion to equilibrium. From the table above, the adjustment term which is negative -0.65 divulges that the reversion of the model following short run fluctuations to long run equilibrium is at or occurs at an adjustment speed of 65 percent. Put differently, the coefficient of the lagged error correction term of -0.65 suggests that the model estimated revert or convergences to long run equilibrium following short run impulses brought about by volatility in the endogenous variables at a speed of 65 percent. This gives the equilibrating speed of the model as 65 percent. The implication of this is that, 65 percent of fluctuation that occur are bound to be corrected before the next period and the correction of existing disequilibrium to achieve long run equilibrium will take about

Post-Estimation Tests

With the estimation of the error correction model (ECM), certain post-estimation or diagnostic tests were conducted to see if the adopted model is free from the problem associated with time series. It is imperative that before a model is employed for prediction or forecast purposes it must scale through the four basic diagnostic test which are: the normality test (for which the Jarque-Bera statistics is used), serial correlation test (the Breusch-Godfrey LM test was used), the heteroscedasticity test (the paper employed the Breusch-Pagan-Godfrey Test) and the stability test (for which the CUSUM test was adopted). The summary of the outcome of these tests are reported in the table below;

Table 4.8: Diagnostic Result for Parsimonious ECM

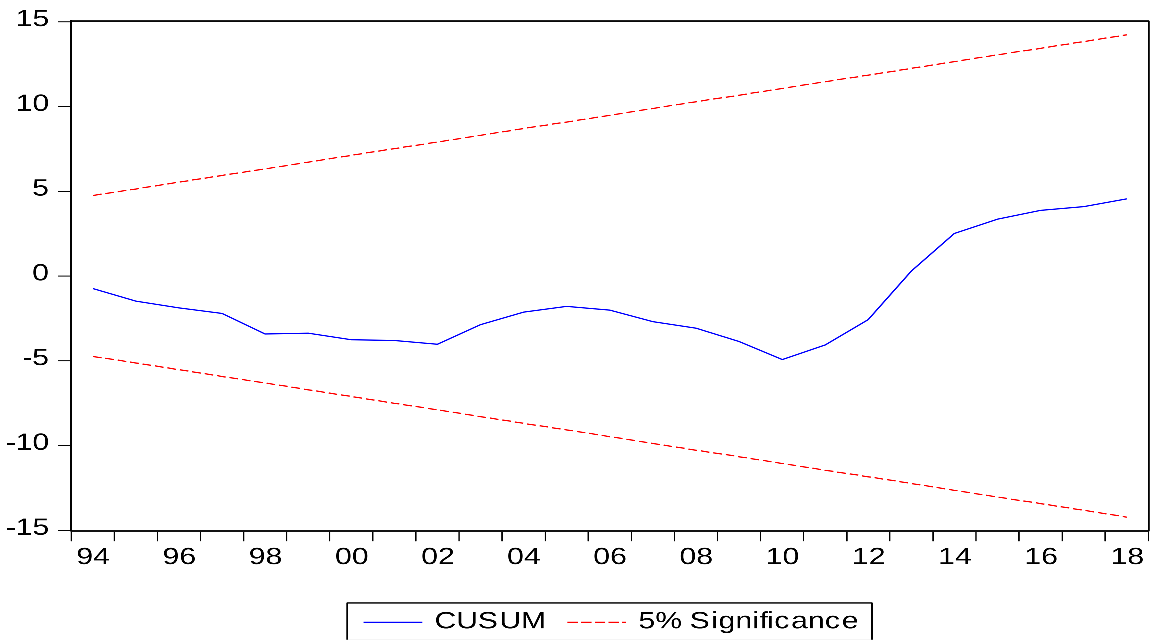
Test/Hypothesis Tested(hypothesis is in null form)	Test type	Test-stats.	Prob.	Decision
Residual Normality **(Residuals are Normally Distributed)**	Jarque-Bera	1.0900	0.5798	Accept
Serial Correlation **(there is no serial correlation)**	Breusch-Godfrey LM Test	1.5864	0.2262	Accept
Heteroskedasticity **(there is Homoskedasticity)**	Breusch-Pagan-Godfrey	0.6337	0.7577	Accept

Source: Author's computation using E-Views 10

The table above reports the summary statistics of the diagnostic test conducted for the estimated error correction model presented in table 4.7. As earlier stated the conduct of these tests is essential to ensure that the estimated model is free from the associated problems of a time series data which is necessary for the purpose of employing the estimated model for prediction purposes. As observed from table 4.8, the Jarque-Bera statistic value of 1.090084 and the associated probability value of 0.5798 implies that we error term is normally distributed as the probability value is greater than 0.05 resulting in the failure to reject the null hypothesis which stipulates that the residual is normally distributed. The result of the Breusch-Godfrey test revealed the absence of serial correlation in the model as the probability value of the Breusch-Godfrey serial correlation LM t-statistics of 0.2262 is above the 0.05 significance level resulting in we failing to reject the null hypothesis of no serial correlation. The diagnostic test which bothers on whether or not a constant variance exists or the test of heteroscedasticity shows no evidence of heteroscedasticity as the probability value of the t-statistics of the Breusch-Pagan-Godfrey statistics computed to be 0.7577 is above the 0.05 level of significance, thus prompting the us to fail to reject the null hypothesis of the presence of homoscedasticity.

The result of the stability test conducted using the cumulative sum (CUSUM) revealed that the parameter estimates are stable over time and there exists no structural break in the distribution of the series. This inference is drawn or based on the fact that the plot of the cumulative sum (CUSUM) as shown in the figure below is within the 5 percent critical bounds. The plot of the cumulative sum (CUSUM) is displayed in figure 1 below;

Figure 1: Plot of CUSUM for the Parsimonious ECM



CONCLUSION AND RECOMMENDATION

The thrust of this paper has been the effect of population growth on manufacturing sector output in Nigeria. The duration of the study was for a period of thirty-eight years that spanned from 1981 to 2018. Again, the augmented Dickey-Fuller test, Johansen co-integration test and error correction model procedure form basis for the data analysis. In order to effectively examined the impact of population on the manufacturing sector output, the entirety of population was split into three categories: the male population, female population and youth population. The result of stationarity test vividly showed that all the variables assumed stationarity after differencing once. The study also utilized the normalized Johansen co-integration procedure to show incidence of common movement between the variables in the long term. The findings shown empirically pointed to male population growth exerting a significant positive impact on manufacturing sector output in the long run, while female population growth and youth population growth tends to significantly impede or reduce manufacturing sector contribution to GDP in the long run. On the basis of this revelation, the resolution of this paper is that population growth contributes significantly or is a key determinant of the manufacturing sector output growth or its ratio to gross domestic product in Nigeria. Guided by the findings, the paper recommended a target of the youth population through increased training in productive venture to boost their human capacity, an aggressive entrepreneurial awareness programme and focus on entrepreneurial growth path. The lack of contribution of the female population to growth in manufacturing output could be ascribed to the non-inclusion of females in productive activities as a result of some misguided male chauvinistic ideology. The study proposed parity or non-dichotomy in employment, pay and other employment benefits to help attract females into the manufacturing employee cycle.

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