

Health, Education and Industrial Output in Nigeria: An Interactive Effect

OLAWUNMI OMITOGUN

Olabisi Onabanjo University, Ago Iwoye. Nigeria

ADEDAYO EMMANUEL LONGE

University of Ibadan, Nigeria

Abstract. This study investigates the interactive impact of human capital investment and industrial output in Nigeria during the period 1990-2013. Various econometrics techniques were used to analyse the data sourced from the Central Bank of Nigeria (CBN) statistical bulletin (2013). The findings revealed that health and education expenditure interactively within the time under study impacted positively and significantly on manufacturing output. Government investment proxy as gross capital formation had a positive and significant effect on manufacturing output. Exchange rate had a negative impact on manufacturing output. The Johansen co-integration technique showed that a long-run co-movement relationship exists between the variables employed in the study. The study concludes that human capital investment plays a significant role in the growth of the manufacturing sector. The major recommendation was that, government should increase its expenditure on health and education expenditure in Nigeria, in order to increase the manufacturing sector output.

Keywords: Education and Health Expenditure, Industrial Output, Exchange rate, and Gross Capital Formation.

1. Introduction

In recent decades, more accentuating attention has been given to the need to develop the health and education of individuals towards enhancing sustainable growth. Theories have explained much about the importance of human capital in promoting the growth of the developing countries. The United Nations (2010) refer to human capital as a stock of knowledge, ability, time, physical and managerial

endowment of labour that are used in the production process for the production of goods and services for final consumption. Previously, natural resources and capital formation are measurement of socio-economic development across nations. But recently, the stock of skills, knowledge, health and habits of the population in the development process are considered more, because it determines how well the country develops in terms of productivity and standard of living (Shultz 1961).

For any nation to grow, especially Nigeria, the focused expenditure on the manufacturing sector should not be underestimated, thus, by all available means; the government should improve and encourage the output of the manufacturing sector (Ishola, 2012). Investing on human capital, the skills, knowledge and productivity of labour lean to increase, which as an upshot increase the sustainable development of the economy. The contribution of human capital investment on industrial performance has been less than satisfactory in Nigeria. This is because the country has been faced with the problem of continuity in maintaining the previous government agenda and the economy has been governed mostly by self-centered leaders (Olayemi, 2012). Ekesiobi, Dimnwobi, Ifebi and Ibekilo (2016) submitted that increased government spending improves education outcome. Through this the manufacturing sector experiences an increased growth. An increase in a country's industrial output increases its income through levies. Aderibigbe (2004) submits that manufacturing industry contributes significantly to the nation's economic development by: increasing government revenue through tax; improving the standard of living; infrastructural growth; contribution to Gross National Products (GNP); employment generation; enhance manpower

development, among others. Adejumo, Olomola, and Adejumo (2013) also submitted that the output generation of human capital in the industrial sector is low. This is because of the poor output effect of the health and education sector on labour productivity.

Having noted from these studies, much concentration has been on the individual effect of human capital investment on industrial output. The question in study is Does human capital variables (health and education) have a joint effect on industrial output in Nigeria. This study therefore aims at examining the interactive effect of education and health investment on industrial output in Nigeria.

The rest of the paper is therefore structured as follow; Section 2 reviews related literature. The sources of data and methodology, and model specification of the study is discussed in Section 3. Section 4 presents the analytical framework of the study. Finally, Section 5 presents the conclusion and recommendations of the paper.

2. Literature Review

Grossman (1972) provided the first formal contribution on the determinants of individual health status. He predicted the possibility of observing a positive relationship between education and health. Most especially, he argued that education has a positive impact on the likelihood of enjoying a good health because it increases the production of health technology by enhancing productive efficiency and distributive efficiency. Silles (2009) investigated the impact of the reform of Minimum School-Living Age, which was an exogenous source of education change, on the health condition of the population of the United Kingdom, employing ordinary least squares method and found that the coefficient that measures the impact of education on all health indicators was positive. In the view of Bhargava *et al.* (2001), a better health is more important for wages in low-income countries than in high income ones. Colantonio *et al.* (2010) argued that health influences GDP indirectly through time preferences and education.

2.1 Harod-Domar Growth Theory

Harod (1939) and Domar (1946) propounded their theory around investment in a country. They argued that for a nation to increase its output or growth part of her income must be saved to augment investment. They opine that doing this will have both demand and supply side effect on growth (that is increasing the country's income and productivity respectively). In explaining their theory they propounded three types

of growth rate; warranted, natural, and actual growth rate (Gw, Gn, G). Warranted growth rate (Gw) measures the rate at which investors reduces their payroll scheme and employed hands in production process in the recession period. Natural growth rate (Gn) explains how output increases as a result of increase population and technological progress, while Actual growth rate is the increase in the economy's GDP per year. A situation where by there is an unequal increase in the three growth rate leads to inflationary effect in the economy. Through the model opinion of savings part of income, investment is encouraged, therefore bringing about more skillful, knowledgeable and healthier hand employed in the process. With this, human capital investment becomes more important to increase the economy's productivity.

2.2 The Endogenous Growth Theory

Romer (1986) relates the endogenous growth model to be increasing returns to scale at the economy-wide level and constant returns to scale at the firm level. In his view, he noted that increased growth in a country is accompanied with human capital role

Lucas (1988) in replacing physical labour in the production function introduces investment on human capital as an additional education. Lucas argued that investment on human capital exhibit constant returns to scale in nature, which implies that the additional skills, knowledge, and ability individual acquire in the production process remains the same and add no value to the productive capacity of the economy. A major critic of Lucas is the assumption of constant returns to scale. Theories argue that the values added to individuals in terms of education and health are not constant in nature as it increases their ability and knowledge towards increased productivity in the production process to spur growth.

Schultz (1961) argued that the acquisition of knowledge, skills and increase in health care services is a function of willing investment or deliberate investment. He argues that the difference between the incomes of individuals is as a function of the additional value they add to their qualifications in terms of health quality and education (knowledge and skills) which determines the productive capacity of the individuals. He submits that the cost of acquiring this factors in the short-run is high and, but in the long-run, the cost catered for through the returns accrued to by the individuals involved.

2.3 Empirical Literature

Ekesiobi, Dimnwobi, Ifebi, and Ibekilo (2016) examine the impact of public sector education

investment on manufacturing output in Nigeria using the Ordinary Least Squares (OLS) technique to analyse the relationship. The study revealed that that public education spending has a positive but insignificant effect on manufacturing output growth in Nigeria.

Olayemi (2012) investigate the relationship between human capital investment and industrial productivity in Nigeria from 1978 to 2008 using Co-integration and Error Correction Mechanism (ECM) techniques. The study found that government expenditure on education maintained a positive long run relationship with index of industrial production while government expenditure on health and Gross Capital Formation exhibited long run negative relationship with the dependent variable.

Bennett, Ayanwu and Kalu (2015) investigated the effect of industrial development on economic growth in Nigeria from 1973 to 2013 using the Personal Computer (PC) give package to analyse the data employed. Their findings revealed that the impact of industrial output on economic growth is not significant, though positively related to (economic growth) GDP but does not hold strong enough. Savings impacted positively and significantly on the economy. Inflation had a negative relationship, while net foreign direct investment is positively and significantly related to economic growth. They recommended that government and its agencies should ensure political stability and also the implementation of strategic policies that will create a fair playing ground for foreign investors which will also improve the establishment of industries especially the manufacturing industries to encourage industrialization of the Nigerian economy as this will facilitate the strengthening of economic growth (GDP).

Elijah and Uchechi (2012) investigated the linkage between financial development sector and industrial production in Nigeria using the Auto-regressive Distributed Lag from the period 1970 to 2009. Their result revealed that a co-integrating relationship exist between financial sector development and industrial production. Both the long run and short run dynamic coefficients of financial sector development variables have negative and statistically significant impact on industrial production. They recommended that government should further introduce financial sector reforms to improve the efficiency of the domestic financial sector which is a pre-requisite for the achievement of industrial development.

Otalu and Keji (2015) assessed the determinants of industrial sector growth in Nigeria adopting the co-

integration and error correction model approach to analyse the variables used in the study. Their result showed that all the identified determinants have more of permanent effect on industrial output than transitory effect. Both labour and capital have significant impact, exchange rate shows a positive and significant impact indicating that currency appreciation might be inimical to the growth of the industrial sector.

Owolabi and Adegbite (2014) examined the monetary policy impact on industrial growth in Nigeria within the period 1970 to 2010 using a multiple regression analysis. They concluded from their findings that Rediscount Rate, and Deposit had significant positive effect on industrial output but Treasury Bills had a negative impact on industrial output. They recommended that government should develop the industrial sectors of the economy through its capital expenditure. With this, capital expenditure on productive activities and social overheads capital will contribute positively to industrial growth which will invariably enhance economic growth.

Adejumo et al (2013) examined the role of Human capital in industrial development in Nigeria using a time series data analysis within the period 1980-2010. It was discovered that human capital has to a large extent impacted on industry value-added, but in terms of output generated industrially, the effect of human capital remains low in Nigeria.

Falade and Olagbaju (2015) investigated the impact of Government capital expenditure on manufacturing sector output in Nigeria within the period of 1970 and 2013. They employed co-integration and error correction techniques to analysed the data employed but first subjects the data to unit root test. Their result revealed that there exists a long-run relationship between the variables employed in the study while the error correction model showed that while government capital expenditure has positive relationship with manufacturing sector output in Nigeria, recurrent expenditure exerts negative effect on manufacturing sector output.

Adofu, Taiga and Tijani (2015) empirically investigated the relationship between Manufacturing sector and Economic Growth in Nigeria for the period 1990 to 2013 using ordinary least squares method to ascertain the relationship between manufacturing, its components and economic growth. Their results showed that the output of the manufacturing sector contributed negatively and had an insignificant relationship to real gross domestic product growth, which was indicative of the fact that

the manufacturing sector of the Nigerian economy is presently experiencing decay as a result of non-implementation of policies aimed at boosting the sector; the average manufacturing capacity utilization rate contributed positively and had a significant relationship to real gross domestic product growth; the exchange rate and interest rate did not contribute to real gross domestic product growth, which shows a sign of macroeconomic instability; inflation rate contributed positively to real gross domestic product growth but, the insignificant nature of the inflation rate was indicative of the fact that the inflation in the Nigerian economy is not properly managed; government expenditure was significant indicating that the expenditure made by the government in the Nigerian economy was adequate but not properly managed, but nevertheless, contributed positively to economic growth.

Isaksson (2010) empirically assessed the relationship between public capital, infrastructure and industrial development in 57 advanced and developing countries for the time period of 1970 to 2000. In estimating the impact of public capital on industry special care is taken to deal with country-specific effects, reverse causality and endogeneity bias. His findings revealed that public capital has important explanatory power for why some countries have managed to industrialize, while others have not.

Akinmulegun and Oluwole (2014) examined the importance of manufacturing sector in the era of globalization using the Ordinary Least Squares (OLS) regression techniques to analyse the data used in the study. The study found that though Nigeria manufacturing sector benefited from globalization process, the level of the development in the sector was found to be highly negligible. Meaning that globalization exerts little impact on economic growth via manufacturing sector of the economy.

Johngbo (2014) investigated the impact of real exchange rate fluctuations on industrial output in Nigeria using Ordinary Least Squares regression technique to analyse the data used. He founds that real exchange rate play a significant role in determining the industrial output. Also, availability of foreign exchange increase through contentious export drive from both oil and non-oil products will contribute tremendously to increase industrial output. The study further reveals that the capacity utilization ratio is low the cases of which may not be too far away from, partly epileptic power supply, lack of adequate and appropriate technology and so on and also that the impact is bidirectional (real exchange rate on industrial output and vice-versa)

Okoye, Nwakoby and Okorie (2016) used the vector error correction method and granger causality test to assess the relationship between economic openness and industrial development in Nigeria from 1986 to 2014. Their findings revealed that the rate of change in exchange rate, trade openness and lending rate exert significant negative impact on industrial output. There is also evidence of significant positive impact of financial deepening on industrial output. The Granger causality estimate showed a weak causal impact of financial deepening on industrial output as well as bi-directional causation between trade openness and industrial output. There is also evidence of causal impact of industrial output on lending rate, an indication that industrial development generates demand for financial resources.

3. Research Methods

The nature of the data used in this study is secondary, sourced from the central bank of Nigeria Statistical bulletin and World Development Indicators (WDI) (2013). The study at first subject all the variables employed to a multicollinearity test in order to avoid a contradictory result. The unit root test was adopted to test for the presence or absence of unit root among the variables used. This is done because of the fluctuations in the data availability. The co-integration technique was employed to test for the long-run co-movement among the variables employed as a result of the unit root test. However, the Fully Modified Ordinary Least Squares (FMOLS) regression technique was employed to assess the interactive impact of human capital investment on industrial output in Nigeria.

3.1 Model Specification

Following the neo-classical model of growth which was based on the Cobb-Douglas production function; $Y = f(A, K, L)$ ----- (1)

Romer and Weil (1992) considering the role of human capital on economic growth incorporated human capital in the framework and the model was written as:

$$Y_{(t)} = K_{(t)}^\alpha H_{(t)}^\beta A_{(t)} L_{(t)}^{1-\alpha-\beta}$$
----- (2)

Where; Y is output; K = Physical capital and H = the Human Capital Stock; L = Labour force; A is level of technology and $\alpha, \beta, < 1$, implying decreasing returns to capital. By implication, there is a strong and positive relationship between investment in human capital and output growth.

Following the model, Olayemi (2012) adopts the model by incorporating public expenditure on health and education as a proxy for human capital and

replace Y proxy for economic growth as industrial index production output. The model was written as;

$$IIP = F(TED, THE, GCF) \text{ -----} \quad (3)$$

Where, IIP- industrial index production, TED- total expenditure on education, THE- total health expenditure, and GCF- gross capital formation proxy for K- capital. In line with these studies, the empirical model adopted for this study is written as;

$$Y = F(HE*ED, GCF, EXR) \text{ -----} \quad (4)$$

Where, Y- industrial output, HE*ED- interactive function of health and education expenditure, GCF-

gross capital formation proxy for investment, EXR- Exchange rate. Exchange rate is included in the model in other to account for the rate at which the value of the country currency in the stock market affects the output of the sector. Looking at the current devaluation in the country currency gave an impetus to include this variable in the model. Interactively, education and health are examine jointly rather than individual assess in previous studies such as Adejumo et al (2013), Olayemi (2012), among others.

4. Analytical Framework

4.1 Pre-estimation test

Table 4.1: Correlation Matrix

VARIABLES	LOG(MOTY)	LOG(HE*ED)	LOG(GCF)	EXR
LOG(MOTY)	1.000000	0.863114	0.560032	0.781397
LOG(HE*ED)	0.863114	1.000000	0.730167	0.923386
LOG(GCF)	0.560032	0.730167	1.000000	0.771277
EXR	0.781397	0.923386	0.771277	1.000000

Source: Authors computation (2016)

The decision criteria for the correlation test follow the criteria of Iyoha and Ekanem (2004) and Hamsal (2006), that a multicollinearity exist among variables if the correlating value is greater than 0.95. From the result, none of the variables correlation value exceeds 0.95, which implies that there is no multi-collinearity among the variables employed in the study. Therefore, the variables are accurate to use in the analysis.

Table 4.2: Augmented Dickey Fuller Test

Variables	Level	first difference	order of integration
LOG(MOTY)	2.377777	(-5.288506)**	I(1)
LOG(HE*ED)	0.502704	(-6.573209)**	I(1)
EXR	1.121207	(-4.002849)**	I(1)
LOG(GCF)	1.882881	(-3.688995)**	I(1)

Source: Authors computation (2016)

The unit root result revealed that all the variables are stationary at first difference and also at the same order of integration, which implies that there is presence of unit root among the variables employed in the study. As a result of this, the johansen co-integration technique was employed to check if there exists a long-run co-movement among the variables employed in the study. the result is presented in Table 4.3 below.

Table 4.3: Johansen Co-integration test results

No. of CE	Trace Test	P-value	Max-Eigen Test	P-value
R = 0*	80.40671	< 0.05	31.39762	< 0.05
R ≤ 1*	49.00909	< 0.05	24.52094	< 0.05
R ≤ 2	24.48815	> 0.05	16.49798	> 0.05
R ≤ 3	7.990163	> 0.05	7.978693	> 0.05
R ≤ 4	0.011470	> 0.05	0.011470	> 0.05

* denotes rejection of the hypothesis at 5% significance level. Likelihood ratio test of both Trace and Max-Eigen indicates 2 co-integrating equation(s)

Source: Authors computation (2016)

The co-integration test revealed that there are at least two co-integrating vectors, which lead to the rejection of the null hypothesis that there exists no long-run co-movement among the variables employed at 5% level of significance at both trace and max-eigen test. Having tested the variables for a long-run co-movement, the Fully Modified Ordinary Least Squares (FMOLS) was used to check the interactive effect. The result is presented below in **Table**

Table 4.4: Fully Modified Ordinary Least Squares Regression Result.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
@LOG(HE*ED)	0.187588	0.053028	3.537544	0.0021
@LOG(GCF)	0.234880	0.007576	31.00345	0.0000
EXR	-0.007023	0.003527	-1.991411	0.0603
R-squared	0.670897	Mean dependent var		5.993476
Adjusted R-squared	0.637987	S.D. dependent var		0.537246
S.E. of regression	0.323247	Sum squared resid		2.089777
Long-run variance	0.139896			

Source: Authors computation (2016).

The FMOLS result revealed that interactively, health expenditure and education expenditure impacted positively and significantly on manufacturing output in Nigeria. This implies that, the joint role of health and education in the industrial sector growth is significant. Government investment proxy as gross capital formation, impacted positively and significantly on industrial output in Nigeria. This is because; the expenditure allocated to the industrial sector has been well monitored and implemented towards developing the sector. Exchange rate had a negative and significant effect at 5% level of significance. This implies that, the rate of exchange of the country currency has not favoured the value of the industrial output. This could be as a result of inappropriate policy implementation towards increasing the value of the sector output. The R-squared value is 0.670897, which implies that, about 67% disparities in the dependent variable can be explained by the independent variables.

5. Conclusion and Recommendations

The study investigates the interactive effect of human capital investment on industrial output in Nigeria from 1990-2014 using various econometric technique. The findings revealed that, interactively, health and education expenditure had a positive and significant impact on industrial output in Nigeria. Gross capital formation also had a positive and significant impact on industrial output in Nigeria. Exchange rate had a negative impact on industrial output in Nigeria. The study therefore concludes that, the role of human capital investment in the growth of the industrial sector output cannot be ignored, which implies that human capital (health and education) jointly play a significant role in industrial growth. This result conforms to the study of Adejumo et al (2013), Olayemi (2012), Johngbo (2014), Ekesiobi et al (2016). From the findings, the following are therefore recommended that; Government should increase its expenditure on health and education in the economy. Government should create an efficient on the job training to increase labour skills in the industry. The monetary sector policy should be

reviewed towards increasing the value of the country’s output in the world market. Government investment should further be well monitored towards increasing the growth of the economy. Government should supply more facilities needed in both the health and education sector, in order to increase individual knowledge and ability status in the industrial sector.

References

Adejumo, A.V., Olomola, P.A., & Adejumo, O.O. (2013). The Role of Human Capital in Industrial Development: The Nigerian Case (1980-2010). *Modern Economy Scientific Research*, 4, 639-651.

Aderibigbe, J.O. (2004) “An Overview of the Nigerian Financial System”, *CBN Bullion*, 28(1)

Adofu, I., Taiga, U.U. & Tijani, Y. (2015). Manufacturing Sector and Economic Growth in Nigeria (1990-2013). *Donnish Journal of Economics and International Finance*. 1(1) 001-006.

Akinmulegun, S.O., & Oluwole, F.O. (2014). An assessment of the Nigerian manufacturing sector in the era of globalization. *American Journal of Social and Management Sciences*, 5(1): 27-32.

Bennett, K.O., Ayanwu, U.N., & Kalu, A.O.U. (2015). The Effect of Industrial Development on Economic Growth: An Empirical Evidence in Nigeria (1973-2013). *European Journal of Business and Social Sciences*, 4(02), 127 – 140.

CBN (2013). Central bank of Nigeria statistical bulletin. *CBN*.

Domar, R.E. (1946), ‘Capital expansion, rate of growth and employment’, *Econometrica* 14(2), 137-147.

Ekesiobi, C.S., Dimnwobi, S.K., Ifebi, O.E., & Ibekilo, B.N. (2016). Public Sector Education Investment and Manufacturing Output in Nigeria: Empirics and Policy

- Options. *Public Policy and Administration Research*, 6(7), 95-106
- Elijah, U., & Uchechi, R.O., (2012). Financial Sector Development and Industrial Production in Nigeria (1970-2009): An ARDL Co-integration Approach. *Journal of Applied Finance & Banking*, 2(4) 49-68.
- Falade, O.E. & Olagbaju, I.O. (2015). Effect of government capital expenditure on manufacturing sector output in Nigeria. *Business and Economic Research*, 5(2), 136-152.
- Hamsal, M. (2006). "Paradoxical Strategies and Firm Performance: The Case of Indonesian Banking Industry", A paper presented at the 1st Doctoral Journey in Management, organized by Management Research Center, Faculty of Economics, *Universitas Indonesia*, November 23, 2006, Jakarta: Indonesia.
- Harrod, Roy F. (1939) "An Essay in Dynamic Theory," *Economic Journal*.
- Isaksson, A., (2010). Public Capital, Infrastructure and Industrial Development. United Nations Industrial Development Organization (UNIDO). *Research and Statistics Branch*. working paper 15/2009
- Ishola S.A. (2012). Government expenditure in the manufacturing sector and economic growth in Nigeria. *International Journal of Scientific & Engineering Research*, 3(11), 1-7.
- Iyoha, M. A., & Ekanem, O. T. (2004). Introduction to Econometrics. *Benin City: Mareh Publishers*.
- Johngbo, O.C. (2014). The impact of real exchange rate fluctuation on industrial output in Nigeria. *Journal of Policy and Development Studies*, 9(1), 268-278.
- Lucas, Jr., R.E. (1988). On the Mechanics of Economic Development, *Journal of Monetary Economics, Elsevier, July, 22(1), 3-42*.
- Okoye, L.U., Nwakoby, C.I.N. and Okorie, E.U. (2016): Economic Openness and Industrial Development in Nigeria. *Journal of Policy and Development Studies*, 10(1), 12-26
- Olayemi, S.O. (2012). Human Capital Investment and Industrial Productivity in Nigeria. *International Journal of Humanities and Social Science*, 2(16), 298-307
- Otalu, J.A., & Keji, S.A. (2015). An assessment of the determinants of industrial sector growth in Nigeria. *Quest Journals. Journal of Research in Business and Management*, 3 (7), 01-09.
- Owolabi, A.U. & Adegbite, T.A. (2014). Impact of Monetary Policy on Industrial Growth in Nigeria. *International Journal of Academic Research in Business and Social Sciences*, 4(1), 18-31.
- Romer, P. M. (1989). Human Capital and Growth: Theory and Evidence, NBER Working Paper 3173.
- Schultz T.W (1961). Investment in Human Capital. *American Economic Review*, 51, 1-17.
- United Nations (2010). *The Millennium Development Goals (MDGS) MDG Report: We Can End Poverty by 2015*. New York.
- WDI (2013): World Development Indicators. *World Bank*.