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Capital Accumulation and Labour Productivity Growth in Nigeria

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Abstract

This study evaluates the role of capital accumulation on labour productivity growth in Nigeria. Endogenous growth and efficiency wage theories are employed in explaining the determinants of labour productivity. The ordinary least squares method of estimation employed to evaluate the effect of capital accumulation on labour productivity and employment generation in Nigeria over the time frame of 1970-2014. The findings of this study include: education expenditure and capital formation's impact on labour productivity growth is time dependent; health expenditure positively impacts labour productivity growth; compensation to employee negatively impacts productivity growth in Nigeria.

Keywords: Capital accumulation; Labour productivity growth; Physical capital; Human capital.

1. Introduction

The postulation of competitive market is that production factors earn their marginal product. Thus, labour is expected to command wage that correspond to it marginal product. It can be argued that competitive market is more of a theoretical postulation than a realistic assumption regarding world economies, it however provide useful ideas that guide market relations. One of such is that the level of productivity of a worker will influence the wage she will earn.

Beyond the increasing number of the unemployed in Nigeria, is the challenge of low labour remuneration. The minimum wage law existing in Nigeria stipulates that no worker should be paid below the threshold of ₦18,000. The implementation of the law has been challenged by States' governors in Nigeria. In November 2015, the Nigerian Governors Forum expressed their inability to continue to adhere to the minimum wage law as a result of declining revenue. The ₦18,000 minimum wage translates to a daily income of ₦600 (assuming 30 days in a month). Hence, a question of how an individual meet the basic needs of life (food, clothing, and shelter) with such meagre income comes to mind.

The challenges of high unemployment (especially among the youths) and low remuneration for those employed constrain the living standard of individuals. The limitations of quality standard of living among the youths pose a threat to the peace and stability of the society. For example, there has been a rise in the report on criminal activities (such as kidnapping, robbery, terrorism among other) in the pages of newspapers (see, for example, The Nation newspaper, March 10th, 23rd and 25th 2016). The low level of living standard contributes to the impasse of these criminal activities. Thus, evaluation of factors responsible for the low employment generation and low labour remuneration becomes expedient in proffering means through which living standards in Nigeria can be augmented.

The main objective of this study is to examine the impact of capital accumulation on labour productivity growth. Specifically, this study will examine the impact of human and physical capital accumulation on labour productivity growth in Nigeria.

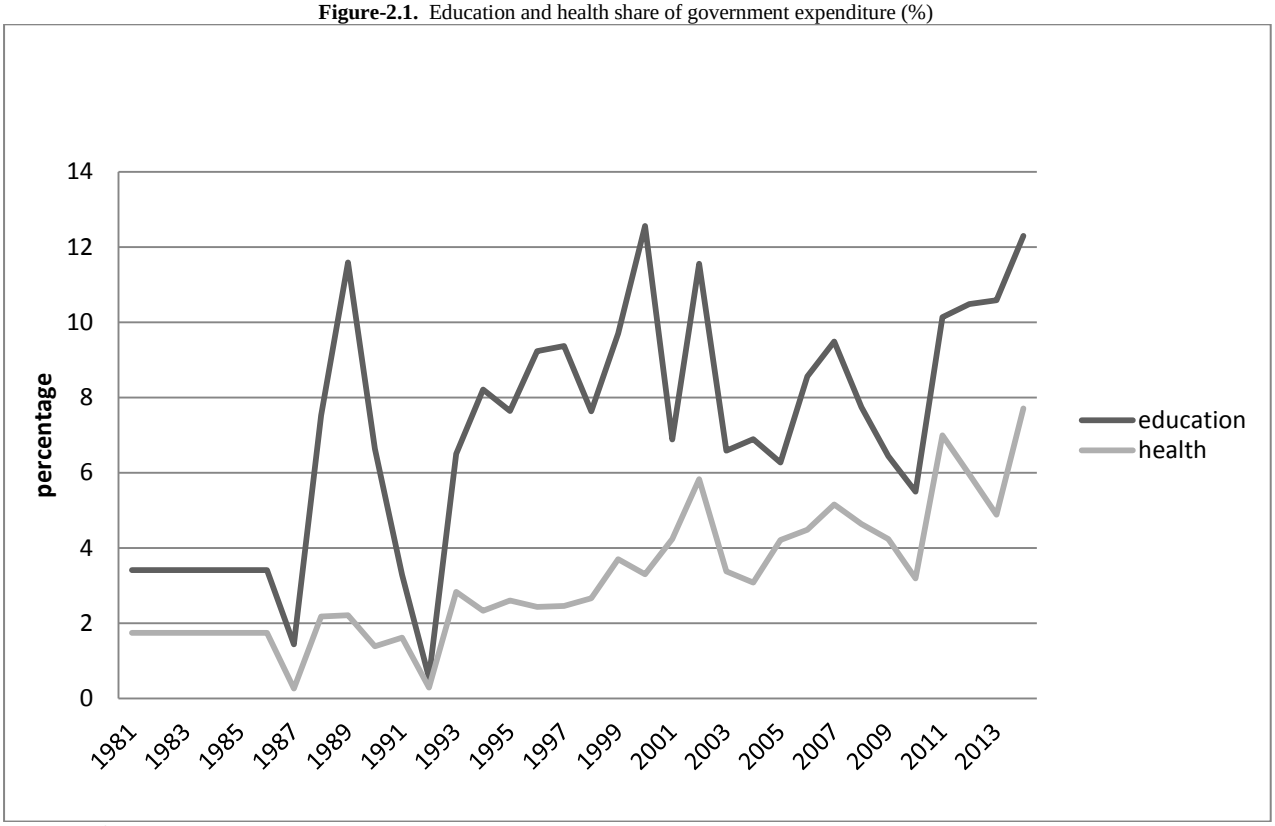
2. Background

2.1. Capital (Human and Physical) Accumulation in Nigeria

Figure 2-1 shows the trend of the ratio of education and health expenditure to total government expenditure from 1981 to 2014. The trend of education and health ratio followed a similar trend over the time frame; a noticeable feature in this plot is the variation in the gap between the share of government expenditure that goes to education and health. The gap reached its peak in 1989, while in 1992 the share education and health in government expenditure were close.

In spite of the volatility in the share of government expenditure spent on health and education, the cumulative of the share of government spending on education and health has increased over the years on the average. Between 1981 and 1990, the sum of the shares government expenditure spent on education and health had an average value of 6.4%. The average cumulative shares of education and health in total government expenditure increased to 9.9%, 11.8% and 17.3% over the years 1991-2000, 2001-2010 and 2011-2014 respectively.

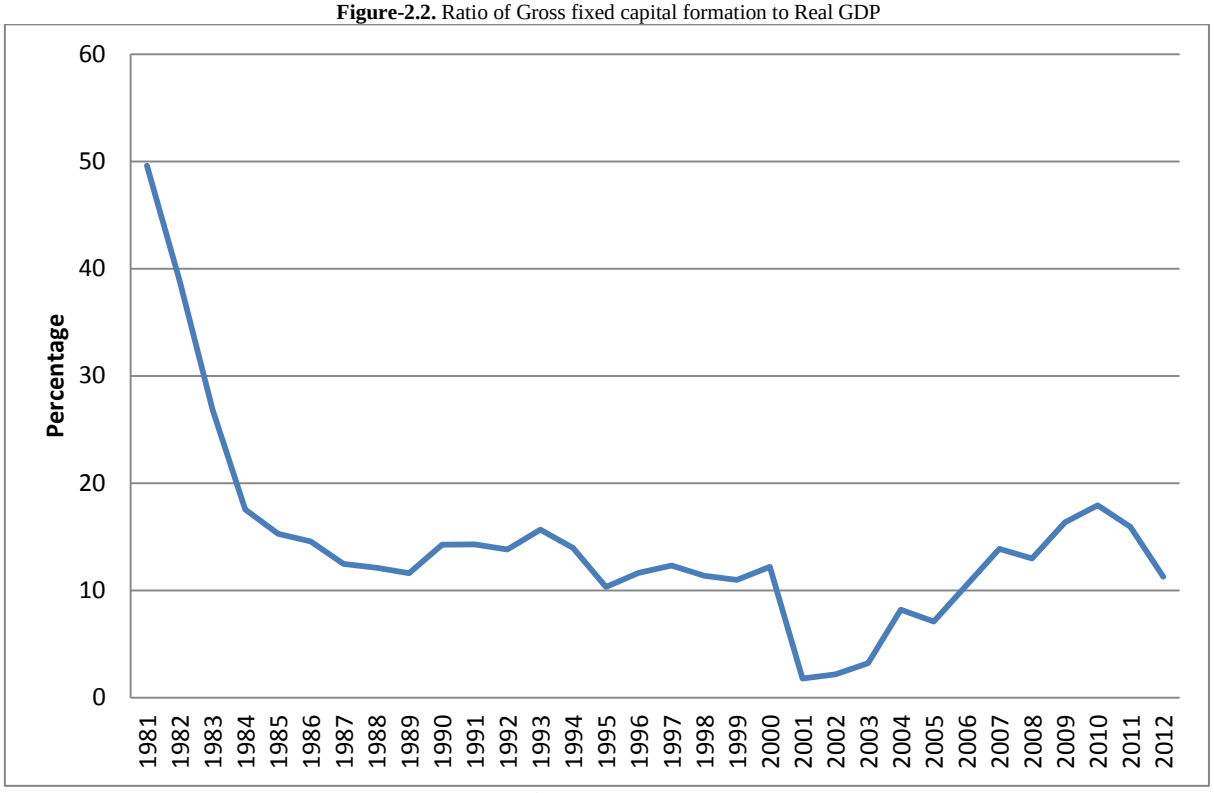
Figure-2.1. Education and health share of government expenditure (%)



Computed from CBN Statistical Bulletin

The evolution of physical capital accumulation in Nigeria is examined using the ratio of gross fixed capital to real Gross Domestic Product. The ratio of gross fixed capital to GDP as shown in figure 2-2 dwindle from about 50% in 1981 to less than 5% in 2001, the ratio, however, started to rise from 2002 only to decline again in 2010. The low level and fluctuation that characterises investment limits the ability of the economy to increase the level labour productivity and the level of output.

Figure-2.2. Ratio of Gross fixed capital formation to Real GDP

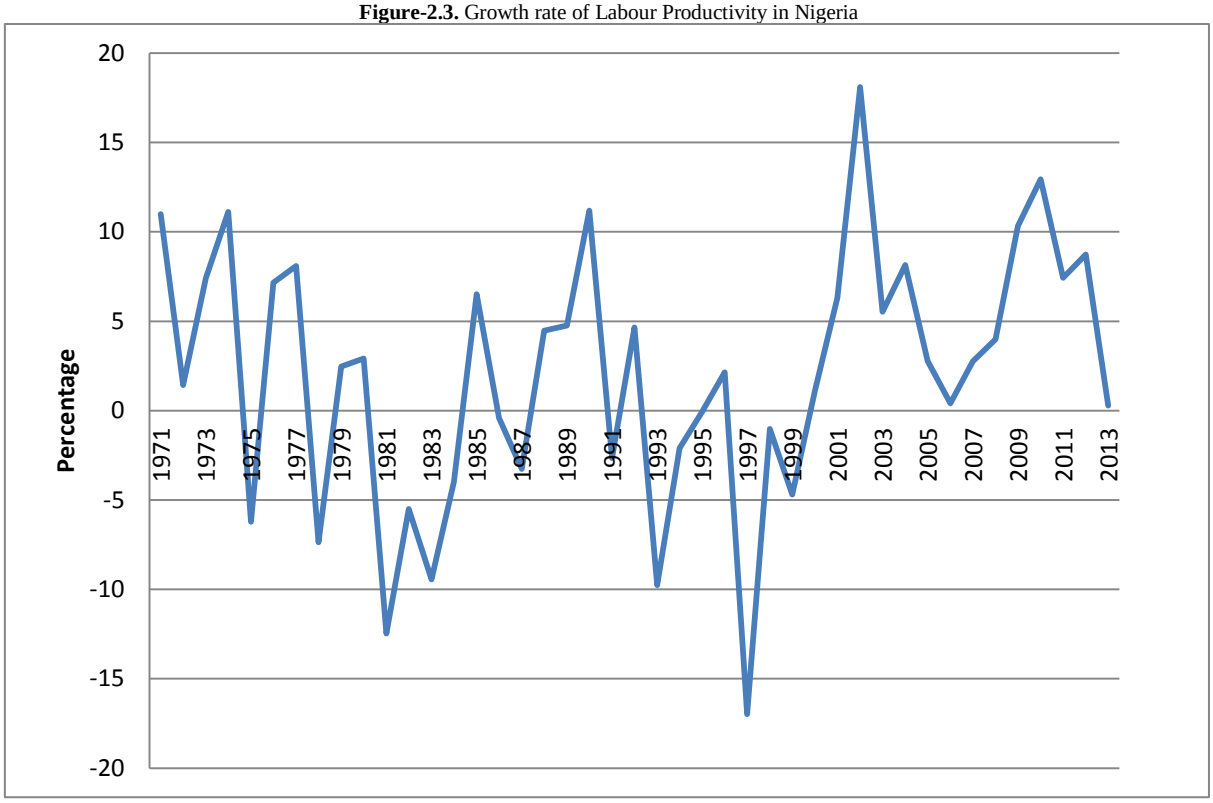


Computed from CBN Statistical Bulletin

2.2. Labour Productivity in Nigeria

The growth rate of labour productivity in Nigeria between 1971 and 2013 is characterised by a high rate of volatility; the mean value of labour productivity growth over this time frame is 2.05%. The standard deviation of labour productivity is high (7.24) compared to that of output growth (6.69) and employment growth (4.29). Average productivity growth values for the periods 1971-1980, 1981-1990, 1991-2000 and 2001-2013 were 3.8%, -0.81%, -2.94% and 6.74% respectively (CBN Statistical bulletin; Sodipe (2008) and Onwuemele (2013)).

Figure-2.3. Growth rate of Labour Productivity in Nigeria



Computed from CBN Statistical bulletin; Sodipe (2008) and Onwuemele (2013)

3. Literature Review

3.1. Concepts of Capital Accumulation and Labour Productivity

According to Routledge dictionary of economics (2002) capital can be defined as follows: Durable goods capable of producing a stream of goods or services over a period of time; a factor of production distinct from land, the entrepreneur and the labour currently being used; a sum of money which is invested in a business enterprise; accumulated expenditures giving rise to higher subsequent incomes. It further defines capital accumulation as increasing the capital stock by undertaking investment in excess of replacement investment.

According to Blanchard *et al.* (2007) Labour productivity is simply output divided by employment level. Ark (cited in (Oloni, 2011)) observes that productivity growth have many faces. He explains that in a static sense, it is simply about more output per unit of input and so it is very close to nominal cost savings. But in a dynamic sense, he explains the concept as to raising output growth faster than input growth; which implies "real" cost reductions which provide firms with larger market shares, and consumers and users with a lower cost of the products and services they are buying.

3.2. Determinants of Labour Productivity: Endogenous Growth Model and Efficiency Wage

The main findings of the neo-classical growth models that productivity determined economic growth resulted in enquiries into factors that determine productivity (technology). This question was taken up by endogenous growth theorists, modeling technology as the output of the research and the development sectors. However, the enquiry into the determinants of productivity growth is still yet to reach a conclusion among economists. The goal of growth theorists is to develop explanations for the difference in per-capita income across countries.

Efficiency wage theories are theories that link labour productivity to wage rate. The theories assume that labour is more productive the higher the wage. Thus, firms that adhere to this hypothesis tend to pay their employees' wages above the market level. Yellen (1984) identified four reasons why firms pay a wage higher than the equilibrium wage rate. These include: higher wages improves worker's nutrition and hence their productivity; higher wage reduces labour turnover rate; higher wages improves the average quality of a firm's workforce; higher wages increases workers' effort and reduces shirking by workers.

Empirical works on the determinants of labour productivity can be classified using two dimensions: Studies on determinants of labour productivity at sectoral and aggregate economy level.

Determinant of labour productivity at sectoral level:

Atomen *et al* (2015) identified factor that affected labour productivity in the construction industry of Nigeria. The factors identified include: the involvement of non-professionals; material shortages; variations in cost of materials; recruitment of supervisors; inclement weather; stoppage because of owner/landowners conflict; stoppage because of insolvency of subcontractor/suppliers; labor disruption; delay in material deliveries to site; and disruption of power/water supply.

Kurre and Eiben (2013) in their work on the "Determinants of Labor Productivity for Detailed Manufacturing Industries" explored reasons for the variations in labour productivity in manufacturing industries across states in the United States of America. They examined the impact of education, investment in physical capital, human capital, public capital, agglomeration economies (both urbanization and localization), patents, and other possible determinants. The most emphatic trend in their study was the significant positive effect of capital on productivity in every industry; however, they observed education did not show any significant impact on labour productivity.

Majid (2010) observed that changes in capital intensity, improvement in management, skill upgrade, longer working hours and greater effective effort as major determinants of labour productivity and employment in the large-scale manufacturing sector in Pakistan. The study further suggested that aggregate productivity can be increased if labour flow in the sector with higher levels of labour productivity.

Giroh *et al.* (2013) focused on analysing the efficiency of latex production and labour productivity in rubber plantations in Edo and Delta state. They analysed labour productivity with the aid of Labour productivity model as developed by Upton (1997) and Likert scale using primary data obtained from farmers' production activities for 2009 and 2010 through a multi-stage sampling technique. A major assumption was the use of 2 as a benchmark to judged the significance of production efficiency constraint. The study showed that the nature of wage contract affected labour productivity among rubber farmers. That is when wages are made to vary with the level of output; production was higher compared to when labour was paid a fixed wage.

Okoye *et al.* (2008) observed that fertiliser usage, cocoyam setts, capital and farmer experience to be positively and significantly related to labour productivity while farm size and household size had a negative relationship with labour productivity. Onu *et al.* (2015) identified IT Skills, work environment and management style as critical factors influencing labour productivity.

Aigbokhan (2011) identified that there was a mild support for efficiency wage model in the manufacturing sector of the Nigerian economy. He found positive but low (0.2) correlation between relative wage and value added. He also observed that education has a negative impact on labour earning which to him was counter-intuitive. He concluded that there's been lack of close relationship between pay and employee productivity. Consistently, wage tends to lag behind productivity especially in the public service.

Anumudu (2010) examined the impact of human capital on labour productivity in manufacturing industries in Enugu and Anambra States. The standard growth accounting framework as adopted by Corvers (1996) served as the framework for this study. The assumptions of the study include: the production process of the firms in the sample can be represented by a production function that relates firm value to four inputs (ordinary capital stock, computer capital stock, labour and research and development); the time and industry in which a firm operates affect the production function. He found that human capital has a positive effect on the sectoral labour productivity level of the industry. Training, Education, Medicare and Research are strongly correlated with productivity.

Determinants of Labour productivity at aggregate economic Level

Bassanini *et al.* (2008) using a "difference-in-difference" framework identified job protection legislation as a factor depressing labour productivity in OECD countries. Umoru and Odjegba (2013) investigated empirically the labour productivity effect of health capital in Nigeria. They used the technological diffusion process framework developed by Bloom *et al.* (2002b) with the assumptions that the production function exhibit constant returns to scale and the productivity of a labour force is driven by the health and education capital status of the labour force. They found the impact of education and health to be statistically insignificant on the Nigerian economy.

Adenikinju (2005) driven by the objectives of analysing the trend of productivity in Nigeria, identifying the determinants of productivity in Nigeria, and analysing the impact of policies directed at impacting labour productivity. He grouped the determinants of productivity in Nigeria into five categories: the fruits of knowledge, the result of accumulation, institutional factors, competition and other factors. Babatunde and Adefabi (2005) evaluated the long-run relationship between education and economic growth in Nigeria; they examined two different channels through which human capital can affect long run economic growth in Nigeria. The first channel is when human capital is a direct input in the production function and the second channel is when the human capital affects the technology parameter. They conclude that a well-educated labour force appears to significantly influence economic growth both as a factor in the production function and through total factor productivity. They also found the coefficient human capital variable measured by the average years of schooling to be positive and significantly influence output per worker.

Campbell and Agbiokoro (2014) in their study on human Capital and economic growth found that human capital alongside with technological development and population growth have positive relationship with the growth of the Nigerian economy. Their model confirmed that adequately trained and employed population enhances the growth of the economy It further revealed that the Nigerian experience does not support Solow's hypothesis of high population growth/low productivity relationship. Umoru and Yaqub (2013) employed time series data set covering the period of 1975 to 2010 in studying factors driving labour productivity. The objective of the study was to analyse the effect of

health capital on labour productivity in Nigeria. The human capital and production theories were used in explaining the relationship between labour productivity and health capital. The model used in the study was derived following Bloom *et al.* (2002b) technological diffusion process. The assumptions of this study include: The production function exhibits constant returns to scale; healthy labour force, educated labour force, government investment in health and education influence labour productivity. The empirical result obtained through the use of the generalised method of moments showed that public health investment and real wage rate positively influenced labour productivity. However, government spending on education had an inverse relationship on labour productivity.

4. Methodology

4.1. Theoretical Framework

This study also delves into the determinant of labour productivity, the endogenous growth model and the efficiency wage hypothesis provides some of the drivers of labour productivity. The Endogenous growth model identifies technology, physical and human capital accumulation as major factors driving labour productivity. As more equipment and machine are added to a given unit of labour, the marginal product of such labour is expected to rise. Similarly, factors that result in building labour's knowledge or technical knowledge such as training; education; research; and quality health facilities are seen as critical drivers of labour productivity. The efficiency wage hypothesis stipulates that higher wage rate (especially above the market clearing wage rate) help to stimulate the productivity of employees. The determinants of labour productivity according to these two theories can be summarised thus:

$$LP = f(K, H, W, A, u) \qquad (4.1)$$

Where LP is labour productivity,
K is physical capital accumulation,
H is human capital accumulation,
W is real wage,
A is technology and
u is other factors affecting labour productivity

Equation 4.1 is an expression of the determinants of labour productivity. Physical capital accumulation, human capital accumulation, real wage and technology positively influence labour productivity.

4.2. Model Specification

Equations 4.1 can be presented in an explicit form. Human capital is indexed using the share of total government expenditure on education and health; physical capital is indexed using gross capital formation. Equation 4.1 can be expressed in the form of an econometric model as:

$$LP_g = \propto_0 + \propto_1 H + \propto_2 E + \propto_3 K + \propto_4 W + v \qquad (4.2)$$

Where LP_g is labour productivity growth
H is share of total government expenditure on health
E is share of total government expenditure on education
K is gross capital formation and
W is compensation to employee

The parameters are defined as follows: $\propto_0$ measures the average value of labour productivity growth when all explanatory variables take the value of zero. $\propto_1$ measures the effect of a change in government health expenditure on labour productivity growth, holding other variables fixed. $\propto_2$ It measures the effect of a change in government education expenditure on labour productivity growth, holding other variables fixed. $\propto_3$ measures the effect of a change in gross capital formation on labour productivity growth, holding other variables fixed. $\propto_4$ measures the effect of a change in compensation to an employee on labour productivity growth, holding other variables fixed.v serves as a catchall variable for other relevant information excluded in the labour productivity growth model. The partial coefficients based on theoretical proposition are expected to take strictly positive values, that is: $\propto_1 > 0$, $\propto_2 > 0$,$\propto_3 > 0$, and $\propto_4 > 0$.

4.3. Empirical Method

In conducting the analysis of the relationship between capital accumulation and labour productivity, I employed certain descriptive statistics (mean, maximum, minimum, and standard deviation), correlation and regression analysis. The descriptive statistics is used to capture individual characteristics of the variables, while correlation analysis helps to capture the association and co-movement that exist among the variables in the model. I examined the stationarity of the variables using the Augmented Dickey-Fuller and Philip Perron unit root test (which specifies three kinds of autoregressive models (one without an intercept and a time trend, one including a constant term, and a model with an intercept along with a time trend)- for conducting unit root/ non-stationarity test). The decision criteria for determining the stationarity of a data set, that is to reject the null hypothesis of the presence of unit root,

the test statistic on the lagged dependent variable (ADF statistic) must be less than the critical/tabulated values. Thus, in estimating the regression models, the variables are specified at their respective level of stationarity.

The utilisation of the regression analysis for hypothesis testing requires that some formal diagnostic test is conducted to ensure that the model is adequate and that the assumptions of the Classical linear regression model are not violated. In the occurrence of the violation of the some of the assumptions, a corrective mechanism is employed. The models are tested for serial independence, homoscedasticity, and imperfect collinearity. These assumptions have implications for the efficiency of the coefficients of the variables in the model and hypothesis testing,

This study examines the relationship between capital accumulation and labour productivity over a time frame of 1970 to 2014. However, some of the data were only available for the years between 1981 and 2014 (share of total government expenditure on health and expenditure). The data on Labour productivity was computed using data from Central Bank of Nigeria Statistical Bulletin, Sodipe (2008) and Onwuemele (2013); while statistics on real wage, gross capital formation, share of total government expenditure on health and education were obtained from the Central Bank of Nigeria Statistical Bulletin.

5. Result and Analysis

5.1. Descriptive Statistics of Variables

Labour productivity grew at the average rate 3.19% between 1970 and 2014. About 7.1% and 3.2% of total government expenditure on the average were spent on the education and health sectors respectively between 1981 and 2014. The mean values of the ratio of the gross capital formation to real gross domestic product and compensation of employee to the real gross domestic product were 14.3% and 11.2% respectively. The average value of employment and labour productivity were 32.8 million and 8.4 respectively.

Table- 5.1. Mean, maximum, minimum and standard deviation values of variables

Variable	Mean	Maximum	Minimum	Standard deviation
Labour productivity growth rate(%)	3.190	22.245	-16.976	7.319
Education(%)	7.109	12.556	0.549	3.171
Health(%)	3.196	7.705	0.264	1.770
Capital accumulation(%)	14.317	49.606	1.791	8.969
Real wage(%)	11.153	24.999	1.739	6.824
Labour productivity	8.439	18.449	0.228	4.999

Correlation Analysis of Variables

Labour productivity is positively correlated with the share of government expenditure on education, the share of government expenditure on health, the ratio of the gross capital formation to GDP and the share of GDP that goes to employees as compensation. The correlation is, however, weak, except for that of government expenditure on health with a correlation coefficient of 67%. Labour productivity growth is positively correlated with the share of government expenditure on education, share of government expenditure on health and the share of GDP that goes to employees as compensation. Labour productivity growth is negatively correlated with the ratio of the gross capital formation to GDP.

Table-5.2. Correlation matrix

	LAP	LABPRTGR	EDUC	HEA	CAP	WAG
Labour productivity		1				
Labour product. Growth		0.6391		1		
Education	0.232	0.169	1			
Health	-0.043	0.347	0.726	1		
Capital	-0.150	-0.172	-0.414	-0.316	1	
Wage	-0.018	0.048	-0.302	0.064	-0.414	1

5.2. Unit Root Tests

The test for stationarity using Augmented Dickey Fuller and Philips-Perron tests reveal that all the variables were stationary in levels save wage rate. The null hypothesis of unit root was rejected labour productivity growth, ratio of the gross capital formation to GDP and share of government expenditure on health at 1% level of significance. The null hypothesis of a unit root for a share of government expenditure on education was rejected at 5% level of significance.

Table-5.3. Result of Unit Root test

	Augmented Dickey-Fuller		Phillips-Perron		
Variable	**Level**	**First difference**	**Level**	**First difference**	**Order**
Labour product. Gr	-4.675***	-	-4.713***	-	I(0)
Education	-3.876**	-	-3.636**	-	I(0)
Health	-4.971***	-	-4.971***	-	I(0)
Capital	-6.450***	-	-6.113***	-	I(0)
Wage	-1.991	-6.670***	-1.848	-7.195***	I(1)

***significant at 1 percent level
** significant at 5 percent level

5.3. Regression Analysis

Labour productivity growth is positively related to health expenditure in the third preceding year and education expenditure in the immediately preceding year. Labour productivity growth is negatively related education expenditure in the current year, education expenditure in the two preceding years, capital accumulation in the immediately preceding year, capital accumulation in the third preceding year and wage rate. The coefficients of health expenditure in the third preceding year, education expenditure in current year capital accumulation in the immediately preceding year, capital accumulation in third preceding year and wage rate in two preceding years are statistically significant at one percent level of significance. The coefficients of the education expenditure in the immediate and two preceding periods are statistically significant at five percent level of significance, while the coefficients of wage rate in the immediately preceding period is statistically significant at ten percent level of significance. The Adjusted R-squared of 0.41, implies that about 41% of the variation in labour productivity growth rate are explained by the explanatory variables specified in the model. The probability values of the F-statistics of 3.298 signify the significance of the overall model at five percent level of significance.

Table-5.4. Labour productivity regression result

Dependent Variable: LPGR				
Variable	**Coefficient**	**Std. Error**	**T-Statistic**	**Prob**
Constant	6.538929	5.768827	1.133494	0.2698
$HEALTH_{-3}$	4.167872	0.953023	4.373315	0.0003
EDUC	-1.375234	0.461956	-2.976981	0.0072
$EDUC_{-1}$	1.383968	0.499089	2.772986	0.0114
$EDUC_{-2}$	-1.313810	0.535497	-2.453440	0.0230
$CAPITAL_{-1}$	-1.910999	0.497461	-3.841507	0.0009
$CAPITAL_{-2}$	2.848296	0.685630	4.154276	0.0004
$CAPITAL_{-3}$	-1.449593	0.389213	3.724418	0.0013
$WAGE_{-1}$	-0.681638	0.328389	2.075705	0.0504
$WAGE_{-2}$	-1.008479	0.338867	-2.976033	0.0072
Adjusted R-squared	0.408064			
S.E. of regression	5.227635			
Durbin-Watson stat	1.366751			
F-stat	3.297905			
Prob (F-stat)	0.011606			

Note: All variables are regressed at the level at which they are stationary

Testing for autocorrelation, multicollinearity and heteroskedasticity

The Durbin-Watson statistics provides an inconclusive indication on the presence of autocorrelation. Hence, the Breusch-Godfrey test for serial correlation was used to test for autocorrelation; the probability value (0.31 or 31%) shows that the null hypothesis of no serial correlation cannot be rejected. The result shows the absence of autocorrelation as the null hypothesis of no serial autocorrelation was not rejected. The tests for heteroskedasticity conducted using four LM tests conclude that the variance of the error terms is homoscedastic as none of the tests rejected the null hypothesis of homoscedasticity. The test for multicollinearity using the autoregressive regression of one of the explanatory variables on other explanatory variables shows that there is no serious multicollinearity as the R-squared from the regression is 55%, which is lower than the 90% threshold.

Table-5.5. Breusch-Godfrey Serial Correlation LM test

F-Statistics	1.242602	Prob F(2,21)	0.3111
LM Statistic (Obs*R-squared)	3.585786	Prob. Chi-Square(2)	0.1665

Table-5.6. Heteroskedasticity Tests

Heteroskedasticity test	LM Statistic	Probability value
Breusch-Pagan-Godfrey test	7.219528	0.9640
Harvey	5.421837	0.7961
Glesjer	6.116229	0.7282
Engle ARCH	0.652416	0.4193

6. Conclusion

The share of total government expenditure that goes to the health sector is positively related to labour productivity. An increase in the share of government expenditure that goes to the health sector results in an increase in the level of labour productivity growth. The impact of government spending on the health sector takes three years before it impacts labour productivity. The impact of the share of total government expenditure that goes to education on labour productivity varies across time. It was observed that increasing the share of government spending that goes to education in year "t" will result in the following effects on labour productivity growth: labour productivity growth falls in period "t", rises in period "t+1", and falls in period "t+2" respectively. Similarly, it is observed that impact of changes in shares of total government expenditure spent on education takes two years to fully impact labour productivity growth. The impact of the ratio of the gross capital formation to real GDP on labour productivity growth varies over time. An increase in the ratio of the gross capital formation to real GDP in period "t" will result in the following effect on labour productivity: labour productivity growth falls in period "t+1", rises in period "t+2", and falls in period "t+3". The full impact of a change in the ratio of the gross capital formation to real GDP on labour productivity growth takes three years. The ratio of compensation to employees to national income is inversely related to labour productivity growth.

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