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IS GOVERNMENT WAGES PRODUCTIVE? EVIDENCE FROM NIGERIA'S EDUCATION SECTOR

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ABSTRACT: *This research used annual data from 1970 to 2019 to investigate the impact of wages on Nigerian productivity growth, employing one of the most advanced econometric approaches to evaluate experimentally the hypotheses developed. In this regard, utilizing a systems simultaneous equation, cointegration analysis was introduced to capture long- and short-run connections among variables. This is because Vector Autoregressive (VAR) considers all variables to be endogenous. The simultaneous equation was simulated using this technique and VAR through the Vector Error Correction Mechanism (VECM) procedure. Ex-ante forecasting using impulse response and variance decomposition simulations, as well as ex-post forecasting to evaluate the time under research, were also used in the study. The study also looked at causality correlations between series using the VECM Granger causality technique, which is used in F-/Wald test simulation to determine short-run causation between variables. The above-mentioned simultaneous equation is then approximated using Ordinary Least Squares (OLS). Wages have a positive and significant association with education growth, whereas government policy has a negative relationship with education growth in its four lags, according to empirical findings. Wages affect education growth, according to the VECM Granger causality result. A closer examination of the impulse response function reveals that wages will have a detrimental short- and long-term impact on educational growth. Furthermore, studies show that wages have a significant role in contributing to educational advancement across all times. This is because, according to variance decomposition innovations, salaries will generate 51.4 percent changes in long-term productivity growth. Based on the findings, this study recommends that the government provide suitable welfare packages to make teachers proud and glad of their profession, because welfare outcomes are crucial for employee productivity, and a lack of reward is a potential cause of worker productivity decline.*

KEYWORDS: recurrent expenditure; education growth; wages; VECM.

INTRODUCTION

Employee productivity is the most important long-term predictor of salaries and living standards, hence federal, state, and local governments are all focused on increasing it. Teachers and support staff's ability to improve their standard of life in Nigeria is dependent on stakeholders' ability to increase output per worker (the number of goods and services each worker produces and the value they add).

Long-term productivity growth, on the other hand, is not yet fulfilling the expectations of teachers and support staff, implying that many of their aspirations for a better quality of life remain unfulfilled. Nigeria's low productivity growth is a long-term issue that has gripped the nation since independence, and it will need a concerted effort on multiple fronts to address. The best way to tell if a sector is thriving is to look at whether employee wages are rising in line with the cost of living. Two things must happen in order for employees' incomes to rise: productivity must grow (producing more overall income), and new income gained from their enhanced productivity must be returned to employees in the form of higher wages (Berger & Fisher, 2013).

Wages, according to economists, can play a significant effect. Clearly, nearly all employees want a raise. Is there, however, a causal relationship between pay and productivity? Finally, some data suggest that salary increases are linked to increased productivity. Wage increases in the case of Amazon, according to Fisman & Luca (2018), enhance productivity for two key reasons. For example, providing above-market salaries can be a powerful motivator because current employees have more to lose. In other words, employees have more to lose by slacking off because it is more difficult to find a comparable job elsewhere. As a result, individuals are more motivated to do good work and stay in their current position. In the end, it appears that inducing a sense of loss aversion is linked to increased production. The second argument is that reciprocity is important. Workers tend to work harder than is required when an employer grants them an unexpected salary boost. This is true even if these employees are unconcerned about being dismissed. Gifts, in fact, are approximately as efficient as hiring extra staff, according to the findings. In essence, reciprocity may be a tremendous force, motivating employees to go above and beyond in order to “payback” the original favour. According to research, children of higher-paid employees are less likely to grow up in poverty, are less likely to be poor as adults, and are more likely to be well educated and paid as adults, making them less likely to rely on food stamps or other forms of government help. Fisher & French (2009).

Knowledge is the most important factor in economic growth and progress, and investing in it pays off handsomely. The value of education to a country cannot be overstated; in most parts of the world, education is considered a basic human right. Education is one of the most important indicators of a country's progress and development. Unfortunately, the level, quality, and standard of education in Nigeria has declined dramatically over the last four decades, making Nigeria the primary nation of origin for African students travelling to other areas of the world in search of quality education (Infoguide-Nigeria, 2020). A number of variables, including low teacher salaries, have been blamed for the drop in standard.

There appear to be some research studies on employee well-being and productivity (Coventry and Barker, 1988; Cowling and Mailer, 1992; Singh, 2009; Owusu-Acheaw, 2010; Osterman, 2010), however, they largely focused on industrial settings, ignoring government ministries, departments, and agencies. As a result, the major goal of this research is to empirically investigate the relationship between teachers and education support staff's salary and productivity in Nigeria. The

following is how the paper is organized: The first section is the introduction. Section two focuses on the relationship between inflation, recurrent education spending, and the growth rate of education contribution to GDP. The Problems and Challenges portion is the third section. The data source, model design, and estimating process are described in section four, while the findings, conclusion, and policy implications are offered in the final part.

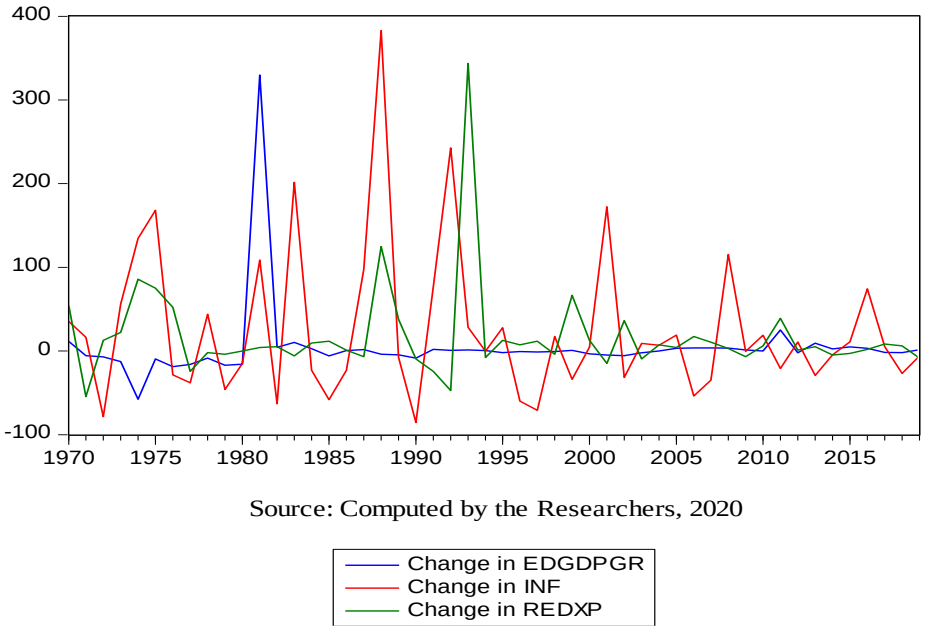
The Relationship between Inflation, Recurrent Expenditure on Education and Productivity

Wages and inflation are intertwined. To sustain the life style at increased prices, excessive inflation demands pay rises. Increased earnings add to the existing inflationary pressures by increasing demand. Raising salaries is one strategy to improve the average person's living standard. Another option is to provide work at the present wage (Obi & Iduh, 2011). Those who believe there is a link between labor productivity and salaries within an occupation implicitly assume the following, according to Bruce (2002): Workers' contributions to business revenue rise as output per worker increases, causing demand for workers to rise as well. Salaries are regulated by supply and demand, therefore if demand rises, wages will rise as well. For two reasons, this "theory" is wrong. To begin with, there is no necessary connection between output per worker and revenue per worker. As previously stated, if demand for an industry's product decreases, the price that may be paid for that product decreases as well. As a result, even if output per worker increases, income per worker could decrease. Furthermore, if output per worker increases, the industry will be forced to sell more units of output, increasing industry supply. However, the rules of supply and demand dictate that as supply rises, prices fall. That is, a rise in worker productivity could lead to a drop in prices.

The relationship between change in purchasing power (percentage change in inflation), the percentage change in education recurrent expenditure (wages) and percentage change in education contribution to GDP (productivity) is reported in figure 1. It shows that in the years, inflation decreased, wages increased except in 1977, 1979, 1990, 1994, 2014 & 2019. An increase in inflation rate reduced wages except in 1970 (immediately after the civil war), 1973 & 1974 (when the Udoji public service review commission (1972-1974)), 1981 (Cookey Commission on Salaries and Conditions of Service of University Staff), 1988, 1993, 2000 (Review the remuneration package of political office holders in the executive, legislature and judiciary at the Federal, State and Local Government levels), 2004, 2008, 2010, 2012, 2016 & 2017. Productivity was highest in 1981, inflation increased by 109% and wages increased by 4.1%. Inflation was highest in 1988 (382.8%) while productivity decreased by 3.9% and wages increased by 124.8%. wages were highest in 1993 (343.7%) shortly after Longe Commission (1991) recommended a general salary increase of 30% to all staff of tertiary institutions within the Elongated University Salary Structure

(EUSS). It also recommended various allowances to go with the salary increase.

Figure 1: Relationship Between Change in Inflation, Change in Recurrent Expenditure on Education and Change in Education Growth Rate



Source: Computed by the Researchers, 2020

The Problems and challenges Facing Nigerian Education

There is no denying that teachers' general performance and productivity are suffering, and education in the country is currently more accurately regarded as an endangered concept. Those in positions of power must understand that teaching is more of a psychological profession, and those involved must give it they're all to succeed. If you educate a man, you are removing a criminal from the streets. Education is a powerful instrument for retraining a man's mind to think clearly and make sound decisions. It helps people grow (Olawale, 2018). Here are just a few of the various issues that Nigerian education faces:

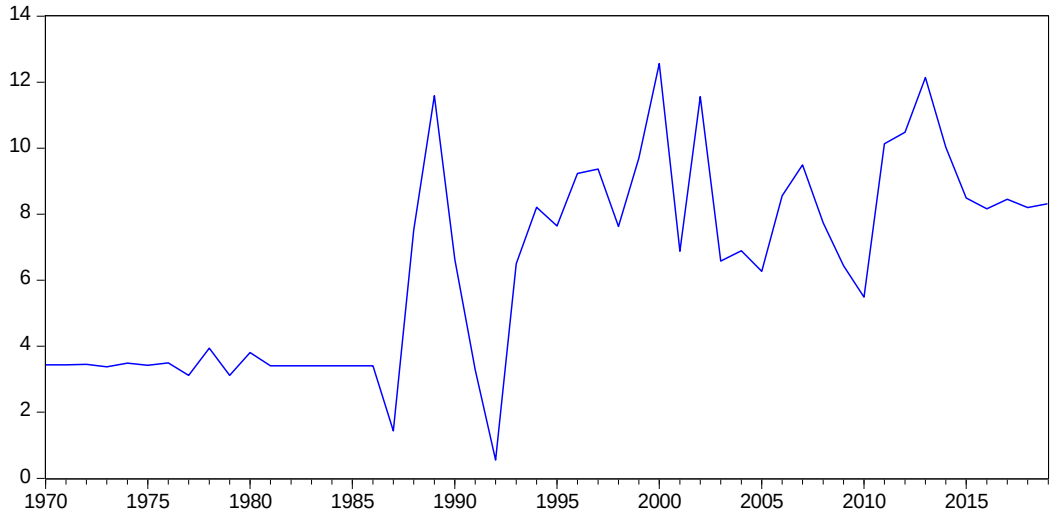
I. Low-Paying Jobs: Teachers in primary, secondary, and university institutions are finding it more difficult, if not impossible, to make ends meet. The main reason for this is because Nigerian teachers' salary is not just among the lowest in the world, but it has also failed to improve in response to market conditions. Teachers in the private sector have it especially bad. Teachers' salaries and working conditions have deteriorated as vast sums of money have been amassed through their sweat; teachers have become increasingly alienated from the riches earned by their labour. The salary gap between politicians and teachers in Nigeria is not only one of the widest in the world, but it has also been widening over time. Simultaneously, politicians and high government officials at education institutions have seen their pay and wealth skyrocket, while teachers have been forced to live on pitiful salaries. Teachers can no longer live on their salaries, and the problem is exacerbated by the fact that those who teach also have to assist family members who are part of the massive

unemployed army. Apart from the fact that teacher salaries in Nigeria are woefully inadequate and often in dispute, several states continue to fall short of expectations when it comes to paying stipends to teachers. Many months of salary arrears are owing, and there is little prospect that these debts will be cleared in the near future. It's tough to comprehend how some state governments expect teachers to perform admirably in their jobs when hungry. The majority of teachers in both private and public schools cannot afford to train their children at the schools where they work, nor can they afford to attend conferences, do research, or extend their education without the assistance of friends and family. TETFUND training is reserved for the fortunate or those with connections. It has become evident that a single teacher compensation scale that cuts across the board is required to keep up with the rate of hyperinflation in the economy.

II. Inadequate Funding: The first and perhaps the most significant challenge confronting Nigeria, which makes it difficult to provide high-quality education that can lead to long-term development, is insufficient funding by the federal, state, and local governments, to the extent that funding has been conditioned by international financial institutions (IFTs) (Saleh, 2013). It has been identified as the primary cause of rot and problems in the education system, particularly in tertiary education, which has resulted in periodic strikes by teaching and non-teaching personnel since the early 1990s. University lecturers went on strike 22 times between 1992 and 2020, having a negative impact on education at the tertiary level in the country. Over the years, Nigeria's financial allocation to the education sector has left a lot to be desired. During the research year, the trends of budgetary allocations to the sector revealed erratic and low allocation. The trends even fell short of the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) requirement that developing countries devote at least 26% of their total yearly budget to education. Between 1970 and 2019, recurrent education expenditure was 6.4 percent (CBN, 2006 & 2018), while total budget allocation to education as a percentage of total budget was 7.40 percent (CBN, 2010 & 2019), which is three times lower than what UNESCO recommends for developing countries. Indeed, the federal government's education budget has been parsimonious over the last ten years. Education received N249.09 billion (4.83 percent) of the Federal Government's N5.160 trillion budget in 2010. In 2011, education received N306.3 billion (6.16 percent) of the N4.972 trillion budget, which was a slight improvement. The marginal gains continued in 2012 (8.20 percent), 2013 (8.55 percent), and 2014 (9.94 percent) until 2015 (7.74 percent), when there was a large reduction in education allocation. Only N369.6 billion (6.10 percent) of the N6.061 trillion budget was earmarked for education in Buhari's first full year in office, making it the sector's second-worst allocation in ten years. In 2017, however, there was a modest increase (7.38 per cent). It fell to 6.64 percent in 2018 as education received N605.8 billion out of a total of N9.12 trillion in spending (Ndujihe, 2019). Furthermore, a steep drop in crude oil prices, which is the country's main source of revenue, has thrown the country into recession, forcing the government to make drastic cuts in spending, exacerbating Nigeria's school system's bad funding status. The financial crisis also dried up scholarship monies for abroad study,

putting a damper on Nigeria's international student flow.

Figure 2: % of Federal Government Recurrent Allocation to Education (1970-2019)



Source: CBN Statistical Bulletin, 2006 & 2018

III. Education Politicization: Many educational institutions in the country are founded on political grounds. Politicians, not academic performance, are occasionally used to determine admission to universities, colleges, polytechnics, and unity secondary schools. Parents utilize their political clout or influence to influence their children's schooling. The way and why politicians affect the recruitment of teachers is a sensitive issue that has hampered the growth of education. Even if they are unqualified and unable to spell the subject they will teach, teachers are hired primarily on who they know. Even if they have the appropriate certifications, the unpleasant truth is that certifications are secondary to a genuine interest in the profession and enthusiasm for the job, which brings out the best in every teacher. This is a bad precedent since it denies folks who are properly qualified employment or educational possibilities.

IV. Indiscipline: Indiscipline is another issue that continues to wreak havoc on the educational system. Many students engage in activities such as impersonation, paying for marks or certificates with gifts, money, or sexual favours, manipulating academic records, threatening examiners, cultism, and attacking invigilators, among others. All of these things, and many others, should be eliminated because children are Nigeria's leaders and future. There will be no future for Nigeria if its future is not taken care of now.

V. Inability to Meet Increasing Population Demands: According to Infoguide-Nigeria (2020), the overall population of Nigeria was 45.2 million at independence, but this is no longer the case, as the country's population has exploded. Nigeria's population was anticipated to reach 195.9 million in 2018 (World Bank, 2020), posing a significant challenge for the country's education system, which has been unable to completely enrol the country's fast-

growing population. Nigeria's basic education sector, for example, is overburdened due to rapid population increase. In 2015, nearly 44% of the country's population was under the age of 15. Large areas of the rising youth population are left out of the system. According to the United Nations, 8.73 million primary school children, the majority of whom were Almajiri children, did not attend school at all in 2010.

VI. Low Living Standards and Bad Governance: The issue of terrible governance, which affects most African countries, including Nigeria, has had an impact on the progress of education in Nigeria since the country's poverty level has increased as a result of the country's bad governance. Due to financial difficulties and the inability to pay school fees, many underprivileged parents are unable to send their children to school. Furthermore, the government has failed to properly implement its commitments to provide free basic education to its residents (Infoguide-Nigeria, 2020).

METHODOLOGY

Data Source

The analysis relied on secondary data from the Central Bank of Nigeria (CBN) Statistical Bulletins of 2006 and 2018 as well as the World Bank. The study's scope covers the period 1970 through 2019. For time-series processing, all data will be transformed into a log-log equation. As a result, the coefficient can be thought of as an elasticity. Table 1 lists the variables as well as their sources.

Table 1: Variables Measurement and Sources of Data

S/No	Variables	Measurement	Sources of Data
1.	Education growth (EDGDP)	A proxy for education productivity	Computed from CBN Statistical Bulletin, 2006 & 2018
2.	Recurrent expenditure on education (REDEXP)	A proxy for wages of teachers and supporting staff of the education sector (in millions of Naira)	Computed from CBN Statistical Bulletin, 2006 & 2018
3.	Gross fixed capital formation, a proxy for investment (PCAP)	It measures additions of capital goods, such as equipment, tools, transportation assets, and electricity (in billions).	https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=NG
4.	Government policy (GOVP)	Money Supply (in billions)	CBN Statistical Bulletin, 2006 & 2018
5.	Labour force (LF)	Comprises people ages 15 and older who supply labor for the production of goods and services during a specified period. It includes people who are currently employed and people who are unemployed but seeking work as well as first-time job-seekers.	https://data.worldbank.org/indicator/LF
6.	Remittance	Transfers received from non-residents of a country	https://data.worldbank.org

Source: Researcher's Compilation, 2020

Model Specification

The estimation of how wage rate affects productivity in the education sector is performed with macroeconomic variables of wages, investment, labour force, government policy and remittances as explanatory variables and percentage of education contribution to GDP as explained variable. The model is specified as follows:

$$EDGDP = f(REDEXP, INVT, LF, GOVP, REMT) \quad (1)$$

$f_1 > 0, f_2 > 0, f_3 > 0, f_4 > 0, f_5 > 0$

This means that all the identified variables have positive relationship with education growth.

Where:

EDGDP = Percentage of Education Contribution to GDP;
REDEXP = Recurrent Expenditure on Education as a Proxy for Wages;
INVT = Real Gross Fixed Capital Formation as a Proxy for Investment;
LF= Labour Force;
GOVP= Money Supply as a Proxy for Government Policy;
REMT = Remittances from Abroad.

Equation 1 can be written in the econometric model and in their respective natural log form as thus;

$$LEDGDP_t = \beta_0 + \beta_1 LREDEXP_t + \beta_2 LINVT_t + \beta_3 LLF_t + \beta_4 LGOVP_t + \beta_5 REMT_t + \varepsilon_t \quad (2)$$

In the production function, LEDGDP is the natural log of Percentage of Education Contribution to GDP; LREDEXP is the natural log of Recurrent Expenditure on Education as a Proxy for Wages; LINVT is the natural log of Real Gross Fixed Capital Formation as a Proxy for Investment; LLF is the natural log of Labour Force; LGOVP is the natural log money supply as a proxy for government policy; LREMT is natural log of Remittances from Abroad. L is natural logarithm; β_0 is the intercept or autonomous parameter estimate; $\beta_1 ..... \beta_5$ is the Parameter estimate associated with the determinants of education productivity in Nigeria and ε_t is the stochastic error term.

Estimation Procedure

Unit Root Test

Because the majority of time series econometric techniques are based on the assumption that time series variables are non-stationary, examining the property of a series as the first step when using standard estimations and test procedures in a dynamic time series model is required. For any lag, a stationary series is defined as one with a constant mean, constant variance, and constant auto covariance. The stationarity of a time series can be determined using a variety of methods. However, the Augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) tests are the most widely used. The following is the unit root equation for a random walk with drift:

$$\Delta Y_t = \mu + \partial Y_{t-1} + \sum \phi \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

The model provides a random walk model with drift, with Y as the dependent variable. The statistical significance of the Y_{t-1} (∂) coefficient will be determined by comparing it to the various MacKinnon critical values at the 1%, 5%, and 10% levels of significance. If Y is stationary in Equation (3), the time

series is stationary (i.e., has no unit root) $\lambda < 1$. However, the time series is stationary (or has no unit root) $\lambda < 1$, hence Y is stationary. When data is non-stationary, it can be transformed into stationarity by differencing the data set. If Y is not stable, we must regress one period lag of Y to establish whether λ is statistically equal to one or not.

Lag Selection Criteria

For this purpose, several lag selection criteria have been presented in the econometric and statistical literature. The Akaike Information Criterion (AIC), the Schwarz-Bayesian Criterion (SBC), and the Hannan-Quinn Criterion (HQC) are the three most widely used information criteria. It is well recognized that the more lags there are, the less degrees of freedom there are. We chose the lag with the lowest AIC and SBC value when determining the number of lags. Among these criteria, AIC always recommends the greatest order, SIC the smallest order, and HQ falls somewhere in the middle (Lukepohl, 2005). Sometimes, all of the criteria point to the same lag order. The VAR model of EDGDP, REDEXP, INVT, LF, GOVT, and REMT is estimated. The values of AIC are given by the VAR system, maximum lag order 4, with a number of lags order of 4 based on the information criterion.

Cointegration

To evaluate the significance of cointegrating relationships, we used the Johansen approach, which employs two separate likelihood ratio tests of canonical correlations: trace test and Maximum Eigenvalue test.

Trace Statistic: The trace statistic null of r cointegrating relations among the endogenous variables:

$$\int_{trace} = -T \sum_{i=r+1}^{n} Log(1-\hat{\lambda}_i) \qquad (4)$$

$$Where: r = 0 to r = n-1,....until\ it\ fails to reject H_O\ such that\ 0 = No\ \text{int}egrating(None)\ equations$$

$$while 1,2,... = 1 or\ more\ \text{int}egrating equations; k = Number\ of\ endogenous\ \text{var}iables; T = Sample\ size;$$

$$\hat{\lambda}_i = i^{th}\ l\ \text{arg}est\ Eigenvalue of\ long run coefficient\ matrix.$$

Trace statistics are based on the hypothesis until it fails to reject the null:

Hypothesis 1, 2……..:

$$H_0 : Trace\ static < Critical value = Integrating\ equation$$

$$H_1 : Trace static > Critical value = At\ least\ \text{int}egrating equation$$

Maximum Eigenvalue Statistic: The Maximum Eigenvalue statistic null of r cointegrating relations, based on the equation:

$$\int_{\max} = -TLog(1-\hat{\lambda}_{r+1}) \qquad (5)$$

$$Where: r = 0,1,....,n-1 until\ it\ fails to reject\ H_0$$

The Maximum Eigenvalue statistic is based on the hypothesis until it fails to reject the null, specified as follows:

Hypothesis 1, 2……..:

$H_0 : Eigenvalue < Critical value = No\ Integrating\ equation$

$H_1 : Eigenvalue > Critical value = At\ least, 1\ integrating\ equation$

Simultaneous Equation Estimation under a VAR Approach

The VAR model is a typical tool used for forecasting systems equations of interrelated time series. The VAR model is based on Sargan's (1964) broad approach to model formulation, which was later extended by Davidison et al. (1978), Hendry & Von UngernSternberg (1981), and Mizon and Richard (1986), (Song & Witts 2000). The general equation is described in the form of an Autoregressive Distributed Lag Model (ADLM) using this approach, with the long-run relationship between the variables represented by expressing the equation as follows:

$$y_t = \alpha + \sum_{j=1}^{k}\sum_{i=0}^{p}\beta_{ji}x_{jt-i} + \sum_{i=1}^{p}\phi_i y_{t-i} + \varepsilon_t \qquad (6)$$

$Where: y_t = Dependent\ variable; k = Explanatory\ variables; p = 1\ for\ annual\ seeies\ data;$

$j = Explanatory\ variable\ k\ affects\ on\ the\ nation; i = Country\ specific\ effects; \varepsilon_t = Error\ term;$

$t = Time$

Equation 6 explains a linear relationship that first identifies the dependent and explanatory variables' relationship. Second, a nation's growth is sustained because of the government's role (IIbouldo, 2014). The linear model's coefficients can be computed to reveal a long-term relationship between the variables. As a result, the linear equations show how sensitive changes in explanatory variables are to changes in independent variables. This lays the groundwork for this study's use of VECM as a forecasting and model estimation approach.

Theoretical VECM Procedure for Estimating the Simultaneous Equation

Following Equation 11, the short and long-run relationship among variables is explained as:

$$\Delta Y_t = \sum_{i=1}^{p-1}\phi_i \Delta Y_{t-i} + \phi Y_{t-p} + U_t = VECM \qquad (7)$$

$Where: \phi_i = -(1-\beta_1-\beta_2-\cdots\beta_i); \phi = -(1-\beta_1-\beta_2-\cdots\beta_p); \phi Y_{t-p} = Error\ correction\ term;$

$\phi_1\ and\ \phi = Short\ and\ long\ run\ adjustments\ to\ change\ in\ Y_t$

The linear relationship first indicates the relationship between the dependent and explanatory variables. Second, the coefficients in the linear model can be estimated indicating the sensitivity of the explanatory variables changes to the independent variables. Following Equation 7, for estimation and hypothesis testing, VECM can be expressed as:

$$\Delta Y_t = \alpha B' Y_{t-1} \sum_{i=1}^{p-1}\Gamma_i \Delta Y_{t-i} + \cdots BX_t + \varepsilon_t \qquad (8)$$

$Where: \beta = Long-run\ measures\ among\ variables; \Gamma_i = Coefficient\ measure\ for\ short-run\ effects\ of\ shock\ on\ \Delta Y_t$

As indicated, VECM enables identifying the short and long-run relationship among variables. In

this way, forecasting the impact of the variables in the study is facilitated. Following this approach, this study specifies the model and simulations are conducted to indicate the long-run and short-run.

Procedure for VECM Estimation of Short-Run and Long-Run Relationship

The easiest way to demonstrate how VECM estimates the simultaneous equation is to adopt the Engle and Granger (1987) causality approach. Following Wickremasinghe (2011) the Engle and Granger approach is demonstrated assuming two variables as:

$$\Delta x_t = \alpha_1 + b_1 ect_{t-1} + \sum_{i=1}^{m} c_1 \Delta x_{t-i} + \sum_{i=1}^{n} d_1 \Delta y_{t-i} + \varepsilon_{1t} \quad (9)$$

$$\Delta y_t = \alpha_2 + b_2 ect_{t-1} + \sum_{i=1}^{m} c_2 \Delta x_{t-i} + \sum_{i=1}^{n} d_2 \Delta y_{t-i} + \varepsilon_{2t} \quad (10)$$

$Where: x_t, y_t, = Variables; \Delta = Operator\ difference; m, n = \text{var}iable\ lag\ lenghts; ect_t = Co\text{int}egration\ equation\ residuals; \varepsilon_1 \varepsilon_2 = White\ noise\ residuals.$

The model is then expanded to a multivariate system using the approach shown in Equations 9 and 10. As a result, the number of equations equals the number of variables in the multivariate case, whereas the number of error correction terms equals the number of cointegrating relations. The advantage of VECM (the error correction term that is not relevant in normal Granger causality tests) is that it opens up a new channel via which causality can be indicated by a second t-test, which also indicates the short-run. Second, the new channel uses the F-/Wald Chi-square test to determine the delays for each explanatory variable as a joint significance. Third, the joint F-/ Wald Chi-square test provides the error correction term for the channel. These characteristics explain why the VECM technique is used in this study for model specification and forecasting. This study simulates the model after fitting the data into it using Eviews. There are two parts to the simulated model. The error correction term, which indicates the long-run relationship, is the first part. The short-run relationship is presented in the second part. Following model simulation, the systems model must be validated. The model's long- and short-run analyses, as well as ex-ante forecasts, are then performed.

Impulse Response

The immediate effect of innovation or shock resulting from one series to another within the system is referred to as impulse response (Wei, 2013). This is a technique that may be used to illustrate how one variable reacts to an impulse or shock on another variable in the system. In a VAR model, the impulse response is represented by a one-standard-deviation positive shock to the model's error terms to observe the variables' reaction. The consequences of innovation within the system are calculated using the residuals so that one unit's innovations cause the system to move forward. In this method, the variable's first invention has a direct impact on the same variable. The VAR dynamic lag structure transmits its innovations (variable) to all other endogenous variables in the system. The impulse response function traces the effect of a one-time innovation on the current and future values of the variable in response to one of the shocks.

The graphical output shows a visual display and generates various graphs that show the impact of the innovations on the system's series. How the line graph departs from the zero lines demonstrates the impact of advancements. The impulse line graph depicts the path that a variable takes from the short to the long term, indicated using a positive or negative sign, as they depart from zero. Meanwhile, the numerical output displays the actual values of the influence of the innovations, whether positive or negative. The numerical approach is used in this work to interpret the impulse response outcomes. This is because, unlike line graphs, numeric values may be easily explained. Short-run means are considered in this study to be 2 years, whereas long-run means are considered to be 5 years.

Variance Decomposing

The manner one standard deviation shock causes variations in arithmetic terms from one period to the next is explained by variance decomposition. In this method, variance decomposition reveals a variable's forecast inaccuracy. Each variable in the system has internally induced innovations in proportions attributable to innovations (shocks), including its own (Wickremasinghe 2011). In a simple linear equation, any change in the independent variable corresponds to a change in the dependent variable. On the dependent variable, the variance decomposition is stated as:

$$\text{var}(y) = E\left[\text{var}\left(\frac{y}{x}\right)\right] + \text{var}\left[E\left(\frac{y}{x}\right)\right] \qquad (11)$$

Equation 11 demonstrates that in a relationship between x and y. In a VAR model, variance decomposition attempts to explain the proportion of the variance of the forecast error in predicting $y_t, T+h$ due to a structural shock or innovation, expressed as: η_t Based on orthogonal innovations η_t the $h-step$ future forecast error vector can be expressed with known coefficients, as provided by the VECM model. The forecast in this study is divided into three categories: short-term (two years), medium-term (five years), and long-term (ten years) based on the Monte Carlo procedure and Cholesky's ordering.

VECM Model Validation

Model validation is required to ensure that the model's residuals meet the normality, constant error variance, and uncorrelated error terms assumptions. As a result, the following diagnostic tests are performed to evaluate the simulated VECM model: model stability, correlogram analysis, and residual investigation. VECM validation tests and other tests will be conducted after model estimate due to the limitations.

Data Presentation and Analysis
The analysis will be divided into two namely; descriptive statistics and empirical analysis.

Descriptive Statistics
Table 1. Summary Statistics of the variables (1970-2019).

	EDGDP	LREDEXP	LGOVP	LREMT	LINVT	LLF
Mean	0.17	3.68	2.55	9.69	0.82	7.56
Median	0.19	3.97	2.47	10.65	0.94	7.55
Maximum	0.46	5.67	4.41	12.80	1.17	7.80
Minimum	-0.43	0.60	0.97	6.26	0.37	7.37
Std. Dev.	0.19	1.54	1.21	2.46	0.29	0.12
Skewness	-1.55	-0.28	0.25	-0.07	-0.40	0.25
Kurtosis	5.38	1.77	1.50	1.25	1.46	2.13
Jarque-Bera	31.84	3.80	5.17	6.41	6.28	2.12
Probability	0.00	0.15	0.08	0.04	0.04	0.35
Sum	8.66	183.97	127.56	484.74	41.24	378.1
Sum Sq. Dev.	1.72	116.16	71.75	296.61	4.09	0.70
Observations	50	50	50	50	50	50

Source: Authors computation using Eviews 10, 2021.

The sample means, maximums, minimums, medians, standard deviations, skewness, kurtosis, and the Jarque-Bera tests, as well as their p-values, are all listed in Table 1. All of the statistics, for example, normality in the form of platykurtic, show the characteristics common to most time series. However, there are a few notable discrepancies between the variables. To begin, the unconditional average for remittances is 9.69 percent, whereas the unconditional average for investment is 0.82 percent. The standard deviation indicates how volatile the variables are. It shows the rate at which each variable deviates from its mean. Remittances are the most volatile at 2.46 percent, while the labour force is the least volatile at 0.12 percent, according to the table above. The skewness of the data is a measure of how asymmetric (lopsided) it is.

Empirical Result

Series Trend Analysis
Data in time series often show increasing or decreasing trends, as well as volatility. As a result, trend analysis is required before unit root testing in order to determine whether the series has a unit root. With the exception of the inflation rate, the results of the graphical depiction in Figure 3 reveal that the series exhibit a random walk with drift and trend. The series is non-stationary because they depict a trend with a pattern of substantial fluctuations.

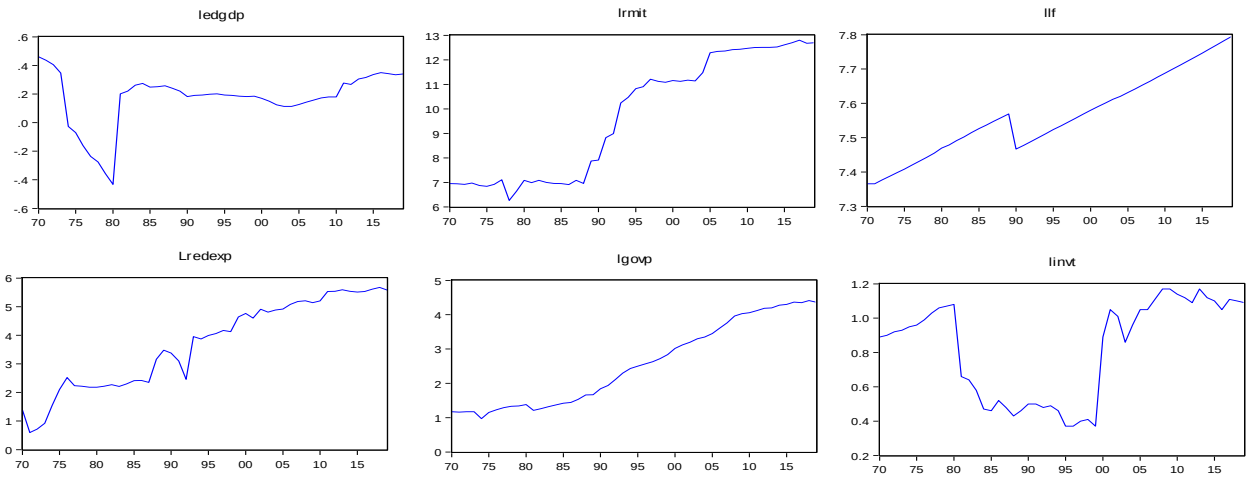


Figure 3: The Series In Their Raw (Undifferentiated) Form
Source: Researcher's Computation Using Eviews 9

Stationarity Test: Augmented Dickey-Fuller (ADF) Unit Root Tests

Unit root tests will be conducted based on the Ender (1995) approach. The second ADF test at level involved a trend and intercept, while in the third, none were included. Later data was tested at first difference. Following Dickey & Fuller (1979) method, the series are estimated. The results of the ADF tests at level and first difference are summarized in table 2 below.

Table 2: ADF Unit Root Test Result

Variables	ADF Test Statistic			
	Constant	Constant & Trend	None	First difference
LEDGDP	-2.34	-2.89	-1.82	-4.26*
LREDEXP	-0.99	-3.33	1.24	-8.23*
LINVT	0.32	-2.29	1.70	-6.01*
LLF	0.13	-1.67	3.67	-6.90*
LGOVP	-0.12	-2.31	1.74	-5.31*
LRMET	-0.75	-2.02	1.29	-3.29*

Notes: Test critical values at 5% (At level: constant = -2.92, Constant and trend = -3.50, none = -1.94 while at First difference = -2.92); P-value= Probability value, * signifies stationarity.

As indicated by the asterisk, all variables are non-stationary when tested at level with a constant, constant & trend and none. Since the series are not stationary when tested at constant and trend, it is concluded that the series are non-stationary at level. However, as indicated by the asterisk all variables are stationary at first difference. We therefore conclude that series for all variables are stationary, because data is stationary when the ADF test statistics are less than the test critical values at 5%($ADF\ test\ statistics < test\ critical value\ at\ 5\%$). The corresponding probability value for stationary data is less than $0.05(P-value < 0.05)$. Following the ADF test in Table 2, all series are non-stationary at level but stationary at first difference. However, ADF tests are often affected

by the choice of the lag length (p) and lose power while estimating a large sample. As such, the ADF tests results are validated by the Phillips–Perron (PP) test.

The Phillips–Perron Unit Root Test

The PP test has an advantage over the ADF test in that it corrects for heteroscedasticity and serial correlation in error terms (u_t). PP tests are also based on a serially correlated regression error term and do not require lag selection. The null for PP, like the ADF test, is predicated on the assumption that the series are non-stationary. Table 3 summarizes the results of the PP test. According to the findings, the series are non-stationary at the level but stationary at the first difference. The variables are depicted in their differentiated form in Figure 4. The adoption of the VAR model for estimation is justified as a result of this outcome.

Table 3: PP Unit Root Test Result

Variables	PP Test Statistic			
	Constant	Constant & Trend	None	First difference
LEDGDP	-2.61	-2.98	-1.98	-6.45*
LREDEXP	-0.85	-3.49	1.97	-10.45*
LINVT	-1.28	-1.51	-0.18	-5.97*
LLF	0.14	-1.71	3.79	-6.90*
LGOVP	0.52	-2.47	3.97	-5.41*
LRMET	-0.40	-1.86	2.04	-6.93*

Notes: Test critical values at 5% (At level: constant = -2.92, Constant and trend = -3.50, none = -1.94 while at First difference = -2.92); P-value= Probability value, * signifies stationarity.

We produced a graphical visual display of the series at first difference based on the PP test, which confirmed that all series are non-stationary at level but stationary at first difference. All of the series in Figure 4 move upwards with fluctuations, indicating that they are not stationary at first difference. The method for estimating and forecasting used in this study was VECM. The series must be non-stationary at the level but stationary at the first difference, which is one of the preconditions.

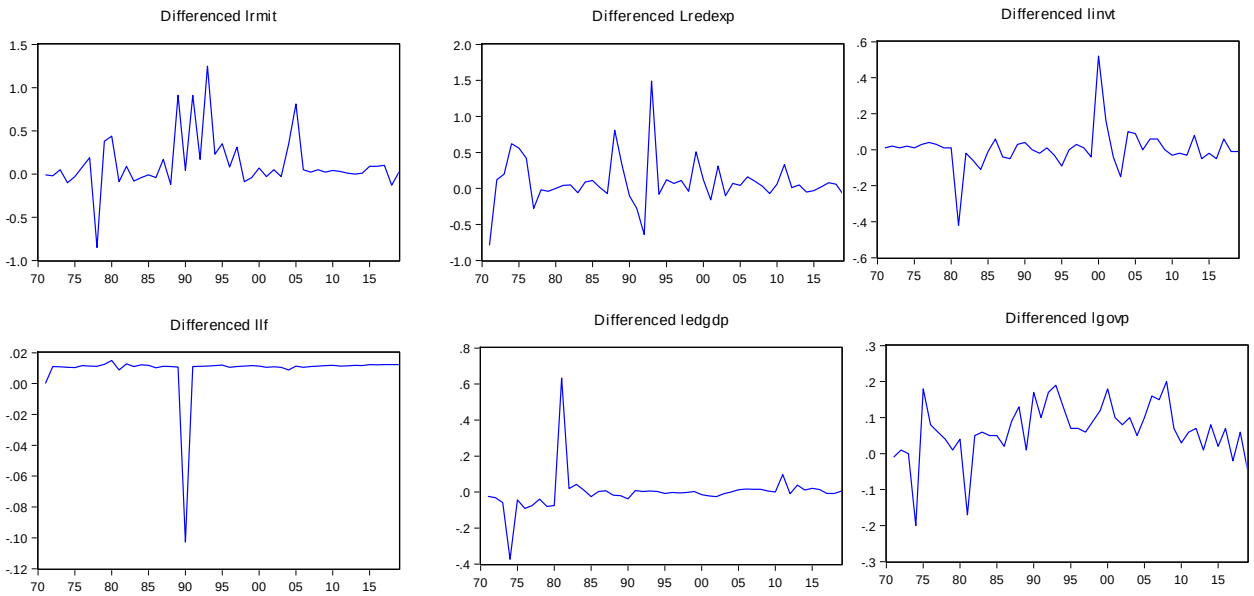


Figure 4: Results Of The Series Trend Test After First Difference
Source: Researcher's Computation Using Eviews 9

Endogeneity Analysis

Endogeneity analysis is required to determine if variables are exogenous or endogenous. The Pairwise Granger causality test can be used to check it. The results of the Pairwise Granger causality tests are shown in Table 4. At 1 percent, 5%, and 10% F-statistic critical values, the null hypothesis is rejected.

Table 4: Pairwise Granger Causality test (Lags: 2)

Null Hypothesis: Obs (48)	**F-Stat.**	**Prob.**	**Null Hypothesis:** Obs (48)	**F-Stat.**	**Prob.**
LREDEXP does not Granger Cause LEDGDP	1.91	0.16	LREDEXP does not Granger Cause LINVT	1.38	0.26
LEDGDP does not Granger Cause LREDEXP	0.92	0.40	LLF does not Granger Cause LREDEXP	1.34	0.27
LGOVP does not Granger Cause LEDGDP	1.54	0.23	LREDEXP does not Granger Cause LLF	0.45	0.64
LEDGDP does not Granger Cause LGOVP	0.07	0.94	LREMT does not Granger Cause LGOVP	3.90	0.03**
LREMT does not Granger Cause LEDGDP	2.04	0.14	LGOVP does not Granger Cause LREMT	2.43	0.10
LEDGDP does not Granger Cause LREMT	0.04	0.96	LINVT does not Granger Cause LGOVP	3.81	0.03*
LINVT does not Granger Cause LEDGDP	0.01	0.99	LGOVP does not Granger Cause LINVT	1.20	0.31
LEDGDP does not Granger Cause LINVT	0.80	0.45	LLF does not Granger Cause LGOVP	0.04	0.96
LLF does not Granger Cause LEDGDP	2.66	0.08**	LGOVP does not Granger Cause LLF	2.69	0.08**
LEDGDP does not Granger Cause LLF	0.11	0.89	LINVT does not Granger Cause LREMT	1.84	0.17
LGOVP does not Granger Cause LREDEXP	3.00	0.06**	LREMT does not Granger Cause LINVT	2.87	0.07**
LREDEXP does not Granger Cause LGOVP	4.50	0.02*	LLF does not Granger Cause LREMT	3.29	0.05**
LREMT does not Granger Cause LREDEXP	4.25	0.02*	LREMT does not Granger Cause LLF	6.70	0.00*
LREDEXP does not Granger Cause LREMT	0.60	0.55	LLF does not Granger Cause LINVT	0.52	0.60
LINVT does not Granger Cause LREDEXP	0.20	0.82	LINVT does not Granger Cause LLF	1.17	0.32

Source: Researcher's calculations from Eviews 9, 2020.
*Causality at 1 % critical level; ** Causality at 5 % critical level; *** Causality at 10 % critical level

Based on the Pairwise Granger causality test, the study concludes that the first; only labour force (LLF) variable in the study does Granger-cause education growth in Nigeria with no feedback effect on education growth. Second, money supply which is a proxy for government policy does

Granger-cause recurrent expenditure on education (proxy wages) with feedback from recurrent expenditure on education. Third, remittances do Granger-cause recurrent expenditure on education (wages) and money supply which is a proxy for government policy with no feedback. Fourth, investment does Granger-cause government policy with no feedback. Fifth, remittances do Granger-cause investment with feedback from investment. Finally remittances Granger-cause labour force with no feedback.

Lag Determination

Table 5 shows the results of lag-order selection. The SC, HQ, and FPE selection criteria exhibit a lag order of one, while the AIC selection criteria show a lag order of four. AIC has the lowest value so the study will proceed further tests with lags (4).

Table 5: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	42.25065	NA	8.33e-09	-1.576115	-1.337597	-1.486765
1	295.3336	429.1407	6.73e-13*	-11.01451	-9.344877*	-10.38905*
2	317.7586	32.17499	1.32e-12	-10.42429	-7.323549	-9.262733
3	358.3483	47.64879	1.34e-12	-10.62384	-6.091991	-8.926183
4	416.4548	53.05369*	8.24e-13	-11.58499*	-5.622029	-9.351229

Source: Researcher's calculations from Eviews 9, 2020. * indicates lag order selected by the criterion

CointegrationTest

After ensuring that all variables are integrated to order one I(1), the cointegration test is conducted. Because there are multivariate time series, the multivariate cointegration technique proposed by Johansen (1988) is used to see if there are stable long-run relationships between (LREDEXP) Recurrent Education Expenditure as a Proxy for Wages; (LINVT) Real Gross Fixed Capital Formation as a Proxy for Investment; (LLF) Labour Force; and (LGOVP) money supply as a proxy for government spending. It's worth noting that the cointegration test comes before the Vector Error Correction Model (VECM) because the cointegration vectors will be used in the vector error correction model that follows (VECM).

Table 6: Cointegration Results

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	224.9502	95.75366	0.0000	None *	77.39281	40.07757	0.0000
At most 1 *	147.5574	69.81889	0.0000	At most 1 *	64.45217	33.87687	0.0000
At most 2 *	83.10522	47.85613	0.0000	At most 2 *	39.08352	27.58434	0.0011
At most 3 *	44.02170	29.79707	0.0006	At most 3 *	22.51446	21.13162	0.0318
At most 4 *	21.50724	15.49471	0.0055	At most 4	13.49004	14.26460	0.0660
At most 5 *	8.017206	3.841466	0.0046	At most 5 *	8.017206	3.841466	0.0046

Source: Researcher's calculations from Eviews 9, 2020.
* Denotes rejection of the null hypothesis at the 0.05 level

The null hypothesis is rejected using trace test statistics since the trace statistic value is greater than the critical value (224.9502>95.75366) and the probability value is less than 5% (P-value =

0.000). This indicates that at least one cointegrating vector exists. We reject the null hypothesis for asterisks ranked one–five since the trace statistic value is greater than the crucial values, according to a second review. The associated probability values are all less than 5%. In conclusion, there is at least one cointegrating vector, and the findings show that at the 0.05 critical level, all six equations are cointegrated to order one (1).

The null hypothesis that there are no cointegrating equations is also rejected based on the Max-Eigen results. Because the Max-Eigen Statistic is more than the crucial value (77.39281>40.07757), and the probability value is less than 5% (P-value = 0.000), this is the case. This indicates that at least one cointegrating vector exists. The series are cointegrated to the same order (1), as shown in table 6, based on the trace Statistic Test and Max-Eigen Test. In addition, the series used in this study have a long-term relationship. Because it provides a more precise alternative hypothesis that pins down the number of cointegrating vectors, this study will use trace value statistics to estimate the VECM. As a result, it may be argued that the variables have a long-term link, and the VECM model can be used to detect the long-term and short-term dynamics of these variables.

Vector Error Correction Model (VECM) Estimation

Two Vector Auto-regression Models (VAR and VEC) were built using the same variables to find the best model for the empirical relationship between wage rate and productivity in Nigeria. Although not as structural as the VAR, the VEC model worked as a constrained alternative. In the meantime, the presence of a cointegration relationship between the variables, as shown in Table 7, rendered the VAR useless. In this case, the Vector Error Correction Model (VECM) is the best model to use. Table 7 shows the results of the vector error correction model (VECM) in the first, second, third, and fourth differences of the cointegrated series, as well as the error correction terms from Equation (8). The results are presented in two sections: the first part displays the cointegrating equations, and the second part displays the Vector Error Correction models' results. Table 8 shows the outcome of the regression.

Table 7: The Result of Vector Error Correction Model

Cointegrating Eq	CointEq1	Std. Error	t-Statistic			
C	22.09486					
LEDGDP(-1)	1					
LREDEXP(-1)	0.363948	-0.04962	7.33524			
LGOVP(-1)	-0.10291	-0.13836	-0.74374			
LREMT(-1)	-0.09108	-0.03606	-2.52577			
LINVT(-1)	0.389559	-0.06508	5.98597			
LLF(-1)	-3.0108	-0.52899	-5.69161			
Error Correction:	**D(LEDGDP)**	**D(LREDEXP)**	**D(LGOVP)**	**D(LREMT)**	**D(LINVT)**	**D(LLF)**
CointEq1	-1.13369	0.329925	0.580377	0.533678	0.346872	0.151751
D(LEDGDP(-1))	0.706511	-0.65137	-0.34756	-0.45481	-0.36056	-0.04917

D(LEDGDP(-2))	0.449486	-0.32446	-0.25713	-0.36851	-0.16438	-0.10983
D(LEDGDP(-3))	0.380992	-0.195	-0.14966	-0.79994	-0.34371	-0.10086
D(LEDGDP(-4))	0.313123	-0.20891	-0.15291	0.430688	-0.06916	-0.07983
D(LREDEXP(-1))	0.247456	0.027967	-0.09978	0.254399	0.130867	-0.07094
D(LREDEXP(-2))	0.138112	-0.16433	-0.14586	-0.34068	-0.12525	-0.0786
D(LREDEXP(-3))	0.23639	-0.19454	-0.16312	-0.31728	-0.19683	-0.03712
D(LREDEXP(-4))	-0.00703	-0.15499	-0.03852	-0.03461	0.039155	-0.03676
D(LGOVP(-1))	-0.17093	0.02838	-0.06458	0.386581	0.434762	0.075174
D(LGOVP(-2))	-0.25706	-0.82815	0.111229	0.847452	0.530013	-0.01326
D(LGOVP(-3))	-0.18549	0.689394	-0.04057	-0.16329	0.354423	-0.02198
D(LGOVP(-4))	-0.08939	0.057759	-0.07556	1.012945	-0.31397	-0.03447
D(LREMT(-1))	0.068724	-0.04204	0.070876	-0.03179	-0.10354	-0.01704
D(LREMT(-2))	0.113928	0.044018	0.013205	0.041207	-0.04323	0.004757
D(LREMT(-3))	-0.20963	0.03993	0.164487	0.058638	0.233277	0.000772
D(LREMT(-4))	0.064119	0.046466	0.002156	-0.0068	-0.13976	0.038611
D(LINVT(-1))	0.400376	-0.57833	-0.00978	-0.35018	-0.00895	-0.06044
D(LINVT(-2))	0.208118	0.474595	-0.0354	-0.43476	-0.1934	-0.03097
D(LINVT(-3))	0.497154	-0.44517	-0.09689	-0.73759	-0.60708	-0.02489
D(LINVT(-4))	0.366212	-0.33166	-0.12534	0.493243	0.210618	-0.05696
D(LLF(-1))	-1.38479	4.367629	0.160383	-8.18694	-0.85966	0.393534
D(LLF(-2))	-3.29369	4.639464	1.533774	0.112877	1.509877	0.082445
D(LLF(-3))	0.61279	-11.6146	-0.6945	-10.8832	-1.15732	0.827723
D(LLF(-4))	-1.74373	3.423375	2.554012	8.435094	5.418261	-0.08882
C	0.033981	0.12715	0.065549	0.120142	-0.08556	0.017833
R-squared	**0.860897**	**0.751905**	**0.699108**	**0.727661**	**0.631461**	**0.639486**

Source: Researcher's calculations from Eviews 9, 2020.

Table 7 above show that the error correction term of the target equation D(LEDGDP) is negative (-1.13) while that of D(LREDEXP), D(LINVT), D(LLF), D(LGOVT) and D(RLEMT) are positive. The R squared of the target variable D(LEDGDP) and that of D(LREDEXP), D(LINVT), D(LLF), D(LGOVT) and D(RLEMT) equations in the VEC model shows that about 86 percent and 75%, 70%, 73%, 63% and 64% of the variation in the dependable variables are explained by the models respectively. This indicates that the seven models are fit.

In Table 7, VAR has created and calculated a simultaneous equation using the VECM technique. The simultaneous equation calculated under VAR using the VECM approach, on the other hand, only provides coefficients, standard errors, and t-statistics, but no probability values. As a result, the simultaneous equation must be estimated as a basis for assessing the interaction between teachers and supporting staff in the education sector, as well as other explanatory factors on productivity in Nigeria's education sector. This is because the t-statistic is best used in studies with two samples and within-group design. As a result, this being a simultaneous model interpreting results based on t-statistics results becomes inadequate. Second, for a sample size higher than or equal to 30 ($n \geq 30$), t-statistics

are inappropriate. The independent variables have the two groups' variances, but they are not homogeneous (Engle & Granger, 1987). The study uses OLS to estimate the simultaneous equation to determine the impact of the explanatory variables on Nigeria's education growth.

Table 8: Error Correction Result

	Coefficient	Std. Error	t-Statistic	Prob.
ECT	-1.133691	0.241128	-4.701620	0.0002
D(LEDGDP(-1))	0.706511	0.159790	4.421510	0.0003
D(LEDGDP(-2))	0.449486	0.157791	2.848620	0.0103
D(LEDGDP(-3))	0.380992	0.137040	2.780143	0.0119
D(LEDGDP(-4))	0.313123	0.130563	2.398249	0.0269
D(LREDEXP(-1))	0.247456	0.091223	2.712652	0.0138
D(LREDEXP(-2))	0.138112	0.084649	1.631588	0.1192
D(LREDEXP(-3))	0.236390	0.060661	3.896899	0.0010
D(LREDEXP(-4))	-0.007028	0.048145	-0.145984	0.8855
D(LGOVP(-1))	-0.170929	0.165385	-1.033527	0.3143
D(LGOVP(-2))	-0.257064	0.152534	-1.685287	0.1083
D(LGOVP(-3))	-0.185487	0.176688	-1.049802	0.3070
D(LGOVP(-4))	-0.089386	0.173775	-0.514378	0.6129
D(LREMT(-1))	0.068724	0.042939	1.600516	0.1260
D(LREMT(-2))	0.113928	0.047808	2.383047	0.0278
D(LREMT(-3))	-0.209634	0.047633	-4.401023	0.0003
D(LREMT(-4))	0.064119	0.058777	1.090881	0.2890
D(LINVT(-1))	0.400376	0.148656	2.693303	0.0144
D(LINVT(-2))	0.208118	0.129224	1.610518	0.1238
D(LINVT(-3))	0.497154	0.131229	3.788443	0.0012
D(LINVT(-4))	0.366212	0.141083	2.595720	0.0177
D(LLF(-1))	-1.384790	0.907449	-1.526025	0.1435
D(LLF(-2))	-3.293687	0.959695	-3.432016	0.0028
D(LLF(-3))	0.612790	0.979230	0.625787	0.5389
D(LLF(-4))	-1.743734	1.165973	-1.495519	0.1512
C	0.033981	0.028777	1.180835	0.2522

R-squared, 86%; Adjusted R-squared, 67%
Source: Researcher's calculations from Eviews 9, 2020.

The rate at which the disequilibrium between the long-run and short-run estimations is corrected is indicated by the error correction term (ECT) in table 8. According to VECM estimates, 113 percent of the disequilibrium between long-run and short-run estimations is corrected and brought back to equilibrium on an annual basis. With a p-value of 0.0002 at a 1% confidence level and a standard error of 0.241128, this value is significant.

VAR Model Checking

The error correction term which indicates the long-run equilibrium has been reported in Table 8, while the short-run relationship will be reported in Table 12. Before interpreting and conducting the short-run simulation and ex-ante forecasting, the VECM model will be validated for serial correlation, stability, heteroskedasticity and normality.

Autocorrelation Residual LM Test

Table 9: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.208605	Prob. F(2,17)	0.8138
Obs*R-squared	1.077927	Prob. Chi-Square(2)	0.5834

Source: Researcher's calculations from Eviews 9, 2020.

The results of Table 9 shows that the null hypothesis of no serial autocorrelation will be accepted for Godfrey LM test for 2 lags since their p-values are greater than the significance values of 0.05 and 2 lags rejects the null hypothesis that there is serial autocorrelation. Hence we can conclude that there is no serial autocorrelation since the lags accept the null hypothesis.

Test for Stability

Stability is tested by conducting the actual and fitted Table, as well as the CUSUM test and recursive coefficients stability test. The results are indicated in Figures 5 & 6. All tests indicated that the systems equation is valid and provides sufficient results for economic analysis. Findings indicate an absence of any instability because the Cusum and Cusum of squares plots test statistic are confirmed within the 5% critical bounds of parameter stability. This means that we accept the null hypothesis and conclude that our parameters are stable, and as such are without misspecification.

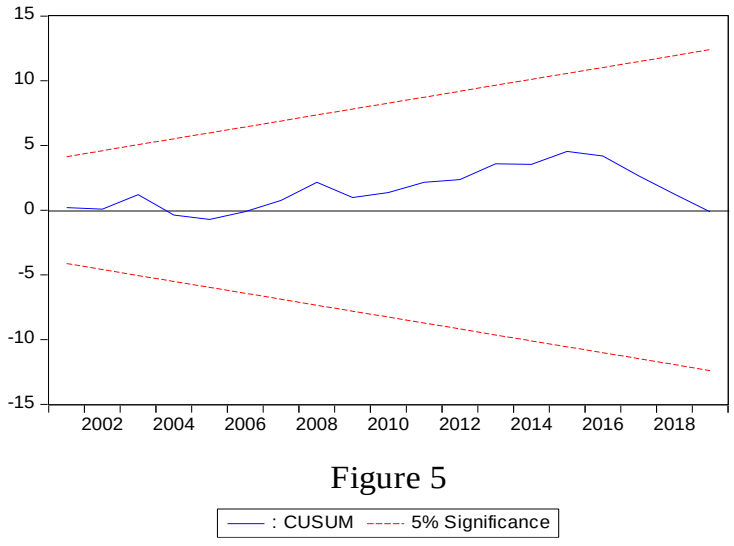


Figure 5

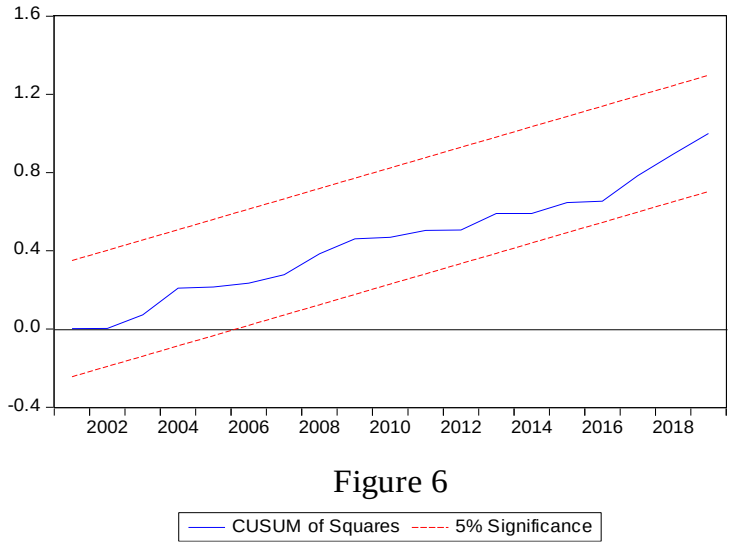


Figure 6

Table 11: Breusch-Pagan-Godfrey Tests for heteroscedasticity

F-statistic	1.203678	Prob. F(30,14)	0.3671
Obs*R-squared	32.42775	Prob. Chi-Square(30)	0.3479
Scaled explained SS	7.686864	Prob. Chi-Square(30)	1.0000

Table 12: ARCH Tests for heteroscedasticity

F-statistic	0.280470	Prob. F(1,42)	0.5992
Obs*R-squared	0.291876	Prob. Chi-Square(1)	0.5890

Source: Researcher's calculations from Eviews 9, 2020.

The heteroscedasticity tests indicate constant variance. Both the observed R-square probability values for the Breusch-Pagan-Godfrey Test and ARCH test are not significant at 5% critical value. This means that the LEDGDP systems equation is stationary, homoscedastic and, as such, valid for economic analysis.

Test for Normality

A normal model is indicated by residual skewness and kurtosis, and confirmed by JB test.

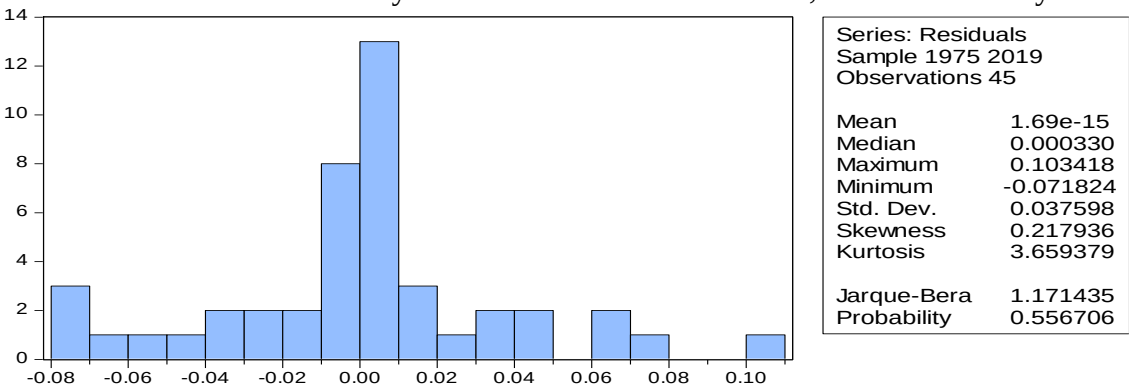


Figure 7: Normality

According to our results, skewness is 0.22 while the kurtosis indicates 3.66. The JB is indicated by1.17, with a corresponding probability value not significant at 5% critical value. Based on this test, our model is normally distributed. The diagnostic tests conducted included stability, serial correlation, heteroscedasticity and normality, and suggested that our model is valid because all probability values for the tests are greater than 5%, meaning that our education growth (productivity) equation is valid for economic analysis.

Simultaneous Equation Short-Run Simulation and Analysis

The results of the short-run test are presented below:

Table 13: Wald tests and short-run test

Dependent Variable: DLGDPPC			
Variables	Chi-square test	Prob.	Relationship
D(LREDEXP)	27.5	0.00	Short-run causality
D(LGOVP)	4.29	0.37	No Short-run causality
D(LREMT)	37.4	0.00	Short-run causality
D(LINVT)	18.0	0.00	Short-run causality
D(LLF)	17.9	0.00	Short-run causality
ALL	83.8	0.00	Short-run causality

Source: Researcher's calculations from Eviews 9, 2020.

According to our findings, there exist a short-run relationship between the explanatory variables and the independent variable except LGOVP, as indicated by the Chi-square joint statistics probability values. The p-value of chi-square test for (LREDEXP) Recurrent Expenditure on Education as a Proxy for Wages; (LLF) Labour Force; (LGOVP) money supply as a proxy for government policy and (LREMT) remittances from abroad is less than 0.05, the null hypotheses ($H0$): $\beta 5=0$ will be rejected, therefore they cause LEDGDP in the short run while (LINVT) Real

Gross Fixed Capital Formation as a Proxy for Investment does not cause LEDGDP in the short run. The VECM systems Granger causality tests results does not conform to the Pairwise Granger causality tests except for LLF. The next step is to conduct exante forecasting involving impulse response and variance decomposition tests.

Impulse Response Function

In Nigeria, the education growth forecast shows a favourable trend with fluctuations due to shocks and innovations. According to the findings, education growth (LEDGDP) and remittances from abroad (LREMT) will account for the country's increased education growth. In the short run, a one standard deviation positive own shock will cause a change from 0.046 to 0.015, and in the long run, it will continue to increase at a decreasing rate to 0.015. Second, forecasts show that (LREDEXP) Recurrent Expenditure on Education as a Proxy for Wages has a negative influence on education growth in the short (-0.034) and long-run (-0.130). This demonstrates that Recurrent Education Expenditure as a proxy for Wages has no impact on educational productivity.

Third, a one positive standard deviation shock from (LGOVP) money supply as a proxy for government policy will cause economic growth to decrease by -0.041 in the short run, according to the simulation. In the long run, the shocks will remain negative -0.026. Fourth, during the course of five years, innovations for remittances from abroad (LREMT) cause economic growth to increase. According to simulations, a one-standard deviation rise in LREMT causes education growth to increase by 0.033 in the short run and 0.039 in the long run. This means that the amount of money sent from abroad by nonresidents is critical for the education sector's long-term productivity growth. Fifth, forecasts show that (LINVT) Real Gross Fixed Capital Formation as a Proxy for Investment will be a source of concern for the education sector, with short-term increases and long-term decreases. Sixth, a one standard deviation positive shock increases the Labour Force by 0.024 in the short run and 0.008 in the long run.

Table: 14: Impulse Response Analysis

Response of LEDGDP:						
Period	**LEDGDP**	**LREDEXP**	**LGOVP**	**LREMT**	**LINVT**	**LLF**
1	0.057216	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.046425	-0.034731	-0.041400	0.032966	0.003280	0.024390
3	0.033904	-0.083899	-0.034003	0.065985	-0.025096	-0.011107
4	0.013268	-0.102128	-0.019334	0.030134	-0.008189	-0.001158
5	0.014867	-0.130421	-0.026053	0.039213	-0.016807	0.007814

Source: Researcher's calculations from Eviews 9, 2020.

Variance Decomposition

Variance decomposition is adopted to forecast the error variance effects for each endogenous variable within a system. In a simple linear equation, for any change in x at time (t) there is a corresponding change in y as a dependent variable (Wickremasinghe 2011). In this study, based on the Monte Carlo procedure and ordering by Cholesky, the forecast is comprised of short-run (two years),

medium-term (five years) and long-run (ten years). The results of variance decomposition forecast for endogenous variables are EDGDP, REDEXP, INVT, LF, GOVT and REMT.

Table 15: Variance decomposition

PERIOD	LEDGDP	LREDEXP	LGOVP	LREMT	LINVT	LLF
SHORT-RUN	77.0	6.0	8.5	5.4	0.1	3.0
MEDIUM-TERM	42.4	32.1	8.9	12.9	1.3	2.4
LONG-RUN	26.6	51.4	7.0	11.1	1.6	2.4

Source: Researcher's calculations from Eviews 9, 2020.

In the short-run, impulses, innovations or shocks to education growth account for 77.0% of fluctuations in education growth own shock. However, the education growth own shock fluctuations continuously decline to 26.6% in the long-run. Meanwhile, shocks to recurrent expenditure on education as a proxy for wages account for 6.0% of fluctuations of education growth in the short-run. The fluctuations of education growth due to recurrent expenditure on education as a proxy for wages increase in the long-run to 51.4%. In the short-run, shocks to money supply as a proxy for government policy account for 8.5%, remittances from abroad accounts for 5.4%, real gross fixed capital formation as a proxy for investment accounts for 0.1% and labour force accounts for 3.0%. In the long-run, shocks to money supply as a proxy for government policy decrease to 7.0%, remittances from abroad increases to 11.1%, real gross fixed capital formation as a proxy for investment accounts for 1.6% and labour force accounts for 2.4%. Shocks to recurrent expenditure on education as a proxy for wages will account for the highest fluctuations in Nigeria's education growth, followed by its own shock.

FINDINGS

Except for the fourth lag, Table 7 shows a positive link between education growth and all lags of Recurrent Expenditure on Education as a Proxy for Wages. LLF and LEDGDP have a negative relationship in the first, second, and fourth lags, but a positive link in the third lag. In each of the four lags, government policy exhibits a negative relationship with educational growth. Furthermore, because the coefficient of the government policy equation is positive, despite being significant, it indicates that government monetary policy does not have a long-run relationship with recurrent expenditure (wages). The data also show that the federal government's wage-increase plans have not improved the situation of education workers. This may be due to inflation. The education sector's recurrent expenditure increased by 17% over the study period, while inflation increased by 24%, indicating that, after every increase, the education sector's workers' purchasing power is unchanged or reduced. In the first, third, and fourth lags, remittances from overseas have a positive relationship with educational growth, but the second lag shows a negative relationship.

Because the error correction term is significant and shows a negative coefficient value, the results of Table 8 suggest that there is a long-run relationship between education growth (LEDGDP) and (LREDEXP) Recurrent Expenditure on Education as a Proxy for Wages. According to the findings, a 1% increase in LEDEXP will boost LEDGDP by 25% in the first lag and by 24% in the third lag.

CONCLUSION

Finally, the purpose of estimating the education (productivity) growth equation was to examine the short and long-run impact of recurrent expenditure on education as a proxy for wages and other explanatory variables included in the system's equation on Nigeria's education productivity growth using annual data spanning the period 1970 to 2019. This was done by first determining whether cointegrating vectors exist. This was also done to see if the cointegrating series have any sort of long-term relationship. The use of trace test statistic and Max-Eigen test statistic vectors cointegrates, according to the findings. The long-run relationship between series was interpreted using normalised cointegrating coefficients. According to the data, there is a long-term association between series.

Second, the study examined whether there is a short-run link between series. A cointegration analysis was used in the first part to explain the long-run and short-run relationships between the series. According to the findings, the series are cointegrated to the same order (1), implying that the variables studied have a long-run relationship. A VECM system model was built to validate the long-run relationship explained by the normalised coefficients of the cointegration simulation. In addition, a VECM systems model for a short-run relationship among variables was developed. A VECM simultaneous systems model with six endogenous variables was created to achieve these objectives. The long-run relationship is indicated by an error correction term section after simulating the aforementioned VECM systems model, whereas the short-run relationship is indicated by the second part. The VECM systems model was evaluated for stability, absence of serial correlation, heteroscedasticity, and normalcy before the results were interpreted. The VECM system model was found to be valid for policy analysis, according to the findings. The error correction term coefficient results show a long-run relationship between the dependent variable education productivity growth and the independent variables recurrent education expenditure as a proxy for wages; real gross fixed capital formation as a proxy for investment; labour force; money supply as a proxy for government policy; and remittances from abroad. The fact that the explanatory variables are 4.70 in absolute terms implies the existence of a long-run relationship.

An F-/Wald test simulation was used to establish a short-run link among the endogenous variables. According to the findings, all endogenous variables, except for money supply as a proxy for government policy, have a short-run relationship. According to impulse response analysis, recurrent education spending as a proxy for wages will cause Nigeria's education productivity growth to decline. Meanwhile, variance decomposition shows that recurrent education expenditure as a proxy for wages causes short-, mid-and long-term changes in education growth.

Policy Consequences

1. Adequate welfare packages should be introduced by the government to make teachers proud and happy in their profession because welfare outcomes are vital for employee productivity, and a lack of incentive is a potential cause of worker productivity decline.

The wage has the greatest impact on output; a successful employee receives his or her rights through a wage compensation framework.

2. The government should enhance sector financing to at least 15% of the UNESCO recommendation of 26% to recruit the best into the profession, particularly the young because young teachers represent the profession's future.
3. Government measures aimed at improving teacher remuneration should focus on increasing the teacher's purchasing power (real income) rather than the nominal wage.

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