



Empirical Analysis of the Macroeconomic Linkages Between Public Education Funding and Tertiary Education Enrolment In Nigeria, 2000–2019

Abstract

This study empirically analysed the macroeconomic linkages between public education funding and tertiary school enrolment in Nigeria from 2000 to 2019. The study examined the trends in public education funding and tertiary school enrolment and assessed the effects of public education funding, economic growth and inflation on tertiary school enrolment. Annual secondary data were obtained from published sources, with tertiary school enrolment data sourced from UNESCO Institute for Statistics, while public education expenditure was derived from government recurrent expenditure on education relative to real gross domestic product. Gross domestic product growth and inflation were included as control variables. This study is primarily anchored on Human Capital Theory, supported by Public Expenditure Theory. Descriptive statistics, correlation analysis and time series econometric techniques were employed. Preliminary ordinary least squares estimation indicated a positive relationship between public education funding and tertiary school enrolment. However, diagnostic tests revealed serial correlation and heteroskedasticity, making conventional OLS inference unreliable. Heteroskedasticity and autocorrelation consistent estimation, first difference analysis and a parsimonious dynamic model were therefore applied. The corrected results showed that public education funding remained positively associated with tertiary school enrolment but was not statistically significant at the 5 percent level. Economic growth and inflation were also statistically insignificant. The study concluded that increased public education funding alone did not provide a statistically robust explanation of changes in tertiary school enrolment during the study period.

Keywords: Macro-economics, Linkages, Public Funding, Tertiary Education, Statistics, Heteroskedasticity, Autocorrelation.

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Introduction

Public education funding and tertiary education enrolment are closely connected, but the relationship is not as

straightforward as the assumption that more government spending automatically produces more students in higher education. Funding determines, among other things, the capacity of

institutions to provide places, facilities, teaching personnel and other academic resources. Enrolment, however, also responds to the economic circumstances within which students and institutions operate. Household income, inflation, employment prospects and the general strength of the economy can affect whether prospective students can afford tertiary education and whether government can sustain expenditure on it. The issue in Nigeria, therefore, is not simply whether government spends on education, but whether changes in public education funding are associated with changes in tertiary participation when the wider macroeconomic environment is taken into account.

The importance of this relationship are clearer when tertiary education is considered as part of Nigeria's human capital development. Recent Nigerian evidence connect education participation and public expenditure with wider economic outcomes. Bolarinwa (2023), found that government education expenditure and school enrolment significantly influenced labour force participation. More specifically, the study reported that “enrolment in secondary and tertiary education positively correlates with increased labour force participation” (Bolarinwa, 2023, p. 73). From this, tertiary enrolment should not be viewed only as an educational statistic. Changes in participation affect the stock of educated labour available to the economy, while the economic

environment can influence the ability of individuals to enter and remain in tertiary education.

This creates a two-way relationship between education financing and the wider economy as government needs fiscal resources to finance education. While the expansion of tertiary education creates human capital that can support economic activity, this relationship in Nigeria has been complicated by persistent pressure on public resources and the increasing demand for tertiary education. Jones Esan (2022) observes that African governments face budget constraints that make it difficult to sustain educational programmes, arguing that “public private partnership efforts provide a way out of this financial dilemma” (p. 1). The point is not that private financing can simply replace public funding but that the financing structure of higher education is itself part of the problem.

The Nigerian tertiary education system has experienced substantial changes in enrolment over the period under consideration. World Bank education data, drawn from UNESCO Institute for Statistics, show a long period of expansion in Nigeria's tertiary enrolment indicators. Although the quality and consistency of the underlying series require careful consideration when constructing a historical econometric model. The same international database provides measures of government

expenditure on education as a share of GDP and other education financing indicators, making it possible to examine education funding alongside participation within a common empirical framework. The availability of these indicators is useful, but it does not by itself establish a relationship between them which has to be tested.

Evidence from the wider higher education literature supports the need for such testing. Using data for 86 countries, Yang and McCall (2014) found that both GDP per capita and public education spending as a percentage of GDP were positively associated with tertiary enrolment, while public expenditure per tertiary student had a negative association with enrolment. Their conclusion is particularly relevant because it separates the amount of public education spending from the amount spent per student. They report that “GDP per capita and public spending on education as a percentage of GDP both have a positive effect on tertiary enrollment” (Yang & McCall, 2014, p. 25). This suggests that the effect of public funding cannot be understood without considering the broader economic environment and the way expenditure is measured.

For Nigeria, the issue becomes more complicated because economic instability can affect both sides of the relationship. A rise in public education expenditure may indicate stronger

government commitment, but its real effect can be weakened when inflation reduces purchasing power and increases the cost of educational provision. Conversely, economic expansion may increase government revenue and household capacity to finance education, creating conditions that favour higher enrolment. Ihugba *et al.* (2025), examining tertiary enrolment over a much longer period from 1981 to 2024, found a long run relationship among tertiary enrolment, government education expenditure and other economic variables. Their analysis reports that “education expenditure shows delayed and inconsistent influence on enrollment” (Ihugba *et al.*, 2025, p. 26).

This finding is useful because it cautions against assuming that changes in education expenditure will immediately appear as corresponding changes in enrolment. The timing and wider economic conditions surrounding the expenditure matter. The Nigerian evidence also suggests that the connection between education financing and participation deserves more precise empirical treatment.

Research Objectives

The study’s objectives are to:

- i. Empirically analyse the macroeconomic linkages between public education funding and

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tertiary education enrolment in Nigeria from 2000 to 2019.

- ii. Examine the trend and pattern of public education funding and tertiary education enrolment in Nigeria from 2000 to 2019.
- iii. Determine the effect of public education funding on tertiary education enrolment in Nigeria during the study period.
- iv. Examine the influence of selected macroeconomic variables on tertiary education enrolment in Nigeria from 2000 to 2019.
- v. Determine the joint effect of public education funding and selected macroeconomic variables on tertiary education enrolment in Nigeria during the study period.

Statement of the Research Problem

Nigeria's expansion of tertiary education has not occurred under conditions of unlimited public resources. The number of people seeking tertiary education has geometrically grown, while government faces competing demands for expenditure across education, health, infrastructure, security and other sectors. This creates a practical policy problem where expanding access to tertiary education requires institutional capacity, though institutional capacity depends partly on the resources available to the education sector. The problem is

therefore not simply that education requires more money but whether the public resources committed to education have been sufficient, consistent and economically meaningful enough to support corresponding improvements in tertiary participation.

Theoretical Framework

This study is primarily anchored on Human Capital Theory, supported by Public Expenditure Theory. The choice of these theories reflects the central argument of the study that government funding can influence the availability and quality of educational opportunities, while broader economic conditions can affect both the capacity of government to finance education and the ability of individuals to participate in tertiary education. Human Capital Theory is principally associated with the works of Schultz (1961) and Becker (1964). The theory views education as an investment that develops the knowledge, skills and productive abilities of individuals. Schultz (1961) argues that “investment in human capital” is important for explaining differences in productivity and economic growth. The central implication is that expenditure on education should not be regarded only as consumption. It represents an investment in people whose accumulated knowledge and skills can generate economic and social returns.

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Becker (1964) developed this argument by examining education as an investment that produces returns through improved earnings, employment opportunities and productivity. His analysis also considers the possibility of underinvestment in college education, which is relevant to the present study because access to tertiary education can be constrained when the resources available for educational participation and provision are inadequate. Applied to Nigeria, Human Capital Theory provides a theoretical explanation for the expected relationship between public education funding and tertiary education enrolment.

Public Expenditure Theory provides the supporting framework for understanding why government allocates resources to education and how such expenditure can influence social outcomes. The theory is associated with the broader public finance tradition, particularly Musgrave's analysis of the functions of government expenditure. Public expenditure can serve economic and social purposes that may not be adequately achieved through private decisions alone. Education is relevant because its benefits extend beyond the individual student to the wider economy and society.

Conceptual Review

Public Education Funding

Public education funding refers to financial resources provided by

government for the development, administration and delivery of education. It may include current expenditure, capital expenditure, transfers and other government supported educational spending. The measure includes spending by different levels of government and is compiled from education expenditure information supplied through national statistical and education reporting systems.

The concept is important because the amount of resources available to the education sector can affect the capacity of educational institutions to provide services. In tertiary education, public funding may support academic personnel, infrastructure, teaching materials, administration, student support and other institutional requirements. However, the amount allocated to education should not automatically be interpreted as evidence of effective expenditure. The impact of funding can depend on how resources are distributed and utilised.

Tertiary Education Enrolment

Tertiary education enrolment refers to participation in education beyond the secondary level. It covers programmes that require completion of secondary education as a normal condition for admission and includes different forms of post secondary education. Enrolment therefore reflects the extent to which the population participates in the tertiary education

system. The first is the absolute number of students enrolled in tertiary institutions while the second is the gross tertiary enrolment ratio. Although enrolment numbers are useful for describing the expansion of the tertiary education system, they are strongly affected by population growth. For this reason, the present study preferably uses the tertiary gross enrolment ratio as its dependent variable.

Gross Domestic Product

Gross domestic product represents the total income generated through the production of goods and services within an economy during a specified period. Within this study, GDP represents the broader economic condition under which government education expenditure and tertiary education participation occur. A stronger economy can increase government revenue and fiscal capacity, potentially creating greater room for public expenditure on education. It may also improve household economic circumstances and their capacity to meet the direct and indirect costs associated with tertiary education.

Inflation

Inflation refers to a sustained increase in the general price level of goods and services. Inflation is relevant to this study for two related reasons. First, it can reduce the real value of government education expenditure. Second, inflation can increase the cost of living faced by households. Where

education related costs rise alongside other household expenses, families may face greater difficulty financing tertiary education. Inflation is consequently included as a macroeconomic control variable. The expected relationship with tertiary enrolment is potentially negative, although the empirical direction and magnitude must be established from the Nigerian data rather than assumed in advance. The annual consumer price inflation rate is therefore an appropriate operational measure because it provides a consistent annual indicator of changes in the general cost of consumption.

Empirical Review

Empirical studies on education financing and educational outcomes in Nigeria have examined the relationship from different perspectives. Some studies focus directly on public education expenditure and educational outcomes, while others examine household income, macroeconomic conditions, economic growth or broader human capital outcomes. More importantly, relatively few studies examine public education funding and tertiary education enrolment together while controlling for macroeconomic conditions within a clearly defined Nigerian time series framework. Okonkwo *et al.* (2022), for example, examined household income and expenditure in relation to tertiary enrolment in Nigeria using an autoregressive distributed lag approach and incorporated total education

expenditure into the analysis. Their work shifts attention from government funding alone to the economic capacity of households to participate in tertiary education. This is significant because public funding and household economic conditions can operate simultaneously. Increased government spending may expand institutional capacity, but students still face the private costs associated with tuition, accommodation, transportation, learning materials and other expenses. A study of tertiary enrolment that ignores the economic environment can therefore miss part of the mechanism through which funding is translated into actual participation.

The period from 2000 to 2019 provides a useful basis for investigating this relationship. It captures years in which Nigeria experienced changes in government expenditure, economic growth, inflation and tertiary education demand before the exceptional disruptions associated with the COVID 19 pandemic. Restricting the analysis to 2019 also creates a clearly defined pre pandemic period in which the relationship between public education funding, macroeconomic conditions and tertiary enrolment can be examined without the extraordinary disruption introduced from 2020 onward. The period is also sufficiently long to permit a time series examination of changes rather than relying on a single year or a short cross-sectional comparison.

Torruam *et al.* (2014), for example, used cointegration and an error correction technique to examine public expenditure on tertiary education and economic growth in Nigeria and found evidence of a long run relationship between tertiary education expenditure and economic growth. Their study does not directly answer whether education funding increases tertiary enrolment, but it demonstrates why Nigerian education financing relationships are better investigated within a time series framework that considers both short run movements and longer run relationships.

More recent evidence makes the problem even less straightforward as Ihugba *et al.* (2025), using a nonlinear ARDL framework for Nigerian tertiary enrolment between 1981 and 2024, found that education expenditure had a delayed and inconsistent influence on enrolment. That finding is particularly relevant to the present study because it suggests that expenditure may not translate into enrolment immediately. A funding increase in one year may take time to produce additional institutional capacity, while changes in household affordability or economic conditions may influence enrolment more quickly. It therefore becomes necessary to distinguish between a simple contemporaneous association and a broader relationship that may operate over time.

The empirical literature also leaves a gap in the way these issues are brought

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together. Existing Nigerian studies have considered public education expenditure and schooling outcomes, household income and tertiary enrolment, tertiary education expenditure and economic growth, and the effects of macroeconomic uncertainty on educational outcomes. What is less clearly established is the specific relationship between public education funding and tertiary education enrolment within a defined period while simultaneously accounting for selected macroeconomic conditions. This distinction matters because evidence that education expenditure affects economic growth does not establish that it expands tertiary enrolment, just as evidence that household income affects enrolment does not establish the contribution of government funding.

Dauda (2011) examined the effect of public educational spending and macroeconomic uncertainty on schooling outcomes in Nigeria using annual data from 1975 to 2007. The study used cointegration and error correction techniques together with vector autoregression. Public education expenditure was measured as a percentage of GDP, while educational attainment was represented by adult literacy. The study also incorporated GDP per capita, urbanisation and macroeconomic uncertainty. The results showed a positive and significant relationship between government educational expenditure and educational outcomes, while macroeconomic

instability had a negative effect. The study further established a long run relationship among the variables.

Torruam, Chiawa, and Abur (2014) investigated public expenditure on tertiary education and economic growth in Nigeria using annual time series data covering 1990 to 2011. The authors employed cointegration and error correction techniques and concluded that public expenditure on tertiary education had a positive impact on economic growth. This study is relevant because it focuses specifically on tertiary education expenditure rather than aggregate education spending. It also confirms the suitability of time series methods for examining relationships involving public education expenditure in Nigeria.

However, the direction of analysis differs from that of the present study as Torruam *et al.* (2014) treated economic growth as the outcome of tertiary education expenditure, whereas this study treats tertiary education enrolment as the outcome and public education funding as the principal explanatory variable. Economic growth is therefore incorporated into the present study as a macroeconomic control rather than as the dependent variable. This distinction is important because an increase in education expenditure may contribute to economic growth without necessarily producing an immediate increase in tertiary enrolment.

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Ihugba, Obiukwu, Akobundu, Osunkwo, Oyalede, and Okonkwo (2022) provide more direct evidence on tertiary education participation. Their study examined the effect of household income and expenditure on tertiary school enrolment in Nigeria using data from 1970 to 2020. The researchers employed the autoregressive distributed lag approach and found evidence of a long run relationship among tertiary enrolment, household expenditure, household income and total education expenditure. Household consumption expenditure had a positive relationship with tertiary enrolment, while the study reported a negative relationship between GDP per capita and tertiary enrolment at some lags. Total education expenditure was also found to have a delayed relationship with tertiary enrolment.

Earlier evidence from Ihugba, Ukwunna, and Obiukwu (2019) examined government education expenditure and primary school enrolment in Nigeria over the period 1970 to 2017. Using the ARDL bounds testing approach, the study investigated government education expenditure alongside per capita income, remittances, investment and population growth. The study established a long run relationship among the variables, but government education expenditure was not found to have a statistically significant positive effect on primary school enrolment. This finding is important because it challenges the assumption that increased government

education expenditure automatically produces higher enrolment.

More recent evidence further strengthens the argument for considering macroeconomic conditions. Ihugba, Okonkwo, Sharon El, Immaculata, Okoro, and Nwogwugwu (2025) examined tertiary school enrolment in Nigeria from 1981 to 2024 using a nonlinear ARDL framework. The study included government education expenditure, secondary school enrolment, real GDP per capita, exchange rate movements and the effects of Academic Staff Union of Universities strikes. The authors found a long run relationship among the variables and reported that rising cost of living reduced tertiary enrolment. They also found that education expenditure had a delayed and inconsistent influence on enrolment, while secondary school enrolment had a strong positive effect.

Oladipo *et al.* (2024) provide another perspective by examining the relationship between oil price shocks and human capital channels in Nigeria. Using a structural vector autoregression approach, the study found that oil price shocks were associated with higher government expenditure on tertiary education but lower tertiary institution enrolment. This finding is significant because it illustrates the possibility that an increase in public expenditure may coexist with a decline in enrolment when wider economic shocks affect the education system. For an oil dependent

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economy such as Nigeria, changes in government revenue and macroeconomic conditions can therefore influence education outcomes through channels that are not captured by expenditure figures alone.

Methodology

This study adopts a quantitative research approach and an ex post facto research design. The design is considered appropriate because the study examines the relationship between public education funding and tertiary school enrolment using historical annual data that already exist and cannot be manipulated by the researcher. The analysis focuses on Nigeria over the period 2000 to 2019. The period provides 20 annual observations and was selected to provide a defined period for examining changes in public education funding, tertiary school enrolment and the wider macroeconomic environment before the major disruption associated with the COVID 19 period.

The study relies entirely on secondary data on tertiary school enrolment obtained from the tertiary school enrolment series reported by Eniekezimene, Wodu and Anda Owei (2023), who state that their annual primary, secondary and tertiary school enrolment data were obtained from the UNESCO Institute for Statistics. Their reported dataset contains annual tertiary school enrolment observations covering the study period. Data on government

recurrent expenditure on education are obtained from the Central Bank of Nigeria Statistical Bulletin. The CBN Statistical Bulletin provides federal government recurrent expenditure data under its public finance statistics, while previous Nigerian studies have also used the CBN series for government education expenditure. Data on real GDP growth and inflation are obtained from established Nigerian and international macroeconomic data sources.

The dependent variable is Tertiary School Enrolment (TSE) measured as the tertiary school enrolment rate reported in percentage terms. The measure captures changes in participation in tertiary education over the study period. The study deliberately retains the terminology used by the source and refers to the variable as tertiary school enrolment rather than describing it as the current World Bank gross tertiary enrolment ratio. This distinction is important because the current World Bank tertiary gross enrolment indicator does not provide a complete series for all the years required for this study, whereas the UNESCO based series reported by Eniekezimene et al. (2023) provides annual observations for the period under investigation.

The main explanatory variable is Public Education Funding (PEF). Public education funding is operationalised using federal government recurrent expenditure on education as a proportion of real gross domestic product. Recurrent

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expenditure is used because the CBN provides a consistent annual series for government education expenditure and because it represents government expenditure directed towards the recurrent operation of the education system. The measure therefore serves as an empirical proxy for the public funding commitment to education during the study period. It should be noted that this measure represents federal recurrent education expenditure and does not constitute total education expenditure by the federal, state and local governments combined. The distinction is maintained throughout the analysis.

Two macroeconomic variables are included as control variables with the first being real GDP growth (GDPG), measured as the annual percentage growth rate of real gross domestic product. GDP growth is included because changes in economic activity can affect both government fiscal capacity and households' ability to participate in tertiary education. The second control variable is inflation (INF), measured by the annual percentage change in consumer prices. Inflation is included because persistent increases in the general price level can reduce the real value of government expenditure and affect the capacity of households to meet the direct and indirect costs associated with tertiary education. The functional relationship for the study is expressed as:

$$TSE_t = f(PEF_t, GDPG_t, INF_t)$$

The econometric model is specified as:

$$TSE_t = \beta_0 + \beta_1 PEF_t + \beta_2 GDPG_t + \beta_3 INF_t + \varepsilon_t$$

Where:

TSE_t = tertiary school enrolment rate in year t

PEF_t = public education funding in year t

$GDPG_t$ = real GDP growth rate in year t

INF_t = inflation rate in year t

β_0 = constant term

$\beta_1, \beta_2, \beta_3$ = parameters to be estimated

ε_t = error term.

The coefficient of primary interest is β_1 because it captures the estimated relationship between public education funding and tertiary school enrolment after accounting for GDP growth and inflation. A positive coefficient would indicate that higher public education funding is associated with higher tertiary school enrolment, while a negative coefficient would indicate an inverse relationship, holding the other variables constant. The coefficients of GDP growth and inflation will similarly indicate their respective relationships with tertiary school enrolment.

The analysis will begin with descriptive statistics and trend analysis. The descriptive analysis will examine the mean, minimum, maximum and standard deviation of the variables and will be complemented by an examination of their annual movements from 2000 to 2019. This stage addresses the first research objective by establishing the pattern of public education funding and tertiary

school enrolment before proceeding to the econometric analysis.

Because the data are annual time series observations, the study will test the stationarity properties of the variables before estimating the regression model. The Augmented Dickey Fuller unit root test will be employed for this purpose. The test is necessary because regression involving non stationary time series can produce misleading statistical relationships. The results of the stationarity tests will therefore guide the final estimation procedure.

Given the relatively small sample of 20 annual observations, the study will adopt a parsimonious estimation strategy. The regression model will not be unnecessarily expanded with numerous lags or explanatory variables because doing so would substantially reduce the available degrees of freedom. Where the stationarity properties of the variables justify estimation in levels, the specified regression model will be estimated. If the tests indicate that an alternative time series specification is required, the estimation procedure will be adjusted accordingly. This approach avoids imposing an econometric technique before the statistical properties of the actual data have been established.

Post estimation diagnostic tests will also be conducted to assess the reliability of the estimated model. These will include tests for serial correlation, heteroskedasticity and model

specification. Where applicable, the normality of the residuals will also be examined. These tests are necessary to determine whether the estimated coefficients can reasonably be used for statistical inference. The hypotheses will be tested at the 5 percent level of significance. The first hypothesis will be assessed using the estimated coefficient of public education funding. The second will be evaluated through the significance of the macroeconomic variables, while the third will be assessed using the overall significance of the estimated model. The statistical evidence will be interpreted alongside the direction and magnitude of the coefficients rather than relying only on statistical significance.

The methodology is directly aligned with the objectives of the study with descriptive and trend analysis addressing the first objective. The estimated coefficient of public education funding addresses the second objective. The coefficients of GDP growth and inflation address the third objective, while the overall significance of the model addresses the fourth objective. This provides a consistent link between the research objectives, variables, econometric model and subsequent interpretation of the findings.

Findings and Discussion

Descriptive Analysis of the Variables

The study first examined the movement of tertiary school enrolment, public education funding and the selected

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macroeconomic variables between 2000 and 2019. The descriptive results provide an initial indication of the changes in the variables before the econometric analysis.

Variable	Mean	Standard Deviation	Minimum	Maximum
TSE	10.176	1.422	6.670	12.320
PEF	0.406	0.189	0.148	0.823
GDPG	5.662	3.545	-1.617	15.329
INF	12.067	3.665	5.386	18.874

Tertiary school enrolment increased from 6.67 percent in 2000 to 12.32 percent in 2019. This represents an increase of 5.65 percentage points over the study period. The pattern, however, was not completely uniform. Enrolment increased during most of the early and later years but declined from 10.94 percent in 2007 to 9.21 percent in 2009 before recovering thereafter. By 2019, tertiary enrolment had reached its highest level within the study period.

Public education funding, measured as federal government recurrent expenditure on education as a percentage of real GDP, also increased over the period. It rose from approximately 0.23 percent of real GDP in 2000 to 0.82 percent in 2019. The largest increases occurred during the later part of the period, particularly after 2010. The increase in funding alongside the general increase in tertiary enrolment provides an initial descriptive indication of a positive

relationship, although the trend alone cannot establish whether changes in funding independently influenced enrolment.

GDP growth averaged 5.66 percent during the period. The highest annual growth rate was 15.33 percent in 2002, while the lowest was -1.62 percent in 2016. The negative growth recorded in 2016 indicates the contraction in economic activity during that year. Inflation averaged 12.07 percent, with a minimum of 5.39 percent in 2007 and a maximum of 18.87 percent in 2001. The variation in GDP growth and inflation indicates that the economic environment within which public education funding and tertiary enrolment changed was not stable throughout the study period.

Correlation Analysis

The correlation analysis was used to examine the direction and strength of the simple relationships among the variables before estimating the multivariate model.

Variables TSE PEF GDPG INF

TSE	1.000	0.719	-0.491	-0.096
PEF	0.719	1.000	-0.581	-0.233
GDPG	-0.491	-0.581	1.000	-0.059
INF	-0.096	-0.233	-0.059	1.000

The correlation between public education funding and tertiary school enrolment was positive and relatively strong at 0.719.

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This indicates that the two variables generally moved in the same direction during the study period. However, correlation does not establish an independent effect because both variables may have been influenced by other changes occurring over time.

GDP growth had a negative correlation of -0.491 with tertiary school enrolment, while inflation had a very weak negative correlation of -0.096 . These results provide useful descriptive information but should not be interpreted as evidence of causal relationships. The correlation between PEF and GDP growth was -0.581 . Although this indicates a moderate inverse association in the sample, it does not by itself establish problematic multicollinearity. The correlations among the explanatory variables were not sufficiently high to suggest that the variables were measuring the same phenomenon.

Preliminary Econometric Estimation and Diagnostic Tests

The initial level OLS model was estimated in accordance with the specified functional relationship:

$$TSE_t = \beta_0 + \beta_1 PEF_t + \beta_2 GDPG_t + \beta_3 INF_t + \varepsilon_t$$

The initial OLS estimation produced an R^2 of 0.528 and an adjusted R^2 of 0.439. Public education funding had a positive coefficient of 5.093 and a conventional p value of 0.008. GDP growth and inflation were statistically insignificant. However,

further diagnostic testing showed that the conventional OLS results could not be accepted as the final basis for inference. The Durbin Watson statistic was only 0.366, indicating substantial positive serial correlation in the residuals. This was supported by the Breusch Godfrey test, which indicated statistically significant serial correlation at different lag orders. The Breusch Pagan test also indicated evidence of heteroskedasticity.

The stationarity assessment raised an additional concern as the level series did not provide sufficiently strong evidence that all variables were stationary at level. Consequently, interpreting the significant conventional OLS coefficient for public education funding without addressing the time series properties of the variables could produce misleading statistical inference. For this reason, the conventional OLS p values were not used for the final hypothesis decisions. Instead, the study employed heteroskedasticity and autocorrelation consistent estimation and a parsimonious dynamic specification to examine whether the observed relationship remained statistically robust.

Econometric Results

The first correction involved estimating the level relationship using Newey West heteroskedasticity and autocorrelation consistent standard errors. The coefficient estimates remain unchanged from OLS, but the standard errors are adjusted to account for serial

correlation and heteroskedasticity. The public education funding coefficient remained positive at 5.093. However, its statistical significance was substantially reduced after the correction. Depending on the bandwidth specification, the p value was approximately between 0.075 and 0.089. Therefore, public education funding was not statistically significant at the 5 percent level under the corrected estimation.

This finding is important because it shows that the positive relationship observed in the conventional OLS model was sensitive to the treatment of the error structure. The evidence therefore supports a positive association between public education funding and tertiary school enrolment, but it does not provide sufficiently robust evidence to conclude that public education funding independently determined enrolment during the period. The first difference specification was also estimated to examine changes in the variables rather than their levels:

$$\Delta TSE_t = \beta_0 + \beta_1 \Delta PEF_t + \beta_2 \Delta GDPG_t + \beta_3 \Delta INF_t + \varepsilon_t$$

The coefficient for changes in public education funding was 1.840, but its HAC corrected p value was 0.243. Changes in GDP growth and inflation were also statistically insignificant. The model produced an R^2 of 0.110 and an adjusted R^2 of -0.068. Although the explanatory power of the differenced model was relatively low, the model provided a

useful robustness assessment because the transformation substantially reduced the serial correlation problem observed in the level OLS model.

A parsimonious dynamic model was subsequently estimated by including the lagged value of tertiary school enrolment:

$$TSE_t = \beta_0 + \phi TSE_{t-1} + \beta_1 PEF_t + \beta_2 GDPG_t + \beta_3 INF_t + \varepsilon_t$$

The lagged enrolment variable was positive and statistically significant, with a coefficient of 0.664 and a p value below 0.001. This indicates considerable persistence in tertiary school enrolment. In practical terms, current enrolment was strongly associated with enrolment in the preceding year. Public education funding remained positive in the dynamic specification, with a coefficient of 1.464, but it was not statistically significant at the 5 percent level, with a p value of 0.127. GDP growth and inflation were also statistically insignificant. The Durbin Watson statistic improved to approximately 1.344, while the Breusch Godfrey test no longer indicated statistically significant first order serial correlation.

These results suggest that the relationship between tertiary school enrolment and its previous level is more statistically stable than the direct relationship between current public education funding and enrolment. This is reasonable given the nature of tertiary

education, where enrolment is influenced by continuing institutional capacity, existing student populations and gradual changes in access rather than by annual expenditure changes alone.

Discussion of Findings

The first objective was to examine the trend and pattern of public education funding and tertiary school enrolment between 2000 and 2019. The descriptive evidence shows that both variables increased substantially over the study period. Tertiary school enrolment increased from 6.67 percent to 12.32 percent, while public education funding as a percentage of real GDP increased from approximately 0.23 percent to 0.82 percent. The increases indicate an overall expansion in both public education funding and tertiary participation, although the movements were not identical in every year.

The second objective was to determine the effect of public education funding on tertiary school enrolment. The preliminary OLS model produced a positive and statistically significant coefficient, but this result did not remain statistically significant after correcting for serial correlation and heteroskedasticity. The corrected level model produced a positive coefficient but a p value above 0.05, while the first difference and dynamic specifications also produced statistically insignificant funding coefficients. The evidence therefore does not support a statistically significant

independent effect of public education funding on tertiary school enrolment at the 5 percent level.

This does not mean that public funding is unimportant to tertiary education. Rather, the result suggests that the amount of public expenditure alone may not adequately explain annual changes in enrolment. The effectiveness of funding may depend on how resources are allocated, the availability of tertiary places, institutional capacity, admission policies, household economic conditions and other factors not explicitly included in the model.

The third objective examined the influence of selected macroeconomic variables on tertiary school enrolment. Neither GDP growth nor inflation was statistically significant in the corrected specifications. The results therefore do not provide sufficient evidence that annual changes in GDP growth or inflation independently influenced tertiary school enrolment within the estimated model during 2000 to 2019.

The fourth objective examined the joint effect of public education funding and the selected macroeconomic variables. The corrected first difference model produced an overall p value of approximately 0.502, indicating that the explanatory variables were not jointly significant at the 5 percent level in that specification. The evidence therefore does not provide a sufficiently robust basis for

rejecting the null hypothesis of no significant joint effect.

The findings provide only partial support for the Human Capital Theory and Public Expenditure Theory adopted in the study. Human Capital Theory views education as an investment capable of improving knowledge and productive capacity. The descriptive increase in tertiary enrolment is consistent with continued expansion of participation in higher education. However, the econometric results indicate that increasing public education funding did not have a statistically robust independent relationship with enrolment during the study period.

The finding also provides a useful qualification to Public Expenditure Theory. Public spending can provide resources for infrastructure, personnel and educational services, but expenditure does not automatically translate into increased participation. The way expenditure is allocated and converted into institutional capacity may be more important than the aggregate level of spending alone. The strong significance of lagged tertiary enrolment in the dynamic specification further suggests that enrolment is characterised by persistence. This implies that changes in tertiary participation may reflect accumulated institutional and demographic factors rather than immediate responses to annual changes in government expenditure.

Conclusion

This study has been an examination of the macroeconomic linkages between public education funding and tertiary school enrolment in Nigeria from 2000 to 2019. The study specifically elucidates the trend in public education funding and tertiary school enrolment, assessed the relationship between public education funding and tertiary school enrolment, examined the influence of GDP growth and inflation, and considered the joint contribution of the explanatory variables to tertiary school enrolment.

The descriptive findings show that tertiary school enrolment increased considerably during the study period. The tertiary school enrolment rate increased from 6.67 percent in 2000 to 12.32 percent in 2019. Public education funding, measured as federal government recurrent expenditure on education as a percentage of real GDP, also increased from approximately 0.23 percent in 2000 to 0.82 percent in 2019. The two variables therefore displayed a generally positive movement over the period. However, the pattern was not uniform across all years, indicating that changes in enrolment did not simply follow annual changes in public education funding.

The preliminary level OLS estimation initially indicated a positive relationship between public education funding and tertiary school enrolment.

However, diagnostic tests identified substantial serial correlation and evidence of heteroskedasticity in the model. The low Durbin Watson statistic of 0.366 was particularly important because it indicated that the conventional OLS significance tests could not be relied upon. After correcting the standard errors using a heteroskedasticity and autocorrelation consistent procedure, the coefficient of public education funding remained positive but was no longer statistically significant at the 5 percent level.

The robustness analysis produced a similar conclusion such that in the first difference model, changes in public education funding were positively associated with changes in tertiary school enrolment, but the relationship was not statistically significant. The parsimonious dynamic model also produced a positive coefficient for public education funding, but this coefficient remained statistically insignificant. In contrast, the lagged value of tertiary school enrolment was positive and highly significant, suggesting that tertiary enrolment has a strong persistent component. This indicates that current enrolment is influenced considerably by previous enrolment levels and that changes in participation may occur gradually rather than responding immediately to annual changes in government expenditure.

The selected macroeconomic variables also did not demonstrate

statistically significant effects within the corrected specifications. GDP growth and inflation were not statistically significant predictors of tertiary school enrolment during the study period. Similarly, the corrected joint test did not provide sufficient evidence to conclude that public education funding, GDP growth and inflation jointly had a statistically significant effect on tertiary school enrolment.

Based on these findings, the study does not reject the null hypothesis that public education funding had no statistically significant effect on tertiary school enrolment during 2000 to 2019. The same decision applies to the null hypothesis concerning the selected macroeconomic variables. The evidence also does not provide sufficient grounds for rejecting the null hypothesis concerning the joint effect of the explanatory variables. The findings should not be interpreted to mean that public education funding is unimportant to tertiary education. Rather, they indicate that the aggregate level of public funding alone does not provide a sufficiently strong statistical explanation of annual changes in tertiary school enrolment within the period and model examined. The positive descriptive movement between funding and enrolment suggests that public expenditure remains relevant to the expansion of tertiary education, but its effect may depend on how resources are allocated and translated into institutional

capacity, admission opportunities, infrastructure, personnel and other forms of educational provision.

The findings therefore provide a qualified perspective on the Human Capital Theory and Public Expenditure Theory adopted in the study. The continued increase in tertiary enrolment is consistent with the importance of education in human capital development. However, the absence of a statistically robust independent funding effect suggests that increasing expenditure does not automatically translate into proportional increases in tertiary participation. The strong role of previous enrolment levels further suggests that tertiary participation is shaped by accumulated institutional and socioeconomic conditions rather than by annual expenditure changes alone.

Recommendations

Based on the findings of the study, the following recommendations are made.

i. Public education funding should be sustained, but greater attention should be given to how funds are used.

Although the econometric results did not establish a statistically significant independent effect of public education funding on tertiary school enrolment, public funding remains an important component of tertiary education provision. Government at all levels should therefore sustain adequate

funding while placing greater emphasis on the efficiency and effectiveness of expenditure. Funding increases should be accompanied by clear priorities for infrastructure, teaching facilities, academic staffing and other areas that directly support the capacity of tertiary institutions.

2. Greater attention should be given to the allocation and efficiency of education expenditure.

The findings suggest that the aggregate amount spent on education alone may not adequately explain changes in tertiary school enrolment. Government at all levels should therefore, strengthen expenditure planning, monitoring and accountability within the education sector. Resources should be directed towards areas where they can contribute most directly to improved access and participation rather than focusing only on increases in total expenditure.

3. Tertiary education planning should recognise the persistent nature of enrolment.

The dynamic model showed that previous tertiary school enrolment was strongly associated with current enrolment. This suggests that enrolment responds gradually to changes in the education system. Tertiary education planning should therefore use multi year projections of student demand rather than relying mainly on annual changes in expenditure. This would allow

government and institutions to plan infrastructure, staffing and other resources ahead of expected changes in student numbers.

4. Funding decisions should consider wider economic conditions.

GDP growth and inflation were not statistically significant in the corrected models, but the descriptive analysis showed considerable variation in Nigeria's economic conditions during the study period. Education authorities should therefore consider the wider macroeconomic environment when planning public education expenditure. Particular attention should be given to periods of economic contraction and rising prices because these conditions can affect the real value of allocated resources and the ability of institutions to implement planned programmes.

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