IMPACT OF INTERNET USAGE ON NIGERIA SECONDARY SCHOOL STUDENTS PERFORMANCE: VAR APPROACH

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Abstract

Using quarterly data from 1996 to 2019, this study examined the relationship between internet usage and secondary school student performance in Nigeria. Using a systems simultaneous equation, cointegration analysis was established to capture long- and short-run relationships between variables. The simultaneous equation was simulated using the vector auto-regression (VAR) model technique. To explore short-run causality among variables, the researchers used the VAR Granger causality methodology to look at causality correlations between series. The findings show that internet use, the environment, infrastructure, and government policy have no bearing on tertiary school enrollment. The study recommends that the government hire more qualified counsellors to provide correct guidance on how to use the internet properly, as well as increase the education budget to reach the UNESCO recommendation of 25% to enable schools to improve their environment, upgrade infrastructure, and give free internet within the school environment.

JEL CODES: *L86, H54, G18, C32.*

1 Introduction

Without a doubt, the Internet is one of the most important developments of the late twentieth century. It's being utilized in classrooms to help students study more effectively. It features a number of valuable tools that can help turn today's isolated, text-bound classrooms into rich, student-centered, interactive learning environments (Ogunsola, 2005). Internet usage has had a substantial impact on secondary school teaching and learning methods, according to Ema & Ajayi (2006).

Teachers use online resources to plan lessons, and students use them to expand their horizons. Teachers can provide more attention to individual students' needs and enhance shared learning by using interactive teaching methods, which are made possible by the Internet. This may aid in the correction of educational inequities faced by girls and women. Internet access aids educational administrators in lowering expenses and improving the quality of schools and institutions (Internet society, 2017). Despite the educational benefits of this instrument, some issues persist in internet usage in the country's secondary school system, particularly connectivity and when children are in charge of the navigation process.

There are no standards for secondary school achievement. Although the most popular standard strategy focuses on curricula, how students comprehend things, and how they achieve their grades, there are other approaches. Skills, competencies, and attitudes acquired through education, on the other hand, are more comprehensive definitions (kamba, 2009). The more limited definition allows for the observation of the effects of any change in secondary education, whereas the more comprehensive definition necessitates a more sophisticated observation approach and a concentration on the labor market.

The impact of internet usage on education has attracted research debate in Nigeria. However, most of these studies discussed its impact on academic performance (grades), communication and general education purposes (Apuke & Iyendo, 2018; Shahibi & Ku-Rusli, 2017; Rashid & Han, 2016; Sushma, Suman & Ulysses, 2014; Adogbeji & Toyo, 2006; Berson & Berson, 2005). To the knowledge of this study, no detailed study has been carried out on the relationship between internet usage and the performance of secondary school students. Performance in this study will be measured by enrolment rate into tertiary institutions in Nigeria because the study believes that higher institutions entrance, validate the level of education goals achieved by secondary school students.

The study's findings are expected to aid in the enhancement of research findings that would be useful in informing teaching and learning practices in Nigeria's secondary schools. The remainder of the paper is laid out as follows. The necessary literature and theoretical framework are presented in Section 2. The methods used in the study is described in Section 3. The results and explanation of the empirical finding are found in Section 4, while the conclusion is found in Section 5.

2.1 Relevant Literature

Over the last two decades, researchers have been studying the effects of the Internet on students' academic performance and communication. Scherer (1997) conducted one of the first studies on the use of the Internet among college students, finding that only 2% of a group of 531 students believed the Internet had a negative

impact on their academic performance, while 13% believed that dependent patterns of Internet use always interfered with their regular activities (academic, professional and social-related work). Matthews & Schrum (2003) conducted a survey of a large public university in the United States' southeast region. According to the findings, there is a substantial positive relationship between grade performance and (1) impression of the Internet as a beneficial academic tool and (2) time spent on the Internet. Cheng & Huang (2005) discovered that Internet use was substantially connected with students' evaluations of learning as well as their job prospects in a survey conducted at a large institution.

According to Olatokun (2008), most students believe the internet is far better and more convenient than their school libraries. Students regard the internet as a source of general knowledge, and it helps them improve their reading habits, which leads to improved academic achievement. According to Ogedebe (2012), the majority of students use the internet to access relevant information such as academic materials. This indicates that pupils utilize the internet to supplement their learning. Ruth & Adedotun (2015) found that the source and access to information can affect secondary school students' academic performance in a similar study.

Pea, Hoadley, Grodon (2002) in their work as reported by Bolu-Steve, Oyeyemi & Amali (2015), posited that the internet can be used in many ways, some of which may be beneficial to the students and that non-educational sites may be just the opposite. However as revealed from their findings, internet usage does not enable students to develop networking website that could help their academic performance; does distract students' attention and prevent them from attending lectures regularly. According to Olatokum (2008), students mostly used the internet for communication, entertainment, and leisure (reading and sending e-mails, online chatting, instant messaging, playing games and downloading music videos, and reading newspapers). Similarly, Sahin, Balta & Ercan (2010), noted that while university students frequently use email and forum/chat-line in their daily life, they do not use them in their studies. A similar work by Singh, Gupta & Garg (2013), brings to the fore that students are more into the use of the internet but in reality, they are using it mainly for non-academic purposes like mailing, gaming and social networking. This led to losses in their study schedules. This brings to the fore the controversy among empirical studies on the influence of internet use on the academic performance of students.

2.2 Theoretical Framework

The Internet has had a significant impact on Nigerian secondary school students' lives and society in general. Because the underlying goal of this study is student outcomes in senior secondary school, the study will explain why we believe Internet usage, environment, infrastructure, and government policy can have a positive impact on student outcomes.

The theoretical framework was developed by analyzing previous research on internet usage and its impacts on academic performance. All of the variables were identified in Figure 1. Four articles comprising the model, framework, and theoretical theories have been selected and used in this theoretical framework.

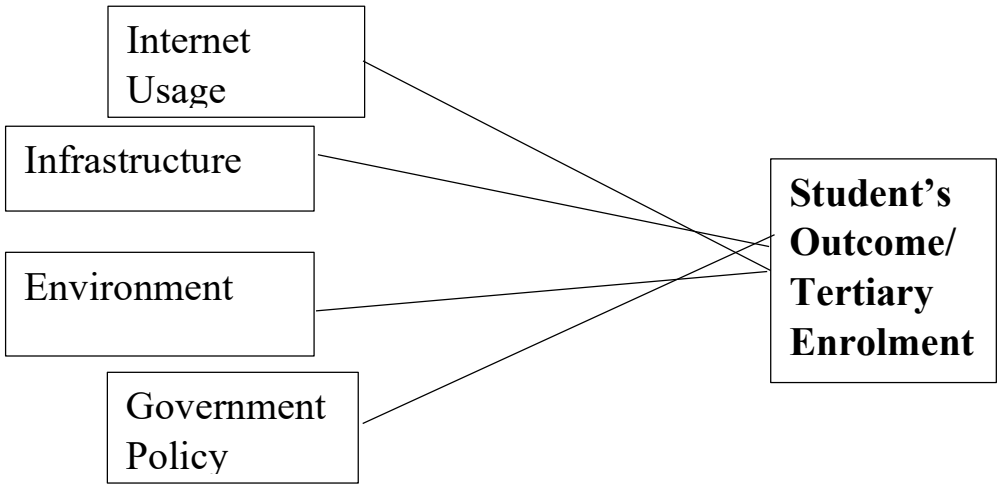


Figure 1. Theoretical Framework

Internet Usage: It can also be called "information superhighway" or "net" which is a global computer network. According to Bear (1999), as reported by Bolu-Steve, et al. (2015), the use of the internet has helped in facilitating library services, administrative process, distance learning and instructional structures. The internet has transformed education into student's centered learning rather than institution and faculty-centred instruction. The

internet can be used as a source of information for students in the knowledge of interest. The process of learning has gone beyond consultation of textbooks and other library resources as such with the use of the internet which helps students update their knowledge. Thus, E-mail, instant messages and posting of messages on websites are also a source of information (Bolu-Steve et.al, 2015).

Infrastructure: it can be defined as the basic physical & organizational structures and facilities (e.g. buildings, roads and power supplies) needed for the operation of a society or enterprise i.e. school. Infrastructure has an impact on the mental development of a student. According to Sanoff (2001), schools that are properly built motivate the students to stay in school and learn. Fisher (2006), researched the impact of school infrastructures on student outcomes and behaviour in Georgia and established that academic achievement improves with improved building conditions, lighting levels, air quality and temperatures. Mark (2002) in his study of the factors affecting learners' performance in schools in Canada as reported by Mokaya (2013), maintained that one cannot expect a high level of students' academic performance where school buildings are poorly located and substandard. He emphasized that well-planned structures, clean, quiet, safe, comfortable and healthy environment are important components of successful teaching and learning. The extent to which these infrastructures could enhance quality education depends on their location, their structures and facilities available in them. It is not unlikely that well-planned learning infrastructures in terms of location, structures and facilities will affect facilitate the teaching and learning process and as well as enhance the good academic performance of the students (Ajayi, 2007).

Environment: According to Chan (1996), the theoretical basis of the American facility planners is that the environment has an impact on students learning. Therefore, any improvement effort to the environment will help enhance student achievement. A so-called "good" learning environment consists of four main factors: visual, acoustical, aesthetic and thermal environments. This study will focus on the visual environment which refers to an appropriate lighting system in the classroom to facilitate students in focusing their tasks. TheThe difference between new and old school buildings is whether attention has been paid to the application of these four basic factors. Facility experts believe that students achieve higher in newer school facilities with adequate visual, acoustical, aesthetic and thermal environments.

Government Policy: the major aim of government policy on education is to ensure that all citizens acquire quality education. Student performance is thus paramount in the establishment of the education system by any government. The specification for the establishment and requirement of physical and material resources in public secondary schools are stipulated in the laws and policies that govern a country's education system (Makoya, 2013).

3.0 Methodology

3.1 Data Source

The study utilizes time-series data (1996–2019), obtained from various issues of the Central Bank of Nigeria (Statistical Bulletin & Annual Report and Statement of Accounts) and the World Bank. All data will be converted into a log-log equation for time series processing. Thus, the coefficient can be interpreted as an elasticity. The variables and their sources are presented in table 1.

Table 1: Variables Measurement and Sources of Data

S/No	Variables	Measurement	Sources of Data
1.	Internet Usage	The amount of information transferred over your internet connection (i.e. web browsing, checking email, downloading and uploading files, streaming audio and video, etc.)	https://data.worldbank.org/indicator
2.	Tertiary education enrolment ratio	The gross enrolment ratio is the proportion of total enrollment, regardless of age, to the population of the age group that corresponds to the educational level shown. Tertiary education, whether leading to an advanced research degree or not, usually needs successful completion of secondary education as a minimum condition of entrance.	UNESCO Institute for Statistics (http://uis.unesco.org/)
3.	Government expenditure on education (a proxy for government policy)	Measures the total amount of money spent on education in a specific period i.e. year (in billions)	https://www.indexmundi.com/
4.	Gross domestic investment (a proxy for infrastructure)	It measures additions of capital goods, such as equipment, tools, transportation assets, and electricity (in billions). A proxy for infrastructure.	https://data.worldbank.org/indicator
5.	Electricity Consumption per capita (a proxy for the environment)	Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants. (refers to an appropriate lighting system in the classroom to facilitate students in focusing their tasks)	http://www.iea.org/stats/index.asp
6.	Number of universities in Nigeria (a proxy for government policy)	The number of new universities established in Nigeria between 1996 and 2019.	Computed by the author from various sources

Source: Researcher's Compilation, 2020

3.2: Analytical Techniques

The study employed the vector autoregressive (VAR) model to understand the interaction among the six variables. However, the properties of these variables such as stationarity and long-term relationship were verified before estimating the model with VAR. the study employed the [9] to test stationarity while the Johansen co-integrated was used to test for the presence of a long-term relationship. The study will also adopt the VAR Granger Causality test to test the existence of causality among the variables. Finally, impulse response function and variance decomposition were employed to examine the effects of the shocks and variations caused by the variable itself and other variables respectively.

3.2.1 Unit Root Test

To determine the presence of unit root, or if the variables are stationary, the researchers utilized the Augmented Dickey-Fuller (ADF) (1979) test and the Phillips-Perron (PP) (1988) test. The ADF test was chosen to test for unit root because it is the simplest approach to testing for unit root and it is particularly well suited to dealing with a large and complex set of time series data with unknown orders, whereas the PP test corrects any heteroscedasticity and serial correlation in the errors terms. PP tests are also based on a serially correlated regression error term and do not require lag selection.

3.2.2 Cointegration Test

The presence of a long term relationship was determined using a cointegration test. The Trace and Maximum Eigenvalue statistics of the Maximum Likelihood method (ML) were used to accomplish this.

3.2.3 Impulse Response

An endogenous variable's reaction to one of the innovations is explained by the impulse response function. It shows how one standard deviation shock to one of the innovations affects the present and future values of the endogenous variable (Anetor, Ogbechie, Kelikume & Ikpesu, 2016).

3.2.4 Variance Decomposition

Variance decomposition divides fluctuation in an endogenous variable into component shocks to the VAR. As a result, variance decomposition reveals the relative relevance of each random innovation in influencing the VAR variables. It is vital to note that if cointegration between series is identified, there is a long-term equilibrium relationship, and hence the vector error correction model (VECM) should be used instead of VAR. VAR becomes increasingly important in the absence of cointegration.

3.3 Model Specification

This study's estimation will differ from empirical works that studied the relationship between the internet and performance Apuke & Iyendo, (2018) and Ruth & Adedotun (2015). As a result, the study will evaluate the type of association between the target variable (internet availability) and enrolment in Nigerian tertiary institutions. The following is an implicit expression of the relationship:

$$TER = f(ITU, GDI, LELC, REDXP, NUV) \quad (1)$$

The economic expectations of each the parameters of the explanatory variables in relationship with the dependent variable are stated below as

$$f_1 > 0, f_2 > 0, f_3 < 0, f_4 > 0, f_5 > f_6 > 0;$$

This means that all the identified variables have a positive relationship with the tertiary enrolment ratio.

The VAR models that establish the interaction of the variables of this study are expressed as follows:

$$LTER_t = \alpha_1 + \sum_{j=1}^{n} \beta_j LTER_{t-j} + \sum_{j=1}^{n} \theta_j LITU_{t-j} + \sum_{j=1}^{n} \phi_j LGDI_{t-j} + \sum_{j=1}^{n} \varphi_j LELC_{t-j} + \sum_{j=1}^{n} \gamma_j LREDXP_{t-j} + \sum_{j=1}^{n} \kappa_j LNUV_{t-j} + \mu_{1t} \quad (1)$$

$$LITU_t = \alpha_2 + \sum_{j=1}^{n} \theta_j LITU_{t-j} + \sum_{j=1}^{n} \beta_j LTER_{t-j} + \sum_{j=1}^{n} \phi_j LGDI_{t-j} + \sum_{j=1}^{n} \varphi_j LELC_{t-j} + \sum_{j=1}^{n} \gamma_j LREDXP_{t-j} + \sum_{j=1}^{n} \kappa_j LNUV_{t-j} + \mu_{2t} \quad (2)$$

$$LGDI_t = \alpha_3 + \sum_{j=1}^{n} \phi_j LGDI_{t-j} + \sum_{j=1}^{n} \theta_j LITU_{t-j} + \sum_{j=1}^{n} \beta_j LTER_{t-j} + \sum_{j=1}^{n} \varphi_j LELC_{t-j} + \sum_{j=1}^{n} \gamma_j LREDXP_{t-j} + \sum_{j=1}^{n} \kappa_j LNUV_{t-j} + \mu_{3t} \quad (3)$$

$$LELC_t = \alpha_4 + \sum_{j=1}^{n} \varphi_j LELC_{t-j} + \sum_{j=1}^{n} \theta_j LITU_{t-j} + \sum_{j=1}^{n} \phi_j LGDI_{t-j} + \sum_{j=1}^{n} \beta_j LTER_{t-j} + \sum_{j=1}^{n} \gamma_j LREDXP_{t-j} + \sum_{j=1}^{n} \kappa_j LNUV_{t-j} + \mu_{4t} \quad (4)$$

$$LREDXP_t = \alpha_5 + \sum_{j=1}^{n} \gamma_j LREDXP_{t-j} + \sum_{j=1}^{n} \theta_j LITU_{t-j} + \sum_{j=1}^{n} \phi_j LGDI_{t-j} + \sum_{j=1}^{n} \varphi_j LELC_{t-j} + \sum_{j=1}^{n} \beta_j LTER_{t-j} + \sum_{j=1}^{n} \kappa_j LNUV_{t-j} + \mu_{5t} \quad (5)$$

$$LNUV_t = \alpha_6 + \sum_{j=1}^{n} \kappa_j LNUV_{t-j} + \sum_{j=1}^{n} \theta_j LITU_{t-j} + \sum_{j=1}^{n} \phi_j LGDI_{t-j} + \sum_{j=1}^{n} \varphi_j LELC_{t-j} + \sum_{j=1}^{n} \gamma_j LREDXP_{t-j} + \sum_{j=1}^{n} \beta_j LTER_{t-j} + \mu_{6t} \quad (6)$$

Where:

LTER = Log of tertiary enrolment ratio;
LITU= Log of internet usage;
LGDI = Log of gross domestic investment, a proxy for infrastructure;
LELC= Log of electricity consumption, a proxy for the environment;
LREDXP= Log of real expenditure on education, a proxy for government policy;
LNUV = Log of the number of universities, a proxy for higher institutions in Nigeria.

μ^s = The stochastic error term called impulses or innovations or shocks in VAR

t= Current time

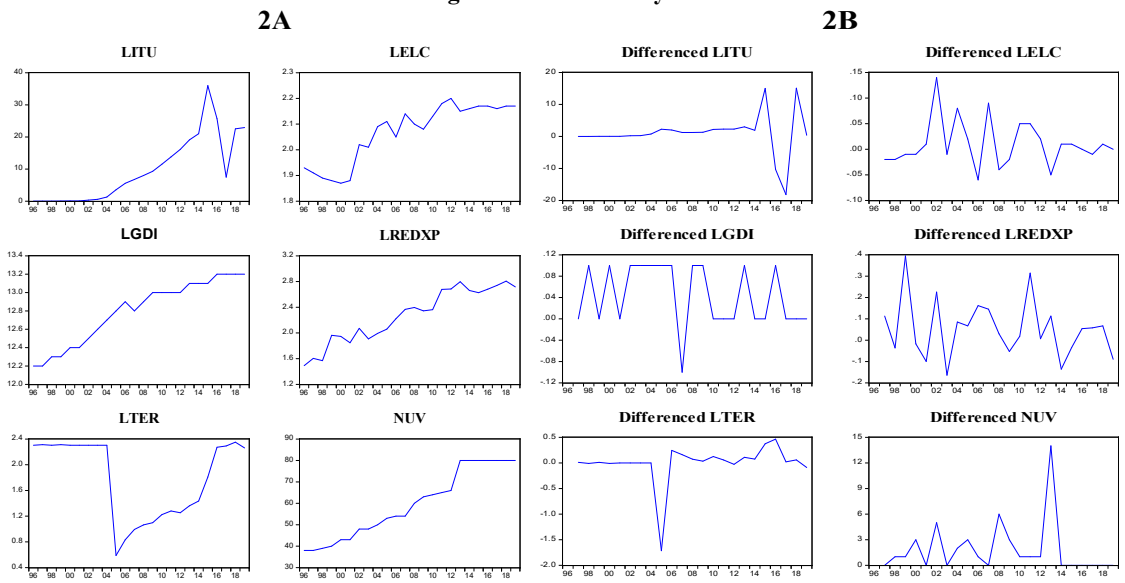
4 Results and Discussion

4.1 Series Trend Analysis

Data in time series often shows growing or decreasing trends, as well as fluctuations. As a result, trend analysis is required before unit root testing in order to determine whether the series has a unit root. The series exhibit a

random walk with drift and trend, according to the results of the graphical representation in Figure 2A. The data in Figure 2B represent a trend with a pattern of substantial variations, indicating that they are non-stationary.

Figure 2: Trend Analysis



4.2 Unit Root Tests

The variables are not stationary when examined at a level with a constant and constant and trend, as indicated by the asterisk in table 2. As a result, we infer that the series are non-stationary since data is stationary when the ADF test statistics are less than the test critical values at any point in time 5% ($ADF\ test\ statistics\ <test\ critical\ value\ at\ 5\%$). For stationary data, the appropriate probability value is less than $0.05 (P-value\ <0.05)$. All series are non-stationary at level but stationary at first difference after the ADF test. ADF tests, on the other hand, are frequently influenced by the lag length (p) chosen and lose power when estimating a large sample. As a result, the results of the ADF tests are validated by the Phillips–Perron (PP) test. The PP test results show that the series is non-stationary at the level but stationary at the first difference. The variables are shown in their differenced form in Figure 2B. The adoption of the VAR model for estimation is justified as a result of this outcome.

Table 2: Unit Root Tests Result

Variables	ADF Test Statistic				PP Test Statistic			
	Constant	Constant & Trend	None	First Difference	Constant	Constant & Trend	None	First Difference
LTER	-1.57	-1.32	-0.52	-4.66*	-1.61	-1.32	-0.51	-4.66*
LITU	-1.54	-2.43	-0.96	-6.04*	-0.94	-3.32	-0.48	-10.7*
LGDI	-1.49	-1.19	3.47	-5.52*	-1.93	-0.89	4.09	-5.51*
LELC	-1.18	-2.07	1.02	-5.58*	-1.04	-2.06	1.22	-5.61*
LREDXP	-1.63	-2.89	1.53	-6.10*	-1.86	-2.85	2.43	-6.99*
LNUV	-0.54	-2.55	2.49	-5.16*	-0.47	-2.55	2.79	-5.28*

Notes (ADF): 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.
Notes (PP): 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.

4.3 Determination of Lags

Table 3 reports lag-order selection statistics. Criteria of LR, FPE, AIC, SC, and HQ show a lag order of one. AIC has the lowest value. So the study will proceed with further tests with lags (1).

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-358.1684	NA	0.000158	8.276554	8.445464	8.344604
1	166.1943	965.3041	2.40e-09*	-2.822598*	-1.640233*	-2.346253*
2	173.4863	12.42951	4.66e-09	-2.170143	0.025678	-1.285502
3	184.9067	17.90932	8.38e-09	-1.611517	1.597761	-0.318579
4	206.1334	30.39271	1.24e-08	-1.275759	2.946974	0.425475
5	243.9405	48.97746	1.30e-08	-1.316831	3.919359	0.792699
6	255.1527	12.99587	2.65e-08	-0.753470	5.496175	1.764355
7	277.1439	22.49104	4.51e-08	-0.435089	6.828012	2.491032
8	377.3909	88.85531*	1.43e-08	-1.895248	6.381309	1.439169

Source: Researcher's calculations from Eviews 9, 2021. * indicates lag order selected by the criterion

4.4 Cointegration Test

The results of the cointegration tests in tables 4 show both the Trace and the Maximum Eigenvalue tests. The results show the absence of a long-run relationship among the six variables; hence, the use of the VAR model becomes appropriate.

Table 4: 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	74.73899	95.75366	0.5531	None	23.21169	40.07757	0.8664
At most 1	51.52730	69.81889	0.5704	At most 1	18.33775	33.87687	0.8600
At most 2	33.18955	47.85613	0.5464	At most 2	16.78437	27.58434	0.5985
At most 3	16.40519	29.79707	0.6835	At most 3	10.74747	21.13162	0.6725
At most 4	5.657716	15.49471	0.7355	At most 4	3.975903	14.26460	0.8619
At most 5	1.681813	3.841466	0.1947	At most 5	1.681813	3.841466	0.1947

Source: Researcher's calculations from Eviews 9, 2021. * Denotes rejection of the null hypothesis at the 0.05 level

4.5 Model Estimation Results

Our target equation's VAR estimation result in table 5 indicates an R^2 of 0.911835. (91 percent). It means that the explanatory variables account for 91 percent of the overall variation in the tertiary school enrolment ratio. The explanatory variables were strong in explaining the variation in tertiary school enrolment ratio and were a good fit, according to the adjusted R^2 of 91 percent. Internet usage, electricity consumption, gross domestic investment, real education expenditure, and the number of universities in Nigeria have R^2 values of 0.918238, 0.962656, 0.990453, 0.973257, and 0.988790, respectively, with adjusted R^2 values of 91 percent, 96 percent, 99 percent, 97 percent, and 99 percent. This means the models were a good fit.

Table 5: The Result of Vector Autoregression Estimates
***Standard errors in ( ) & t-statistics in [ ]**

	LTER	LITU	LELC	LGDI	LREDXP	LNUV
LTER(-1)	0.870733	-1.114260	0.003451	0.003988	-0.001734	0.086828
	(0.04580)	(0.74241)	(0.00554)	(0.00845)	(0.01701)	(0.42089)
	[19.0108]	[-1.50087]	[0.62260]	[0.47171]	[-0.10194]	[0.20630]
LITU(-1)	0.002657	0.726574	2.95E-05	0.000278	0.001183	0.021776
	(0.00447)	(0.07253)	(0.00054)	(0.00083)	(0.00166)	(0.04112)
	[0.59387]	[10.0178]	[0.05454]	[0.33667]	[0.71220]	[0.52961]
LELC(-1)	-0.806238	3.313681	0.848267	0.158013	-0.053808	5.176883
	(0.48353)	(7.83762)	(0.05851)	(0.08924)	(0.17954)	(4.44329)
	[-1.66739]	[0.42279]	[14.4983]	[1.77058]	[-0.29969]	[1.16510]
LGDI(-1)	-0.364460	-8.124836	0.090588	0.935445	0.195556	-0.981588
	(0.30493)	(4.94261)	(0.03690)	(0.05628)	(0.11323)	(2.80205)
	[-1.19524]	[-1.64384]	[2.45518]	[16.6214]	[1.72714]	[-0.35031]
LREDXP(-1)	0.046974	0.461283	-0.008427	0.021158	0.866566	2.709531
	(0.16210)	(2.62757)	(0.01961)	(0.02992)	(0.06019)	(1.48961)
	[0.28978]	[0.17556]	[-0.42960]	[0.70719]	[14.3966]	[1.81895]
LNUV(-1)	0.010342	0.289067	-0.000780	-0.000591	-0.001650	0.901556
	(0.00721)	(0.11690)	(0.00087)	(0.00133)	(0.00268)	(0.06627)
	[1.43402]	[2.47273]	[-0.89373]	[-0.44421]	[-0.61632]	[13.6035]
C	5.813745	83.74973	-0.783833	0.487042	-1.985238	1.621810
	(3.23337)	(52.4101)	(0.39124)	(0.59677)	(1.20061)	(29.7122)
	[1.79804]	[1.59797]	[-2.00345]	[0.81613]	[-1.65352]	[0.05458]
R-squared	0.911835	0.918238	0.962656	0.990453	0.973257	0.988790
Adj. R-squared	0.905823	0.912663	0.960110	0.989802	0.971434	0.988026
Sum sq. resids	3.004338	789.3477	0.043987	0.102343	0.414231	253.6932
S.E. equation	0.184771	2.994972	0.022357	0.034103	0.068609	1.697904
F-statistic	151.6876	164.7157	378.0769	1521.552	533.7616	1293.739
Log-likelihood	29.25727	-235.3723	229.8929	189.7829	123.3733	-181.4560
Akaike AIC	-0.468574	5.102575	-4.692482	-3.848061	-2.449964	3.967494
Schwarz SC	-0.280394	5.290756	-4.504302	-3.659881	-2.261783	4.155675
Mean dependent	1.780396	9.754347	2.068947	12.80211	2.280763	59.64211
S.D. dependent	0.602090	10.13432	0.111941	0.337695	0.405930	15.51658

Source: Researcher's calculations from Eviews 9, 2021.

The absence of probability values in the estimate cannot be used to explain the relevance of the individual variables. As a result, the simultaneous equation must be estimated as a basis for establishing the relationship between the tertiary school enrolment ratio and other explanatory factors. This is because the t-statistic was designed for a study with two samples and a within-groups design in the first place. As a result, this being a simultaneous model interpreting findings using t-statistics becomes ineffective. Second, t-statistics are not appropriate for a sample size greater or equal to 30 ($n \geq 30$) as in this study. The independent variables have the variances of the two groups but are not homogeneous (Engle & Granger, 1987). To establish the impact of the explanatory variables on Nigeria's tertiary school enrolment, the study estimates the simultaneous equation by employing OLS.

Table 6: Estimation Method: Least Squares

	Coefficient	Std. Error	t-Statistic	Prob.
LTER(-1)	0.870733	0.045802	19.01082	0.0000
LITU(-1)	0.002657	0.004475	0.593866	0.5541
LELC(-1)	-0.806238	0.483531	-1.667395	0.0990
LGDI(-1)	-0.364460	0.304927	-1.195236	0.2352
LREDXP(-1)	0.046974	0.162104	0.289775	0.7727
LNUV(-1)	0.010342	0.007212	1.434024	0.1551
C	5.813745	3.233370	1.798045	0.0756

Source: Researcher's calculations from Eviews 9, 2021.

Table 6 reveals that, despite the fact that the coefficient is clearly signed, the probability value of internet usage is not significant because it is greater than 5%. As a result, internet usage in Nigeria has a positive relationship with the ratio of tertiary school enrolment. The findings support the findings of Sahin et al. (2010) and Singh et al (2013). The findings also demonstrate that real education spending and the number of universities in Nigeria have a positive relationship with the tertiary school enrolment ratio, which is in line with our Apriori expectation, although insignificant.

Infrastructure and environment have probability values that are greater than 5% and also negatively related to tertiary school enrolment ratio. This could be a result of slow internet connection, inadequate school internet facilities and the cost of data subscription. Also, the electricity supply in the country is nothing to write home about, most secondary schools in the country don't have electricity supply from the national grid and those that have still use generators. However, government policy is positively related to tertiary school enrolment, this goes a long way to show the importance of government expenditure on the growth of education. The insignificant relationship could be attributed to the percentage of government expenditure on education. Between 1981 and 2019, the share of education expenditure to total expenditure was less than 8% (Ihugba, 2020). This amount is too small to provide the basic needs of secondary schools such as teaching instruments and facilities that aid adequate teaching and learning.

4.6 Granger Causality

Based on the result in Table 7, internet usage does not cause a tertiary school enrolment ratio because the p-value exceeded 0.05 (0.55). Hence, the null hypothesis that LITU does not Granger cause LTER cannot be rejected. This outcome implies that internet usage since its inception in 1996, has not influenced the tertiary school enrolment ratio. The test also, shows that infrastructure, environment and government policy does not cause tertiary school enrolment ratio in Nigeria. The result also signals the fact that there is no joint effect on the tertiary school enrolment ratio. Ex-ante forecasting using impulse response and variance decomposition tests is the next stage.

Table 7: VAR Granger Causality/Block Exogeneity Wald Tests

Independent Variables	**Dependent Variables**													
	LTER		**LITU**		**LELC**		**LGDI**		**LREDXP**		**LNUV**		**ALL**	
	C	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**
LTER			2.25	0.13	0.39	0.53	0.22	0.64	0.01	0.92	0.04	0.84	10.06	0.07
LITU	0.35	0.55			0.00	0.96	0.11	0.74	0.51	0.48	0.28	0.60	13.28	0.02
LELC	2.78	0.10	0.18	0.67			3.13	0.08	0.09	0.76	1.36	0.24	8.62	0.13
LGDI	1.43	0.23	2.70	0.10	6.03	0.01			2.98	0.08	0.12	0.73	4.32	0.50
LREDXP	0.08	0.77	0.03	0.86	0.18	0.67	0.50	0.48			3.31	0.07	6.28	0.28
LNUV	2.06	0.15	6.11	0.01	0.80	0.37	0.20	0.66	0.38	0.54			7.17	0.21

Source: Researcher's calculations from Eviews 9, 2021.
Note: C= Chi-square; P= probability value

4.7 Impulse Response Function

The impulse response function serves the pivotal role in assessing how and to what extent shocks on independent variables influence the tertiary school enrolment ratio in Nigeria. The horizontal axis of the impulse response function (IRF) shows the number of periods that have passed after the impulse has been given while the vertical axis measures the responses of the variables. It can be observed from graph B in Figure 3 that one per cent innovation in internet usage (LITU) produced a positive response by tertiary school enrolment ratio (LTER), i.e. a positive response of 0.2 in the fourth period up to the ninth period and 0.3 at the tenth period. This result implies that internet usage has yielded a positive impact on the tertiary school enrolment ratio. Graphs C & D show that environment (LELC) and infrastructure (LGDI) produced a negative impact on tertiary school enrolment ratio. For instance, the shock in LELC resulted in a negative response of -0.01 in the first period and -0.04 in the tenth period while LGDI also recorded negative response all through the periods. The shocks to government policy E & F, produced positive responses.

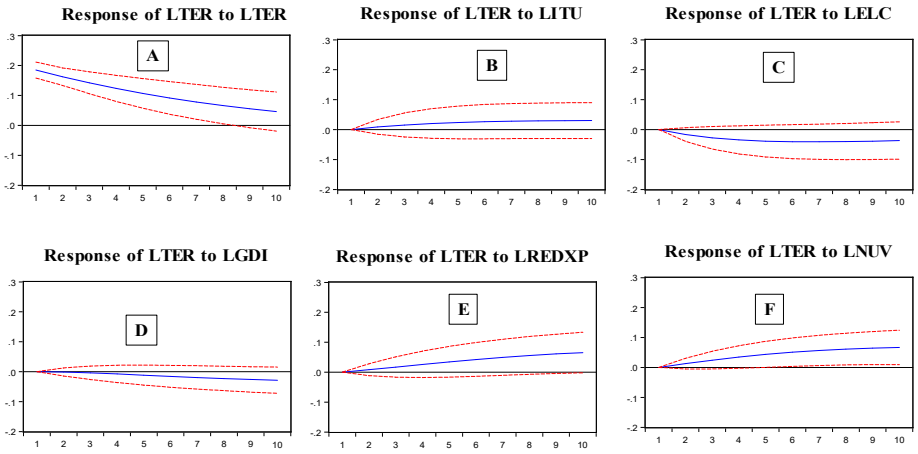


Figure 3: Response of LTER to Dependent Variables

4.8 Inverse Roots of AR

The graph of the AR inverse root of the VAR is shown in Figure 4. All of the polynomial roots are found within the unit circle, as seen in the graph. This finding indicates that the VAR model is stable or stationary, implying that the impulse response functions are reliable.

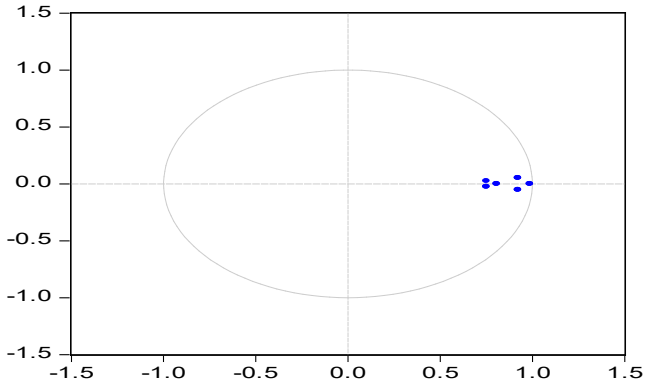


Figure 4: Inverse Roots of AR Characteristic Polynomial

4.8 Variance Decomposition

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 tertiary school enrolment ratio, internet usage, electricity consumption, gross domestic investment, real education expenditure and the number of universities in Nigeria. Table 8 provides the portion of the forecast error variance of each variable that is attributed to its innovation and innovations in another variable. The own shocks of LTER constitute a significant source of variation in its forecast error in the time horizon, ranging from 99.5% to 86.9%. Ten years later, variation in LTER is accounted for by LITU (1.31%), LELC (3.28%), LGDI (0.47%), LREDXP (3.33%) and LNUV (4.74%). This result implies that the predominant source of variation in tertiary school enrolment ratio is the number of universities in the country (Nigeria) while infrastructure (LGDI) accounts for a very low variation.

Table 8: Variance Decomposition

Periods	LTER	LITU	LELC	LGDI	LREDXP	LNUV
SHORT-RUN	99.52471	0.063141	0.224333	0.001235	0.054993	0.131593
MEDIUM-TERM	96.13277	0.454702	1.406416	0.054971	0.683151	1.267988
LONG-RUN	86.86054	1.314817	3.281462	0.466446	3.332937	4.743795

Source: Researcher's calculations from Eviews 9, 2021.

4.9 VAR Model Checking

Before concluding, the VAR model will be validated for serial correlation and stability.

4.9.1 Autocorrelation Residual LM Test

In autoregressive model one $[AR\ (1)]$, the LM test is widely employed to check for serial correlation. Under the hypothesis that there is no serial correlation from lag one, the LM Test statistic computes lag order p using an auxiliary regression of the residuals of the estimated regression. The LM's findings are presented below.

Table 9: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.058168	Prob. F(1,87)	0.8100
Obs*R-squared	0.063474	Prob. Chi-Square(1)	0.8011

Source: Researcher's calculations from Eviews 9, 2021.

The results of Table 9 shows that the null hypothesis of no serial autocorrelation will be accepted for the Godfrey LM test for 1 lag since their p-values are greater than the significance values of 0.05. Hence we can conclude that there is no serial autocorrelation since the lag accepts the null hypothesis.

4.9.2 Test for Stability

Stability is tested by conducting the CUSUM test and recursive coefficients stability test.

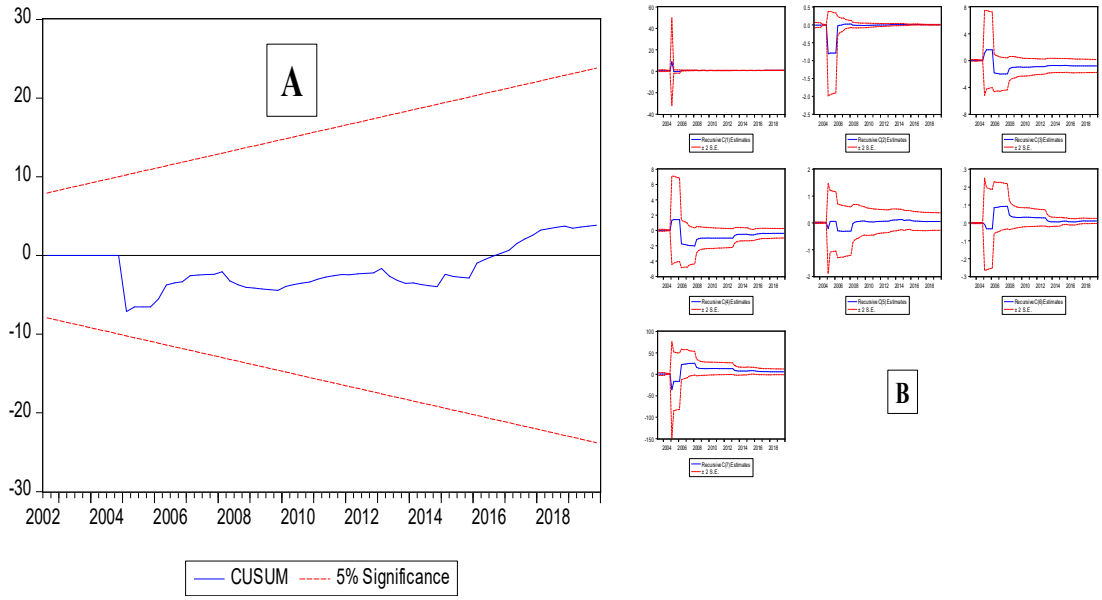


Figure 5; Stability Test

The results are shown in Figures 5A and 5B. The system's equation is valid, according to all tests, and provides sufficient results for economic analysis. To check for structural change instability, recursive residual estimations were used. Because the Cusum plots test statistic and the recursive coefficients are confirmed within the 5% critical bounds of parameter stability, the findings show that there is no instability. This means we accept null hypothesis and conclude that our parameters are stable and, as a result, would not have any misspecification. In conclusion, all probability values for the tests are greater than 5% critical values, implying that our model is valid because all probability values for the tests are greater than 5%, indicating that our economic growth equation is valid for economic analysis.

5 Conclusions

Based on the findings, the study concludes that internet usage, environment, infrastructure and government policy on education have no significant impact on tertiary school enrolment in Nigeria. However, it was evident from the outcome of the study that internet usage is positively related to tertiary school enrolment in Nigeria. The positive insignificant relationship between internet usage and tertiary school enrolment in Nigeria may be as a result of secondary school students using the internet for communication, entertainment and leisure (reading and sending e-mails, online chatting, instant messaging, playing games and downloading music videos, and reading newspapers). The findings also show that students are more into the use of the internet but in reality, they are using it mainly for non-academic purposes and this has led to losses in their academic activities.

The study also concludes that the share of education (7%) from total government expenditure is not sufficient to improve the education sector. The number of Nigerian universities is not enough to absorb the number of

secondary school leavers seeking admission in Nigerian universities. In the 2006 academic session, a total of 803,472 sat for Joint Admission Matriculation Board Examination out of which 123,626 (15.4%) secured university admission. 194,521 (18.5%) was admitted out of 1,054,053 applicants in 2008 but increased to 33.3% in 2011 which was grossly inadequate, despite the phenomenal expansion in the number of universities in the country from 16 in 1980 to 104 at the end of 2009 (NUC, 2010). Also, overcrowding has been a major problem in Nigerian universities as most universities admit more than their capacity. Hence, for internet users to improve academic performance, the government must ensure:

- Increase the number of trained counsellors employed to provide suitable assistance on how to use the internet properly.
- Students should be encouraged to use the internet to find material that will enrich and improve their academic performance.
- The government should increase education funding to achieve the UNESCO recommendation of 25% to enable schools to improve their environment, infrastructure, and provide free internet access within the school environment.

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