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Impact of Teledensity on Economic Growth in Nigeria, 1980 – 2018

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ABSTRACT
The upsurge in the rate of Teledensity and the level of economic growth in Nigeria raises a debate amongst the scholars and stakeholders in the telecommunication industries on the impact teledensity has on economic growth. More so, it's an empirical issue to ascertain the correlation between teledensity, foreign direct investment, unemployment rate, and consumer price index. Inconclusiveness and mixed

result in literature in regard to the impact of teledensity on economic growth in Nigeria motivate this study. This study investigates the impact of teledensity on economic growth in Nigeria between the periods spanning from 1980 to 2018. The study equally established the correlation between teledensity, foreign direct investment, unemployment rate, and consumer price index. The Autoregressive Distributed Lag (ARDL) econometric technique and group statistic of correlation, correlogram, and maximum likelihood technique was employed to analyze the time series secondary data sourced from World Bank Development Indicators, 2017 in order to explain the long-run relationship between teledensity and economic growth, as well as to ascertain correlation between teledensity, foreign direct investment, unemployment rate and consumer price index. The findings of this study reveal that both in short-run and long-run estimation of error correction model (ECM) teledensity have positive and statistically significant impacts on economic growth in Nigeria between 1980 and 2018. Also, the study result shows that there is significant correlation between teledensity, foreign direct investment, unemployment rate, and consumer price index. Based on the findings of this study, the following recommendations are made: That policy formulation that will encourage the expansion of teledensity targeting on economic growth, foreign direct investment inflow, and reduction in the rate of unemployment and price stability should be formulated and implemented. Such policy includes accessibility and affordability of mobile telephone and network services, a low tariff on a voice call and data usage and subsidies on imports telecommunication types of equipment as well as tax holiday.

Keyword: Teledensity, Economic Growth, Foreign Direct Investment, Unemployment Rate, and Consumer Price Index.

1. INTRODUCTION

Nigerian telecommunication industry provides a range of services which include radio, television, fixed and mobile telephones, and the internet. This in no doubt buttress the fact that the telecommunication industry is playing an important role in Nigeria's economy in terms of contribution to gross domestic production (GDP), reducing unemployment rate through employment generation, providing platform and channels of efficient and effective communication for both local and foreign direct investors subsequently enhancing foreign direct investment (FDI) in Nigeria.

More so, it is reasonable to assume that there is an indirect nexus between telecommunication and consumer price index. According to James (2019), Consumer Price Index (CPI) is a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food, and medical care. It is calculated by taking price changes for each item in the predetermined basket of goods and averaging them. Changes in the CPI are used to assess price change associated with the cost of living; the CPI is one of the most frequently used statistics for identifying periods of inflation or deflation. However, telecommunication in Nigeria to an extent plays an important role in saving time and reduces the cost of transportation and distribution thus, influence predetermined prices of a basket of goods and services.

According to the World Bank (2018), the Nigerian telecommunication industry contribution in GDP has risen to 11% as of 2017 to $70 billion. The report observed that the industry also collected 32% of FDI in the country from the fiscal year 2016 which stood at $931.2 million. In the form of taxes, revenue telecom sector contributed about N 1.4 Trillion to the federal government during the same period of time. In cellular mobile network data platform, about 14million people get subscriptions each month. In 2017 users of the mobile phone had been increased by 89.6 million.

However, empirical evidence has shown that among several services offered by Nigerian telecommunication industry notably, mobile-cellular services growing rapidly, in part responding to the shortcomings of the fixed-line network; multiple cellular providers operate nationally with a subscribership approaching 60 per 100 persons (World Factbook, U.S. Central Intelligence Agency, 2014) that notwithstanding, network quality remains a problem. In addition, deregulation of the mobile phone market has led to the introduction of Global System for Mobile Communication (GSM) network providers operating in Nigeria with major four network providers they include, MTN Nigeria, Airtel, Globalcom, and 9mobile. Use of cell-phones has soared, which implies increases in teledensity and has

mostly replaced the unreliable fixed-line services of Nigerian Telecommunications Limited (NITEL). The term Teledensity means the number of telephone connections for every hundred individuals living within an area (World Bank, 2017).

Furthermore, due to continuous innovation and improvement of telecommunication technology system a new dimension to internet connectivity has been introduced with millions of people accessing the internet on their Wireless Application Protocol (WAP) -enabled mobile phones, Smartphone's and on their Personal Computer system (PCs) using their phones as a modem. This is largely due to the introduction of GPRS (General Packet Radio Service) and EDGE (Enhanced Data Rates for GSM Evolution) connectivity by the GSM operators. All existing GSM networks presently offer GPRS services and have introduced 3G/UMTS. Thus, ranges of services by this GSM operators are expected to directly or indirectly impact on economic growth, create a new job, attract more foreign direct investment and as well as checkmate price makers that are found in imperfectly competitive markets such as Monopoly and Oligopoly.

Nevertheless, despite several packages of services offered by telecommunication industries in particularly, mobile telephones and the internet connectivity coupled with the increase in numbers of teledensity Nigeria is still witnessing slow economic growth (GDP), high rate of unemployment (UNER), decline in foreign direct investment (FDI) and increase in prices of a basket of consumer goods and services (CPI) this situation have led to questions as to what an extent teledensity has impacted the Nigerian economy in term of economic growth (GDP), reduction in unemployment rate (UNER), foreign direct investment (FDI) and consumer price index (CPI). However, several pieces of literature review on the impact of teledensity in Nigeria and elsewhere as related to economic growth, unemployment rate (UNER), the decline in foreign direct investment (FDI) and inflation measure (CPI) are inconclusive with a mixed outcome. For instances, Mamoun and Talib (2017); Haider and Sharif, (2016); Sridhar and Sridhar (2014) concludes that teledensity and telecommunication have a positive and significant impact on economic growth.

On the other hand, Mamoun and Talib (2017) posited that there is no significant impact of telecommunication on the economic growth of oil-producing countries Nigeria inclusive. Similarly, Atsu, Agyei, Darbi, and Adjei-Mensah, (2013) posited that telecommunications revenue does not contribute significantly to economic growth. Thus, following inconclusiveness and mixed results in the literatures on impacts teledensity has on economic growth called for deliberate empirical research in order to ascertain impact of teledensity on economic growth of Nigeria as well as to examine the nexus between teledensity and unemployment rate, foreign direct investment and consumer price index between the period of 1980 and 2018.

Therefore, this study proposes the following null hypotheses; (i) that teledensity does not has any significant impact on the economic growth of Nigeria between the period of 1980 and 2018 (ii) there is no significant correlation between teledensity, foreign direct investment, unemployment rate, and consumer price index. The rest of the paper is organized as follows; Section two is the review of selected literature relevant to the subject matter. Section three focuses on methodology while section four focuses on the result of data analysis and discussion while, section five, deals with conclusion and recommendation.

2. Literature Review

Conceptually, Raman (2015) defines a telecommunication system in the following terms: "Telecommunication occurs when the exchange of information between two entities (communication) includes the use of technology. Communication technology uses channels to transmit information (as electrical signals), either over a physical medium (such as signal cables) or in the form of electromagnetic waves". In the same vein, teledensity is the number of telephone connections for every hundred individuals living within an area (World Bank, 2018). Mamoun and Talib (2017) defined teledensity simply as the number of telephone lines per a given population of people. Sulaiman, (2013) defined teledensity is the rate of growth of mobile telephone user.

On the other hand, economic growth is defined as according to Uwakaeme (2015) The term economic growth is described as the positive and sustained increase in aggregate goods and services produced in an

economy within a given time period. According to Adeneye, Otto and Cookey (2014) foreign direct investment (FDI) is when a company owns another company in a different country. FDI is different from when companies simply put their money into assets in another country—what economists call portfolio investment. With FDI, foreign companies are directly involved with day-to-day operations in the other country. This means they aren't just bringing money with them, but also knowledge, skills, and technology.

More so, the unemployment rate is defined as the percentage of unemployed workers in the total labor force (Adeneye, Saheed, Alexander & Ibrahim, 2018). While Tahir, Amjid, Noureen, Muhammad, Sadia, Hafiz Zafar, Nasir, and Iram, (2014) defined unemployment as an excess supply of labor resulting from a failure in the market economy. International Labour Organization (ILO) defines the unemployed as numbers of the economically active population who are without work but available for and seeking work, including people who have lost their jobs and those who have voluntarily left work (Mohammed, Okoroafor, & Awe, 2015). The concept of inflation has been defined as a persistence rise in the general price level of a broad spectrum of goods and services in a country over a long period of time (Adeneye, Saheed, Alexander & Ibrahim, 2018; Mankiw, 2011).

Theoretically, there is no singular theory that will be sufficient to explain the nexus between teledensity and economic growth. However, among several theories on communication and telecommunication this study anchored on both Information theory originally proposed by Claude Shannon in 1948 and Telecommunications Enhanced Community (TEC) theory by Wilde and Swatman (1997) both make an attempt to theorize the relationship between the need of telecommunications and communities' sustainability.

For instance; Information theory studies the quantification, storage, and communication of information. It was originally proposed by Claude Shannon in 1948 to find fundamental limits on signal processing and communication operations such as data compression, in a landmark paper entitled "A Mathematical Theory of Communication". Its impact has been crucial to the success of the Voyager missions to deep space, the invention of the compact disc, the feasibility of mobile phones, the development of the Internet, the study of linguistics and of human perception, the understanding of black holes, and numerous other fields. Information theory in sum studies the transmission, processing, extraction, and utilization of information. This theory is well fitted to the activities of telecommunications network which could be described as a collection of transmitters, receivers, and communications channels that send messages to one another.

Similarly, Telecommunications Enhanced Community (TEC) theory by Wilde and Swatman (1997) make an attempt to integrate several theories on communication theory such as social interaction in a general computer network are discussed by Wellman (1997); Computer-mediated social networks by Sproull and Faraj (1997) as well as Romm and Clarke (1995), theory of Virtual Communities and Society.

Telecommunications Enhanced Community (TEC) theory proposed that if a community is to remain viable as a self-sustaining entity a necessary condition is that its component parts be supported by a critical mass of activity within the context of telecommunications network activities. The TEC is a community which has a variable mix of real and telecommunications services for reasons of community sustainability. According to Wilde and Swatman (1997), the growth in and diversity of computer networks since the mid-1970s has been truly astonishing. Since computing and communication technologies converged, the potential in both business and social networking applications has increased at an exponential rate, the social applications increasing at a rate unimagined in the early days of networking. The development of social computer networks now affects whole communities, the practice outpacing the development of the theoretical concepts on which they may be based. The adoption of electronic networking by whole communities is often a survival strategy in an environment of economic rationalism and declining population. The form of these networks varies from computer networks or virtual communities in that a network of electronic services is superimposed upon an existing geographic community. The intention is not only to survive but to actually strengthen the community. This is achieved by adopting electronic services and communication methods not only to retain the current population but to increase it by structuring an attractive lifestyle of integrated real and virtual services.

Empirically, elsewhere there are recent several kinds of the empirical literature on the effect of telecommunication or teledensity on the economic growth, however, in Nigeria little is been known on the impact of teledensity on the economic growth. For instance, Mamoun and Talib (2017) assess the impact of investment in the infrastructure of the telecommunications sector on economic growth in the Arab countries, using advanced econometric techniques, such as fully modified ordinary least squares, and panel data analysis utilizing cross-sectional data covering 12 countries and a period of 20 years 1996-2015. The study finds evidence that investment in infrastructure for the telecommunications sector has a positive and significant effect on economic growth in non-oil producing countries in the long-term. More so, the findings show that there is no impact of telecommunication on the economic growth of oil-producing countries

Haider and Sharif, (2016) analyze the impact of teledensity on the economic growth of South Asian countries from the period of 1994 to 2014. The GDP which is the proxy of economic growth was outed as a dependent variable, while predictors were gross fixed capital formation, labor force, and teledensity. The pooled regression methodology was employed. The findings of the study reveal that all variables are positive and significant in explaining the economic growth and teledensity contributes more among all variables. Sridhar and Sridhar (2014) investigate the relationship between telephone penetration and economic growth, using data for developing countries. Using 3SLS, the study estimate a system of equations that endogenizes economic growth and telecom penetration. Findings of the study show that the traditional economic factors explain the demand for mainline and mobile phones, even in developing countries. More so, the findings of the study reveal that mainline and mobile phones have positive impacts on national output when we control for the effects of capital and labor

Atsu, Agyei, Darbi, and Adjei-Mensah, (2013) investigate the long-run impact of telecommunication revenue and telecommunications investment on the economic growth of Ghana for the time horizon1976-2007. The study adopted the Augmented Dickey-Fuller and Phillips Perron unit root test to explore the stationarity property of the variables and the Engle-Granger residual-based test of cointegration to model an appropriate restricted error correction model. The outcome of the analysis produced mixed results. While telecommunications revenue does not contribute significantly to economic growth on the other hand telecommunications investment does.

Sulaiman, (2013) examines the impact of the GSM sub-sector on the teledensity (rate of growth of mobile telephone user). The study used quarterly time series data between 2001 and 2012 using OLS estimator. The findings of the study revealed that GSM has a positive impact on the teledensity rate and economic growth of Nigeria. However, inconclusiveness with the mixed outcome on the impact of teledensity and its implication on economic growth has created a gap in the literature.

3. METHODOLOGY

This section discusses the source of data collection, model specification and method of data analysis. The study employed Autoregressive Distributed Lag (ARDL) approach (i.e. the bounds testing approach to cointegration) popularized by Pesaran, Shin, and Smith, (2001) and group statistic in particular correlation and covariance analysis technique. The ARDL bounds test technique is applied to determine the existence of a long-run relationship in the model in order to investigate the impact of teledensity on economic growth in Nigeria between 1980 and 2018. More so, correlation and covariance analysis technique were adopted in order to examine if there is a correlation between teledensity, foreign direct investment, unemployment rate, and consumers' price index.

The ARDL bounds test technique has some econometric advantages over the Engle-Granger (1987) and the maximum likelihood-based approach proposed by Johansen and Juselius (1990) and Johansen (1991) cointegration techniques. Firstly, the bounds test does not require pre-testing of the series to determine their order of integration since the test can be conducted regardless of whether the series are purely I(1), purely I(0), or mutually integrated. Second, the ARDL framework is relatively more efficient in the case of small and finite samples. Third, we obtain unbiased estimates of the long-run model by applying the ARDL methodology (Harris and Sollis, 2003).

Secondary time series data was sourced from the World Bank/World Development Indicator, (2018) on variables which include; economic growth (GDP), teledensity (TLD), foreign direct investment (FDI), unemployment rate (UNER) and consumer price index (CPT) in Nigeria between 1980 and 2018. GDP is the proxy of economic growth serves as a dependent variable, while predictors were TLD, FDI, UNER, and CPI. The empirical study utilizes the economic growth model of the form:

$\log(GDP)_t = f(\log(TLD), \log(FDI), \log(UNER), \log(CPI))$……..…… (1)

Equation 1 is then expressed as a linear multiple regression equation shown as follows:

$\log(GDP) = \beta_0 + \beta_1\log(TLD) + \beta_2\log(FDI) + \beta_3\log(UNER) + \beta_4\log(CPI) + \varepsilon$…….(2)

Where: $\log(GDP)_t$ = log of Gross Domestic Product at time *t*, a proxy of economic growth

$\log(TLD)$ = log of teledensity at time *t*

$\log(FDI)_t$= log of foreign direct investment at time *t*

$\log(UNER)_t$ = log of unemployment rate at time *t*

$\log(CPI)_t$ = log of consumer price index at time *t*

β_0 is intercept; β_1, β_2, β_3 and β_4 = model coefficients of elasticity

ε = epsilon which represents a random variable called the error term

Therefore, this study adopt the unrestricted autoregressive distributed lag model developed by Pesaran *et al* (2001) and recently used by Zhong, Zhang, Shi, and Jiang (2019) to test for the existence of long-run relationship among electricity consumption, economic growth, and employment in China. The ARDL model bounds testing approach is represented as follows:

$$\log GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta \log TLD + \sum_{i=1}^{p} \beta_2 \Delta \log FDI + \sum_{t-1}^{p} \beta_3 \Delta \log UNER + \sum_{t-1}^{p} \beta_4 \Delta \log CPI + \delta_1 tld + \delta_2 fdi + \delta_3 uner + \delta_4 cpi + \mu_t \quad \text{..... (3)}$$

Where Δ is a difference operator, t is time, β_0 is an intercept term, β_1, β_2, β_3 *and* β_4 and $\delta 1$to $\delta 4$ are the coefficients of their respective variables and ps are the lag lengths. Other variables are as defined earlier.

To examine the existence of long-run relationship following Pesaran et al (2001), the study first test, based on Wald test (F-statistics), for the joint significance of the coefficients of the lagged levels of the variables, i.e.

Ho: $\delta 1 = \delta 2 = \delta 3 = \delta 4 = 0$ and H1: $\delta 1 \neq \delta 2 \neq \delta 3 \neq \delta 4 \neq 0$

The asymptotic critical values bounds, which were tabulated in Pesaran et al (2001), provide a test for cointegration with the lower values assuming the regressors are I(0), and upper values assuming purely I(1) regressors. If the calculated F-statistics exceeds the upper critical value, the null hypothesis is rejected, implying that there is cointegration. However, if it is below the lower critical value, the null hypothesis cannot be rejected, indicating lack of cointegration. If the calculated F-statistics falls between the lower and upper critical values, the result is inconclusive. Once cointegration is established, the conditional ARDL long-run model can be estimated as:

$$\log GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta \log TLD + \sum_{i=1}^{p} \beta_2 \Delta \log FDI + \sum_{t-1}^{p} \beta_3 \Delta \log UNER + \sum_{t-1}^{p} \beta_4 \Delta \log CPI + \mu_t \text{ .... (4)}$$

In the next step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\log GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta \log TLD_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta \log FDI_{t-1} + \sum_{i=0}^{p} \beta_3 \Delta \log UNER_{t-1} + \sum_{i=0}^{p} \beta_4 \Delta \log CPI_{t-1} + \vartheta ecm + \mu_t \quad \ldots\ldots\ldots\ldots (5)$$

Where ecm is the error correction representation of equation (3) and ϑ is the speed of adjustment.

Alternatively, the generalized ARDL model consists of a set of β endogenous variables

The generalized ARDL model consists of a set of β endogenous variables

$\log GDP_t = \beta_0 + \beta_1 \log TLD_{t-1} + \beta_2 \log FDI_{t-1} + \beta_3 \log UNER_{t-1} + \beta_4 \log CPI_{t-1} + \boldsymbol{\varepsilon}$

Substitute the variables understudy in this equation is written as follows;

$\Delta \log GDP_t = \beta_0 + \beta_1 \Delta \log TLD_{t-1} + \beta_2 \Delta \log FDI_{t-1} + \beta_3 \Delta \log UNER_{t-1} + \beta_4 \Delta \log CPI_{t-1} + ECM + \varepsilon_t$

β_0 = intercept, β_1, β_2, and β_3 = Coefficient of the independent variables

μ = white noise or error term

The apriori expectation**:** $b_1, b_2, > 0$; $b_3, b_4 < 0$

4. RESULTS AND DISCUSSION

The study examine the existence of long-run relationship between teledensity and economic growth spanning period of 1980 to 2018 The study proceeds on the ARDL long-run model estimated as presented in table 1, 2, 3, 4 and 5 as follows.

Table 1

ARDL Regression Estimation

Dependent Variable: LOG_GDP_
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LOG_TLD_ LOG_FDI_ LOG_UNER_ LOG_CPI_
Fixed regressors: C
Selected Model: ARDL(4, 4, 2, 3, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG_GDP_(-1)	0.586523	0.195548	2.999385	0.0090
LOG_GDP_(-2)	-0.195991	0.228131	-0.859114	0.4038
LOG_GDP_(-3)	-0.262318	0.242171	-1.083190	0.2958
LOG_GDP_(-4)	-0.287776	0.211534	-1.360424	0.1938
LOG_TLD_	0.079013	0.079107	0.998808	0.3337
LOG_TLD_(-1)	-0.076264	0.087927	-0.867352	0.3994
LOG_TLD_(-2)	0.243366	0.116998	2.080086	0.0551
LOG_TLD_(-3)	0.126908	0.090637	1.400188	0.1818
LOG_TLD_(-4)	-0.242479	0.075922	-3.193784	0.0060
LOG_FDI_	0.025287	0.024030	1.052297	0.3093
LOG_FDI_(-1)	-0.039659	0.017320	-2.289737	0.0369
LOG_FDI_(-2)	0.080434	0.028354	2.836814	0.0125
LOG_UNER_	0.256109	0.136243	1.879796	0.0797
LOG_UNER_(-1)	-0.442147	0.368898	-1.198564	0.2493
LOG_UNER_(-2)	0.095100	0.125188	0.759659	0.4592
LOG_UNER_(-3)	-0.799814	0.378821	-2.111324	0.0519
LOG_CPI_	-0.021185	0.124795	-0.169761	0.8675
LOG_CPI_(-1)	0.165275	0.164067	1.007361	0.3297
LOG_CPI_(-2)	-0.304385	0.108036	-2.817435	0.0130
C	11.44104	2.656605	4.306639	0.0006

R-squared	0.989057	Mean dependent var	10.11393
Adjusted R-squared	0.975196	S.D. dependent var	0.288444
S.E. of regression	0.045428	Akaike info criterion	-3.049823
Sum squared resid	0.030955	Schwarz criterion	-2.161053
Log likelihood	73.37191	Hannan-Quinn criter.	-2.743020
F-statistic	71.35492	Durbin-Watson stat	2.404032
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.
Source: Author calculations using Eview 10

Table 2 present, ARDL regression estimation, the first part of the output gives a summary of the settings used during estimation. The result shows that automatic selection (using the Akaike Information Criterion) was used with a maximum of 4 lags of both the dependent variable and the regressor. Out of the 2500 models evaluated, the procedure has selected an ARDL (4, 4, 2, 3, 2), model. The result show that LOG_GDP_(-1) lags of the dependent variable, economic growth, and LOG_TLD_(-2), LOG_TLD_(-4), LOG_FDI_(-1), LOG_FDI_(-2), LOG_UNER_(-

3) as well as LOG_CPI_(-2) respectively were all significant with their probability values of (0.01, 0.05, 0.01, 0.03, 0.01, 0.05 and 0.01) respectively which is less than or equal to 0.05 level of significance in explaining the existences of long-run relationship between the understudy variables.

The Coefficient sign simply described the direction of the relationship. The positive sign implies that both the dependent and independent variable move in the same direction, that is increase in one side leads to increase in other side vice-viser while, negative sign refers to the opposite direction which suggest that a decline in one side (independent variable) did not suggest reduction in another side (dependent variable). Furthermore, the result that R - Square is 0.99, which measures the goodness-of-fit, is 99%. This means that 99% of the changes in economic growth (GDP) are explained by the changes in the explanatory variables (TLD, FDI, UNER, and CPI). The F-statistic of 71.35 with a probability F-statistic of 0.000 less than 0.05 shows that the overall model is statistically significant at 5% level while the approximate DW = 2 shows there is the absence of serial autocorrelation.

In the second stage, of the ARDL Long Run Form and Bounds Test are computed as presented in table 3,4 and 5 below. The asymptotic critical values bounds, which were tabulated in Pesaran, Shin, and Smith, (2001), provide a test for cointegration with the lower values assuming the regressors are I(0), and upper values assuming purely I(1) regressors. If the calculated F-statistics exceeds the upper critical value, the null hypothesis is rejected, implying that there is cointegration. However, if it is below the lower critical value, the null hypothesis cannot be rejected, indicating lack of cointegration. If the calculated F-statistics falls between the lower and upper critical values, the result is inconclusive. Once cointegration is established, the conditional ARDL long-run model can be estimated.

Table 2
ARDL F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	4.368943	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	35		Finite Sample: n=35	
		10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532

Source: Author calculations using Eview 10

Table 2 present F-bound test on which decision on cointegration status are based: At 10%, 5%, and 2.5% significant level the calculated F-statistics of (4.37) is above the upper critical value I(1) of (3.09), (3.49) and (3.87) respectively indicating cointegration, therefore, the null hypothesis is rejected. This implies that there is cointegration among the variable under study. However, at 1% significant level the result is inconclusive. Subsequently, estimation of conditional ARDL long-run model as presented in table 4 below refers to appendix ii for detailed Conditional Error Correction Regression. However, table 4 presents a summary of the level equation.

Table 3
ARDL Long Run Form and Bounds Test Levels Equation

Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_TLD_	0.112581	0.020952	5.373390	0.0001
LOG_FDI_	0.056972	0.031005	1.837520	0.0860
LOG_UNER_	-0.768180	0.262584	-2.925465	0.0104
LOG_CPI_	-0.138238	0.029065	-4.756235	0.0003
C	9.866693	0.322022	30.63985	0.0000

EC = LOG_GDP_ - (0.1126*LOG_TLD_ + 0.0570*LOG_FDI_ -0.7682
*LOG_UNER_ -0.1382*LOG_CPI_ + 9.8667)

Source: Author calculations using Eview 10

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Table 3 present the Conditional Error Correction Regression outcome refers to appendix ii and level equation, which summarized the speed of error correction adjustment. The result shows that for the exception of FDI all the explanatory variables at the level equation were all statistically significant base on the p-value which is less than 0.05% level of significance. This result indicates that at level equation change in economic growth (GDP) is explained by a change in TLD, UNER, and CPI.

However, the EC equation suggests that TLD, FDI, UNER and CPI coefficient associated with this regressor is typically the speed of adjustment to equilibrium in every period. If variables are indeed cointegrated, we typically expect this coefficient to be negative and highly significant as been mirror in table 4 above. The positive sign associated with TLD and FDI meets the prior expectation. Similarly, the negative sign associated with UNER and CPI as well in conformity with study a prior expectation. However, the sign associated with each coefficient explained the direction of the relationship between the dependent variable and the predictors. TLD and FDI with a positive sign simply suggest that both variables are positively related to GDP; an increase in TLD and FDI lead to an increase in GDP and vice-viser.

On the other hand, UNER and CPI both variables were negatively related to GDP which implies that a decrease in UNER and CPI lead to an increase in GDP and vice-viser. Theoretically, according to the Keynes, an increase in unemployment and inflation leads to a decrease in the total output of an economy and subsequently slow economic growth (Jhingan, 2010).

Test of Hypotheses

The decision criteria to reject or accept the stated hypotheses is based on the p-value, where p-value is less than 0.05% level of significance null hypothesis is rejected otherwise, where p-value is greater than 0.05% alternative hypothesis is accepted.

Mathematically,

EC=LOG_GDP_-(0.1126*LOG_TLD_+0.0570*LOG_FDI_-0.7682*LOG_UNER_0.1382
*LOG_CPI_ + 9.8667)

P-value = (0.00) (0.08) (0.01) (0.00)

Statement of Hypotheses

$H0_1$: stated that teledensity does not have any significant impacts on economic growth in Nigeria between 1980 and 2018. The TLD p-value = 0.00 less than 0.05. Therefore, the study rejects the null hypothesis one and concludes that teledensity have positive and statistical significant impacts on economic growth in Nigeria between 1980 and 2018. The finding of this study is agreement with Mamoun and Talib (2017); Haider and Sharif, (2016); Sridhar and Sridhar (2014) that concludes that teledensity and telecommunication have positive and significant impact on economic growth.

$H0_2$: stated that there is no significant correlation between teledensity, foreign direct investment, unemployment rate and consumer price index between the period of 1980 and 2018. The result shows that all the probability value of correlogram residuals in table 6, supported by Maximum Likelihood Chi-square probability value in appendix ii is 0.00 less than 0.05% level of significance. Consequently, the study rejects the null hypothesis two and accepted alternative hypothesis by conclude that there is significant correlation between teledensity, foreign direct investment, unemployment rate and consumer price index in Nigeria between the period of 1980 and 2018. The findings is in conformity with outcome of Mamoun and Talib (2017)

5. CONCLUSION AND RECOMMENDATIONS

The study investigates the impact of teledensity on economic growth in Nigeria between the periods spanning from 1980 - 2018. Additionally, the study ascertains the significant correlation between teledensity, foreign direct investment, and the unemployment rate as well as the consumers' price index in Nigeria. The econometric analysis of autoregressive distributed lag (ARDL) findings reveals that both in the short and long run teledensity have positive and statistically significant impacts on economic growth in Nigeria between 1980 and 2018. Similarly, the correlation test, correlogram residuals, and Maximum Likelihood analysis shows that there is a significant correlation between teledensity, foreign direct investment, unemployment rate and as well as a consumers price index in Nigeria. Given the strong relationship between economic growth and teledensity, as well as perfect correlation between teledensity, foreign direct investment, unemployment rate and as well as consumers price index in Nigeria as evidently in this study, it is, therefore recommended that policy formulation that will encourage expansion of teledensity targeting on economic growth, foreign direct investment inflow, and reduction in the rate of unemployment and price stability should be formulated and implemented. Such policy includes accessibility, affordability of mobile telephone and network services, a low tariff on a voice call and data usage and subsidies on imports telecommunication types of equipment as well as tax holiday.

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