

Urbanisation and Income Inequality in Nigeria: Augmented Dickey Fuller Lag Approach

Magdalene E. L. Kenya¹, Chukuemeka R. Amadi², Joseph I. Onyema³, & Dennis B. Ewubare⁴
Rivers State University, Port Harcourt, Rivers State, Nigeria^{1,2,3,&4}
unchuksa@gmail.com&magarchi@yahoo.com, joseonyema@yahoo.co.uk⁴

Abstract

The study examines the impact of urbanisation on income inequality in Nigeria. The Augmented Dickey Fuller Lag unit root test and the ARDL Bounds cointegration test was used for the pre-estimation tests. The result of the analysis showed that urban population, infrastructure availability and urban fertility rate has a negative, significant relationship with income inequality, while access to electricity has a negative insignificant relationship with income inequality. This implies that the higher the urban population, the lower the income inequality, the higher the infrastructure availability; the lower the income inequality. Also, increased urban fertility rate results in a decrease in income inequality. Electricity access were also seen to reduce inequality levels though not statistically significant. The study concludes that urbanisation reduces income inequality significantly; therefore, the study recommends that the Electricity transmission company should prioritize expansion of National grid to boost electrical power supply and the National Electricity Regulation Commission should commit to lowering electricity tariffs aimed at improving affordability to promote access to electricity.

Keywords: Urbanisation, Income Inequality, Urban Population, Infrastructure Availability, Urban Fertility Rate

Introduction

Income inequality is a complex and multidimensional phenomenon, which requires careful handling in an attempt to proffer solutions aimed at reducing them. Income Inequality simply refers to the difference in earnings between the rich and the poor. It is a measure of how evenly or unevenly wealth is distributed throughout a population. Income inequality can be measured using the Gini Index or Gini coefficient, the Lorenz curve, the Palma ratio, the Theil Index and Kuznet's curve. This study would utilize the Gini coefficient as a measure of income inequality. The Gini coefficient is a typical measure of income inequality. The coefficient varies between 0 and 1, with 0 representing perfect equality and 1 representing perfect inequality.

Income inequality in Nigeria is a contentious problem, the difference between the -haves and the -have-nots can be seen all too clearly with the lavish lifestyles of a few juxtaposed amongst the squalor of the many. According to Adegoke (2013), Nigeria ranks among the top thirty countries in the world with respect to income distribution, with the poorest half of the population controlling only 10% of national income. Also, inflation prevalent in the country has fueled the gap between the rich and the poor thus deepening the income inequality further. Diverse reasons have been given as being responsible for aggravating income differentials in Nigeria namely Overpopulation, Low productivity, market imperfections, political instability, deficiency in education, and environmental degradation (Tamuno, 2013; Aidelunuoghene, 2014). Lowering income inequality is often viewed as important for achieving greater equality of opportunities to access economic, social, and political resources. Others view it as intrinsically undesirable because the existing income inequality is perceived to be the outcome of unfair access to resources and thus detrimental to social cohesion (Sharimakin, Oseni and Adegboye, 2015). While there is a dichotomy of views regarding income inequality, there is the belief that the reduction of income inequality could lead to increased and sustainable economic growth,

economic development, a safer Nigeria with less social conflict, among others (Wilkinson & Pickett, 2016).

Nurudeen and Ibrahim (2014) carried out an empirical study on the relationship between Poverty, Inequality and Economic Growth in Nigeria. The result showed that there is a unidirectional causal relationship running from RGDP to poverty which means that an increase in GDP in Nigeria causes high level of poverty. Nguyen and Nguyen (2019) examined the impact of urbanization on income inequality in Vietnam using the regression estimation method with panel data. The results showed that in the long term, urbanization has a negligible impact on reducing income inequality though it has an impact in the short term. Wu and Rao (2017) investigated inequality in China, focusing on identifying the main causes of inequality. The main objective of the study was to examine the relationship between urbanization and income inequality using provincial data. The review of related literature has shown a gap in examining the impact of urbanisation in Nigeria. The persistence of income inequality in Nigeria, some authors have posited, could have emanated from her urbanisation rate and it begs the question: does urbanisation fuel income inequality in Nigeria? This has to be looked into as a possible means to bridge the widening gap between the rich and the poor in Nigeria. It is on this backdrop that this study seeks to examine the impact of urbanisation on income inequality in Nigeria.

Literature Review

Dual City Theory

John Friedman put the dual city theory forward and it states that globalization and urbanisation lead to a new form of economic polarization marked by the emergence of two cities in urban centres: a global city made up of the rich and an urban hinterland where the marginalized poor settle. He described the global city as the epicenter of the urban town where financial and corporate power lies and act as hubs for the flow of information, capital and services. The urban hinterland is described as the marginalized and excluded areas within the same city which is characterized by poverty, unemployment and social exclusion. The urban hinterland usually provides the labour force for the global city but lacks access to the opportunities and benefits enjoyed by its global counterparts. This gives rise to a dual city: one, a symbol of prosperity and the other represents poverty and social inequality thereby perpetuating income inequality. Experts have different thoughts on the dual city theory. According to Joel Rast, author of *The origins of the dual city*. He is of the opinion that the division is a result of historical policy decisions that prioritized economic growth over social equity; while Saskia Sassen is of the opinion that the dual city is not spatial segregation but also about the expulsion of low-income and marginalized groups from the urban economy. Mike Davis argues that the dual city is a product of neoliberal policies, which prioritize market-driven growth over social equity.

Gentrification Theory

This theory was propounded by Ruth Glass to describe the influx of middle of middle-class individuals into a working-class neighbourhood thereby displacing the former residents of those localities. The theory revolves around the process of changing economic value of a neighbourhood called gentrification and occurs when people with higher incomes move over from neighbouring cities and towns, increasing investments and infrastructure. While gentrification fosters economic development, lower crime rates and increased investment; it also fuels income inequality. Gentrification is the transformation of a neighbourhood from low value to high value. Residents are displaced from rising rents and living costs. Scholars have diverse views on the gentrification theory. Neil Smith views gentrification as a form of revanchist urbanism where the urban elite seeks revenge against marginalized groups, emphasizing that gentrification leads to displacement of low-income, working class and minority residents. On the

other hand, Sharon Zukin views gentrification as a process of urban pioneerism where affluent individuals revitalize neighbourhoods emphasizing the role of cultural capital in attracting gentrifiers. Richard Florida sees gentrification as a catalyst for economic growth, innovation and urban renewal as he emphasizes that gentrification attracts talented individuals, fostering a competitive advantage.

Concept of Urbanisation

Broadly, urbanisation is defined as the increase in the number of people living in towns and cities, and is coined from the word 'Urban'. The term 'Urban' lacks a very specific definition as it is described in terms of political status, demographic attributes, economic variables and socio-cultural behaviours (Gibbs, 1966). According to Macura (1961), about thirty definitions of urban are in use but none of them is very succinct and this makes it difficult for international comparisons. Despite the problems, various researchers define the term urban from various perspectives, mostly based on the discipline. Geographers are space – oriented and hence tend to link urban with the space and the people that occupy the space. To geographers, an area is defined as urban based upon a certain concentration of population. Urban, to them, is a settlement agglomeration with a certain density of population and/or a minimum required population threshold. This concentration is usually within a specified area hence geographers to define urban also use density sometimes. Since there is no standard minimum threshold for determining an area as urban, every country has its own definition for urban when using demography as a means of definition. In Ghana, a settlement becomes urban on attaining a population size of 5,000. In Sierra Leone, the minimum population threshold for designating an area as urban is 10,000. While in Cameroon, settlements with a population of 2,000 and above are considered urban. In Nigeria, a settlement is classified as urban if it contains 20,000 people or more (Williams, 2003).

Income Inequality

Income inequality is defined as the inequitable distribution of income among the members of a particular group, an economy or society. Joseph Sigmund defines Income Inequality as the disparity in the distribution of income among individuals or households within a society. Paul Krugman defines income inequality as the extent to which the distribution of income deviates from equality, with some individuals or groups receiving much more than others. Income inequality according to Amartya Sen is a measure of the disparity in the command over resources that different individuals or groups have. Income inequality can be measured generally using the Lorenz curve, the Gini coefficient and the General Entropy class. The Gini coefficient is the most frequently used measure and it is close to the Lorenz curve. The Gini coefficient measures income inequality based on the Lorenz curve and has values between 0 and 1 where figures closer to 0 signify more equality in the distribution, and values closer to 1 show a higher inequitable distribution of income (Zhang & Naceur, 2019).

Empirical Literature

Adinde (2017) examined the impact of income inequality on Economic Growth in Nigeria focusing on examining whether Kuznet's curve holds and suggest probable and effective policy measures to help reduce the gap between the rich and the poor. A quadratic function was estimated and the results confirm that the Kuznet's inverted-U curve does not hold for Nigeria. The Granger causality test was also conducted to determine the direction of the relationship between income inequality and economic growth. The results indicate that GDP granger causes income inequality in Nigeria. Finally, a multiple regression analysis was employed to estimate the relationship between the Gini coefficient, GDP and other explanatory variables. The results suggest that GDP, CPI, population growth and education are all true determinants of income

inequality in Nigeria. The findings from the research showed that as economic growth increases, the level of income inequality actually worsens in Nigeria.

Nurudeen and Ibrahim (2014) carried out an empirical study on the relationship between Poverty, Inequality and Economic Growth in Nigeria using bound testing approach to cointegration and Granger causality test to determine the relationship between poverty, inequality and economic growth in Nigeria. A secondary time series data was used from 2000 to 2012. The result showed that there is a unidirectional causal relationship running from RGDP to poverty which means that an increase in GDP in Nigeria causes high level of poverty. The result further infers that the bidirectional causal relationship existed between literacy and poverty. The study also indicated that population growth Granger causes literacy while unidirectional causality exists between poverty and population. The policy implication is that policies aimed at reducing the gap between rich and poor should be vigorously pursued in order to minimize inequality.

Khanbur and Zhuang (2013) studied the impact of the change of two sectional economic structure and urbanization that affect inequality in Asia. Based on the Kuznets model and the inequality measurement method using the Theil index, this study analyzes four specific countries: China, India, Indonesia, and the Philippines. Their results show the following. First, the effect of urbanization and the economic structure change on income inequality depends on the specific country. Urbanization contributes about 300% to the increase in inequality in the Philippines, more than 50% in Indonesia, and nearly 15% in India. However, it reduces inequality in China. Meanwhile, the change in the urban-rural income gap reduces inequality in Indonesia and the Philippines, but it increases inequality in India and China. Moreover, in China, the increase in income inequality is mainly due to the raise of 43% rural inequality. This is contrary to the popular point of view that increasing income inequality is the result of the expansion in the urban-rural income gap and the rising urban inequality.

Wu and Rao (2017) investigated inequality in China, focusing on identifying the main causes of inequality. The main objective of the study was to examine the relationship between urbanization and income inequality using provincial data. Panel data in 20 provinces was collected from the China Statistical Yearbook for five years include 1998, 2000, 2002, 2005, and 2010. The empirical analysis was based on ordinary least squares estimator and fixed and random effects models, showing a strong inverted -U-shaped relationship between inequality and urbanization. An urbanization rate of 0.53 has been determined, with the implication that provinces with higher levels of urbanization can reduce income inequality. Nguyen and Nguyen (2019) examined the impact of urbanization on income inequality in Vietnam using the regression estimation method with panel data. The results showed that in the long term, urbanization has a negligible impact on reducing income inequality though it has an impact in the short term.

Methodology

The data collection method is purely from secondary source. The study used ex post facto design and annual time series data. Specifically, the data focused on the urbanisation indicators (Rural Urban Migration, Urban Employment Level, Urbanisation Rate and Urban Birth Rate) and the Gini coefficient as proxy for Income Inequality. The datasets were obtained from the United Nations Statistics Division, the World Bank and the National Bureau of Statistics (NBS).

$$IEQ = f(URBP, IFAV, UFER, AEC) \quad (1.0)$$

Where: IEQ = Income Inequality
 URBP = Urban Population
 IFAV = Infrastructure Availability

UFER= Urban Fertility Rate

AEC = Access to Electricity

$$IEQ = \pi_0 + \pi_1 URBP + \pi_2 IFAV + \pi_3 UFER + \pi_4 AEC + U_t \quad (1.1)$$

A priori expectation- URBP, IFAV, UFER and AEC >0.

For the data analysis, the Auto Regressive Distributed Lag (ARDL) was used. The benefit of this estimation method is that it offers flexibility in modeling complex relationships and it is able to provide robust estimates of the long run relationship between variables. The equation for the ARDL is:

$$\Delta IEQ = \beta_{10} + \Sigma \beta_{11i} IEQ-i + \Sigma \beta_{12i} URBP-i + \Sigma \beta_{13i} IFAV-i + \Sigma \beta_{14i} UFER-i + \Sigma \beta_{15i} AEC-i + \varepsilon_{1t} \quad (1.2)$$

Data Analysis and Results

The time series data were first analysed for stationarity using the Augmented Dickey Fuller(ADF) test and the results are presented below:

Table 1: Augmented Dickey Fuller (ADF) Unit Root Test

Variables	Levels		First Difference		Order of Integration	P-value
	ADF Statistics	5% Critical Value	ADF Statistics	5% Critical Value		
LINQ	-0.372706	-1.952066	-2.899240	-1.952066	I(1)	0.0052
LURBP	0.247381	-2.957100	-10.50984	-2.960411	I(1)	0.0000
LIFAV	-2.304537	-2.957110	-6.013986	-2.960411	I(1)	0.0000
LUFER	-0.086474	-2.957110	-6.906472	-2.960411	I(1)	0.0000
LAEC	-3.231057	-2.971853			I(0)	0.0286

Source: Author Computation 2024* Level of significance at 5%

This study employs the Augmented Dickey-Fuller (ADF) unit root tests to check the order of integration of the variables and the results are presented in Table1.0. The results of Augmented Dickey-Fuller (ADF) showed that the variables are integrated in different order or a combination of I(0) and I(1) series. The ADF result revealed that LAEC was stationary at levels I(0) while, LINQ, LURBP, LIFAV, and LUFER, are stationary after first differencing I(1). This condition makes the Autoregressive Distributive Lag (ARDL) Bounds test approach to co-integration appropriate for investigating the long-run relationship among these variables.

Table 2: ARDL Bounds Test of Cointegration

F-statistics	6.137325	4
Significance	I (0)	1(1)
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Researcher's Computation (2024), E-views 12.0

From Table 2 the bound test result indicates that there exist long run relationships amongst the variables as the F-statistic value of 6.137325 exceeds the lower and upper bound critical values. Thus, we reject the null hypotheses of no long run relationship and accept its alternative. This means that there is a long-run relationship between urbanisation and income inequality in Nigeria. The long run and short run dynamic relationship between urbanisation and the economic development in Nigeria was estimated using ARDL method. The results are presented in Table 3

Table 3: ARDL Long-run Result (Dependent Variable = LINQ)

Variable	Coefficient	Std. Error	t-statistics	Prob
LURBP	-0.699271	0.229117	-3.052028	0.0015
LIFAV	0.102914	0.064108	1.605320	0.1344
LUFER	-0.099068	0.041874	-2.365851	0.0270
LAEC	2.277778	1.434955	1.587351	0.1384
EC = LINQ - (-0.6993*LURBP + 0.1029*LIFAV -0.0991*LUFER + 2.2778 *LAEC)				

Source: Authors' Computation 2024

Table 3 of the Autoregressive Distributive Lag (ARDL) long-run result suggest a negative -0.699271 relationship between the logarithm of urban population (URBP) and the log value of income inequality (INQ) as a proxy for economic development. This means that a unit increase in LURBP is associated with a decrease in annual LINQ of 0.70% yearly. However, the p-value of 0.0015 indicates that there is a statistical significant relationship between LURBP and LINQ. Investigation of the log value of infrastructural availability (LIFAV) advocates a positive +0.102914 relationship with the log value of income inequality (INQ) as a proxy for economic development. The result denotes that a unit rise in LURBP is related to an increase in annual LINQ of about 0.10 percent increase per year. Astoundingly, the p-value of 0.1344 shows that there is no statistical significant relationship between LIFAV and LINQ. Furthermore, the log value of urban fertility rate (LUFER) suggests a negative -0.099068 relationship with the log value of income inequality (LINQ) as a proxy for economic development. This implies that a unit increase in the log value of urban fertility rate (LUFER) will result to about 0.10 percent in annual LINQ per yearly. Conversely, the p-value of 0.0270 signpost that there is a statistical significant relationship between LUFER and LINQ. Finally, the log value of access to electricity (LAEC) suggest a positive +2.277778 relationship with log value of income inequality (LINQ) as a proxy for economic development. This suggests that a unit increase in the log value of access to electricity (LAEC) will result to about 2.3 units in LINQ per yearly. Conversely, the p-value of 0.1384 indicates that there is no statistical significant relationship between LAEC and LINQ.

Table 4: Ramsey Reset Test

	F-Statistic	Prob-Value
Ramsey Reset Test	0.475537	0.5047
Breusch-Godfrey Serial Correlation LM Test	0.624110	0.5554
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.732311	0.7288

Source: Authors' Computation 2024, E-views 12.0

From Table 4, the results of the diagnostic test shows that the linearity test using Ramsey Reset test indicates that the f-statistic (0.475537) with computed p-value of 0.5047 which is greater than 5 percent (0.05) critical value, hence the study reject the null hypothesis and conclude that the model is correctly specified. The result of the Serial or Autocorrelation Test using Breusch-Godfrey Serial Correlation LM Test shows that the f-statistic is 0.624110, with a Chi-Square probability value is 0.5554. This indicates that the probability value of about 56 percent (0.5554) is greater than 5 percent (0.05) critical value; hence the study confirms no serial correlation in the model. The result of the heteroscedasticity test using Breusch-Pagan-Godfrey test shows that the f-statistic is 0.732311 with a Chi-Square probability value of 0.7288. The result suggests that there is no evidence of heteroskedasticity in the model since the probability Chi-square value is

more than 5 percent ($P > 0.05$). So, residuals do have constant variance which is desirable in regression meaning that residuals are Homoscedastic.

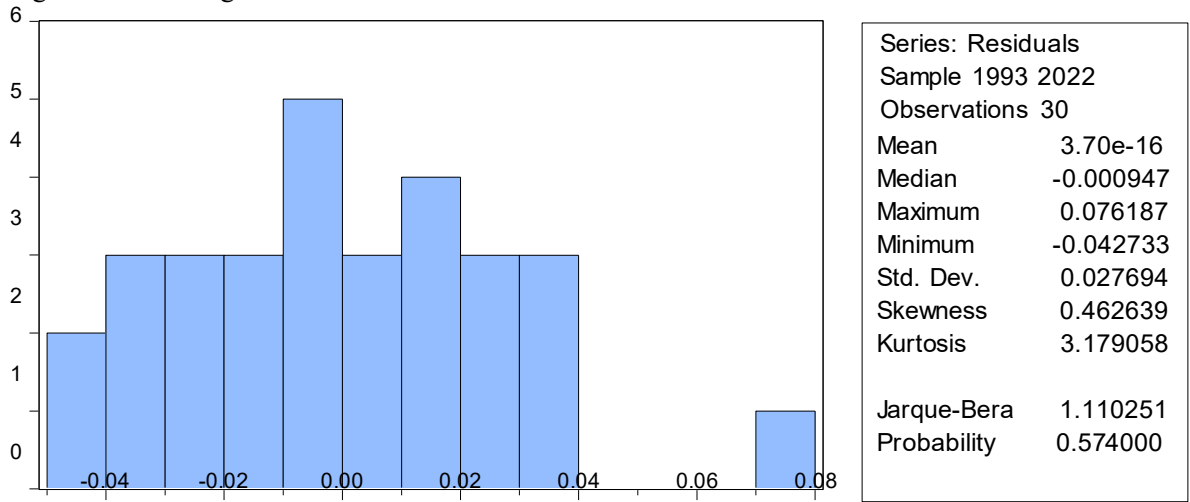


Figure 1: Normality Test

The Figure 1 shows summary of the normality test with Jarque-Bera value of 1.110251 and a corresponding probability value of 0.574000 more than 0.05 level of significance, indicating that the residuals are normally distributed.

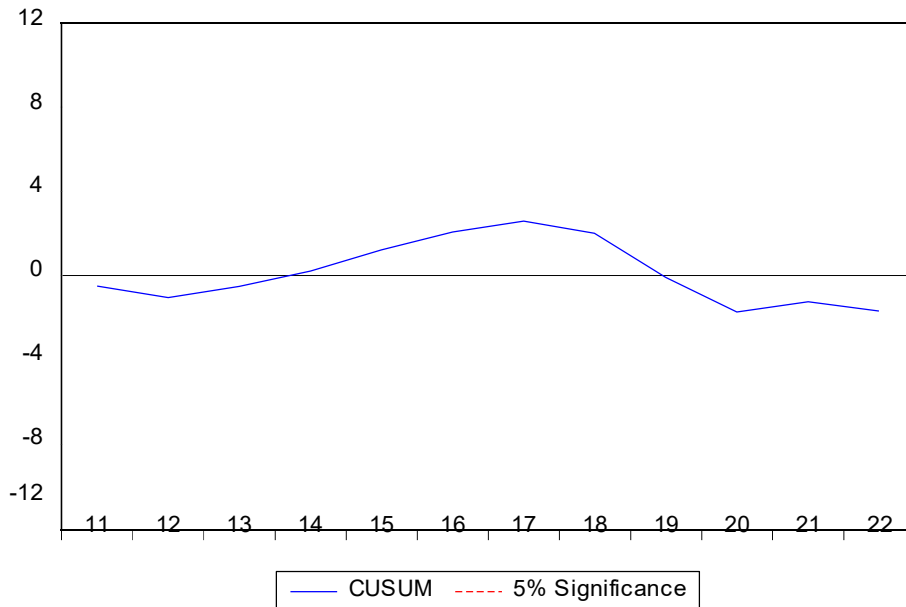


Figure 2: Stability Test

Discussion of Findings

The study centres on the relationship between urbanisation and income inequality in Nigeria. The analysis using the Auto-Regressive Distributive Lag (ARDL) Model reveals a striking economic insight: Urban population (URBP) exhibits a negative relationship with income inequality (INQ) in the long-run. This suggests that as migration from rural areas to urban centers increases,

income disparities tend to lessen. Interestingly, this negative relationship between urban population growth and income inequality conform with traditional economic expectations, where a rise in urban population is typically anticipated to reduce income inequality by providing more opportunities and access to resources. However, the p-value of the results indicates that this relationship is statistically significant, meaning that urban population growth have a significant impact on income inequality. Consequently, the study rejects the null hypothesis, concluding that there is a significant relationship between urban population and income inequality in the long run. These findings are not consistent with previous research by Bloom et al. (2008) further validating the conclusion that urban population had a crucial effects in alleviating poverty. Analysis using the Auto-Regressive Distributive Lag (ARDL) Model reveals a compelling economic finding: infrastructure availability (IFAV) has a negative relationship with income inequality (INQ) in the previous and second years of the short-run. This indicates that as infrastructure, such as roads and bridges, expands, income disparities tend to decrease. This negative relationship aligns with economic theory, which posits that improved infrastructure fosters economic growth, enhances productivity, and provides greater opportunities for all, thereby reducing income inequality. The p-value of the results confirms that this relationship is statistically significant, leading the study to reject the null hypothesis and conclude that there is indeed a significant relationship between infrastructure availability and income inequality. The analysis using the Auto-Regressive Distributive Lag (ARDL) Model uncovers a significant economic insight: urban fertility rate (UFER) have a negative relationship with income inequality (INQ) in the short run and long-run. This suggests that as urban fertility rate increases, income disparities tend to diminish. This negative relationship aligns with economic theory, which posits that increase in urban fertility rate enhances opportunities for education, entrepreneurship, and economic participation, thereby reducing income inequality. Also, the p-value of the results indicates that the urban fertility rate UFER on income inequality is statistically significant. As a result, the study rejects the null hypothesis, concluding that there is a significant relationship between urban fertility rate, and income inequality in this context. The analysis using the Auto-Regressive Distributive Lag (ARDL) Model reveals an intriguing and somewhat unexpected economic insight: access to electricity (AEC) has a negative relationship with income inequality (INQ) in the short run. This suggests that as access to electricity improves, income disparities actually lessen. This negative relationship between access to electricity and income inequality aggress with economic theory, which generally expects that increased access to electricity should spur investment, boost employment, and ultimately reduce income inequality. However, the p-value of the results shows that this relationship is statistically insignificant, leading the study to accepting the null hypothesis and concludes that there is, in fact, no significant relationship between access to electricity and income inequality. These findings are not consistent with previous research by Aliyu and Amadu (2017) validate the conclusion that access to electricity encourage poverty alleviation.

Conclusion

This study examines the effect of urbanisation on income inequality in Nigeria. The findings of the study showed that urban population, infrastructure availability, urban fertility rate significantly reduces income inequality in Nigeria while access to electricity reduces inequality in Nigeria, though not significantly. Premised on the findings of the study, it is concluded that urbanisation significantly reduces income inequality in Nigeria. It is therefore concluded that urbanisation significantly contributes to the reduction of income inequality in Nigeria.

Recommendations

The study recommends that:

1. The Federal Ministry of Works and Housing and the Nigerian Sovereign Investment Agency should prioritize infrastructure projects by investing in affordable housing, clean water, and sanitation infrastructure to lure rural dwellers to urban centres in order to boost urban population with a view to reducing income inequality directly while improving health outcomes.
2. Government budgets should be formulated to allocate huge resources to infrastructure development in the urban areas to ensure infrastructure availability in urban centres.
3. Health Centres should be equipped with manpower and equipment to ensure safe maternity to encourage women of child bearing age to procreate in order to boost urban fertility rates, birth rates which would ultimately result to an increase in urban population.
4. The Electricity transmission company should prioritize expansion of National grid to boost electrical power supply and the National Electricity Regulation Commission should commit to lowering electricity tariffs aimed at improving affordability to promote access to electricity.

Contribution to Knowledge

Sufficient attention has not been given to how urbanisation can be employed or utilized to achieve a more equitable distribution line in Nigeria; as evidenced by a dearth of empirical literature on the subject matter. This study set out to investigate the effect of urbanisation on income inequality using independent variables namely: urban population, infrastructure availability, urban fertility rate and access to electricity. The results showed that each of the variables reduced income inequality in Nigeria. Thus, this study has brought to fore an avenue to stem down income inequality in Nigeria. This study also serves by adding to the existing stock of knowledge and filling the gap that exists in academic literature. The study has contributed to stock of knowledge and expanding literature on the effect of urbanisation on Income inequality in Nigeria.

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