



(RESEARCH ARTICLE)



## The impact of education on income inequality: A comparative analysis of Nigeria and South Africa

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### Abstract

Nigeria is plagued with the problem of poverty, and this is exacerbated by the problem of income inequality. Inequality has also limited the opportunities of individuals in Nigeria as Valentine (1968) said that “the essence of poverty is inequality; in slightly different words the meaning of poverty can be said to be deprivation”. The Gini coefficient of Nigeria lies between 40 and 60% (Bakare A.S, 2012). Also, South Africa has one of the worst cases of income inequality in the World, As South Africa’s Gini index increased from 0.64 in 1995 to 0.69 in the year 2005 which is one of the highest in the world. Studies will be carried out on both countries to further understanding on the relationship between income inequality and Education. With the aid of descriptive and empirical analysis, this study aims at identifying factors that are responsible for the high levels of income inequality, with a focus on Education growth in Nigeria and South Africa. Both countries will be compared using time series data spanning from 1981 to 2016.

The study examines the effect of education on income inequality in Nigeria and South Africa and examines if a long-run relationship exists between education and income inequality in Nigeria and South Africa. The Johansen Cointegration and Vector Error Correction Model were applied. The result of the Johansen Cointegration shows that there is a long-run relationship between the independent variables –Inflation, Real Gross Domestic Product, Foreign Direct Investment and Primary School Enrollment rate in Nigeria and South Africa. Findings also attest to the impact of education on income inequality in Nigeria but not in South Africa as further research showed that the income inequality situation in South Africa was connected to racial segregation. It was concluded that the government should devote more attention to this dwindling sector so as to reduce the income gap in the Country.

**Keywords:** Education; Income; Inequality; Poverty

### 1. Introduction

Income inequality has been an issue of contention in many economies as the rate is becoming alarming, the divide between the rich and the poor is growing every day. Different reasons for this have been given namely rising bargaining power of top earners, technological advancements thereby reducing the need for lower skilled workers, increase in complexities of the business world, but a major determinant which is education is going to be the focus of this research work.

Income Inequality is disparity in income received by various individuals in the economy. It is the disparity in remuneration received by households or individuals in an economy. Over the years countries generally have experienced economic growth, but there is a growing consensus that rewards from growth are not evenly shared among individuals in the economy. Some degree of inequality is a common feature of a functioning economy, although extreme levels of inequality have severe negative long-term effects (Champernowne and Cowell, 1998). There are many social

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vices attributed to inequality, some of which are lower life expectancy, higher crime rate and high rates of corruption (Wilkinson and Pickett, 2009). These implications affect everyone in the country.

Education is a key determinant of income inequality as places with unequal education opportunities have seen a rise in income inequality. Children who do not have access to education will find it hard to get meaningful jobs as technological advancements have increased the demand for skilled workers thereby contributing to the income gap. Economic trends show that there is a positive relationship between education inequality and income inequality. Education is a powerful tool by which families and societies can improve their lives and become more productive. Although with rising levels of income inequality coupled with problems of cost of education, the pursuit of education seems to widen rather than reduce the great divide between the rich and the poor according to finance online publication as access to quality education is becoming more difficult for those at the bottom spectrum to attain.

### **1.1. Research questions.**

The research questions are:

- Does education significantly reduce income inequality in Nigeria and South Africa?
- To what extent does education reduce the income inequality gap in Nigeria and South Africa?

#### *Objectives of the study*

- The aim of the research work will be to
- To examine if education significantly reduces income inequality in Nigeria and South Africa.
- To analyze the effects of education access on income inequality in Nigeria and South Africa.

#### Research hypotheses

To address the risk questions, the research hypotheses stated in the null and alternative forms are:

- $H_0$ : There is no significant relationship between education and income inequality in Nigeria and South Africa
- $H_1$ : There is a significant relationship between education and income inequality in Nigeria and South Africa
- $H_0$ : Education has a negative impact on income inequality in Nigeria and South Africa
- $H_1$ : Education has a positive impact on income inequality in Nigeria and South Africa

### **1.2. Scope of the study**

The study is centered on investigating the relationship between access to education and its impact on income inequality in Nigeria and South Africa. The research will be to find out if increase in access to education in Nigeria overtime has had any significant impact on income inequality over the years if it has increased or reduced income inequality in Nigeria. The research will cover a period of 36 years which goes with the central limit theorem. This time period is significant to this study as both countries experienced a rise in inequality levels and also an increase in access to education. Notably South Africa achieved UPE during this period.

### **1.3. Research method.**

I will make use of Ordinary least square method and Johansen Co integration analysis to test the relationship between the dependent variable which is the Income Gini index and the independent variables. The dependent variable will be Gini index which will represent the level of income inequality while the independent variables are Tertiary School Enrolment Rate representing the level of schooling, Real GDP per capital, Inflation, Foreign Direct Investment, Primary School Enrollment.

### **1.4. Structure of the study**

The study comprises five chapters. The first is the Introduction while the second chapter, which is the Literature Review will provide literature from other researchers on the topic at hand. The third chapter contains Research Methodology. The fourth chapter contains the Presentation of Analysis and interpretation of regression results. The last chapter presents the conclusion.

## **2. Literature review**

### **2.1. Education in Nigeria**

Education in Nigeria has passed two significant stages, the colonial and post-independence eras. The Christian missionaries arrived in 1842 on the coastal area of the southern part of Nigeria and introduced western education. The aims of education as given by the missionaries were to enable recipients to learn to read the bible in English and the local language, gardening, and agriculture as well as train local school masters, catechists, and clergymen. Inequality in Education began to set in due to the indirect rule of the British policy and so this restricted access of missionaries in the northern protectorates.

### **2.2. Education in South Africa**

Access to education in South Africa has increased over the years as they have met the MDG goal and spends 18.5% of its budget on education, also according to statistics South Africa has achieved universal access to Primary Education as over 98% of South African Children attend School and this shows that education to a large extent has been made available to all in the country Brenda Modisaotsile (2012).

Education in South Africa is regulated by two departments which are the Department of Basic Education (DBE) which handles primary and secondary education and the Department of Higher Education and Training (DHET) which handles tertiary education and vocational training. In 2010 basic education comprised of 12,644,208 students and 439,394 teachers. In 2009, higher education comprised 837,779 in higher education institutions and 420,475 students in state-controlled FET institutions. The Government funds the departments of education from taxes. Basic Education comprises 12 grades with the primary phase comprising of grade 1-7 while the secondary phase comprises grades 8-12.

### **2.3. Income inequality in Nigeria**

Nigeria is plagued with the problem of poverty, and this is exacerbated by the problem of income inequality. Inequality has also limited the opportunities of individuals in Nigeria as Valentine (1968) said that “the essence of poverty is inequality; in slightly different words the meaning of poverty can be said to be deprivation”. The Gini coefficient of Nigeria lies between 40 and 60% (Bakare A.S, 2012). Also, in vision 2020 it was asserted that though years of efforts put into the development process the huge divide between the rich and the poor continues to grow wider and remains a challenge in the development process in the country. This was previously stated in vision 2010. As a result of the strong link between poverty and income inequality, fighting inequality has become one of the top priorities of the Nigerian Government as different studies have identified income inequality as a major cause of widespread poverty, Ali and Torbecke (2000) in their cross country African data discovered that income distribution has more effects on poverty than growth, also Ravallion (1997) estimated that income-growth elasticity of poverty was a decreasing function of income inequality.

### **2.4. Income inequality in south Africa**

The post-apartheid period of 1994 in South Africa was a period of positive economic growth and was one of the most successful period in the country’s history but with this they have also experienced high levels of inequality particularly in income distribution, also during this period poverty levels did not reduce significantly as the World Bank study showed an increase in poverty levels using the \$2 per day line from 32 percent to 34 percent. South Africa’s Gini index increased from 0.64 in 1995 to 0.69 in the year 2005. Lorenz curve also shows that in 1995 the bottom 80 percent of South Africa’s population accounted for just 30 percent of the total expenditure, by 2005 the same share of population accounted for 25 percent of the total expenditure, from another angle in 1995 the richest 20 percent were responsible for 70 percent of the total expenditure but coming to 2005 they accounted for 75 percent of the total expenditure, (Haroon Bhorat and Carlene Van Der Westhuizen, 2012).

### **2.5. Education and income inequality**

Education plays a significant role in income inequality as it determines an Individual’s employment opportunities and level of pay and is also an indicator of an individual’s productivity in the labor market. Mincer (1958) and Becker and Chiswick (1966) opined that the relationship between education and income inequality is ambiguous as the effects of education on income inequality can be positive or negative but overall, the impact of the former on the latter depends on various factors for example the rate of return on education.

### 3. Research methodology

#### 3.1. Model specification

This section introduces the model which will be employed to examine the relationship between the dependent variable which is income inequality and the independent variables. The model is therefore given as thus:

$$GINI_{NIG} = f(RGDP_{NIG}, PSEE_{NIG}, INF_{NIG}, FDI_{NIG}) \quad (2)$$

$$GINI_{SA} = f(RGDP_{SA}, PSEE_{SA}, FDI_{SA}, INF_{SA}) \quad (3)$$

Where:

GINI = Gini index; RGDP = Real Gross Domestic Product; TSEE = Tertiary School Enrolment Rate; FDI= Foreign Direct Investment (% of gross); INF= Inflation (GDP deflator); f = Functional relationship

The model in its non-linear form is therefore represented as

$$GINI_{NIG} = RGDP_{NIG}^{\alpha_1} + PSEE_{NIG}^{\alpha_2} + FDI_{NIG}^{\alpha_3} + INF_{NIG}^{\alpha_4} \quad (4)$$

$$GINI_{SA} = RGDP_{SA}^{\alpha_1} + PSEE_{SA}^{\alpha_2} + FDI_{SA}^{\alpha_3} + INF_{SA}^{\alpha_4} \quad (5)$$

The equation above is in its non-linear form and therefore cannot be estimated, so it has to be linearized to enable estimation. Hence in its econometric linear form we have:

$$GINI_{N} = \alpha_0 + \alpha_1 RGDP_{NIG} + \alpha_2 PSEE_{NIG} + \alpha_3 FDI_{NIG} + \alpha_4 INF_{NIG} + \mu_t \quad (6)$$

$$GINI_{SA} = \alpha_0 + \alpha_1 RGDP_{SA} + \alpha_2 TSEE_{SA} + \alpha_3 FDI_{SA} + \alpha_4 INF_{SA} + \mu_t \quad (7)$$

With  $\mu_t$  representing the error term

Taking the natural logarithm of both sides of equation (3) and assuming linearity among the variables gives:

$$\ln GINI_{N} = \alpha_0 + \alpha_1 \ln RGDP_{NIG} + \alpha_2 \ln PSEE_{NIG} + \alpha_3 \ln FDI_{NIG} + \alpha_4 \ln INF_{NIG} + \mu_t \quad (8)$$

$$\ln GINI_{SA} = \alpha_0 + \alpha_1 \ln RGDP_{SA} + \alpha_2 \ln TSEE_{SA} + \alpha_3 \ln FDI_{SA} + \alpha_4 \ln INF_{SA} + \mu_t \quad (9)$$

Where:

$\alpha_0$  = Intercept term;  $\alpha_1$ - $\alpha_4$  = Slope coefficients;  $\mu_t$  = Stochastic error term;  $\ln RGDP$  = natural log of real gross domestic product;  $\ln TSEE$  = natural log of Tertiary School Enrolment Rate;  $\ln FDI$  = natural log of Foreign Direct Investment;  $\ln INF$  = natural log of Inflation

#### 3.2. Estimation techniques

The estimation techniques used in this research are herein discussed.

##### 3.2.1. Unit root test

Unit root test is a test for stationarity in time series. It shows the order of integration and how many times a variable must be integrated to become stationary. While carrying out integration all the variables in the model must be stationary or else outcomes of the analysis could be spurious. The Augmented Dickey fuller test will be carried out in this study as it is suitable for large sample sizes. Other test that could be carried out include the Elliot Rothenbeg-Stock test which includes the P-test and the DF-GLS test, the Schmidt-Phillips test, the Phillips-Perron test, the Zivot-Andrews test, the Automated Dickey-Fuller test.

### 3.2.2. Co-integration

Following the determination of the order of the integration the co-integration test can be conducted. co-integration is used to determine the long-run relationship between variables. Economic theory suggests a long-term relationship between economic variables may diverge from each other in the short run, economic forces will however restore the variables to their original equilibrium in the long run. There are three common methods for co-integration testing, and they include the Johansen's test, the Engle-Granger two-step method and the Phillips-Ouliaris co-integration test and so on. The Johansen Co-integration test will be used for this research work as it is the most appropriate and it is suitable for large samples.

### 3.2.3. Error-correction mechanism

The error correction mechanism indicates the speed it takes from adjustment from a short run equilibrium to a long run equilibrium. It helps in analyzing the short-term dynamics between two variables. The greater the coefficient of the ECM, the faster the adjustment from the short run to the long run. For example, when a variable has overshoot its equilibrium, the ECM works to push that variable back to its equilibrium.

## 3.3. Data sources, definitions, and measurement

### 3.3.1. Definition of variables

- **Gini Index (GINI):** Income Inequality proxied by GINI Index refers to the extent of uneven distribution of income in a society. It is a measurement of the skewness of income distribution of the population or society.
- **Real Gross Domestic Product (RGDP):** Is a macroeconomic measure of the value of economic output adjusted for changes in prices overtime (i.e. inflation). It is a measure of economic performance adjusted for inflation.
- **Primary School Enrolment Rate (PSEE):** Primary School Enrolment Rate represents the number of intakes into Primary Schools in a year expressed as a percentage of the total population.
- **Inflation:** Inflation is the rate at which the general price level of goods and services rises over a period. For this research work we will use inflation rate obtained using the GDP deflator.
- **Foreign Direct Investment:** Foreign Direct Investment refers to investment from a foreign country in a domestic country that is above 10% of the total share value of that company. For this research work we will be using Foreign Direct Investment as a percentage of Gross investment.

The research work makes use of secondary data obtained from the World Development Indicators (WDI). The table below shows the data sources, definitions, measurements, and description of the variables used in the research work.

**Table 1** Description of Variables

Variable	Label	Definition	Source	Measurement
Income Gini	GINI	Income Inequality proxied by income Gini refers to extent of uneven distribution of income in a society	Nigeria Bureau of Statistics (NBS)	Gini index
Real Gross Domestic Product	RGDP	Is a macroeconomic measure of the value of economic output adjusted for changes in prices overtime (i.e. inflation)	World Bank (WDI)	\$ dollars
Primary School Enrolment Rate	PSEE	Primary School Enrolment Rate represents the number of intakes into tertiary Schools in a year expressed as a percentage of the total population.	World Bank (WDI)	Expressed as a % of the population
Inflation	INF	Inflation is the rate at which the general price level of goods and services rises over a period.	World Bank (WDI)	% GDP deflator
Foreign Direct Investment	FDI	Foreign Direct Investment refers to investment from a foreign country in a domestic country that is above 10% of the total share value of that company	World Bank (WDI)	\$ dollars

## 4. Preamble

This chapter focuses on the analysis, estimation, presentation, and interpretation of the results obtained from the model specified in the preceding chapter in order to assess the impact of Education on Income Inequality in Nigeria and South Africa. This chapter will contain a trend analysis and descriptive analysis of the variables. The second chapter will represent an econometric analysis of the data. Johansen Cointegration approach will be used to show the long run relationship between Income Inequality and Education Inequality in both countries using the variables RGDP (Real GDP), PGR (Population Growth Rate), TSE (Tertiary School Enrollment) and TGEE (Total Government Expenditure) using time series data from 1981-2016.

### 4.1. Econometric analysis of the data

This study examines time series data from the period 1981 to 2016. E-views 9 software is used whereby the sequential method of unit root test is employed by using the Augmented Dickey-Fuller (ADF) to test for the stationarity of each variable. Johansen Co-integration is used to examine the long run relationship among variables while Vector Error Correction Model is used to estimate the speed of adjustment.

#### Uni root test

The Augmented Dickey-Fuller test was employed in this study for the purpose of testing for the stationarity of variables in the research work. The Augmented Dickey-Fuller test was employed in this study for the purpose of testing for the stationarity of variables in the research work. The decision rule is as follows: if the ADF t-stat is greater than the absolute value of the critical value at the 5% level, we reject the null hypothesis that the variable is not stationary and vice versa. When the variables GINI, INF, RGDP, FDI0 and PSEE are integrated or order 1(1), the ADF test statistics are greater than their 5% critical value in absolute terms. Therefore, we conclude that the variables are stationary at first difference.

The study adopts the unit root at first difference, because all variables are integrated of order one.

### 4.2. Diagnostic test

**Table 2** Test for Heteroscedasticity

<b>Nigeria.</b>			
<b>Heteroskedasticity Test: Breusch-Pagan-Godfrey</b>			
F-statistic	1.24	Prob. F(4,31)	0.31
Obs*R-squared	4.98	Prob. Chi-Square(4)	0.28
Scaled explained SS	19.77	Prob. Chi-Square(4)	0.0006
Source: Author's Computations			
<b>South Africa</b>			
<b>Heteroskedasticity Test: Breusch-Pagan-Godfrey</b>			
F-statistic	1.26	Prob. F(4,31)	0.30
Obs*R-squared	5.06	Prob. Chi-Square(4)	0.28
Scaled explained SS	8.70	Prob. Chi-Square(4)	0.06
Source: Author's Computations			

The null hypothesis of the heteroscedasticity test above is that there is no heteroscedasticity. If the value of the probability is less than the 5 percent level, we reject the null hypothesis. However, if the value of the probability is greater than the 5 percent level, we do not reject the null hypothesis. From the tables of the result for Nigeria and South Africa, we can see that the probability value beside the Obs\*R-squared is greater than 5 percent, therefore the residuals are homoscedastic.

### 4.3. Cointegration test

In line with the study's objective to ascertain whether there is presence of a long run relationship between the variables of study, the Johansen Maximum Likelihood Co-integration Test was employed. Using the trace statistics for Nigeria, we can see presence of three cointegrating equation at the 0.05 level using the trace statistics while using the max statistics we see 1 cointegrating relationship. This shows that a long run relationship exists between the variables. The trace statistics for South Africa indicates that there is one cointegrating equation while the max statistics indicates that there are two cointegrating equation at the 0.05 level which also shows that a long run relationship exists between the variables.

**Table 3** Unrestricted Cointegration Rank Test for Nigeria

<b>Unrestricted Cointegration Rank Test (Trace)</b>				
<b>Hypothesized No. of CE(s)</b>	<b>Eigenvalue</b>	<b>Trace Statistic</b>	<b>0.05 Critical Value</b>	<b>Prob.**</b>
None *	0.65	95.27	69.81	0.0001
At most 1 *	0.55	59.17	47.86	0.0031
At most 2 *	0.43	31.92	29.79	0.0280
At most 3	0.29	12.69	15.49	0.12
At most 4	0.02	0.89	3.84	0.34
<i>Trace test indicates 3 cointegrating equations at 0.05 level</i>				
<b>Unrestricted Cointegration Rank Test (Maximum Eigenvalue)</b>				
<b>Hypothesized No. of CE(s)</b>	<b>Eigenvalue</b>	<b>Max-Eigen Statistic</b>	<b>0.05 Critical Value</b>	<b>Prob.**</b>
None *	0.65	36.10	33.87	0.02
At most 1	0.55	27.24	27.58	0.05
At most 2	0.43	19.22	21.13	0.09
At most 3	0.29	11.80	14.26	0.12
At most 4	0.03	0.89	3.84	0.35

Maxeigenvalue test indicates 1 cointegrating equation at level 0.05; Source: Author's Computations

The results obtained from the Johansen Co-integration Test of Nigeria can be viewed below in Table 4.3 The T-statistics is used to show the significance of the independent variable in the long run. If the T-statistics is approximately equal to 2 or greater than 2, the variable is statistically significant but however, if the T-statistics is less than 2, the variable is not statistically significant.

**Table 4** Cointegration Result for Nigeria

<b>GINI</b>	<b>INF</b>	<b>RGDP</b>	<b>FDI</b>	<b>PSEE</b>
1.00000	0.26	2.6E-14	-1.74	0.23
T-stat	7.37	5.73	4.93	2.99
Standard Error	0.03	4.6E-14	0.35	0.08

Notes: GINI = Gini Index; INF = Inflation; RGDP = Real Gross Domestic Product; FDI = Foreign Domestic Investment; PSEE = Primary School Enrollment Rate; Source: Author's Computations

**4.4. Normalized Cointegration Coefficients**

The normalized co-integration result is written in its implicit form, hence, to make to explicit it is rewritten by changing the signs as follows:

$$\text{GINI} = - 0.26\text{INF} -0.26\text{E-14RGDP} +1.74\text{FDI} - 0.23\text{PSEE}.....4.1$$

The normalized cointegrating coefficient of INF is -0.26 showing that a 1 percent increase in inflation will bring about a 0.26 drop in the Gini coefficient of Nigeria ceteris paribus. This indicates there is a negative relationship between Inflation rate and the Gini Coefficient which is theoretically expected. The significance level of the t-statistic is 7.37 > 2 so we can say that the long run relationship between inflation and income inequality is statistically significant.

The normalized cointegrating coefficient of RGDP is -2.6E-14 showing that a 1 unit increase in Real GDP will bring about a 2.6E-14 unit drop in the Gini coefficient of Nigeria ceteris paribus. This indicates there is a negative relationship between Real GDP and the Gini Coefficient which is theoretically expected. The significance level of the t-statistic value is 5.73 > 2 so we can conclude that the long run relationship between Real GDP and income inequality is statistically significant.

The normalized cointegrating coefficient of FDI is 1.74 showing that a 1 percent increase in Foreign Direct Investment will bring about a 1.74 increase in the Gini coefficient of Nigeria ceteris paribus. This indicates there is a positive relationship between FDI and the Gini Coefficient. The significance level of the t-statistic value is 4.93 > 2 so we can conclude that the long run relationship between FDI and income inequality is statistically significant.

The normalized cointegrating coefficient of PSEE is - 0.23 showing that a 1 percent increase in Primary School Enrollment rate will bring about a 0.23 drop in the Gini coefficient of Nigeria ceteris paribus. This indicates there is a negative relationship between PSEE and the Gini Coefficient which is in line with our apriori expectation as an increase in Primary School Enrollment indicates an increase access to education which will increase their human capital and their income generating capacity, and this will lead to a drop in income inequality as more people will have access to this opportunity. The significance level of the t-statistic value is 2.99 > 2 so we can conclude that the long run relationship between PSEE and income inequality is statistically significant.

**Table 5** Unrestricted Cointegration Rank Test for South Africa

<b>Unrestricted Cointegration Rank Test (Trace)</b>				
<b>Hypothesized No. of CE(s)</b>	<b>Eigenvalue</b>	<b>Trace Statistic</b>	<b>0.05 Critical Value</b>	<b>Prob.**</b>
None *	0.6	76.83	69.81	0.01
At most 1	0.56	46.09	47.86	0.07
At most 2	0.28	18.10	29.8	0.56
At most 3	0.19	7.024	15.49	0.57
At most 4	0.002	0.008	3.84	0.93
Trace test indicates 1 cointegrating equation at 0.05 level				
<b>Unrestricted Cointegration Rank Test (Maximum Eigenvalue)</b>				
<b>Hypothesized No. of CE(s)</b>	<b>Eigenvalue</b>	<b>Max-Eigen Statistic</b>	<b>0.05 Critical Value</b>	<b>Prob.**</b>
None	0.6	30.74	33.88	0.11
At most 1 *	0.56	27.98	27.58	0.04
At most 2	0.28	11.08	21.13	0.63
At most 3	0.19	7.016	14.26	0.48
At most 4	0.0002	0.008	3.84	0.93

Maxeigenvalue test indicates 2 cointegrating equation at level 0.05

The results obtained from the Johansen Co-integration Test of South Africa can be viewed below in Table 4.5 The T-statistics is used to show the significance of the independent variable in the long run. If the T-statistics is approximately equal to 2 or greater than 2, the variable is statistically significant but however, if the T-statistics is less than 2, the variable is not statistically significant.

**Table 6** Cointegration Result for South Africa

GINI	INF	RGDP	FDI	PSEE
1.00000	-3.79	-8.17E-12	-15.85	-0.027
T-stat	2.74	1.43	5.86	0.12
Standard Error	1.38	5.7E-11	2.70	0.22

Notes: GINI = Gini Index; INF = Inflation; RGDP = Real Gross Domestic Product; FDI = Foreign Domestic Investment; PSEE = Primary School Enrollment Rate; Source: Author’s Computations

The normalized co-integration result is written in its implicit form, hence, to make to explicit it is rewritten by changing the signs as follows:

$$\text{GINI} = 3.79\text{INF} + 8.16\text{E-}11\text{GDP} + 15.85\text{FDI} + 0.03\text{PSEE} \dots\dots\dots 4.1$$

The normalized cointegrating coefficient of INF is 3.7927 showing that a 1 percent increase in inflation will bring about a 3.79 rise in the Gini coefficient of South Africa ceteris paribus. This indicates there is a positive relationship between Inflation rate and the Gini Coefficient which is against our apriori expectation. The significant level of the t-statistic value is 274 > 2 so we can conclude that the long run relationship between inflation and income inequality is statistically significant.

The normalized cointegrating coefficient of RGDP is +8.16E-11 showing that a 1 unit increase in the Real GDP will bring about a 2.64E-13 unit increase in the Gini coefficient of South Africa ceteris paribus. This indicates there is a positive relationship between Real GDP and the Gini Coefficient which is against our apriori expectation. The significance level of the t-statistic value is 1.43 < 2 so we conclude that the long run relationship between Real GDP and income inequality is statistically insignificant.

The normalized cointegrating coefficient of FDI is 15.85 showing that a 1 percent increase in Foreign Direct Investment will bring about a 15.85 increase in the Gini coefficient of South Africa ceteris paribus. This indicates there is a positive relationship between FDI and the Gini Coefficient. The significance level of the t-statistic value is 5.86 > 2 so we can conclude that the long run relationship between FDI and income inequality is statistically significant.

The normalized cointegrating coefficient of PSEE is 0.02 showing that a 1 percent increase in Primary School Enrollment rate will bring about a 0.02 increase in the Gini coefficient of South Africa ceteris paribus. This indicates there is a positive relationship between PSEE and the Gini Coefficient which is against our apriori expectation of a negative relationship. The significance level of the t-statistic value is 0.11852 < 2 so we can conclude that the long run relationship between PSEE and income inequality is statistically insignificant for South Africa.

**4.5. Vector error correction model**

The restricted VAR (VECM) is adopted in this study for estimation purposes due to the presence of a cointegrating relationship between the variables. The VECM shows the convergence between variables in the long-run while also correcting the short-run errors that occur in the model. For satisfying the stability condition, the coefficient of

VECM should have a negative sign, the absolute value of the coefficient must lie between 0 and 1, and the t-statistic must be statistically significant. The first property implies convergence in the long run, the second property measures the rate or error correction while the last property of statistical significance captures the speed of error correction.

**Table 7** Vector Error Correction Results for Nigeria

Variable	D(LGINI)	D(INF)	D(RGDP)	D(FDI)	D(PSEE)
ECM(-1)	0.09	-5.1470	8.68E+10	0.28	-0.31
Standard error	0.17	1.28	9.0E+10	0.1	0.17
T-statistics	0.58	-4.04	0.97	2.86	-1.74

Notes: GINI = Gini Index; INF = Inflation; RGDP = Real Gross Domestic Product; FDI = Foreign Domestic Investment; PSEE = Primary School Enrollment Rate; Source: Author's Computations

From the table above, the co-efficient of the error term has a positive sign and is not statistically significant in the model. This shows that there is a long-run divergence between the dependent variable GINI and the independent variables (INF, RGDP, FDI, PSEE). The result indicates that all short run errors can never be corrected in subsequent periods and therefore there is no speed of adjustment of errors present. They will blow out thereby making it hard for the errors to be corrected. A t-statistic value of 0.58 indicates that it is not significant, so there is no speed of convergence in the model but rather divergence.

**Table 8** Vector Error Correction Results for South Africa

Variable	D(LGINI)	D(INF)	D(RGDP)	D(FDI)	D(PSEE)
ECM(-1)	-0.2	0.02	92033507	0.08	-0.08
Standard error	0.09	0.037	1.1E+8	0.03	0.1
T-statistics	-2.31	0.58	0.88	-3.50	-0.78

Notes: GINI = Gini Index; INF = Inflation; RGDP = Real Gross Domestic Product; FDI = Foreign Domestic Investment; PSEE = Primary School Enrollment Rate; Source: Author's Computations

From the result above, the coefficient of the error correction model for the dependent variable D(GINI) is negative and lies between 0 and 1. The absolute value of the t-statistics is 2.31. This means that approximately 5 percent of the errors generated in the current period will be corrected in the subsequent periods or long run equilibrium path. The t-statistic value of 2.31 indicates that the speed of adjustment of the errors generated in the current period to be corrected in the long run is fast, causing a convergence.

## 5. Discussion of results

This chapter mainly focused on the empirical analysis of the relationship between government expenditure on education and economic growth in Nigeria and South Africa. The results obtained showed that there exists a long run relationship between the variables in both Nigeria and South Africa. For Nigeria, the variables diverge in the long run while they converge in South Africa if there is any shock.

To commence the analysis, the chapter started with the description of the variables through a trend analysis over the period 1981 – 2016, after which diagnostic tests such as autocorrelation, heteroscedasticity and normality tests were carried out. At levels, all the variables for both Nigeria and South Africa were non-stationary however, they were stationary at first difference. The Johansen Cointegration test followed for both trace statistics and max statistics. There is a presence of long-run relationship in the two countries. The VECM results revealed that for Nigeria, none of the errors generated in the current period will be corrected in the subsequent period while for South Africa, the errors generated in the current period will be corrected in the long run.

For Nigeria the coefficient of Inflation is -0.26 with t-stats of 7.37 indicating a significant negative relationship between the two variables. So, it could be explained that a 1 percent increase in Inflation will bring about a 0.26 drop in the Gini Coefficient of Nigeria *ceteris paribus*.

The coefficient of RGDP is -2.64E-13 with t-stats of 5.74 indicating a significant negative relationship between the two variables. So, it could be explained that a 1 percent increase in Real GDP will bring about a 0.00000000000026 fall in the Gini Coefficient of Nigeria *ceteris paribus*. The coefficient of FDI is 1.75 with t-stats of 4.94 indicating a positive significant relationship between the two variables. So, it could be explained that a 1 percent increase in FDI will bring about a 1.75 drop in the Gini Coefficient of Nigeria *ceteris paribus*.

The coefficient of PSEE is -0.24 with t-stats of 2.99695 indicating a positive significant relationship between the two variables. So, it could be explained that a 1 percent increase in the Primary School Enrollment rate will bring about a 0.24 drop in the Gini Coefficient of Nigeria *ceteris paribus*. This explains that the Government should put more resources and efforts into increasing access to education at the primary and other levels as it will play a key role in reducing levels of income inequality in the country. For South Africa the coefficient of INF is 3.8 with t-statistics of 2.74 indicating a significant positive relationship between the two variables which is in line with the *apriori* expectation. So, it could be explained that a 1 percent increase in Inflation will bring about a 3.8 increase in the Gini Coefficient of Nigeria *ceteris paribus*.

The coefficient of FDI is 15.88 with t-statistics of 5.86 indicating a significant positive relationship between the two variables. So, it could be explained that a 1 percent increase in FDI will bring about a 15.85 increase in the Gini Coefficient of Nigeria *ceteris paribus*. The coefficient of RGDP is 8.16E-11 with t-statistics of 1.43 which is lower than 2 and this indicates that there is no significant relationship between Real GDP growth and Income Inequality in South Africa.

The coefficients of PSEE are 0.03 with t-statistics of 0.12 which is lower than 2 and this indicates that there is no significant relationship between education and Real GDP growth in South Africa. This goes on to say that the income inequality situation in South Africa is not related to education access but due to other causes like racial discrimination and segregation situation in the country as the income level of white citizens are higher than black citizens. Data shows that income inequality between the two groups in 1995 was 0.38 while in 2005 it increased to 0.50 according to the World Bank. This supports the fact that segregation is a major factor driving income inequality in the country.

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## 6. Conclusion

This study examines the nature of relationship between income inequality and Education in Nigeria and South Africa. For Nigeria, a positive and significant relationship obtained between income inequality and Education which is in line with our *apriori* expectation. For South Africa, an insignificant relationship was found between income inequality and Education. The results of this research work therefore shows that Nigeria must put more efforts in increasing access to education in the country so as to increase the human capital of the lower income groups thereby increasing their productivity and income earning potential, this will contribute to reducing the income gap. For South Africa, efforts should be put in place to end racial prejudice in all its forms and in every aspect of the country to significantly reduce the income inequality situation in the country. In conclusion, Nigeria can solve improve its income inequality situation by improving access to education at all levels and in every region in the society especially in the Northern region as they are far behind in educational attainment when compared to the western and eastern region of the society. This will be instrumental in reducing the income inequality level in the country.

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