

## Original Research Article

# Application of Quantile Regression to the Role of Economic and Social Services on Citizen's Standard of Living in Nigeria

## ABSTRACT

The role of economic and social services development on the standard of living has different effects on various class of citizens. In this study, we investigate the significant role of economic and social services development on standard of living in Nigeria using quantile regression analysis to model various quantiles of the standard of living. The dataset, which covered period of 41 years is obtained from Central Bank Statistical Bulletin. All the independent variables showed skewed distribution, and evidence of multicollinearity. Therefore, quantreg and tseries R-package were employed for the implementation of quantile regression. The quantile values considered are 0.1, 0.25, 0.5, 0.75 and 0.9. Results showed that only the compensation of employees (COE) has significant effect on the standard of living across all the quantiles distribution except the 0.25<sup>th</sup> quantile that is not significant. Also, the independent variables considered showed significant effect at 0.75<sup>th</sup> quantile. This suggests that economic and social services development only have significant effect on the higher class citizens' living standard.

*Keyword: Standard of living, Economic service, Social service, Quantile regression and Capital expenditure.*

## 1. INTRODUCTION

Allocation of funds to various economic sectors by the governments is one of the major channels to provide the needs for citizens [1] ((Jeff-Anyeneh & Ibenta, 2019). The standard of living of a citizen in financial prudence that constantly experience economic growth is favored to financial prudence with volatility in growth rate. This usually results to logical advancement in basic economic, social and community services. As a matter of fact, the standard of living of citizens in a country experiencing boost in economic and social services will advance, which is the consequence of increase in government expenditure. A nation with low level of expenditure in economic and social service like those of Agriculture, road and construction, transport and communication, education, health services, among others, finds it difficult and sometimes practically difficult to progress and considerably increases her gross domestic product (GDP) thus, worsening the citizen's standard of living (Ahmad and Batul, 2013). Boosting the economic and social services, especially through the capital expenditure will increase the livelihoods of individual citizen and possibly provides equitable distributive effect on the overall income distribution of the economy, such that all sections of the population will equally benefit in a nation's wealth through the social services (Tiwari, 2012).

Standard of living is a statistic that indicates the level of comfort and wealth of citizens in a nation. It is determined by the basic needs and other variety of factors. The Gross Domestic

Product (GDP) per capital income is one of the most common variables used to proxy the standard of living. GDP Per capital income is the total value of all the goods and services produced in a country divided by the number of people living there. Among other is the Human Development Index, which looks at health, education, and income, and the Gini index, which used to proxy income inequality.

With the assurance that the government capital expenditure will enhance the economic and social services, the government of Nigeria have been engaging in spending huge sum of money on infrastructures, and other projects promoting services over times. However, the current standard of living of a citizen is yet to witness the output growth. Based on the recent information on Nigerian government capital expenditure to administration, economic, social and community services and transfers, it can be observed that the capital expenditure as a percentage of the GDP is significantly small in value. For instance, the total capital expenditure for 2021 is  $2,522.47 \times 10^9$  with GDP percentage of 1.45(source?). Also the decreasing in capital expenditure as percentage of GDP is a signal that the Nigerian Government do not pay serious attention to the economy, especially the sectors that can improve the citizen's standard of living.

Alimi (2014) empirically substantiated that the government expenditure play an important role in the improvement of citizens standard of living. The amount (size) of capital expenditure on economic and social services by the government can directly or indirectly affect the standard of living of the citizens as reduction in poverty level. Dahmardeh and Tabar (2013) specified that the direct effects arise in the form of benefits the poor receive from compensation to employee and welfare programs while the indirect effects arise when government invests in rural infrastructures, agricultural researches, and the wellbeing and education of the country individuals, revitalize agricultural and non-agricultural development, driving to more noticeable business and pay winning openings for the poor, and to cheaper nourishment. The study of Jha, Biswal and Biswal (2005) has revealed that government expenditure on social services (such as education, health) and development aids the standard of living in India by minimizing the level of poverty. They also emphasized that government expenditure on higher, university, technical, adult and vocational educations as opposed to primary and secondary education is more efficient in improving the citizen's standard of living.

Strinivasu and Strinivasa (2013) analyzed the relationship between infrastructure development and economic growth in India and the result revealed that Infrastructure services are essential to achieve development targets in any economy. Hassan et al. (2017) investigated the impact of lack of infrastructure on economic development in Somalia. The results showed that lack of infrastructure brings poor standard of living, economic deficit and increases poverty. The findings of the study proved that lack of infrastructure holds back economic development raises unemployment and promotes poor standard of living. Novitasari et al. (2017) investigated the impacts of infrastructure development on economic growth. The results of the study showed that infrastructure has significant impacts on economic growth indicators. Incham et al. (2018) reviewed previous works related to the impact of infrastructural development on rural communities in Malaysia. The survey carried out given the relationship between social well-

being and the provision of complete infrastructure facilities. The result revealed that the impact of infrastructure development in rural areas is not only focused on physical development but also concerns the efforts to improve the quality of life of rural communities. De-Graft et al. (2019) examined the impact of infrastructure development on economic growth in Ghana using autoregressive distributed lag (ARDL) to determine the long- and short-run effects of the selected infrastructure stock and quality indices on Ghana's economic growth. The Findings indicated a statistically significant relationship between infrastructure development and economic growth. Stungwa and Daw (2021) examined the degree of association between infrastructure development and population growth on economic growth in South Africa. The study used Cross-section Seemingly Unrelated regression to evaluate the relationship between infrastructure development and population growth on economic growth. From the result, it is clear that there is a significant and negative relationship between infrastructure services and economic growth in the long run.

Babarinde (2022) assessed the effect of the investment activity of microfinance banks on the standard of living in Nigeria from 1992 to 2018 employing annual time series data. With the application of cointegrating regression method, this study discovers evidence of a long-run relationship between standard of living and microfinance investment portfolio, with the lagged value of the latter having a significant negative influence on standard of living in the long-run but the significant positive association was established in the short run. The study suggests that microfinance banks 'investment activity is only a short term means of floating the Nigeria's standard of living, for in the long run, rather than floating, it reduces the standard of living in Nigeria significantly.

The empirical studies on fiscal policy-a standard of living nexus is varied and inconsistent, particularly in developing countries. This is usually related to the econometrical approach used by practitioners. **This study intends** to empirically examine the different behavior of government capital expenditure in Nigeria over the years and whether the extremely low or high changes in economic and social services capital expenditure by government would improve the standard of living.

Unlike quantile regression (QR) method, the methods applied in those aforementioned studies are subjected to some restrictions such as normality assumption, particularly the usual least square regression. Indeed, quantile regression is less sensitive to any assumption and capable to work with wide range of distributions. The QR model allows us to characterize all the conditional distribution of response variable, based on certain regressors, since several parameters estimations for different percentiles are found, which can be understood as differences in the behavior of the response variable, because of the changes in the regressors, at the most diverse point of the conditional distribution from the first. As a Consequence of its advantages, many practitioners find great interest in QR technique since it has been initially introduced by Koenker and Basset (1987). QR technique is widely used in determination of wages discriminations, effects and income inequality (e.g. Buchinsky, 1994; Chay and Honore,

1998; Eide and Showalter, 1999; Budd and McCall, 2001; Machado and Mata, 2005; Melly, 2005; Lemieux, 2006). Also it is used to address the quality of schooling (Bedi and Edwards, 2002; Eide and Showalter, 1998) and demographics impact on infant birth weight (Abreveya, 2001). Shaeck (2008) applied QR in a study that dealt with bank failure and the time occurrence of this failure

In a recent study, Suresh et al. (2017) analyzed the socio economic determinants of nutrition, and reveals how understanding the role of several socio economic features can assist in the process of developing program and policy interventions at various levels. Troster et al. (2018) carried out study on renewable energy, oil price and economic growth. They used QR method to determine whether the extremely low or high changes in energy consumption price would lead to economic growth. Due to the controversy and the contradicting results encountered in several energy-growth nexus studies, Angeliki (2021) provided an overview on usefulness of QR method and used it to estimate the extreme values in the energy growth nexus. Faik et al. (2021) employed quantile regression procedure to model the nexus between public and private health expenditure, carbon dioxide emissions, and economic growth in various 36 Asia countries for the period of 27 years, between 1991 and 2017.

In this study, since our response variable is likely to be asymmetrical in term of distributions for different period and population, we intend to investigate the different behaviors of regressors for different percentiles of the distribution. The study demonstrates the technique of QR to capture the effect of infrastructure on standard of living that measures by GDP per capital income for the period under the study.

## 2. METHODS

### 2.1 Quantile Regression Model

Since the study is aiming at estimating parameters of a regression model that can provide detail relationship between the standard of living and infrastructural development. The model is briefly illustrated as follows:

$$Y_i = \beta_0 + \beta_{\tau 1} X_{1i} + \beta_{\tau 2} X_{2i} + \dots + \beta_{\tau k} X_{ki} + \epsilon_{\tau i} \quad (1)$$

$\beta_{\tau}$  is the marginal change in the  $\tau$ th quantile due to the marginal change in  $X$ ,  $Y_i$  is the dependent variable,  $X_i$  is a regressors,  $\beta$  is the parameter to be estimated, and  $\epsilon$  is a residual error. The conventional quantile regression model, first introduced by Koenker and Bassett (1978), can be written as:

$$Y_i = X_i' \beta_{\tau} + \epsilon_{\tau i} \text{ with } Quant_{\tau}(Y_i|X_i) = X_i' \beta_{\tau} + \epsilon_{\tau i} \quad (2)$$

where  $Quant_{\tau}(Y_i|X_i)$  represents the quantile  $\tau$  ( $0 < \tau < 1$ ) of the response variable  $Y$ , conditional to the vector of regressors  $X'$ . The evaluation of the parameters in Expression (1) can be obtained by solving a linear programming problem, whose objective function is given by the following expression:

$$\min_{\beta \in R^k} \left\{ \sum_{i:Y_i \geq X_i\beta} \tau|Y_i - X_i'\beta + \sum_{i:Y_i < X_i\beta} (1 - \tau)|Y_i - X_i'\beta \right\} = \min_{\beta \in R^k} \sum_{i=1}^n p_{\tau} \epsilon_{\tau i} \quad (3)$$

where  $p_{\tau}(\cdot)$  is refer as check point and is given as

$$p_{\tau}(\epsilon_{\tau i}) = \begin{cases} \tau \epsilon_{\tau i} & \text{if } \epsilon_{\tau i} \geq 0 \\ (1 - \tau) \epsilon_{\tau i} & \text{if } \epsilon_{\tau i} < 0 \end{cases} \quad (4)$$

For simplicity, of the equation (3) and (4) and for further clarification of the quantile regression, the equation for the 0.05, 0.10, 0.25, 0.50, 0.75, 0.90 and 0.95 quantiles are respectively illustrated as follow:

$$Q(\beta_{0.05}) = \min_{\beta \in R^k} [\tau_{0.05}(Y_1 - X_1\beta) + \tau_{0.05}(Y_2 - X_2\beta) + \dots + \tau_{0.05}(Y_n - X_n\beta)]$$

with

$$p_{0.05}(Y_i - X_i\beta) = \begin{cases} 0.05(Y_i - X_i\beta) & \text{if } (Y_i - X_i\beta) \geq 0 \\ 0.95(Y_i - X_i\beta) & \text{if } (Y_i - X_i\beta) < 0 \end{cases}$$

⋮

$$Q(\beta_{0.9}) = \min_{\beta \in R^k} [\tau_{0.9}(Y_1 - X_1\beta) + \tau_{0.9}(Y_2 - X_2\beta) + \dots + \tau_{0.9}(Y_n - X_n\beta)]$$

with

$$p_{0.9}(Y_i - X_i\beta) = \begin{cases} 0.9(Y_i - X_i\beta) & \text{if } (Y_i - X_i\beta) \geq 0 \\ 0.1(Y_i - X_i\beta) & \text{if } (Y_i - X_i\beta) < 0 \end{cases}$$

where equation(3) is then solved by linear programming methods. As one increase  $\tau$  continuously from 0 to 1, one traces the entire conditional distribution of  $Y_i$  conditional on  $X_i$  (Buchinsky 1998).

### 2.1.1 Equivalence of Slope Coefficient

In quantile regression, a covariance matrix of the cross-quantile estimate, which would be employed to perform the equivalence test is produced using pair bootstrapping method. For a given variable, the covariance matrix gives room for the examination of whether any difference between the slope coefficients of any pair of quantile is statistically different. Here, the Wald statistic for the test of equivalence is given by

$$W^* = \frac{\hat{\beta}_1^{(p)} - \hat{\beta}_1^{(q)}}{\sigma_{\hat{\beta}_1^{(p)} - \hat{\beta}_1^{(q)}}^2} \quad (5)$$

where  $\hat{\beta}_1^{(p)}$  is the parameter estimate from the  $p^{\text{th}}$  quantile regression model and  $\hat{\beta}_1^{(q)}$  is the parameter estimate from the  $q^{\text{th}}$  quantile regression model (i.e., any given pair of quantiles). The denominator is the variance of the difference between the two coefficients for the  $p^{\text{th}}$  and  $q^{\text{th}}$  quantile regressions. We test  $H_0: \hat{\beta}_1^{(p)} = \hat{\beta}_1^{(q)}$  vs  $H_0: \hat{\beta}_1^{(p)} \neq \hat{\beta}_1^{(q)}$  and we reject  $H_0$  at the level  $\alpha$  if  $w < w_{\alpha/2}$  or  $> w_{1-\alpha/2}^*$ , where  $W_q^*$  denotes the  $q^{\text{th}}$  quantile of  $W_1^*, \dots, W_\beta^*$

### 2.1.2 Model Specification

Here we will analyze the data by assume that Standard of living is the function of transportation electricity, telecommunication, water supply, sanitation, education and health which can be in;

- Ordinary least squared model of form:

$$SOL = \beta_0 + \beta_1 ES_i + \beta_2 SS_i + \beta_3 COE_i + \epsilon_i \quad (6)$$

- Linear quantiles model of the form

$$SOL_{\tau i} = \beta_{\tau,0} + \beta_{\tau,1} ES_i + \beta_{\tau,2} SS_i + \beta_{\tau,3} COE_i + \epsilon_{\tau,i} \quad (7)$$

The variables are defined as follows;

$SOL$  = Standard of living proxy by GDP per capital income (₦)

$ES$  = Government capital expenditure on economic service (₦, Billion)

$SS$  = Government capital expenditure on social service (₦, Billion)

$COE$  = Compensation of employee (₦, Billion)

From equation (7) we estimate the parameters of the quantile model using  $\tau = \{0.05, 0.25, 0.5, 0.75, 0.95\}$  and the model will be designed as follows

$$SOL_{0.05i} = \beta_{0.05,0} + \beta_{0.05,1} ES_i + \beta_{0.05,2} SS_i + \epsilon_{0.05,i}$$

⋮

$$SOL_{0.95i} = \beta_{0.95,0} + \beta_{0.95,1} ES_i + \beta_{0.95,2} SS_i + \beta_{0.95,3} COE_i + \epsilon_{0.95,i}$$

In quantile regression, a similar index to  $R^2$  is suggested by Koenker and Machado (1999), which is the likelihood ratio of the sum of weighted absolute distances for the full  $p^{th}$  quantile regression model  $V^1(p)$  and the sum of the weighted absolute distances for a model with only the intercept  $V^0(p)$

$$Pseudo R^2 = 1 - \frac{V^1(p)}{V^0(p)} = \frac{P \sum_{y_i \geq \hat{y}_i} |y_i - (\beta_0^p + \beta_1^p)| + (1-p) \sum_{y_i < \hat{y}_i} |y_i - (\beta_0^p + \beta_1^p)|}{P \sum_{y_i \geq Q^{(p)}} |y_i - \beta_0^p| + (1-p) \sum_{y_i < Q^{(p)}} |y_i - \beta_0^p|} \quad (8)$$

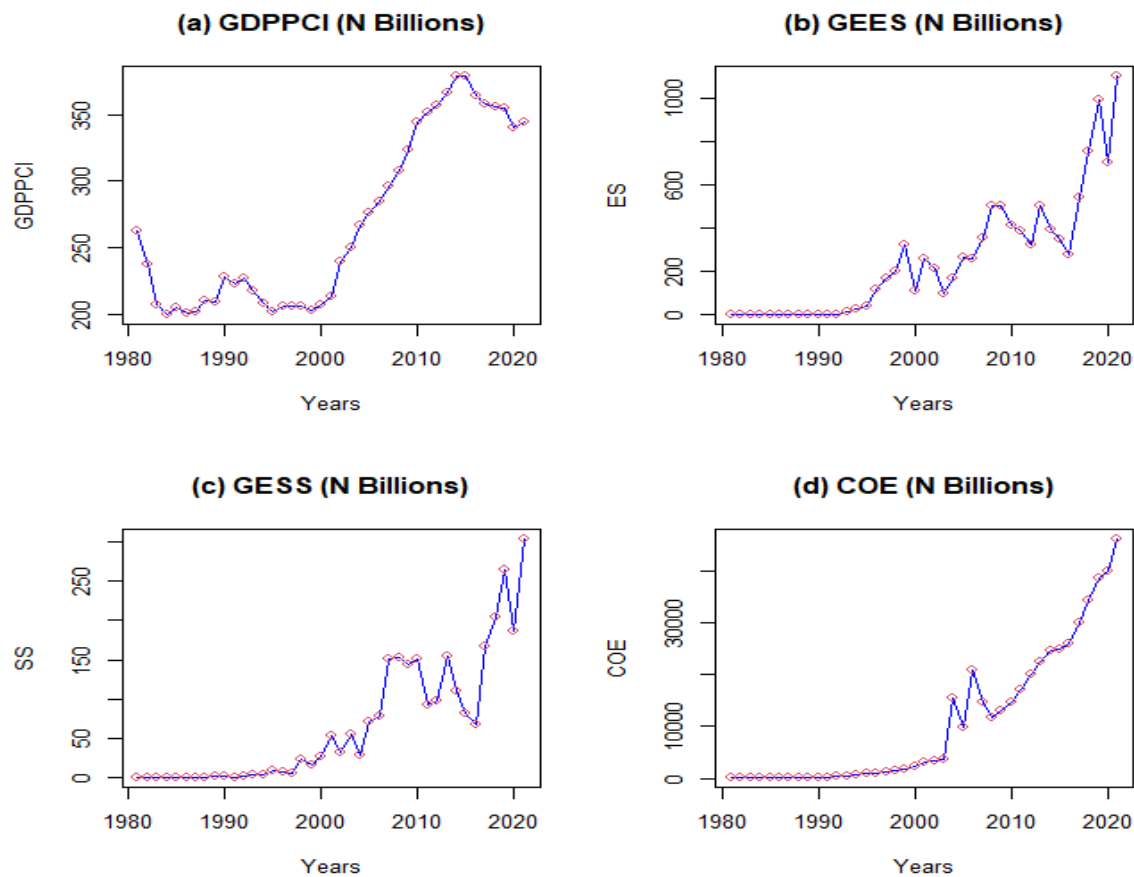
For the model  $V^0(p)$ , the intercept is the sample  $p^{th}$  quantile  $\hat{Q}^{(p)}$  of the response variable. At this point, the intercept for the  $p^{th}$  quantile regression is the reading score at the  $p^{th}$  percentile. Both  $V^0(p)$  and  $V^1(p)$  are nonnegative since they are the sum of absolute values.  $V^1(p)$  is always equal to or smaller than  $V^0(p)$  since a covariate is supposed to explain some variance of the dependent variable. Similar to the  $R^2$ , the pseudo  $R^2$  range is 0–1, with a larger value indicating better model fit.

### 3. ANALYSIS AND DISCUSSIONS

GDP per capital income (dependent variable) is used to observe the pattern and examine the distribution of the standard of living as given in figure 1 (a). The GDP per capital income within the Nigeria population relatively increased from 2001 (by ₦210,000) to 2022 (by ₦350,000). This increased by ₦140,000 and suggesting irregular distribution in citizen's standard of living over the years. The year with the highest GDPPCI were 2014 and 2015 with ₦380,000.

The concerned economic and social services that contributed to the citizen's standard of living include agriculture, road and construction, transport and communication, education, health and others. Adequate spending and thorough supervision of economic and social services is expected to enhance the standard of living of a country. Figure 1 (b)-(d) shows the government capital expenditure on economic service, social service and compensation of employee. It can be observed that they have upward increase in trend over the years. As reported in table 1, it can be found that the GEES, GESS and COE have positive relationship with the GDPPCI.

Further, it is observed that the explanatory variables GEES, GESS and GOE are highly correlated to the extent that will result in problem of multicollinearity which is one of reasons that makes quantile regression analysis appropriate and suitable for the study (figure 1). Likewise, Table 2 depicts the variables descriptive features. The standard deviation (SD) shows dispersion of the variables from one year to another, the values of skewness and kurtosis reveal that the distribution of the variables are asymmetrical which indicates that the variables are not normally distributed.



**Fig. 1. Time plot of (a) GDP per capital income (GDPPCI) (b) Government capital expenditure on economic service (GEES) (c) Government capital expenditure on social service (GESS) and (d) Compensation of employee (COE) in Nigeria**

**Table 1. Correlation Matrix**

	<i>GDPPCI</i>	<i>ES</i>	<i>SS</i>	<i>COE</i>
<i>GDPPCI</i>	1	0.76286	0.807709	0.873633
<i>GEES</i>	0.76286	1	0.96849	0.907298
<i>GESS</i>	0.807709	0.96849	1	0.907951
<i>COE</i>	0.873633	0.907298	0.907951	1

**Table 2. Variable Descriptive**

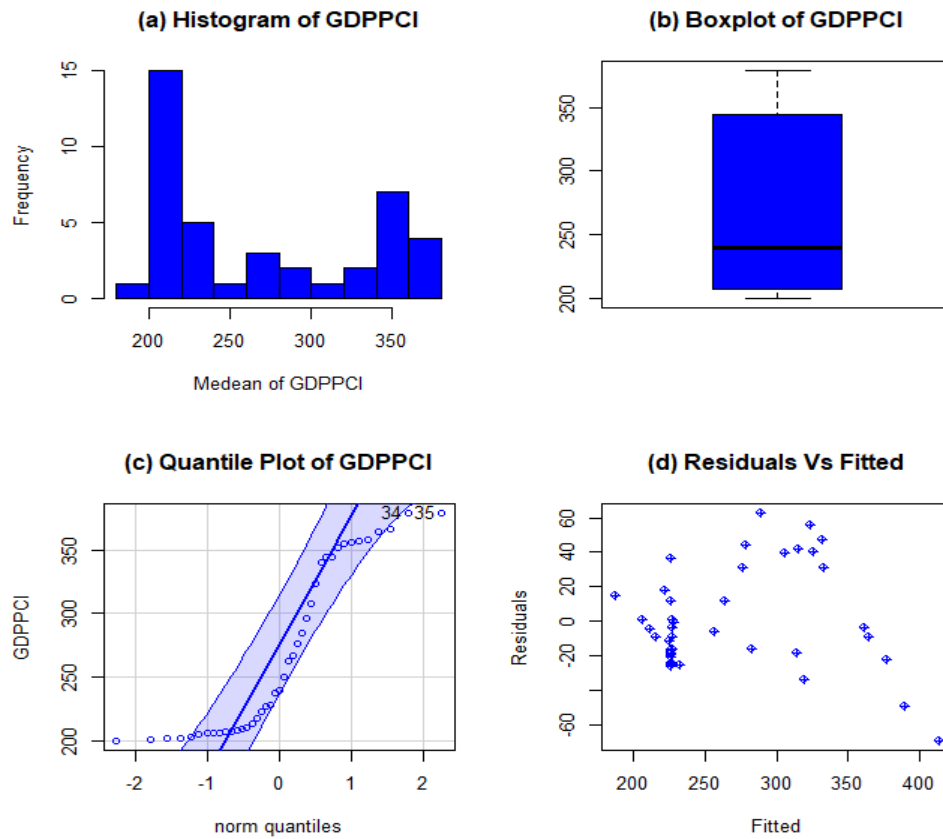
	<i>Mean</i>	<i>SD</i>	<i>Median</i>	<i>Min</i>	<i>Max</i>	<i>Range</i>	<i>Skew</i>	<i>Kurtosis</i>
<i>GDPPCI</i>	268.65	65.7	239.72	199.31	379.25	179.94	0.43	-1.54
<i>GEES</i>	254.08	277.29	200.86	0.66	1102.46	1101.8	1.23	1.12
<i>GESS</i>	67.63	80.03	30.03	0.24	303.66	303.42	1.14	0.46
<i>COE</i>	10892.6	13287.69	3274	120.85	46111.65	45990.8	1.02	-0.13

Figure 2 (a) provides the histogram of GDPPCI and indicates that its distribution is skewed. The box plot in figure 2 (b) also confirms that the GDPPCI data is skewed to the left. The error term( $\epsilon$ ) is homoskedastic or equally spread, if the variance of the conditional distribution of  $\epsilon_i$  given  $X_i$  [ $var(\epsilon|X_i)$ ], is constant for  $i = 1 \dots n$  and in particular does not depend on  $X$ ; otherwise, the error term is heteroskedastic. Thus, the scattered plot of the residuals against the fitted values in figure 2 (d) shows that the variance of the model from the least square method is not constant. Consequently, this problem may give wrong estimate of the standard error for the coefficient if we use OLS. It is now evident from Table 1 and figure 2 that the data collected for this study have effect of multicollinearity and is not normal. That no variable follows feature of normality. Therefore, estimation technique like ordinary least squares (OLS) will be biased, consequently the use of quantile regression estimation is more appropriate.

#### 4. RESULTS

Table 3 gives the quantile estimates of the standard of living with corresponding bootstrap standard error of 100 replication shown in bracket and the probability values with asterisk. The bootstrap standard error is used in place of asymptotic standard error due to the assumption of independent distribution that does not hold in our dataset. Figure 3 illustrates how the effects of standard of living distribution spread over quantiles and how the magnitude of the effects at different quantiles changes considerably from the OLS coefficient, even in terms of the confidence intervals around all coefficients. The x-axis of the plots depicts the various conditional quantiles. The red solid horizontal lines shows the OLS coefficients and corresponding confidence interval with red dashed horizontal lines. The shaded area shows the confidence interval of the quantile regression coefficients while the quantile estimates are denoted with the black dashed lines.

Examine the results in Table 3, at lower or left tail of a distribution (i.e 0.1<sup>th</sup> and 0.25<sup>th</sup> quantiles). It is observed that only one predictor i.e COE is significant with positive coefficient while others are not.



**Fig. 2. Shows (a) Histogram (b) Boxplot (c) Quantile Plot and (d) Scatter plot of the Response Variable**

**Table 3. Model of Standard of Living via Quantile Regression with 100 Resampling**

$\tau$	0.1	0.25	0.5	0.75	0.9
(Intercept)	200.86677 [2.22567] 0.0000*	206.0865 [4.24811] 0.0000*	215.0122 [8.31555] 0.0000*	224.2558 [10.99526] 0.0000*	236.8656 [14.47377] 0.0000*
GEES	-0.01065 [0.11716] 0.92805*	-0.13674 [0.09238] 0.14728*	-0.09985 [0.07613] 0.19775*	-0.12712 [0.05712] 0.03222*	-0.10386 [0.11438] 0.36975*
GESS	-0.16301 [0.51121] 0.75161*	0.60929 [0.42722] 0.1622*	0.58631 [0.38952] 0.14076*	0.50588 [0.23848] 0.04066*	0.43813 [0.33624] 0.20062*
COE	0.00443 [0.00167] 0.01176*	0.00319 [0.00216] 0.1484*	0.00329 [0.00187] 0.08723*	0.00602 [0.00153] 0.00034*	0.00575 [0.00096] 0.0000*

(GEES, GESS) are not significant for 0.1<sup>th</sup> quintile. In the case of 0.25<sup>th</sup> quantile, all predictors are not significant.

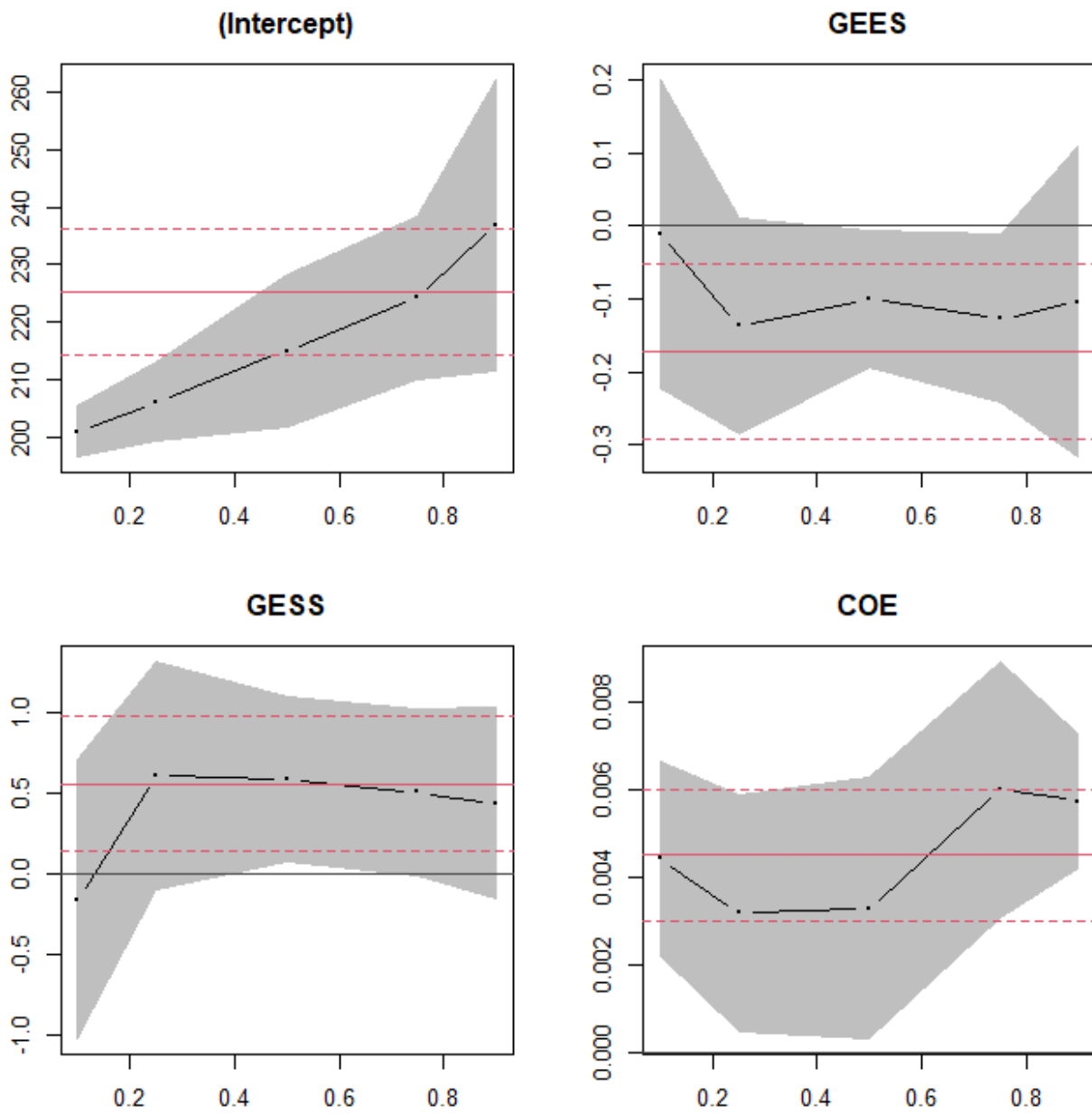
The middle tail or median of distribution (0.5<sup>th</sup> quantile), can be used in place of OLS because both try to model the location of response variable distribution, where we intend to know the location in a dataset but the OLS may not be efficient when try to investigate the extreme of a dataset. Thus, for 0.5<sup>th</sup> quantile, only COE is significant with positive coefficient. At upper tail or right tail of a distribution (0.75<sup>th</sup> and 0.9<sup>th</sup> quantile), for 0.75<sup>th</sup> quantile, GEES is significant with negative coefficient, while others i.e, GESS and COE are significant with positive coefficients. For 0.9<sup>th</sup> quantile only the COE is significant with positive coefficient. Accessing the results critically, it is obvious that compensation of employee has significant effect on standard of living irrespective of the quantiles of the data distribution apart from 0.25<sup>th</sup> that is not significant. Also the estimated coefficient at 0.75<sup>th</sup> quantile of the distribution revealed that GEES, GESS and COE has significant role on standard of living of a citizen. Such that a unit increase in GEES reduces the standard of living by 12.7%, while a unit increase in GESS and COE increases the standard of living by 50.6% and 0.6%, respectively.

#### 4.1 Equivalence of Slope Coefficient

In quantile regression, the pair bootstrapping method is used to produce a covariance matrix of the cross-quantile estimate, which would be employed to perform the equivalence test. For a given variable, the covariance matrix allows the examination of whether any difference between the slope coefficients of any pair of quantile is statistically different. Here for the test of equivalence Wald statistic is given by

$$W = \frac{\hat{\beta}_1^{(p)} - \hat{\beta}_1^{(q)}}{\sigma_{\hat{\beta}_1^{(p)} - \hat{\beta}_1^{(q)}}^2}$$

where  $\hat{\beta}_1^{(p)}$ , is the parameter estimate from the  $p^{th}$  quantile regression model and  $\hat{\beta}_1^{(q)}$ , is the parameter estimate from the  $q^{th}$  quantile regression model (i.e., any given pair of quantiles). The denominator is the variance of the difference between the two coefficients for the  $p^{th}$  and  $q^{th}$  quantile regressions. Table 4 provides the point estimates and probability values for test of equivalence of the estimate at the  $p^{th}$  quantile against those at  $q^{th}$  quantiles. The bold values indicate no statistical difference between the slope coefficient of particular  $p^{th}$  and  $q^{th}$  quantiles. For example at 0.75<sup>th</sup> quantile, the slope of all coefficients GEES, GESS and COE are statistically difference across all the quantiles. Following Chen and Chahoub-Devile, (2014), we computed the pseudo  $R^2$  for different quantiles distribution and reported in Table 5. The pseudo  $R^2$  is used to measure the relative effectiveness of the model to explain the response variable at various quantiles. From the results, it is obvious that the explanatory variables GEES, GESS and COE accounting for about 49.5%, 78.92%, 60.22%, 62.73% and 57.40% variation in standard of living at 0.1<sup>th</sup>, 0.25<sup>th</sup>, 0.5<sup>th</sup>, 0.75<sup>th</sup> and 0.9<sup>th</sup>, respectively.



**Fig.3. Plots of the Coefficient Estimates of the Explanatory Variables with 95% band**

**Table 4. Equivalence of Coefficients across Quantiles of Standard of Living with 100 Resample Bootstrap**

Quantile	Variable	Coeff.	Different from Coeff at 0.1 <sup>th</sup>	Different from Coeff at 0.25 <sup>th</sup>	Different from Coeff at 0.5 <sup>th</sup>	Different from Coeff at 0.75 <sup>th</sup>	Different from Coeff at 0.9 <sup>th</sup>
0.1 <sup>th</sup> Quant	GEES	-0.01065	-	0.05421	0.1532	0.27944	0.097238
	GESS	-0.16301	-	<b>0.00367</b>	<b>0.0143</b>	0.06796	<b>0.000393</b>
	COE	0.00443	-	<b>0.02219</b>	0.49290	0.34202	0.058546
0.25 <sup>th</sup> Quant	GEES	-0.13674	0.05421	-	0.5698	0.93015	0.695053
	GESS	0.60929	<b>0.00367</b>	-	0.939	0.7937	0.584579
	COE	0.00319	<b>0.02219</b>	-	0.9477	0.08269	<b>0.00437</b>
0.5 <sup>th</sup> Quant	GEES	-0.09985	0.1532	0.5698	-	0.75987	0.9551
	GESS	0.58631	<b>0.0143</b>	0.939	-	0.80649	0.6392
	COE	0.00329	0.49290	0.9477	-	0.08367	0.15220
0.75 <sup>th</sup> Quant	GEES	-0.12712	0.27944	0.93015	0.75987	-	0.80610
	GESS	0.50588	0.06796	0.7937	0.80649	-	0.8335
	COE	0.00602	0.34202	0.08269	0.08367	-	0.867
0.9 <sup>th</sup> Quant	GEES	-0.10386	0.097238	0.695053	0.9551	0.80610	-
	GESS	0.43813	<b>0.000393</b>	0.584579	0.6392	0.8335	-
	COE	<b>0.00575</b>	0.058546	0.00437	0.15220	0.867	-

**Table 5. Pseudo-R<sup>2</sup> of Quantile Rgression Model**

Quant	0.1 <sup>th</sup>	0.25 <sup>th</sup>	0.5 <sup>th</sup>	0.75 <sup>th</sup>	0.9 <sup>th</sup>
R <sup>2</sup>	0.494931	0.789243	0.602208	0.627327	0.573973

## 5. CONCLUSION

The study set to investigate the roles of economic and social services to the citizen's standard of living. The economic and social services are proxy with Government capital expenditure on economic and social services (like Agriculture, road construction, transport, communication, education, health and others) as well compensation of employees. The standard of living is also measured with the GDP per capital income. As a matter of fact it is expected that the government capital expenditures on economic and social services and compensation of employees should play a significant role on standard of living of a citizen. However, this is not true reflection of the living standard of various class of citizens in the country. Consequently, this study employed quantile regression analysis to estimate different quantile distribution of the standard of living. We first considered the normality test with the help of various methods on set of data obtained from Central Bank of Nigeria (CBN) statistical bulletin (2022) for period of 41 years, between 1981 and 2021 before the application of quantreg and tseries R-package for estimation of quantile regression. The results showed that the Government capital expenditure on economic and social services and compensation of employees only have significant effect on higher class citizens (0.75<sup>th</sup> quantile) compared to the lower (0.1<sup>th</sup> and 0.25<sup>th</sup> quantiles) and medium

(0.5<sup>th</sup> quantile) class citizens, except for compensation of employees that has significant effect on standard of living of lower class citizens. There is requirement for the Government to increase its capital expenditure and carefully administered to the projects related to economic and social services for the benefits of all citizens instead of few that belong to higher class.

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