



A QUANTILE REGRESSION APPROACH TO ASSESSING THE IMPACT OF GROSS DOMESTIC PRODUCT, POPULATION GROWTH AND FOREIGN DIRECT INVESTMENT ON UNEMPLOYMENT RATE IN NIGERIA

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ABSTRACT

Unemployment is one of the major problem that Nigeria is battling with in the face of rising population and economic instability. This research evaluate the impact of Gross Domestic Product, Population Growth and Foreign Direct Investment on the rate of Unemployment. Annual data from the World Bank Open Data spanning from 1991- 2021 were used. Quantile Regression was used for the analysis and results revealed that Gross Domestic Product although not significant impacted negatively on unemployment. Population Growth and Foreign Direct Investment both negatively and significantly impacted on Unemployment thereby reducing the rate of Unemployment. Government should focus more on attracting foreign direct investment, increasing Gross Domestic Product and maximizing the ever growing population to control the rate of unemployment in the country.

Keywords: Unemployment Rate, Gross Domestic Product, Population Growth, Foreign Direct Investment, Quantile Regression

INTRODUCTION

Gross domestic product, Population growth and foreign direct investment are important variables used in determining the unemployment rate of any country. A person is regarded as employed if he/she is engaged in the production of good and services, thereby contributing to the economic growth of a country in a legitimate manner. People are considered unemployed if they currently do not work, despite the fact that they are able and willing to work.

Unemployment rate is defined as the percentage of unemployed workers in the total labour force. The labour force include the employed and the unemployed who are of working age, able and willing to work. Unemployment is highly dependent on economic activity; when economic activity is high, more production happens and more people are needed to produce the higher amount of goods. When economic activity is low, firm might decide to cut cost by reducing their workforce leading to increase in unemployment. In the light of economic activity, unemployment is countercyclical, meaning it rises when economic growth is low and vice versa.

Unemployment rate is undoubtedly the most widely cited labour market indicator by media and decision makers around the world (ILO, 2018). According to the latest ILO estimates, the global unemployment rate (the share of unemployed in the total labour force) stood at 5.6 percent in 2017 and has been in a long-term downward trend since 2009, when it hit 5.9 per cent (following a sudden increase from 5.5 in 2008 as a result of the global job crisis). This means that fewer than six out of every 100 persons in the labour force around the world are unemployed. The situation is worse in Nigeria with Nigeria being one of the countries with the fastest rising population in the world, being the seventh-largest populated country in the world and the most populous in Africa – with a population of 193,392,517 growing at 2.62% per annum (NBS, 2020). There is no clear cut plan in place to cater for the needs of this rising population; one of which is employment. Increase in the population of a country directly leads to increase in the labour force of that country and with no plan in place to get the labour force gainfully employed, these will increase the unemployment rate of the country.

Unemployment rate in Nigeria increased to 23.1 percent in the third quarter of 2018 from 22.70 percent in the second quarter of 2018 (NBS, 2018) and from 23.1 percent in 2018 to 33.3 percent in 2020 (NBS, 2020). The multinational consulting firm (KPMG) in its newly release report stated that the Nigerian unemployment rate had increased to 37.7 percent in 2022 and will further rise to 40.6 percent in 2023, due to the continuing inflow of job seekers into the job market. The report further states that the unemployment rate will grow to 43 percent while inflation will accelerate to 20.3 percent in 2023 and 20.0 percent in 2024. Hence the need for this study, to look at how the unemployment situation in Nigeria can be improve upon to create a better country for its citizens.

The objective of this study was to assess the impact of gross domestic product, population growth and foreign direct investment on unemployment rate in Nigeria. Many studies conducted in Nigeria to the best of my knowledge employed ordinary least squares (OLS) modeling, which simulates the mean of the unemployment rate conditional to many independent variables. This provides only a partial view of the relationship, as we might be interested in depicting the link at various points in the conditional distribution of unemployment rate. The focus on the mean effects may under-estimate or over-estimate the proper coefficient estimates, or may even fail to capture significant linkages (Binder and Coad, 2011). Therefore, this study employed quantile regression which is a more robust approach to assess unemployment rate in Nigeria across various quantiles of economic variables. In addition to the motivation, this study also highlight the significance of the quantile regression approach which is the ability to measure the relationship between the variables at different level of quantiles in the distribution rather than capture the average relationship as in the ordinary least squares (OLS).

Review of Related Literature

Abdullah, Shah, Sargani, Ali & Siraj (2015) examined the effect of the Increase in Population on the Economic Growth of Bangladesh using data from 1980 to 2005 by employing a multiple linear regression model. The result reveals that economic growth and population are both negatively

correlated and that an increase in population will harm the economic growth of Bangladesh.

Chowdhury and Hossain (2019) did a study on Population Growth and Economic Development in Bangladesh: Revisited Malthus. A simple linear regression analysis was undertaken to determine the relationship between population growth and economic development. The result indicated that population growth is adversely related to per capita GDP growth, which means rapid population growth is a real problem for the development of Bangladesh.

Arshad (2019), examined the role of institutional quality in economic growth and more specifically the role it plays via the channel of foreign direct investments. This paper uses a larger dataset of 104 countries and applies GMM estimation method to dynamic panel data to evaluate the direct impact of institutional quality on economic growth and the indirect impact of institutional quality on economic growth through enhancing the FDI-induced economic growth. The paper provides evidence that both FDI inflows and institutional quality cause stronger economic growth in low and middle-income countries.

Sebikabu et al (2020), this study explores the effects of population growth on economic development in Rwanda from 1974–2013. The study uses data from the World Development Indicators (WDI) and uses economic growth as a proxy for economic development and the neoclassical growth model to capture the effects of population growth on economic development. It also uses the ARDL technique for a time series analysis. In the long run, ARDL results show that population growth has a positive and statistically significant impact on economic development. In the short run, population growth does not have any significant impact on economic development in Rwanda.

Janifar et al., (2020), performed a study to examine the impact of some crucial macroeconomic factors on the increasing growth rate of unemployment in Bangladesh. For the study, the data set of GDPs, inflation, population growth and FDI from the period of 1995-2019 was used. From the result of the augmented dicky fuller test, cointegration and cointegration test and least square method, it is observed that there long-run relationship exist among the factors and unemployment in Bangladesh. Economic factors like GDP and FDI have significant influence on unemployment problem in Bangladesh.

Ukpong, Ekpebu & Ofem (2013) in their research discusses issues of poverty and population growth in Nigeria. The Augmented Dickey-Fuller tests, as well as the Engle-Granger and Johansen's cointegration tests, were used to test for cointegration and stationarity of the time series data on poverty rate, population growth, and gross domestic product (GDP) real growth rate in Nigeria, and ordinary least squares (OLS) regression analysis was used. The results showed a positive relationship between poverty rate and population growth, and a negative relationship between GDP real growth rate and poverty rate in Nigeria.

Nwosu, Dike & Okwara (2014) examined the Effects of Population Growth on Economic Growth in Nigeria employing annual secondary observation from 1960 to 2008. The empirical results were based on Augmented Dickey-Fuller (ADF) stationarity test combined with Granger Causality and Cointegration tests. Empirical results support that population growth has a significant impact on economic growth. The study also found that there is a sustainable long-run equilibrium relationship between economic growth and population growth. There is also evidence of unidirectional causality between population growth and economic growth.

Tartiyus, Dauda & Peter (2015) carried out a research titled 'Impact of Population Growth on Economic Growth in Nigeria', using secondary data obtained from the World Development Indicators from 1980-2010 which were analysed using regression analysis as well as descriptive statistics. The result revealed that there is a positive relationship between economic growth (proxied by GDP growth) and population, fertility and export growth; while negative relationships were found between economic growth (proxied by GDP growth) and life expectancy, and crude death rate.

Lawanson (2016) examined Rapid Population Growth and Economic Development in Nigeria using the ordinary least square technique, the study showed that a growing economy such as Nigeria needs a growing population, that is, an increased supply of workers and consumers, though the exact nature of this relationship is complicated {population shows a positive but insignificant effect on economic growth (at first difference) and a negative but significant effect on economic growth (at first difference lagged) in Nigeria}.

Aidi, Emecheta & Ngwudiobu (2016) carried out a study on Population Dynamics and Economic Growth in Nigeria using time series data spanning from 1970 to 2014. The data were analysed using the ordinary least square estimation technique. The result revealed among others that all the core variables (i.e. fertility, mortality, and netmigration) of the study are inversely related to economic growth during the investigated period. The study further revealed that gross fixed capital formation (GFCF) and savings are strong drivers of economic growth in Nigeria.

Orumie (2016) in his study applied the multiple regression models whose estimation co-integrates the inverse relationship between unemployment rate and gross domestic product considering population growth as well. Thus, providing opportunity to assessing other determinants of economic growth, (in this case, population growth). The results estimated by the model developed in this research study revealed that since 1970, the rate of unemployment and population has been on the increase amidst declining gross domestic product. The result also reveal that unemployment and population growth contribute commensurably to gross domestic product. Furthermore, the result showed that unemployment contributes more to the national gross domestic product during this period in line with existing work.

Musa, Mohammed and Maijama'a (2019) carried out a research to examine the impact of population growth on unemployment in Nigeria. The study applied annual time series data from 19991 to 2017. The research employed dynamic ordinary least squares (DOLS) to estimate the model. The results disclosed that population and exchange rate impacted positively with unemployment. Consumer price index, GDP per capital and foreign direct investment impacted negatively thereby reducing the rate of unemployment in the long-run.

Iyoboyi (2020), investigates the long run impact of institutions on economic growth, using the Dynamic Ordinary Least Squares technique. There was empirical evidence of a statistically significant and positive relationship between property rights and growth. Law and order was also statistically significant and positively associated with growth, while political terror exerted a negative impact on growth in the period of investigation.

Onyeoma (2020), studied the influence of the rising population on Poverty and Unemployment in Nigeria using Autoregressive Distributed Lag Bounds (ARDL) approach on annual data from 1980-2018. It explores the dynamic

relationship between population growth and selected macroeconomic variables of economic growth, poverty, and unemployment as well as the direction of causality between them. The study found that population growth and its components exerted a negative impact on the overall economic conditions in Nigeria.

Samuel (2021), carried out a study to examine rapid population growth and economic development issues in Nigeria. Descriptive and analytical statistics tools were used to analyse the data from CBN, NBS and World Bank. The finding of the study revealed that population, remittance, gross domestic product and unemployment negatively and significantly affect the Human Development Index in Nigeria, while foreign direct investment and effective governance exerted positive and significance effect.

MATERIAL AND METHODS

The estimation method applied for this research study is Quantile Regression. Koenker and Bassett, (1978), indicated that quantile regression can be employ to describe the effect of explanatory variables on the response variable through different quantiles. That is quantile regression allows for understanding relations between variables outside of the conditional mean of the response and it is useful for understanding an outcome at its various quantiles. This gives quantile regression an edge over the ordinary least square (OLS) regression which is used to model the expected value (mean) of an outcome given the covariates in the model. The coefficient estimated using quantile regression is are also more robust, since Quantile Regression technique is more resilient to outliers than OLS.

This study examine the impact Gross Domestic Product, Population Growth and Foreign Direct Investment on Unemployment Rate in Nigeria using an annual data that covers the period starting from 1991 to 2021. The data of the variables were collected from World Bank Open Data.

Model Specification

The model is established following previous studies that define unemployment as a function of population growth (Gideon, 2015), Musa, Mohammed and Majjama'a (2019) and also on other studies that have seen gross domestic product and foreign direct investment as being influenced by unemployment (Imoisi, 2017).

Defining Unemployment (UNEM) as a function of Gross Domestic Product (GDP), Population Growth (PG) and Foreign Direct Investment (FDI), we have

$$\text{Unemployment} = f(\text{Gross Domestic Product, Population Growth, Foreign Direct Investment}) \tag{1}$$

The model for the study is:

$$\text{UNEM} = \alpha + \beta\text{GDP} + \beta\text{PG} + \beta\text{FDI} + \varepsilon \tag{2}$$

Here,

UNEM indicates Unemployment Rate of Nigeria, α is the intercept for each entity, GDP is Gross Domestic Product, PG

is Population Growth, FDI is Foreign Direct Investment and ε is the error term which is assumed to be normally distributed with mean 0 and constant variance 1.

The model for the study can be represented as:

$$y_i = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \varepsilon_i$$

where y is the dependent variable, x_1, x_2, x_3 are the independent variables, ε is the residual of y , and the β s are the mean regression parameters. The estimation involves the minimization of the sum of squared residuals with respect to the β s, namely

$$\min \sum_{i=1}^N (y_i - \hat{y}_i)^2,$$

where the fitted value $\hat{y}_i = x_i'\beta$

Quantile Regression Approach

The basic conditional quantile model can be represented through the following specification:

$$Q_{y_i}(\tau|X) = \beta_{0\tau} + X_i'\beta_{\tau,i}, \tag{3}$$

where τ denotes the quantile with $0 < \tau < 1$, $Q_{y_i}(\tau|X_i, \alpha)$ refers to the τ conditional quantile of y_i , $\beta(\tau)$ is the estimated parameter in the equation, and the regression matrix includes the variables that are assume to influence the conditional quantile of the dependent variable. Hence, the coefficient of the conditional quantile regression can be estimated using the following:

$$\arg \min_{(\beta_{0(\tau)}, \beta_{\tau})} \sum_{i=1}^n \rho_{\tau}(y_i - \beta_{0\tau} - X_i'\beta_{\tau,i}) \tag{4}$$

where $\rho_{\tau}(\mu)$ is the check function, $\rho_{\tau}(\mu) = \tau\mu$ for $\mu \geq 0$, and $\rho_{\tau}(\mu) = (\tau - 1)\mu$ otherwise (Koenker and Bassett). The study establishes 9 quantiles ($\tau = 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9$) and the 9 quantile are grouped under 3 parts: Low for $\tau = 0.1, 0.2, 0.3$, Medium for $\tau = 0.4, 0.5, 0.6$, and High for $\tau = 0.7, 0.8, 0.9$. A part is said to be statistically significant if at least 2 quantiles within the part is statistically significant.

RESULTS AND DISCUSSIONS

This section presents the results of estimation of the model and discusses the findings of the study. The descriptive statistics are presented in Table 1. It is observed that the average level of UEP, GDP, PG and FDI are within the moderate range with a values 4.8723, 4.0800, 2.6384 and 1.6448 respectively. At some period, GDP level was negative with a value of -2.0400 indicating a probable period of recessionary economic growth in the country, with an increase in unemployment and population at the same period. Furthermore, GDP shows a higher increase rate at maximum level of 15.3300 which further signifies the impact of an improved economic activities after recession to reduce the level of unemployment. All the variables considered are positively skewed except for PG which is negatively skewed which implies that the outliers of the distribution curve are further out towards the right and closer to the mean on the left. And since none of the variables exhibit zero skewness, it shows that the data is not normally distributed.

Table 1: Descriptive Statistics Result

Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Minimum	Maximum	Observation
UEP	4.8723	4.0000	1.9364	1.6013	0.8411	3.7000	9.7900	31
GDP	4.0800	4.2300	3.8425	0.4361	0.4332	-2.0400	15.3300	31
PG	2.6384	2.6100	0.1040	-0.0617	-1.3242	2.4400	2.8000	31
FDI	1.6448	1.5200	1.2144	1.7269	3.2271	0.1800	5.7900	31

Table 2 describe the correlation that exist between the variables in our model. From the correlation matrix in Table 2, it can be confirm that there is no pair-wise correlation coefficient that is over 0.80 (Gujarati and Porter, 2006).

Hence, the variables cannot be said to be collinear. GDP is -0.4194, PG is -0.7030 and FDI is -0.4359. Therefore, it can be concluded that there is no multicollinearity among the explanatory variables.

Table 2: Correlation Result

Variable	UEP	GDP	PG	FDI
UEP	1			
GDP	-0.4194	1		
PG	-0.7030	0.6704	1	
FDI	-0.4359	-0.0250	0.3586	1

To examine the property of the data before conducting the estimation of the model, the non-stationarity or integration properties of the time series was conducted using the widely used Augmented Dickey-Fuller (ADF) and Philip-Perron

(PP) unit root test. In Table 3, the stationarity test result shows that UEP, GDP, PG and FDI became stationary after first differencing in ADF and Philip Perron Stationary test, that is all the variables used in the study are I(1) variables

Table 3: Stationarity Result

Variables	ADF		PP		Order of Integration
	levels	1st Difference	levels	1st Difference	
UEP	1.546	-2.512**	1.119	-4.343**	I(1)
GDP	-1.210	-4.306**	-2.863b	-7.66**	I(1)
PG	-0.322	-2.762**	-0.527	-2.768***	I(1)
FDI	-1.587	-6.308**	-2.980a	-6.124**	I(1)

Table 4 show the impact of GDP, PG and FDI on Unemployment in Nigeria a lower level of 0.1 to a higher level measure of 0.9. According to the estimates obtained in Table 4, GDP impacted negatively on unemployment at moderate and high level meaning that percentage increase in the GDP will bring about decline in the rate of unemployment but it is not statistically significant. Similarly, PG impacted on unemployment negatively from low level through moderate level to high level and it is significant mainly at high level. Meaning that increase in PG will lead to a decrease in the rate of unemployment. The estimates of FDI is negative at

moderate and high level and significant mainly at high level to explain unemployment situation in Nigeria. Meaning that at high level, increase in FDI leads to decline in unemployment rate. The result of the OLS estimate shows almost a similar result with the quantile estimates. From the result of the estimate in Table 4, for OLS the relationship between FDI and Unemployment is negative but not significant but for quantile regression, at high level, FDI have a negative and significant relationship with Unemployment rate.

Table 4: Quantile Regression Result

	OLS		Low			Medium			High		
	$\tau = 0.1$	$\tau = 0.2$	$\tau = 0.3$	$\tau = 0.4$	$\tau = 0.5$	$\tau = 0.6$	$\tau = 0.7$	$\tau = 0.8$	$\tau = 0.9$		
GPD	-0.004	0.007	0.003	0.001	-0.000	-0.004	-0.040	-0.062	-0.084	-0.036	
PG	0.964	0.737	0.877	0.991	0.999	0.979	0.490	0.417	0.258	0.486	
FDI	-11.550	-1.627	-1.332	-1.410	-1.847	-2.289	-2.289	-12.441	-13.553	-13.863	
Constant	0.006**	0.061	0.037**	0.438	0.674	0.674	0.000**	0.001**	0.000**	0.000**	
Observation	-0.341	0.041	0.030	0.019	-0.008	-0.028	-0.445	-0.582	-0.711	-0.702	
	0.173	0.196	0.336	0.816	0.982	0.859	0.016**	0.005**	0.001**	0.000**	
	35.923	8.115	7.398	7.660	8.922	10.221	35.717	39.819	43.427	44.274	
	0.001***	0.001***	0.000***	0.108	0.433	0.434	0.000***	0.000***	0.000***	0.000***	
	31	31	31	31	31	31	31	31	31	31	

Statistical significance is represented as *,**,*** for 1%, 5% and 10% respectively

CONCLUSION

This study examines the impact of GDP, PG and FDI on Unemployment rate in Nigeria, with annual data from 1991 to 2022 using Quantile Regression approach for the estimation of the variables. The study shows that Gross Domestic Product, Population Growth and Foreign Direct Investment all have negative relationship with Unemployment meaning that this variables help to reduce the rate of unemployment. But Gross Domestic product is not significant. The results led to the recommendation that government should pursue measures that will help to maximize it's growing population in order to enjoy an abundant supply of labour and consequently led to the reduction in the rate of unemployment, also government should encourage industrialization policy and flow of foreign direct investment into the country in order to provides employment opportunities to the unemployed teaming population.

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