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Parametric Modelling of Impact of Unemployment on Economic Growth in Nigeria

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Abstract
The aim of this study is to examine the relationship between unemployment figures in Nigeria and gross domestic product using curve fitting regression model. The following models of regression analysis were examined to determine the most suitable one to the data collected: linear, quadratic, cubic, exponential, inverse and logarithmic. Our findings revealed that the pattern of relationship between gross domestic product and unemployment is significant in all the models considered. This implies that there is significant relationship (negative or positive) between unemployment and gross domestic prodution (GDP) in the country. Also, the best model that fits the data in terms of the relationship between the two variables is the linear model because the quadratic variable is not significant in the quadratic model. The order of the next models are logarithmic, inverse and exponential models; the cubic variable and the quadratic variable are not also significant in the cubic model.
Keywords: Unemployment, Domestic, linear, inverse, logarithmic, exponential

1 INTRODUCTION

Unemployment is generally seen as a macro-economic problem as well as socio-economic problem. Unemployment arises as a result of insufficient and non-availability of jobs to correspond with the growing population (Nickel, 1999). The term unemployment could be used in relation to any of the factors of production which is idle and not being utilized properly for production process. However, with reference to labour, there is unemployment if it is not possible to find jobs for all those who are eligible and able to work. Labour is said to be underemployed if it is working below capacity or not fully utilized in production (Akintoye 2008).

Unemployment can either be voluntary or involuntary. Voluntary in the sense that one chooses not to work because he or she has means of support other than employment. Example is an idle rich man. On the other hand, involuntary unemployment exists when persons who are eligible and willing to work at the prevailing rate of pay are unable to find work (Ekpo, 2011). Unemployment has been seen as a world-wide economic problem and has been categorized as one of the serious impediments to social progress. Apart from representing a huge waste of a country's manpower resources, it generates welfare loss in terms of lower output thereby leading to lower income and well being of the people. Unemployment is a very serious issue in Africa, and particularly in Nigeria. The need to avert the negative effect of unemployment has made the tackling of unemployment problems to feature very prominently in the development objectives of many developing countries (Levin and Wright, 2000).

Gross domestic product (GDP) measures the output made in the domestic economy, regardless of who owns the production input. It may also be defined as the income received by the residents of a country irrespective of their nationality (Salami et al, 2011). The compilation of Nigeria's gross domestic product (GDP) is carried out using the three approaches namely, output, income and expenditure. While the output approach is compiled on the quarterly basis, the income and expenditure approach is compiled on annual basis. The theoretical basis for the compilation of the gross domestic product (GDP) by output, expenditure and income approach was derived from the circular flow of income in an economy. The circular flow of income is a simple model of the economy showing flows of goods and services and factors of production between firms and households (NBS, 2011).

The output method is the total amount of goods and service produced in one year. The expenditure method is the total amount of domestic spending by consumers, firms, government and foreigners while the income method is the total incomes earned by the individual involved in the production of goods and services in one year. However, the data on GDP used in this study is the one obtained from the output method (NBS, op cit).

1.1 Statement of the problem

Unemployment has reached a very alarming proportion in Nigeria, with a greater number of the unemployed being polytechnic and university graduates. This situation has recently been compounded by the increasing unemployment of professionals such as bankers, engineers and doctors. The toll is within the productive segment of the Nigeria population (Ajetomobi and Ayanwale, 2004). It is believed that a relationship which may be linear or non-linear, exist between the recorded number of unemployed and the gross domestic product but the nature

and pattern of such relationship is lacking in most research work. This research work therefore examines the kind of relationship between the recorded number of unemployed and the gross domestic product for a period of thirty-one years.

1.1.1 Research questions

From the above discussions the research questions are:

1. What is the pattern of relationship between unemployment and gross domestic product?
2. Which model best fits the relationship between unemployment and gross domestic product?

1.1.2 Objectives of the study

1. To determine the pattern and nature of the relationship between unemployment and economic growth in Nigeria.
2. To examine the model that best fits the relationship between unemployment and gross domestic product.

1.1.3 Significance of the study

One of the macroeconomics goals of any country is the actualization of full employment. Therefore, unemployment in any system is seen as a policy failure and there is always concerted effort on the part of the government in checkmating the impact of unemployment in an economy. The study of unemployment is important to the policy makers, politicians, and other stakeholders. Knowing the pattern of the relationship between unemployment and GDP will provide useful information needed by government to fight unemployment and help create employment opportunities in Nigeria.

2 LITERATURE REVIEW

Unemployment in Nigeria

Nigerian universities and other tertiary institutions produce graduates on yearly basis, many of whom looked for white collar jobs. Furthermore, Nigerian governments, both Federal and States in most cases also usually placed embargo on employment. This always had a tall-telling effect on unemployment since government is the largest employer of labour in Nigeria. Following this, total disengagement from the Federal Civil Service rose from 2724 in 1980 to 6294 in 1984 and trend has been on the increase. Graduate unemployment accounted for about 32% of the unemployed labor force between 1992 and 1997 (Lindbect, 1999). Between 2000 and 2001, the unemployment rate was 28% and in 2002 it suddenly dropped to 0.28, a reduction of 27.72% over the previous two years. One wonders what happened to the economy that so improved the employment situation. Surprisingly again, it reverted to 28% in 2003 and reduced to 2.9 in 2006. The unemployment rate doubled in 2007 from 2.9% in 2006 to 5.8% in 2007. In 2008, it reduced by 0.9% from 5.8% in 2007 to 4.9% and remained same between 2008 and 2009 (NBS, 2011).

At a recent Nigeria Economic Summit Group (NESG) on policy dialogue of Nigerian economy, the Minister of Finance quoted data from the National Bureau of Statistics (NBS) that about 10 million Nigerians (19.7%) are unemployed as at 2009 while the unemployment rate had increased to 21.1% and 23.9% in 2010 and 2011 respectively and that almost half of those aged 15-24 years in the urban area are jobless. She added that 49% of the unemployed resides in the urban areas while 39.7% reside in the rural areas. In 2011, the percentage of unemployed in the rural area is 25.6 while that of the urban area is 17.1. Some States are more affected than others. Bayelsa has the highest unemployment rate, followed by Katsina State and Akwa-Ibom State while Plateau State has the lowest unemployment rate followed by Ogun State and Benue State.

The population growth rate of the country is 2.38% (2008 estimate) while the 2005 estimate of rural and urban population distribution was given as 52 and 48 percent respectively. The major tribes in the country are Hausa, Yoruba and Igbo, while the percentage distributions of the population into the major religion are 50% (Islam), 40% (Christianity). The total labour force is made up of people aged 15 – 64 years in most sectors and it excludes students, home keepers, retired persons, stay-at-home parents and persons unable to work or not interested in working (NBS, 2011). The rising rate of the population of the country which is faster than the job opportunities, a situation in which birth rate is rising, death rate is falling and the population growth rate is between 2.5% and 3% unemployment is bound to exist. There had been also a total neglect of the agricultural sectors and consequent mass exodus of able bodied youths from the rural to urban areas in search of the none existing while collar jobs. This further reduces employment in agriculture and puts pressure on existing urban jobs (Austin, 2003). Unemployment also has different types. Seasonal unemployment occurs when industries have a slow season such as construction and other outdoor work in winter. It also occurs at the end of the school year in June, when large number of students and graduates look for work. Underemployment is a situation where people employed on part-time basis or at work that is insufficient or unproductive with a correspondingly low income that is insufficient to meet their needs. Frictional unemployment is the imbalance between demand for and supply of labour. Structural unemployment is the unemployment that results from the imbalance between the kind of workers wanted by employers and the kind of workers looking for job (Bisping and Hilde, 2005).

In the study of unemployment in Africa, Bello (2003) identified three (3) causes of unemployment; the educational system, the choice of technology which can either be labour intensive or capital intensive and

inadequate attention to agriculture. The use of machines to replace work done by labour and computerization has also contributed to these social problems. Unemployment represents wasted resources because unemployed labour has the potential to contribute to national income but are not doing so because they are jobless (Mankiw 1994). Another reason for unemployment according to Ekpo (2011) is that it takes time to match workers with jobs so far labour is not homogeneous and job contents are also different. Again, the flow of information about job candidates and job vacancies is important and geographical mobility of workers is not instantaneous or prompt. Seeking for appropriate job takes time and effort.

Although, there are variations in the measurement of unemployment, official estimates show their results as follows: from 1985-2003, the data shows a highly fluctuation trend from both the urban and rural sectors of the economy. The 1985 figure shows the percentage of the national urban and rural unemployment as follows: national 6.10%, urban 9.8% rural 5.2% while in year 2003, the percentage is as follows: national 3% urban 3.8% rural 2.7 % (CBN 2004).

3 MATERIALS AND METHODS

Data used for this research work is a secondary data extracted from the records of National Bureau of Statistics. The data contained the recorded number of unemployed Nigerians in each year and the gross domestic product. The period of study is thirty one years i. e. 1980 to 2010. Basically, regression analysis is used, which involved curve fitting i. e. determining the best curve that fits the data. The equations of approximation of the relationship between the variables are linear, quadratic, cubic, exponential, inverse and logarithmic.

Given the data points (x_1, y_1), (x_2, y_2), . . . , (x_n, y_n), and a difference of d_i (deviation, error or residual which may be positive, negative or zero) between the original values and the estimated values, a measure of the goodness of fit of the curve to the given data is provided by the quantity $d_1^2 + d_2^2 + \ldots + d_n^2$. If this is small, the fit is good, if it is large, the fit is bad. To be more explicit, we say that all curves approximating a given set of data points, the curve having the property that $d_1^2 + d_2^2 + \ldots + d_n^2$ is a minimum is called a best-fitting curve. A curve having this property is said to fit the data in the least squares sense and is called a least square curve.

The regression models that are used in this research work are explained below according to Murray and Larry (1999):

(i) Linear Regression Curve:

$Y_i = \beta_0 + \beta_1 X_i + e_i$ is called the first order regression model. Here, Y_i is the value of the ith trial; β_0, β_1 are parameters, e_i is a random error term with mean $E(e_i) = 0$ and variance σ^2 ($E_iE_j = 0$) for all i, j; $i \neq j$, i = 1,2, . . . , n, j = 1,2, . . . , m.

(ii) Quadratic Regression Curve

$Y_i = \beta_0 + \beta_1 X + \beta_2 X^2$, where β_0, β_1, β_2 are parameters; X, X^2 are the independent variables where Y_i is the dependent or response variable.

(iii) Cubic Regression Curve

$Y_i = \beta_0 + \beta_1 X + \beta_2 X^2 + \beta_3 X^3$, where β_0, β_1, β_2, β_3 are parameters, X, X^2, X^3 are the independent variables where Y_i is the dependent or response variable.

(iv) Inverse Regression Curve

$Y_i = \dfrac{1}{\beta_0 + \beta_1 X}$ *or* $\dfrac{1}{Y_i} = \beta_0 + \beta_1 X$, where β_0, β_1 are parameters, X is the independent variable, Y_i is the dependent or response variable.

(v) Exponential Regression Curve

$Y = ab^X$ or $\log Y = \log a + (\log b)X = \beta_0 + \beta_1 X$ where β_0, β_1 are parameters, X is the independent variable, Y_i is the dependent or response variable.

(vi) Logarithmic Regression Curve

$\log Y = \log a + (\log b)X = \beta_0 + \beta_1 X$ where β_0, β_1 are parameters, X is the independent variable, Y_i is the dependent or response variable.

The best curve is determined by examining the following parameters for each of the models above: The correlation coefficient, coefficient of determination, adjusted R, ANOVA table and the P-values. In addition to curve fitting, ANOVA is also used to test for the significance of the model. If $P < 0.05$, the curve is significant and accepted but if $P > 0.05$, then the curve is not significant and is rejected. SPSS (Statistical Package for Social Science) Version 17 is used for the analysis.

3.1 Statement of hypothesis

For the ANOVA table;

H_0: Unemployment has no significant impact on economic growth in Nigeria.

vs

H_1: Unemployment has significant impact on the economic growth in Nigeria.

To test the significance of slope, the hypothesis is:
H_0: $\beta_1 = 0$
vs
H_1: $\beta_1 \neq 0$
Reject H_0 if the p-value is less than $\alpha = 5\%$ level of significance.

4 RESULTS

Table 1: Model Summary

Model	R	R Square
Linear	.919	.845
Quadratic	.968	.937
Cubic	.976	.952
Inverse	.738	.545
Exponential	.581	.338
Logarithmic	.840	.705

The table above shows the summary of the models used for the study.

Linear

Table 2: ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.501E15	1	2.501E15	158.547	.000
Residual	4.575E14	29	1.577E13		
Total	2.958E15	30			

The independent variable is Unemployment.

Table 3: Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
X	69.491	5.519	.919	12.592	.000
(Constant)	-5573133.525	1185248.284		-4.702	.000

This tabe shows the estimated linear regression model coefficients of the study.

Logarithmic

Table 4: ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.087E15	1	2.087E15	69.422	.000
Residual	8.717E14	29	3.006E13		
Total	2.958E15	30			

The independent variable is Unemployment.

Inverse

Table 5: ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.613E15	1	1.613E15	34.756	.000
Residual	1.346E15	29	4.640E13		
Total	2.958E15	30			

The independent variable is Unemployment.

Table 6: Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 / X	-1.864E12	3.161E11	-.738	-5.895	.000
(Constant)	2.224E7	2960262.003		7.512	.000

Inverse regression model coefficients

Quadratic

Table 7: ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.771E15	2	1.385E15	206.918	.000
Residual	1.875E14	28	6.696E12		
Total	2.958E15	30			

The independent variable is Unemployment.

Table 8: Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
X	-51.920	19.456	-.687	-2.669	.013
X^2	.000	.000	1.635	6.350	.000
(Constant)	4341995.524	1741991.720		2.493	.019

Quadratic regression model coefficients

Cubic

Table 9: ANOVA

ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.818E15	3	9.392E14	180.201	.000
Residual	1.407E14	27	5.212E12		
Total	2.958E15	30			

The independent variable is Unemployment.

Table 10: Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
X	-220.271	58.773	-2.914	-3.748	.001
X^2	.001	.000	6.396	3.983	.000
X^3	-8.026E-10	.000	-2.608	.	.
(Constant)	1.467E7	3775615.258		3.886	.001

Cubic regression model coefficients

Exponential

Table 11: Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
X	1.007E-5	.000	.581	3.844	.001
(Constant)	197619.033	111154.484		1.778	.086

The dependent variable is ln(GDP).

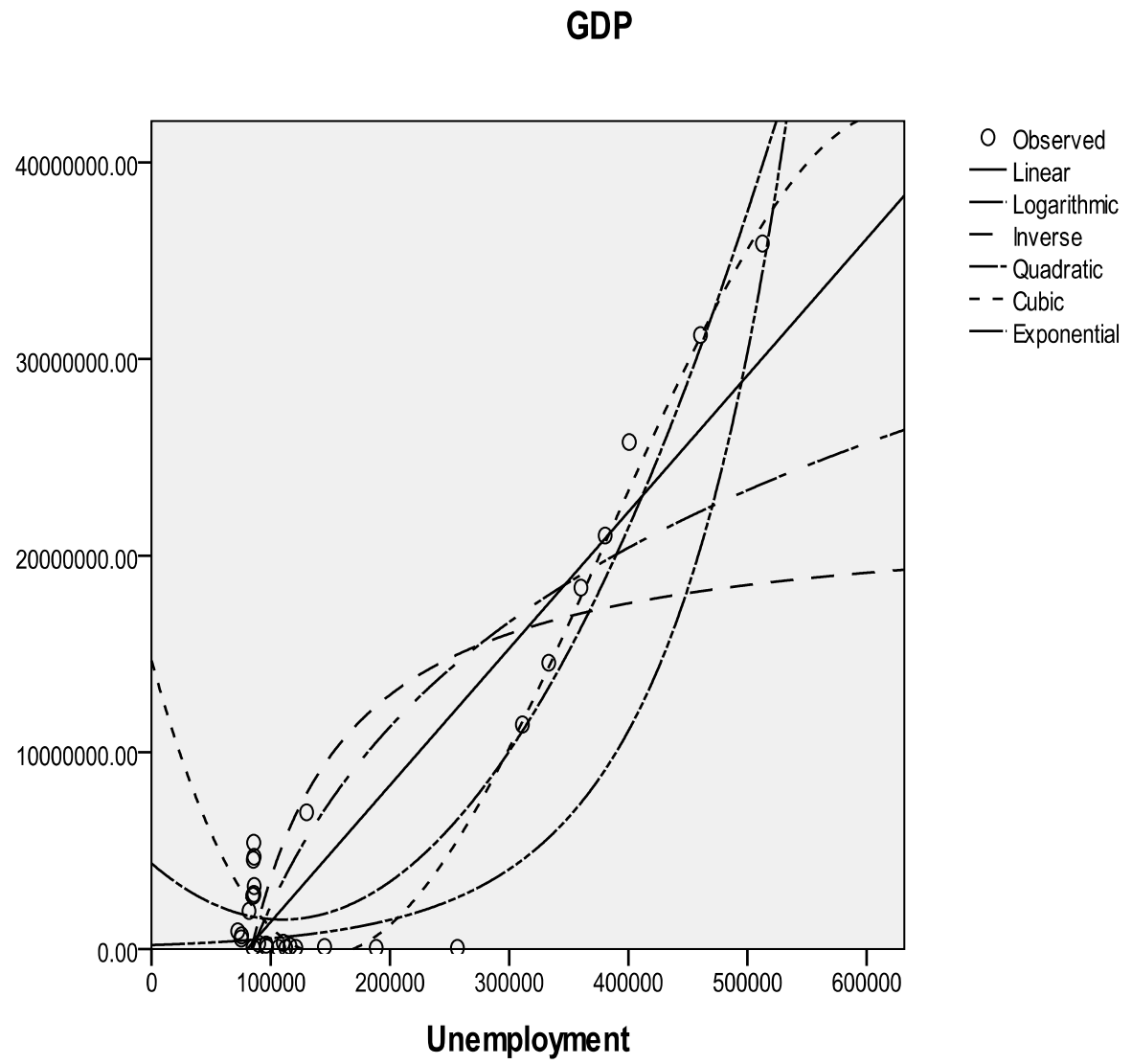

Figure 1: Trend of unemployment against GDP with respect to the models considered

4.1 DISCUSSION

In addition to fitted curves, ANOVA, R and R^2 values are used to test for the significance of each of the model. If $P < 0.05$, the curve is significant and accepted but if $P > 0.05$, then the curve is not significant and is rejected. Also, the highest coefficient of correlation (R) and the coefficient of determination (R^2) were put into consideration to determine the best curve that fits the data.

From table 1 above, the order of the correlation coefficient between Y (GDP) and (X) (unemployment rate) in ascending order of magnitude for the models are Exponential < Inverse < Logarithmic < Linear < Quadratic < Cubic. Due to the insignificance of X^3 coefficient in the cubic model, it approximates to the quadratic model; hence the cubic model may be ignored. Considering the R^2 (coefficient of determination) values, the linear model shows that the independent variable explained 84.5% of the variation in the dependent

variable, the quadratic model: independent variable explained 93.7% of the variation in the dependent variable, inverse model: independent variable explained 54.5% of the variation in the dependent variable, exponential model: independent variable explained 33.8% of the variation in the dependent variable while the logarithmic model shows that the independent variable accounted for 70.5% of the variation in the dependent variable. The ANOVA tables depict that the fitted models to the data and their parameters are significant since their corresponding p-values are less than α.

5 Conclusion

From the above discussions, we conclude that the pattern of relationship between gross domestic product and unemployment is significant in all the models considered. This implies that there is significant relationship (negative or positive) between unemployment and gross domestic prodution (GDP) in the country. Also, the best model that fits the data in terms of the relationship between the two variables is the linear model because the quadratic variable is not significant in the quadratic model.

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APPENDIX

Original data on Gross Domestic Product ('000), unemployed Nigerians, inflation rate and exchange rate ($) from 1980 – 2010

Year	GDP (Y)	Unemployment (X)
1980	46248.90	256623
1981	47619.70	188438
1982	49069.30	106496
1983	53107.40	112588
1984	59622.50	120945
1985	67908.60	96580
1986	69147.00	85158
1987	105220.90	145084
1988	139085.30	116162
1989	216797.50	96055
1990	267550.00	89752
1991	312139.80	110513
1992	532613.80	75143
1993	683869.80	75387
1994	899863.20	72277
1995	1933211.60	81730
1996	2702719.10	85441
1997	2801972.60	85832
1998	2708430.90	84727
1999	3194023.60	86024
2000	4537640.00	85368
2001	4685912.20	85928
2002	5403006.80	85648
2003	6947819.90	130060
2004	11411066.90	311119
2005	14553097.00	333180
2006	18374214.70	360232
2007	21025392.10	380530
2008	25777899.20	400750
2009	31222332.40	460475
2010	35879545.80	512600

Source: Central Bank of Nigeria annual bulletin 2011.

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