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The Effects of Output Shock on Unemployment: An Application of Bounds Testing Approach to Nigeria

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Abstract
There exists a plethora of literature that links unemployment with restiveness as being experienced in Nigeria, especially amongst the youth. Okun's law suggests a negative relationship between output and unemployment. So it would appear that improving the economy would reduce unemployment and by consequence (youth) restiveness. This study investigated the effect of output (GDP) on unemployment rate in Nigeria, if short- and long-run relationship exists between them; a relationship necessary for the validity of Okun's law in Nigeria. The study made use of annual time series data from 1985 – 2013. A robust and recent time series technique known as the Autoregressive Distributed Lag Bounds Test was used which is applicable whether the regressors are I(0) and I(1). The results shows that with the present structure of the economy, output changes in Nigeria, have no significant effect on unemployment rate. The findings in this study implies that for Government or the monetary authority to tackle the issue of unemployment (and poverty) in Nigeria, structural changes need to be made to the economy so that high-job generating sectors like manufacturing and agriculture, will be the drivers of the Nigerian economy.
Keywords: Unemployment, Output, ARDL, Wald Test, Bounds Test, Okun's law, Impulse Response, Variance Decomposition

1. Introduction

The high rate of unemployment prevalent in the country has been one of the greatest challenges of consecutive administrations in Nigeria. Since 1997 when it reached high double digits, it has continued unabated and the trend has continued to pose grave concern to Economists and policy makers. In contrast, the Nigerian economy has faced an overall positive growth rate since 1988, and not even the global financial crisis that started in the autumn of 2008 could alter this trend.

This conflicting scenarios in the Nigerian economy contradicts the widely accepted view in economics that a positive growth rate in Gross Domestic Product (GDP) of an economy translates to an increase in employment because the three most significant elements for an economy overall are productivity, income distribution and unemployment (Akeju and Olanipekun, 2014). This relationship between output and level of unemployment was first investigated by Arthur Okun at the behest of the Council of Economic Advisers, Washington DC, in the early days of the Kennedy Administration and his findings were published in his seminal paper that has intrigued economists and policy makers for over fifty years. Okun's result stated that GDP will experience a gain if unemployment rate decrease from 7% to 4% of the labour force. This led Okun to postulate that an increase in unemployment by 1% will cause a 3% decrease in GNP Arshad (2010). According to Okun (1962), an "increase in labor force size, increased working hours and more productivity".

This paper seeks to investigate 'The Effects of Output Shock on Unemployment: An Application of Bounds Testing Approach to Nigeria'. This research will investigate the relationship between the levels of unemployment to the output growth and see it supports the existence of Okun's (1962) historical relationship in the Nigerian economy. The main objective of the research is to ascertain if a long and short run relationship between unemployment rate and output exists in Nigeria. The plan is to apply autoregressive distributed lag (ARDL) bound test and the error correction model (ECM) to check for long and short run relationship between the variables. Annual time series data of unemployment and GDP from 1985 to 2013 is used. National Bureau of Statistics (NBS) and Central Bank of Nigeria, 2013 Statistical Bulletin are the sources of the data.

Though, there exists literature on this topic, they are all 'pre-rebasing' and this study is interested in analyzing the relationship between Nigerian GDP and unemployment rate, 'post-rebasing'. Also, by focusing on the period of 1985 to 2013, this study is more updated than earlier Nigerian studies on the relationship between unemployment rate and output.

The rest of this paper is organized as follows. The introduction is followed by a presentation of figures on GDP and unemployment in Nigeria over the years. Section 3 comprises of a Review of Empirical Literature. In Section 4, model and method adopted is laid out. In Section 5 we have results and discussion whereas Section

[1] The views expressed herein, are purely that of the author and does not reflect the views or position of the Central Bank of Nigeria

6 contains conclusion and recommendations for possible future research directions.

2 GDP and Unemployment Rate in Nigeria

In the 1980s the home-made recession brought about by the infamous SAP (structural adjustment programme), led to a slow – down in economic growth. GDP growth slumped from 11.33 % in the 1985 to –0.69 % in 1987 which also represents the lowest ever GDP growth in Nigeria's history so far. The growth rate however picked up from 1988 (7.58%) to 1990 (11.36) which also represents the highest GDP rate in Nigeria's history so far. From 1991 to 2013 GDP growth rate increased from 0.01% to 5.49%. Overall, Nigeria's economy has been experiencing positive growth, though fluctuating, for the last 26 years which is quite amazing, considering the economic turmoil and uncertainties that have been bedeviling the nation all this time, including the global financial crisis of 2008 (see Figure 1).

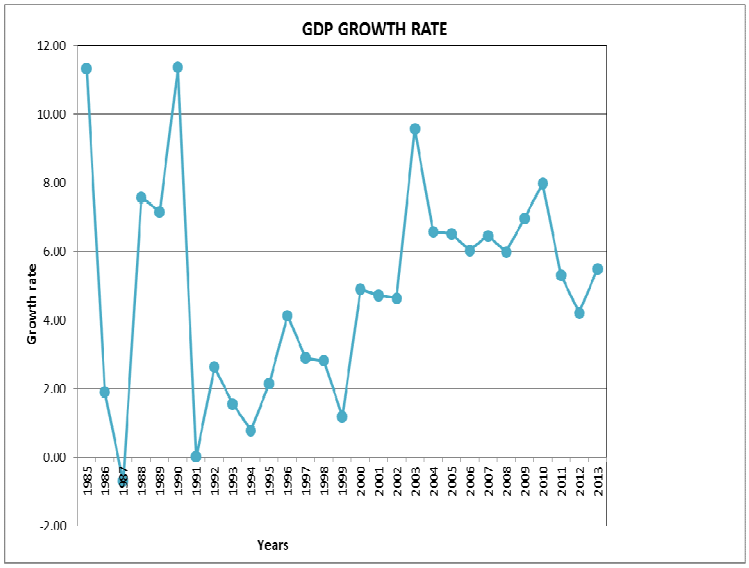

Figure 1: Annual growth rate in Nigeria 1985 - 2013

In the 1980s despite the dismal performance of the Nigerian economy, unemployment experience a gradual though unsteady decline, this continued into the 1990s and in 1995 the rate was 1.9% which represents the lowest unemployment rate ever, so far. However in the period starting 1999 Nigeria's unemployment rate experienced an enormous increase from 3.5% in 1998 to 17.5%. This enormous increase can partly be attributed to the continuous addition of graduated students into the labor force annually. The rate experienced an unsteady decline until 2009 when it spiked again to 19.7%, and then from 2010 it crossed the 20% mark and has not looked back since (see Figure 2).

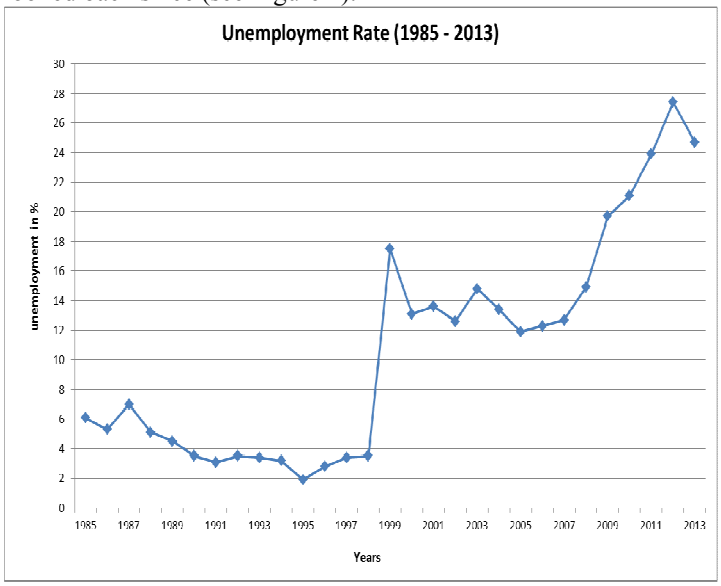

Figure 2: Annual unemployment rates in Nigeria 1985 - 2013

In the 1980s, unemployment maintained a rate of 4 – 6% with a very erratic GDP. During the 1990s unemployment rate was between 1% - 4% but reached a peak of 17.5% in 1999, the same year that GDP recorded the historical rate of 1.9%. In the periods 2000 – 2006, unemployment maintained an average rate of 13.1% while GDP increased from 4.89% to 6.03%. In 2007, unemployment increased to 12.7% while economic growth rather than decrease, actually increased from 6.03 to 6.45. In the periods 2008 - 2010, due to the global financial crisis, unemployment continued its increase, increasing by 6.2 percentage points but again contrary to classical economic theory, GDP grew by 2 percentage points.

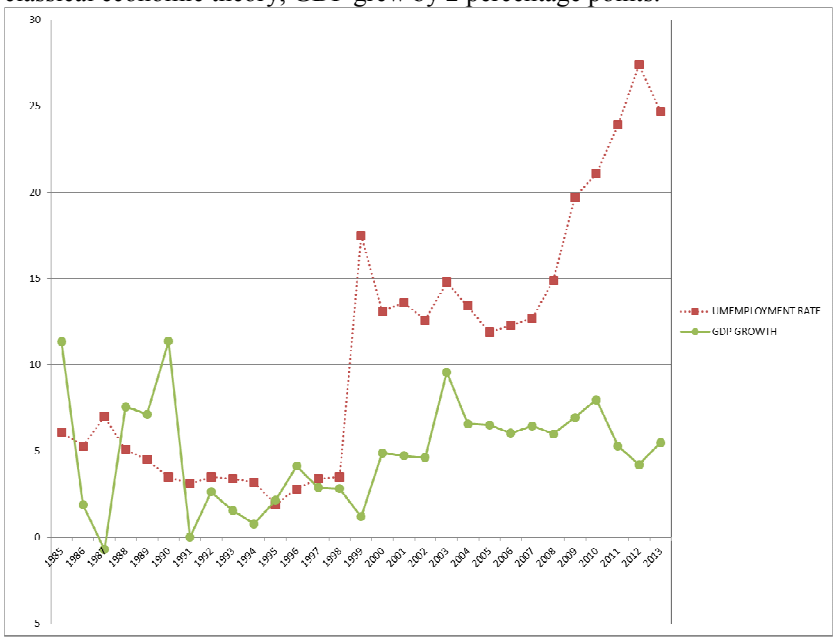

Figure 3: Comparison of annual GDP rate and unemployment rate of Nigeria (1985 - 2013)

3. Literature Review

Quite a number of empirical literatures exist, on the relationship between output and employment. Although majority of literature supports the relationship expressed by Okun (1962), there are some dissenting views too.

Boulton (2010) undertook an investigation of the Okun relationship and also examined the significance of other variables that influence the unemployment/real GDP relationship in the ten eastern European countries. The nature of the countries that were examined in their study also provided some extra insight into the relationship between these two principal economic variables by showing that the original estimate of Okun's law that states three points of real GDP for each 1 percent reduction in the unemployment rate can be revised up to four points for those countries experiencing rapid economic development. The study also examined the significance of pooled estimates in order to see the significance of co-integration and discovered random effect show less significant results than fixed effects when pooled data is analyzed.

Daly and Hobijn (2010) undertook a study whose result showed that in 2009, strong growth in productivity in the United States of America allowed firms to lay off large numbers of workers while holding output relatively steady. The Authors asserted that this behavior threw a wrench into the long-standing relationship between changes in GDP and changes in the unemployment rate, known as Okun's law. If Okun's law had held in 2009, the unemployment rate would have risen by about half as much as it did over the course of the year.

Arshad (2010) examined the relationship between unemployment and GDP with the objective of ascertaining the presence of Okun's relationship in the Swedish economy. Using quarterly time series data for the period 1993Q1 – 2009Q2, the study showed that the Okun's law exists in the Swedish economy in the study period and that there is a long run and short run relationship between unemployment and GDP.

Barnes, Gumbau-Brisa and Olivei (2012), using U.S. real-time data, showed that changes in the unemployment rate unexplained by Okun's Law have significant predictive power for GDP data revisions. They stated that a positive (negative) error in Okun's Law in real time implies that GDP will be later revised to show less (more) growth than initially estimated by the statistical agency. Also they pointed out that information in Okun's Law errors about the true state of real economic activity also helps to improve GDP forecasts in the near term. Their findings added a new dimension to the interpretation of real-time Okun's Law errors, as they show that these errors can convey information other than a change in potential GDP, the equilibrium unemployment

rate, or the use of labor's intensive margin.

Javeid (2012) sought to find out if Okun's relationship is present in the Pakistani economy. Using annual time series data for the period 1981 – 2005, the study verified a negative relationship between unemployment rate and GDP growth and that both variables have a long run relationship with each other.

Amezaga (2013) calculated the Okun's coefficient to measure the impact of economic growth on unemployment rate in Peru. Using monthly time series data covering the period 2001 – 2012 the study compared results for Lima and Peru and confirmed the existence of a negative association relationship between unemployment and economic growth in both cases. The study also ascertained that the negative relationship between these two macroeconomic variables vary from one state to another and is not proportional to the population in each state.

Ball, Leigh and Loungani (2013) asked how well Okun's Law fits short-run unemployment movements in the United States since 1948 and in twenty advanced economies since 1980. They discovered that Okun's Law is a strong and stable relationship in most countries, one that did not change substantially during the Great Recession. They also affirmed that accounts of breakdowns in the Law, such as the emergence of "jobless recoveries," are flawed. Theye also found that the coefficient in the relationship varies substantially across countries. They pointed out that this variation is partly explained by idiosyncratic features of national labor markets, but it is not related to differences in employment protection legislation.

Babalola, Saka and Adenuga (2013) empirically tested the validity of Okun's law in the Nigerian economy from using annual time series data for the periods 1980-2012. Using Var-cointegration method and examining the direction of causality using the VAR Granger causality / Block Exgeneity Wald tests they discovered that the trace test statistic demonstrates only one cointegrating vector at 5% level. Both the VAR Granger causality / Block Exogeneity Wald test and error correction model provided exactly the same conclusion of the existence of a uni-directional causality from unemployment rate to real output growth. However, their results showed that Okun's coefficient estimates carry positive signs which is in fact contrary to unemployment–output relationship even though unemployment rate determines the real output growth in Nigeria but not vice versa from the causality analysis. They therefore recommended a good policy space to create an enabling environment for drastic reduction of unemployment which is a pointer to increasing aggregate demand and output growth in Nigeria in the long run.

Akeju and Olanipekun (2014) tested the validity of Okun's law for Nigeria. Emperical findings from the study showed that there is both the short and long run relationship between unemployment rate and output growth in Nigeria. The Authors recommended the need to formulate fiscal policies that would attract more foreign direct investment into the economy so as to reduce the high rate of unemployment in the country.

Arewa and Nwakanma (2014) undertook an empirical evaluation of the relationship between output and unemployment using the first difference and output-gab versions Okun's law. Their study adopted vector autoregressive (VAR) mechanism to estimate this relationship; and found out that the Okun's coefficient is not significant in Nigerian economy. They added however, that the trade-off between output-gab and unemployment gab is positive, meaning that a decrease in the gap between natural rate of unemployment and current rate of unemployment leads to a decrease in the difference between potential GDP and real GDP.

4. Model and Method

The autoregressive distributed lag (ARDL) bound test of Pesaran, Shin and Smith (2001) will be used for cointegration analysis. The bound test is basically computed based on an estimate of unrestricted ECM (UECM), by ordinary least square estimator. It is the Wald test (F-statistics version of the bound testing approaches) for the lagged level variables in the right hand side of UECM. That is, we test the null hypothesis of non-cointegrating relation (Ho: $\delta_1 = \delta_2 = \delta_3 = \ldots = \delta_8 = 0$) by performing a joint significance test on the lagged level variables. The asymptotic distribution of the F- statistic is non-standard under the null hypothesis of no cointegrating relation between the examined variables, irrespective whether the explanatory variables are purely I(0) or I(1) (Ahmad, Daud and Marzuki, 2008).

ARDL can be used whether the regressors are purely I(0), purely I(1), or mutually conintegrated. It is also not necessary with ARDL, that the order of integration of the underlying regressors be ascertained prior to testing the existence of a level relationship between two variables (Pesaran et al., 2001). Another advantage of the bounds testing procedure employed in this work is that it is robust for small sample study (Pattichis, 1999; Mah, 2000; and Tang and Nair, 2002). Furthermore, the bounds testing approach is feasible even when the explanatory variables are endogenous and the ARDL cointegration test, assumes the existence of only one long run relationship between the dependent variable and the exogenous variables.

Under the conventionally used level of significance such as 10%, 5% and 1%, if the statistic from Wald test falls outside the critical bounds value (lower and upper values), a conclusive inference can be made without considering the order of integration of the explanatory variables. If the F-statistic exceeds upper critical bound, then the null hypothesis of no cointegrating relation can be rejected. If the test statistic (F-statistic) falls below

the lower critical bound, we cannot reject the null of non cointegration. In the case, the F-statistic falls between the upper and lower bounds, a conclusive inference cannot be made. Here, the order of integration, I(d) for the explanatory variables must be known before any conclusion can be drawn (see Pesaran et al., 2001).
The second stage of ARDL approach is to estimate the coefficients of the long run cointegrating relationship and the corresponding ECM.

4.1 ARDL Model

Selection of lag length is very important in the estimation of ARDL regression. The test was run over eight lag lengths to determine the optimal lag length and from table 1 it can be seen that the optimal lag for our ARDL regression is 1, which is usual for annual data.

Table 1: Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-69.1161	NA	51.19622	6.772964	6.872442	6.794553
1	-56.0224	22.44644*	16.20416*	5.621178*	5.770395*	5.653562*
2	-55.4203	0.974842	16.87621	5.659072	5.858029	5.702251
3	-55.4195	0.001109	18.64692	5.754241	6.002937	5.808214
4	-55.3704	0.070186	20.55863	5.844800	6.143235	5.909568
5	-55.3684	0.002610	22.83867	5.939852	6.288026	6.015414
6	-55.2802	0.109205	25.26080	6.026689	6.424603	6.113047
7	-54.9417	0.386917	27.41129	6.089684	6.537337	6.186836
8	-54.7858	0.163264	30.44477	6.170080	6.667472	6.278027

*indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error
AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

The next step will be to estimate the ARDL model using a lag length of one and the output is given in table 2. The short and long run coefficients are given as

$$D(unr)\ c\ D(unr(-1))\ D(gdpr(-1))\ unr(-1)\ gdpr(-1) \qquad (1)$$

Table 2: Estimation of ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.662355	1.583881	0.418185	0.6799
D(UNR(-1))	-0.2353	0.25708	-0.915276	0.37
D(GDPR(-1))	-0.07163	0.223179	-0.320972	0.7513
UNR(-1)	0.002085	0.12131	0.017189	0.9864
GDPR(-1)	0.043397	0.328091	0.132271	0.896

Before going on to check if a long run relationship exists between unemployment and GDP, we need to ascertain the viability of the ARDL model by ensuring there is no serial correlation in the model and also that the model is stable. First thing will be to check if our ARDL model has serial correlation or not. The null hypothesis is thus:

H_0: there is no serial correlation.

From table 3 it can be seen that both probability values are greater than 0.05 which implies that we cannot reject the null hypothesis. Thus the ARDL model has no serial correlation.

Next is to check for stability of the ARDL model and from Figure 4, it can be seen that the model is stable since the blue line is strictly bound between the two red line boundaries.

Table 3: Test for Serial Correlation in ARDL Model

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.040606	Prob. F(2,20)	0.9603
Obs*R-squared	0.109193	Prob. Chi-Square(2)	0.9469

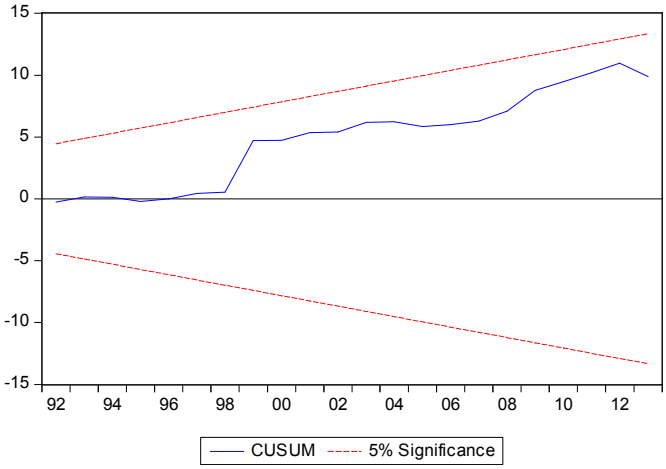

Figure 4: Test for Stability of ARDL Model

5. Results and Discussion

5.1 Existence of a long run relationship

Having estimated the ARDL model and confirming that it is both without serial correlation and stable, the next step is to use Wald Test to determine the existence or otherwise of a long run relationship between unemployment and GDP in Nigeria.

H_0: there is no cointegration between the variables

We find that the computed F-statistics for Nigeria is 0.013265 which is less than the critical bound (4.94, 5.73) at 5 percent significance level (see table 4). This implies that the null hypothesis of no cointegration long-run relationship cannot be rejected. These results reveal that there is no long run relationship between unemployment rate and output growth in Nigeria.

Table 4: Wald Test for Cointegration

Test Statistic	Value	df	Probability
F-statistic	0.013265	(2, 22)	0.9868
Bound Testing Critical Values at 5%			4.94 (lower) 5.73 (upper)

The critical values are taken from Pesaran et al. (2001), unrestricted and no trend with two regressors. * denote accepting the null hypothesis at 1 percent, 5 percent and ten percent level. The range of critical value at 1 percent and 10 percent are 6.84-7.84 and 4.04-4.78 respectively.

5.2 Further Analysis

Next we carry out an investigation of how each of our variables reacts to a shock from the other but specifically we are interested in finding out how output shock affects unemployment rate in Nigeria.

Variance Decomposition

Usually variance decomposition method is used to ascertain the source of the changes in the variables and to overcome the obstacles in the interpretation of the parameters in the VAR model. However, in this study, we are not really interested in the VAR model since we have already used ARDL model.

The results of variance decomposition for 10 periods (table 7) show that the main source of variance for both variables is their own shock.

From the variance decomposition of unemployment rate, in the short run, that is after 3 years impulse or innovation or shock to Unemployment rate accounts for 99.99 percent variation of the fluctuation in

unemployment rate (own shock). Shock to GDP rate (output) has virtually no effect on the fluctuation of unemployment rate in the short run. In the long run, that is about the tenth year, shock to unemployment can contribute up to 99.98 percent to the variance of unemployment rate (own shock). Shock to output again has virtually no effect on the fluctuation in the variance of unemployment.

From the variance decomposition of output rate, in the short run, that is after 3 years impulse or innovation or shock to unemployment rate accounts for 8.94 percent variation of the fluctuation in output. Shock to GDP rate can contribute as much as 91.05 percent to the variation of GDP. In the long run, a shock which arises from unemployment rate can cause a 25.09 percent (moderate but not significant) variation in the fluctuation of output and a shock arising from output can account for a 74.90 percent variation in output.

Table 5: Variance Decomposition of unr and gdpr

Variance Decomposition of UNR:			
Period	S.E.	UNR	GDPR
1	3.350946	100.000000	0.000000
2	4.647373	99.994630	0.005373
3	5.589465	99.991990	0.008009
4	6.341839	99.990600	0.009400
5	6.969606	99.989760	0.010240
6	7.506965	99.989200	0.010799
7	7.974722	99.988800	0.011196
8	8.386747	99.988510	0.011492
9	8.752890	99.988280	0.011721
10	9.080477	99.988100	0.011903
Variance Decomposition of GDPR:			
Period	S.E.	UNR	GDPR
1	2.713570	2.406800	97.593200
2	2.771648	5.263390	94.736610
3	2.827403	8.943397	91.056600
4	2.880134	12.245860	87.754140
5	2.928575	15.124390	84.875610
6	2.972982	17.640590	82.359410
7	3.013736	19.852560	80.147440
8	3.051185	21.807510	78.192490
9	3.085637	23.543580	76.456420
10	3.117368	25.091800	74.908200
Cholesky Ordering: UNR GDPR			

Impulse Response Analysis

The response of variables to a shock which arises from one of the variables can be analyzed via impulse-response function. The response of other variables to the shocks that may occur in the future could be estimated with impulse-response function (Cambazoglu and Karaalp, 2012). In Figure 5 below we show the responses of 'unr' variable to one standard deviation of the 'gdpr' variable shock obtained for twelve periods. Horizontal axis indicates the yearly period of time after the shocks are given and the vertical axis indicates the response of variables to the shocks proportionately. Confidence intervals are provided by using Monte Carlo simulation for the impulse-response functions.

As shown in Figure 5, the response of the 'gdpr' variable to its own shock was downwards between the beginning period and the third period. This response indicates the output contraction. The response of 'unr' variable to the contractionary output shock was found to be none existent. This implies that unemployment rate in Nigeria is not affected by changes in output. This results agrees with earlier work by Arewa and Nwakanma (2012), Babalola, Saka and Adenuga (2013) and Akeju and Olanipekun (2014). However, this study contradicts the findings in Akeju and Olanipekun (2014) which claim the existence of both a short and long run relationship between output and unemployment rate in Nigeria.

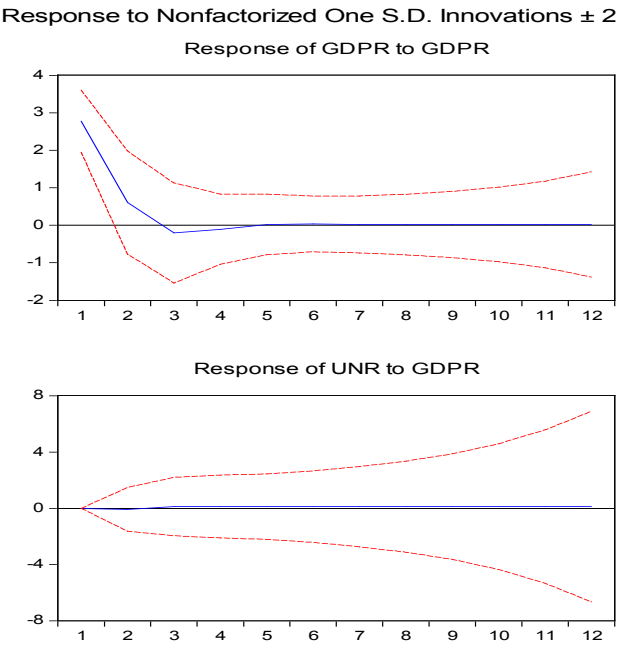

Figure 5: Impulse Response Analysis

5. Conclusion

In this study, we have investigated the relationship between output and unemployment rate in Nigeria, to ascertain if the degree of interaction prescribed in Okun's law is valid for Nigeria. ARDL bound test analysis shows that there is no short run or long run relationship between output and unemployment rate in Nigeria. Further analysis was carried out to understand the speed and quality of the interaction between the two variables. By considering the speed and quality of the unemployment rate variable response to the output shocks, the effectiveness of the believe that an increase in output would lead to a corresponding decline in unemployment is examined. In that context, an immediate response is found for unemployment variable to the output shock. These responses show that the unemployment variable is insensitive to the output variable.

The economic situation on the ground in Nigeria appears to defy prevailing logic of economics. While Nigeria has consistently experienced positive output growth in the last twenty-six, the growth has not been an inclusive growth, hence has not in any way positively impacted on the unemployment rate and hence poverty in Nigeria. There appears to be a structural problem in the Nigerian economy that must be addressed. The sectors currently driving the Nigerian economy are not high-job creating sectors. So the economic output is increasing, but the number of jobs created is not. So Okun's law inherently fails in Nigeria.

Further research are required to clearly outline the suspected structural problems that are may currently be present in the Nigerian economy that appears to be insulating unemployment from the positive performance of the economy. Also, such a research would help ascertain the actual type of growth that the government and monetary authority in Nigeria should pursue so as to achieve their vision of poverty reduction and national prosperity.

As observed by Ogbu (2012), "the question policy makers [in Nigeria] should ask is not whether they should implement growth or redistributionist goals, but what type of growth is needed to alleviate poverty. No other sector is more important than manufacturing in developing an economy, providing quality employment and wages, and reducing poverty. Economic development not only raises incomes, but it also raises the voice of citizens, their political participation, and their ability to demand government accountability. Poverty weakens citizen participation, which in turn exacerbates poverty."

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