DOES ECONOMIC GROWTH INCREASE EMPLOYMENT IN NIGERIA?

Haruna O. Ezekiel I, Ebukiba E. Samuel II Ajibade Y. Eunice III

I. Department of Agricultural Economics and Extension, Kogi State University Anyigba, Kogi State
II. Department of Agricultural Economics, University of Abuja, FCT
III. Department of Agricultural Economics and Extension, Kogi State University Anyigba, Kogi State

ABSTRACT

This study examined whether economic growth increases employment in Nigeria using macroeconomic data obtained from Central Bank, National Bureau of Statistics, International Monitoring Fund (IMF), and the World Bank for the period 1986 – 2014. Using the Autoregressive Distributed Lag (ARDL) model - Bounds testing methodology, we found a long-run relationship between employment rate, gross domestic product (GDP) growth rate, literacy rate and foreign direct investment (FDI) as a percentage of GDP. The long- run coefficient of GDP growth rate, though positive, is statistically insignificant. This implies that GDP growth rate leads to increases in employment in the long run although this is statistically insignificant. This means that recent economic growth increases has not translated to jobs creation nor significantly reduced unemployment in the economy. We recommend policy measures that would lead to skill acquisition in the educational sector and encourage foreign direct investment flow into the economy as these will increase employment in Nigeria.

Keywords: Employment, Economic Growth, Auto-Regressive Distributed Lag (ARDL) Model, Co-integration, Bounds Test.

INTRODUCTION

Unemployment is one of the major macroeconomic problems facing developing countries especially Nigeria today. For instance, the International Labour Organization (ILO, 2012) reported that that about 6% of the world population were unemployed and that most unemployed are the youths. Vanguard online news reported on May 19, 2014 that about 60 million Nigerians are unemployed.

Employment is the opposite of unemployment and it refers to the number of people who work for pay in cash or kind, work on their own account or are unpaid family workers[7]. Employment is an economic drift through which human resources are put into productive use. Employment is one of the most important social and economic issues in every country and the goal of achieving full employment among other macroeconomic goals is an important one in many developing nations where unemployment and underemployment have been a major cause and consequence of widespread poverty. Economic growth on the other hand is defined in terms of increase in a nation's output of goods and services as measured by the Gross Domestic Product[3]. [6] defined a country's economic growth as a long term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that its demand.

The relationship between economic growth and employment has received great attention in the literature. For instance, [18] observed that employment will only increase if gross domestic

product (GDP) is rising faster than productivity. Other things being equal, the greater the amount of goods and services produced, the greater the labour required for production; because economic growth and employment go hand in hand. Similarly, [16] believed that economic growth provides an impetus to employment. It follows from the above that economic growth leads to increases in employment and reduction in unemployment .The implication of this on Nigeria is that strong economic growth anchored on robust performance in agriculture, manufacturing and the service sectors and underscored by substantial increase in investment and the level of capital utilization in industry are bound to boost employment generation in the economy.

How to reduce unemployment has always been an issue of great concern to the economists, policy makers and economic managers alike; giving the devastating effect of this phenomenon on individuals, the society and the economy at large. The implementation of policies on employment creation in Nigeria by successive governments has not yielded much impact as there is a wide gap between the jobs available and the number of job seekers actively seeking for work. For instance, the National Bureau of Statistics (NBS) reported that Nigeria's unemployment crisis worsened in the first quarter of 2016, with unemployment rate rising to 12.1 percent. The Bureau said in its latest unemployment watch report that between December 2015 and March 2016, the population of unemployed Nigerians increased by 518,000 to over 1.45 million. Economically active or working age population, according to NBS, increased from 105.02 million in the fourth quarter of 2015 to 106 million by the end of March 2016. According to [2] Nigeria has maintained remarkable growth over the last decade, recording an average growth rate of 6.8 per cent from a large economic base and the potential for further growth is reasonably high. Real gross domestic product (GDP) growth was estimated at 6.23 per cent in 2014 compared to 5.49 per cent in 2013. However, the impact of these increases on employment generation has not been ascertained in recent time. Empirical studies on Nigeria's employment situation centered primarily on unemployment and its determinants and/or its impacts on economic growth [10,1,12,17], among others) while a few others [11,5] examined the impact of economic growth on employment in Nigeria using OLS and VAR methodologies respectively. This studies differ from this present study because this study uses the ARDL Bounds testing approach to examine the effect of economic growth on employment in Nigeria which has not been examined in recent time by any empirical research.

METHODOLOGY

This study utilized the Bounds testing technique to co-integration in checking the long-run relationship between the variables. This approach is based on the specification of an autoregressive distributed lag (ARDL) model introduced by[13,14],[15] which incorporate variables that are I (0) and I (1) in the same estimation. According to[4] ARDLs are standard least squares regressions that contain lags of both the dependent variable and independent variables as regressors. The popularity of ARDL is based on a number of advantages which include its ability to estimate the long-run and short-run parameters of the model simultaneously while at the same time avoid the problems caused by non-stationarity of the data. The model does not require the determination of the order of integration of the variables in advance. Finally, it is a statistically much more significant approach for the determination of the co-integration relationship in small samples, while allowing different optimal lags of variables.

An ARDL model is usually specified using the following notations $(p, q_1..,q_k)$ where p is the number of lags of the dependent variable, q_1 is the number of lags of the first explanatory

variable, and q_k is the number of lags of the k^{th} explanatory variable. An ARDL model is stated as follows:

$y_t = \propto + \sum_{i=1}^{p} \gamma_i y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{qj} X_{j,t-1}\, \beta_{j,1} + \varepsilon_i$ ……..1

The explanatory variables, X_j in the model which may not have lagged terms in the model (that is $q_j = 0$) are called static or fixed regressors while explanatory variables have at least one lagged term are referred to as dynamic regressors.

In other to specify an ARDL model, one must determine how many lags of each variable should be included (that is, $p, q_1..,q_k$). The usual procedure for doing this is by using Akaike, Schwarz and Hannan-Quinn information criteria. For this study the automatic lag selection option in E-views was used.

Since an ARDL model estimates the dynamic relationship between a dependent variable and explanatory variables the long run response of the dependent variable to changes in the explanatory variables is estimated as follows:

$$\boldsymbol{\theta_j = \frac{\sum_{i=1}^{qj} \beta_{j,1}}{1-\sum_{i=1}^{p} \gamma_i}} \text{ ……2}$$

The delta method can be used to calculate the standard error of these long-run coefficients from the standard errors of the original regression.

[14], has shown that the co-integrating relationship can be estimated as ARDL models with the advantage that the variables in the co-integrating relationship can be either I(0) or I(1) without pre-specifying which variable is I(0) or I(1). The ARDL model does not require symmetry of lag lengths as each variable can have different number of lag terms. The co-integrating regression form of an ARDL model is obtained by transforming equation (1) into differences and substituting the long-run coefficients from equation (2).

$\Delta y_t = -\sum_{i=1}^{p-1} \gamma_i^* \Delta y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{qi-1} \triangle X'_{j,t-1}\, \beta_{j1}^* - \Phi EC_{t-1} + \varepsilon_i$ ……3

Where:

$$EC_t = y_t - \alpha - \sum_{i=0}^{qi} X'_{j,t}\, \hat{\theta}_j$$
$$\Phi - 1 \sum_{i=1}^{p} \hat{\gamma}_i \text{ ……4}$$

$$\gamma_i^* = \sum_{m=i+1}^{p} \hat{\gamma}_m$$

$$\beta_{j1}^* = \sum_{m=i+1}^{q1} \beta_{jm}$$

The delta method can be used to estimate the standard error of the co-integrating relationship coefficients from the standard errors of the original regression[7].

Using the Bounds testing approach,[15] described a methodology for testing whether the ARDL model contains a level or long-run relationship between the dependent variable and the regressors. The Bounds testing approach transforms equation 3 into the following:

$\Delta y_t = -\sum_{i=1}^{p-1} \gamma_i^* \Delta y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{qi-1} \triangle X'_{j,t-1}\, \beta_{j1}^* - \rho y_{t-1} - \alpha - \sum_{j=1}^{k} X'_{jt-1}\, \delta_j + \varepsilon_t$ ……5

The coefficient estimates used in the test may be obtained from a regression using equation (1) or can be estimated directly from equation (5). The test statistic (F- test) based on Equation (5) has a different distribution under the null hypothesis (of no level relationships), depending on whether the regressors are all I(0) or all I(1). The null hypothesis for no co-integration among

variables in equation (1) is stated as $H_0 : \delta_1 = \delta_2 = \delta_3 \ldots \delta_k = 0$ against the alternative hypothesis: $H_1 : \delta_1 \neq \delta_2 \neq \delta_3 \ldots \delta_k \neq 0$. The F-test having a non-standard distribution involves asymptotic critical value bounds, depending whether the variables are I(0) or I(1) or a mixture of both. Consequently, two sets of critical values are produced. One set is related to the I(1) series which is called upper bound critical values and the other refers to the I(0) series that is called lower bound critical values. If the F test statistic exceeds upper critical values, it means that there is long-run relationship between the variables regardless of the order of integration of the variables. If the test statistic is less than the upper critical value, the null hypothesis of no co-integration cannot be rejected and if it lies between the bounds, a decision cannot be made without knowing the order of integration of the underlying regressors.

DATA

The study made use of secondary data obtained from the Statistical Bulletin published annually by the Central Bank of Nigeria. Other sources of data include the publications of the National Bureau of Statistics (NBS), The International Monitoring Fund (IMF), The World Bank and Journals. The data collected were on GDP growth rate, Employment rate, Literacy rate and foreign direct investment as percentage of GDP. The data covered a period of twenty nine years (29) from 1986 - 2014. The data were analyzed using E-views version 9.

RESULTS

Unit Root Test

The unit root test of the variables was conducted using Augmented Dickey Fuller (ADF) test. The result of the ADF test is presented in Table 1.

Table 1: Unit root (ADF) test result

Variable	τ-Statistic	Critical Value	Level of Significance	Order of Integration
EMPRATE	-5.23615	-3.67017	1%	I(1)
FDIPERGDP	-3.51459	-2.96041	5%	I(0)
LITERATE	-3.79756	-3.67017	1%	I(1)
GDPRATE	-8.17548	-3.67017	1%	I(1)

The result of the unit root test as presented in Table 1 revealed that employment rate , literacy rate and GDP growth rate were not stationary in their level form but became stationary after the first difference and therefore they are integrated at order one, I(1). Only foreign direct investment as a percentage of GDP was stationary at level and therefore is integrated at order zero, I (0). So we have a mixture of variables that are integrated at order zero and order one and thus, qualifies us to use the ARDL model.

Using the automatic selection for maximum lag selection, Model selection method was Akaike information criterion (AIC). The short-run result of the ARDL model is presented in Table 2.

Table 2: Short-Run ARDL Model
Dependent variable: EMPRATE

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
EMPRATE(-1)	0.905289	0.073306	12.34949	0
EMPRATE(-2)	-0.393805	0.098308	-4.005842	0.0015
EMPRATE(-3)	0.19374	0.069947	2.76983	0.0159
FDIPERGDP	-0.027381	0.027154	-1.008389	0.3317
FDIPERGDP(-1)	0.044047	0.025033	1.759536	0.102
FDIPERGDP(-2)	0.007225	0.023083	0.312997	0.7592
FDIPERGDP(-3)	0.048652	0.020825	2.336179	0.0361
LITERATE	-0.007108	0.012916	-0.550354	0.5914
LITERATE(-1)	0.019095	0.013749	1.388813	0.1882
GDPRATE	-0.019408	0.025363	-0.765206	0.4578
GDPRATE(-1)	-0.039979	0.026544	-1.506152	0.1559
GDPRATE(-2)	0.035029	0.023451	1.493667	0.1591
GDPRATE(-3)	-0.009328	0.020767	-0.449159	0.6607
GDPRATE(-4)	0.058241	0.020359	2.860667	0.0134
C	14.62651	1.995864	7.32841	0

R-squared	0.981759	Mean dependent var	51.85357
Adjusted R-squared	0.962114	S.D. dependent var	0.92915
S.E. of regression	0.180853	Akaike info criterion	-0.278089
Sum squared resid	0.425202	Schwarz criterion	0.435592
Log likelihood	18.89325	Hannan-Quinn criter.	-0.05991
F-statistic	49.97585	Durbin-Watson stat	2.674281
Prob(F-statistic)	0		

*Note: p-values and any subsequent tests do not account for model selection.

Bounds Test

The results of the Bounds test as presented in Table 3 revealed that the F-Statistic (18.396) is greater than the upper bound value (5.61) at 1% significance level. So, we reject the null hypothesis and accept the alternative hypothesis that the coefficients are statistically different from zero, that is, there the four variables have long run association.

Table 3: ARDL Bounds Test

Test Statistic	**Value**	**K**
F-Statistic	18.39593	3

Critical Value Bounds			
Significance		I0 Bound	I1 Bound
	10%	2.72	3.77
	5%	3.23	4.35
	2.50%	3.69	4.89
	1%	4.29	5.61

ARDL Co-integrating and Long-run Model

We present the ARDL co-integrating equation as follows:
D(EMPRATE) = 0.200065246502*D(EMPRATE(-1)) -0.193740000727*D(EMPRATE(-2)) -0.027381337567*D(FDIPERGDP) -0.007224912189*D(FDIPERGDP(-1)) - 0.048651676893*D(FDIPERGDP(-2)) -0.007108141054*D(LITERATE) - 0.019408084758*D(GDPRATE) -0.035028556136*D(GDPRATE(-1)) +

0.009327501502*D(GDPRATE(-2)) -0.058241439738*D(GDPRATE(-3)) - 0.294775828051*(EMPRATE - (0.24609318*FDIPERGDP(-1) + 0.04066442*LITERATE(-1) + 0.08330218*GDPRATE(-1) + 49.61910402))

The ARDL co-integrating and long run coefficients are presented in Tables 4 and 5. The CointEq(-1) is the speed of adjustment towards long- run equilibrium and it is negative and significant. This implies that the system is getting adjusted towards long run equilibrium at the speed of 29.48 percent. The long- run coefficient of GDPRATE is positive although statistically insignificant. This implies that GDPRATE leads to increases in employment in the long run although this is statistically insignificant. This result is a good reflection of the Nigerian economy because recent economic growth increases has not translated to/significantly reduced unemployment nor created more jobs in the economy. The results of other studies in Nigeria support this finding. For instance,[9] reported that although the Nigerian economy grew by 55.5 percent between 1991 and 2006 which should have resulted to a decrease in the rate of unemployment, rather unemployment increased by 74.8 percent. Similarly,[11] reported that although economic growth had positive relationship with employment, the relationship is not significant. The report concluded that the growth in Nigeria does not support employment. [2] also reported that Nigeria's growth over the last decade has been 'jobless' and sustained largely by factor reallocations rather than productivity enhancement. They concluded that employment elasticity of growth was positive and quite low, reflecting the country's poor overall employment generation record, especially in manufacturing.

Table 4 : ARDL Co-integrating And Long Run Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EMPRATE(-1))	0.200065	0.072511	2.759092	0.0163
D(EMPRATE(-2))	-0.19374	0.069947	-2.76983	0.0159
D(FDIPERGDP)	-0.02738	0.027154	-1.00839	0.3317
D(FDIPERGDP(-1))	-0.00723	0.023083	-0.313	0.7592
D(FDIPERGDP(-2))	-0.04865	0.020825	-2.33618	0.0361
D(LITERATE)	-0.00711	0.012916	-0.55035	0.5914
D(GDPRATE)	-0.01941	0.025363	-0.76521	0.4578
D(GDPRATE(-1))	-0.03503	0.023451	-1.49367	0.1591
D(GDPRATE(-2))	0.009328	0.020767	0.449159	0.6607
D(GDPRATE(-3))	-0.05824	0.020359	-2.86067	0.0134
Coint Eq(-1)	-0.29478	0.037788	-7.80081	0.000

$$\text{Cointeg} = \text{EMPRATE} - (0.2461 * \text{FDIPERGDP} + 0.0407 * \text{LITERATE} + 0.0833 * \text{GDPRATE} + 49.6191)$$

Table 5: Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDIPERGDP	0.246093	0.15996	1.538467	0.1479
LITERATE	0.040664	0.017616	2.308317	0.0381
GDPRATE	0.083302	0.095438	0.872845	0.3986
C	49.6191	1.092891	45.40169	0.0000

Model Diagnostics

We conducted several tests on the ARDL model. The result of test to determine whether the model has serial correlation is presented in Table 6.The hypotheses are as follows:
H_0 : ARDL model has no serial correlation
H_a : ARDL model has serial correlation

Table 6: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.279966	Prob. F(2,11)	0.3164
Obs*R-squared	5.286020	Prob. Chi-Square(2)	0.0711

The probability of F-Statistic of the Breusch-Godfrey serial correlation LM test as presented in Table 6 is greater than 5%. Therefore, we accept the null hypothesis that the ARDL model has no serial correlation.

The result of stability diagnostic test is presented in Figure1. The CUSUM test revealed that the blue line is within the two red lines at 5% probability level. We conclude that the ARDL model is stable and the estimates obtained from the model are reliable.

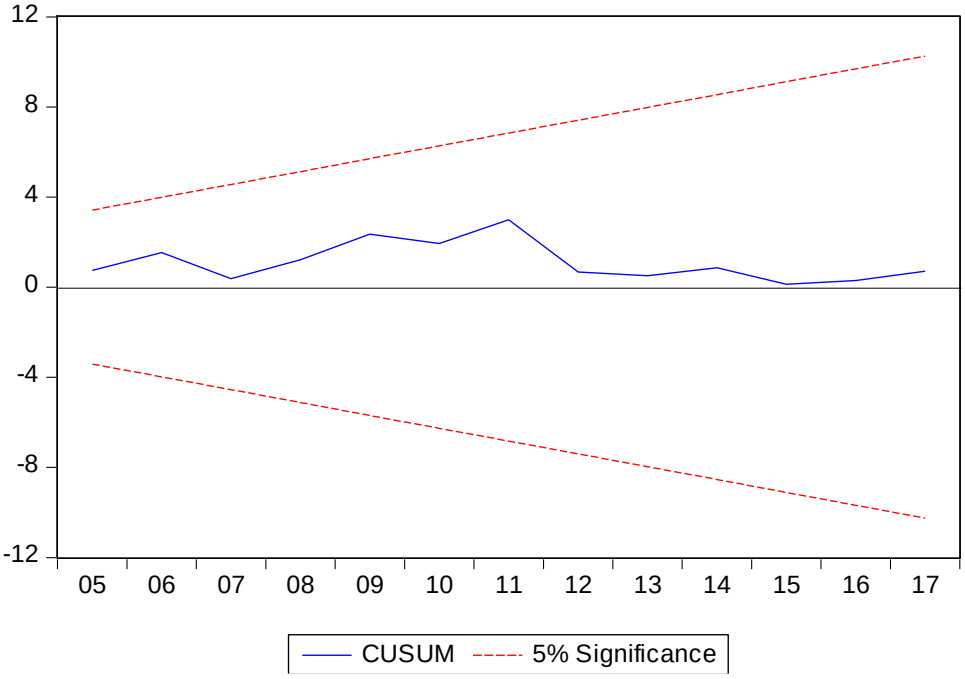


Figure 1: CUSUM Test

Finally, we conducted Heteroskedasticity test in order to check whether our model has ARCH effect. The hypotheses are presented as follows:
H_0 : There is no ARCH effect
H_a : ARCH effect is present.

Table 7: Heteroskedasticity Test: ARCH

F-statistic	0.999966	Prob. F(1,25)	0.3269
Obs*R-squared	1.038428	Prob. Chi-Square(1)	0.3082

The result as presented in Table 7 revealed that the probability of F- Statistic is greater than 5%. Therefore, we accept the null hypothesis that there is no ARCH effect, that is, there is no heteroskedasticity.

CONCLUSION

Unemployment is one of the major macroeconomic problems facing both developing and developed economies and how to increase employment is a major policy goal of any nation of the world.it has been argued in the literature that economic growth can lead to increase in employment. Using the ARDL – Bounds testing methodology, we examined whether GDP growth rate increases employment in Nigeria. Study found a long-run relationship between employment rate, GDP growth rate, foreign direct investment and literacy rate. The long-run coefficient of GDP growth rate was positive but statistically insignificant. Therefore, we conclude that for the period under review, GDP growth rate has not translated to increases in employment in the Nigerian economy.

REFERENCES

1.Adebayo, A., & Ogunrinola, I. O. (2006). Contemporary Dimensions of Unemployment Problem in Nigeria: A Special Challenge under the National Economic Empowerment and Development Strategy. The Nigerian Economic Society, Nigeria.
2.Ajakaiye,O., Jerome,A.T., Nabena,D. and Alaba,O.A.(2016). Understanding the relationship between growth and employment in Nigeria.Understanding the African Lions-Growth Traps and Opportunities in Six Dominant African Economies.Pp 30.
3.Greene, W. H. (2008). The Econometric Approach to Efficiency Analysis. The measurement of productive efficiency and productivity growth. 92-250.
4.Kareem, R. O. (2015). Employment level and economic growth of Nigeria. *Journal of Sustainable Development Studies.*8 (1):53-70.
5.Kuznets (1971). Economic *Growth of Nations: Total Output and Production Structure*, Cambridge, Mass Harvard University press. 86 (4).
6.Mohammad, A. P., Sarmidi, T., Shaar, A.H. and Faizah, S.F. (2017). Using ARDL approach to co-integration for investigating the relationship between payment technologies and money demand on a world scale. *Regional Science Inquiry.* 9 (2): 29-37
7.National Bureau of Statistics (2012). Annual Abstract of Statistics.
8.Njoku, A. & Ihugba,O.A. (2011). Unemployment and Nigerian Economic Growth (1985-2009). Proceedings of the 2011 International Conference on Teaching, Learning and Change. International Association for Teaching and Learning (IATEL).Pp 11.
9.Oladeji, S. I. (1994). Absorption of Educated Manpower into Nigeria's Informal Sector. National Manpower into Nigeria's Informal Sector. Diagnostic Studies Series 1, NMB, Lagos.
10.Oloni, E. F. (2013). The impact of economic growth on employment in Nigeria. *International Business and Management.* 6(1):113-119.
11.Omotor, D. G., & Gbosi, A.N. (2006). The Dynamics of Productivity and Unemployment Nexus: Implications for Employment Generation in Nigeria. In Nigerian Economic Society, Employment Generation in Nigeria. Pp. 177-197.
12.Pesaran, M. H. & Smith, R. P. (1998). Structural analysis of co-integrating vars. *Journal of Economic Surveys.* 12(5): 471-505.

13.Pesaran, M. H., Shin, Y. and Smith, R. P. (1999). Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association* .94(446): 621-634.
14.Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics* 16(3): 289-326.
15.Seyfried, W. (2004). Examining the relationship between employment and economic growth in the Ten Largest State. *South Western Economic Review.*
16.Umoru, D. (2013). Employment and economic growth in Nigeria: A Bounds Specification. *Journal of Economics and Sustainable Development.*4 (5):49-61.
17.Walterskirchen, E. (1999). The Relationship between growth, employment and unemployment in the EU. *European Economist for an Alternative Economic Policy Workshop,Barcelon,Spain.*http://www.memoeurope.uni- bremen.de/tser/Walterskirchen_24months.PDF.

APPENDIX

Null Hypothesis: EMPRATE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.937336	0.3116
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EMPRATE)
Method: Least Squares
Date: 08/26/19 Time: 14:38
Sample (adjusted): 1988 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMPRATE(-1)	-0.223333	0.115279	-1.937336	0.0632
D(EMPRATE(-1))	0.171092	0.173213	0.987757	0.3320
C	11.62507	6.009172	1.934554	0.0636

R-squared	0.129013	Mean dependent var	-0.020000
Adjusted R-squared	0.064496	S.D. dependent var	0.778770
S.E. of regression	0.753238	Akaike info criterion	2.365768
Sum squared resid	15.31891	Schwarz criterion	2.505888
Log likelihood	-32.48652	Hannan-Quinn criter.	2.410593
F-statistic	1.999663	Durbin-Watson stat	1.381770
Prob(F-statistic)	0.154937		

Null Hypothesis: D(EMPRATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.236151	0.0002
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EMPRATE,2)
Method: Least Squares
Date: 08/26/19 Time: 14:39
Sample (adjusted): 1988 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EMPRATE(-1))	-0.917100	0.175148	-5.236151	0.0000
C	-0.013644	0.144749	-0.094262	0.9256

R-squared	0.494742	Mean dependent var	0.056667
Adjusted R-squared	0.476698	S.D. dependent var	1.091245
S.E. of regression	0.789403	Akaike info criterion	2.429261
Sum squared resid	17.44840	Schwarz criterion	2.522674
Log likelihood	-34.43891	Hannan-Quinn criter.	2.459144
F-statistic	27.41728	Durbin-Watson stat	1.547690
Prob(F-statistic)	0.000015		

Null Hypothesis: FDIPERGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.514591	0.0143
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDIPERGDP)
Method: Least Squares
Date: 08/26/19 Time: 14:40
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDIPERGDP(-1)	-0.597420	0.169983	-3.514591	0.0015
C	1.954140	0.673069	2.903327	0.0070

R-squared	0.298710	Mean dependent var	-2.06E-17

Adjusted R-squared	0.274527	S.D. dependent var	2.479516
S.E. of regression	2.111920	Akaike info criterion	4.395413
Sum squared resid	129.3460	Schwarz criterion	4.487928
Log likelihood	-66.12890	Hannan-Quinn criter.	4.425571
F-statistic	12.35235	Durbin-Watson stat	2.030218
Prob(F-statistic)	0.001467		

Null Hypothesis: LITERATE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.702522	0.9903
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LITERATE)
Method: Least Squares
Date: 08/26/19 Time: 14:42
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LITERATE(-1)	0.035922	0.051133	0.702522	0.4880
C	0.655782	0.960404	0.682819	0.5001

R-squared	0.016734	Mean dependent var	1.183226
Adjusted R-squared	-0.017172	S.D. dependent var	3.306335
S.E. of regression	3.334602	Akaike info criterion	5.308925
Sum squared resid	322.4676	Schwarz criterion	5.401440
Log likelihood	-80.28833	Hannan-Quinn criter.	5.339082
F-statistic	0.493537	Durbin-Watson stat	1.453640
Prob(F-statistic)	0.487955		

Null Hypothesis: D(LITERATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.797558	0.0073
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LITERATE,2)
Method: Least Squares
Date: 08/26/19 Time: 14:43

Sample (adjusted): 1988 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LITERATE(-1))	-0.701880	0.184824	-3.797558	0.0007
C	0.835838	0.643614	1.298663	0.2047

R-squared	0.339957	Mean dependent var	-0.086667
Adjusted R-squared	0.316384	S.D. dependent var	3.948286
S.E. of regression	3.264486	Akaike info criterion	5.268422
Sum squared resid	298.3924	Schwarz criterion	5.361835
Log likelihood	-77.02633	Hannan-Quinn criter.	5.298306
F-statistic	14.42145	Durbin-Watson stat	1.918848
Prob(F-statistic)	0.000721		

Null Hypothesis: GDPRATE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.843271	0.0639
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPRATE)
Method: Least Squares
Date: 08/26/19 Time: 14:43
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPRATE(-1)	-0.516882	0.181791	-2.843271	0.0081
C	3.013356	1.064224	2.831506	0.0083

R-squared	0.217996	Mean dependent var	0.288387
Adjusted R-squared	0.191030	S.D. dependent var	2.864037
S.E. of regression	2.575994	Akaike info criterion	4.792689
Sum squared resid	192.4366	Schwarz criterion	4.885204
Log likelihood	-72.28668	Hannan-Quinn criter.	4.822847
F-statistic	8.084188	Durbin-Watson stat	1.968848
Prob(F-statistic)	0.008098		

Null Hypothesis: D(GDPRATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.175480	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPRATE,2)
Method: Least Squares
Date: 08/26/19 Time: 14:44
Sample (adjusted): 1988 2017
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDPRATE(-1))	-1.410635	0.172545	-8.175480	0.0000
C	0.482333	0.478462	1.008090	0.3220

R-squared	0.704761	Mean dependent var	0.261333
Adjusted R-squared	0.694217	S.D. dependent var	4.731591
S.E. of regression	2.616459	Akaike info criterion	4.825861
Sum squared resid	191.6840	Schwarz criterion	4.919274
Log likelihood	-70.38792	Hannan-Quinn criter.	4.855745
F-statistic	66.83847	Durbin-Watson stat	1.255880
Prob(F-statistic)	0.000000		

Dependent Variable: EMPRATE
Method: ARDL
Date: 08/26/19 Time: 14:45
Sample (adjusted): 1990 2017
Included observations: 28 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): FDIPERGDP LITERATE GDPRATE

Fixed regressors: C
Number of models evalulated: 500
Selected Model: ARDL(3, 3, 1, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
EMPRATE(-1)	0.905289	0.073306	12.34949	0.0000
EMPRATE(-2)	-0.393805	0.098308	-4.005842	0.0015
EMPRATE(-3)	0.193740	0.069947	2.769830	0.0159
FDIPERGDP	-0.027381	0.027154	-1.008389	0.3317
FDIPERGDP(-1)	0.044047	0.025033	1.759536	0.1020
FDIPERGDP(-2)	0.007225	0.023083	0.312997	0.7592
FDIPERGDP(-3)	0.048652	0.020825	2.336179	0.0361
LITERATE	-0.007108	0.012916	-0.550354	0.5914
LITERATE(-1)	0.019095	0.013749	1.388813	0.1882
GDPRATE	-0.019408	0.025363	-0.765206	0.4578
GDPRATE(-1)	-0.039979	0.026544	-1.506152	0.1559
GDPRATE(-2)	0.035029	0.023451	1.493667	0.1591

GDPRATE(-3)	-0.009328	0.020767	-0.449159	0.6607
GDPRATE(-4)	0.058241	0.020359	2.860667	0.0134
C	14.62651	1.995864	7.328410	0.0000

R-squared	0.981759	Mean dependent var	51.85357
Adjusted R-squared	0.962114	S.D. dependent var	0.929150
S.E. of regression	0.180853	Akaike info criterion	-0.278089
Sum squared resid	0.425202	Schwarz criterion	0.435592
Log likelihood	18.89325	Hannan-Quinn criter.	-0.059910
F-statistic	49.97585	Durbin-Watson stat	2.674281
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Bounds Test
Date: 08/26/19 Time: 14:48
Sample: 1990 2017
Included observations: 28
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	18.39593	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Test Equation:
Dependent Variable: D(EMPRATE)
Method: Least Squares
Date: 08/26/19 Time: 14:48
Sample: 1990 2017
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EMPRATE(-1))	0.200065	0.072511	2.759092	0.0163
D(EMPRATE(-2))	-0.193740	0.069947	-2.769830	0.0159
D(FDIPERGDP)	-0.027381	0.027154	-1.008389	0.3317
D(FDIPERGDP(-1))	-0.055877	0.028496	-1.960826	0.0717
D(FDIPERGDP(-2))	-0.048652	0.020825	-2.336179	0.0361
D(LITERATE)	-0.007108	0.012916	-0.550354	0.5914
D(GDPRATE)	-0.019408	0.025363	-0.765206	0.4578
D(GDPRATE(-1))	-0.083942	0.028283	-2.967923	0.0109
D(GDPRATE(-2))	-0.048914	0.025998	-1.881436	0.0825
D(GDPRATE(-3))	-0.058241	0.020359	-2.860667	0.0134
C	14.62651	1.995864	7.328410	0.0000
FDIPERGDP(-1)	0.072542	0.047147	1.538626	0.1479
LITERATE(-1)	0.011987	0.005138	2.333136	0.0364
GDPRATE(-1)	0.024555	0.027401	0.896151	0.3865
EMPRATE(-1)	-0.294776	0.037788	-7.800813	0.0000

R-squared	0.945673	Mean dependent var	-0.160714

Adjusted R-squared	0.887168	S.D. dependent var	0.538406
S.E. of regression	0.180853	Akaike info criterion	-0.278089
Sum squared resid	0.425202	Schwarz criterion	0.435592
Log likelihood	18.89325	Hannan-Quinn criter.	-0.059910
F-statistic	16.16384	Durbin-Watson stat	2.674281
Prob(F-statistic)	0.000006		

ARDL Cointegrating And Long Run Form
Dependent Variable: EMPRATE
Selected Model: ARDL(3, 3, 1, 4)
Date: 08/26/19 Time: 14:50
Sample: 1986 2017
Included observations: 28

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EMPRATE(-1))	0.200065	0.072511	2.759092	0.0163
D(EMPRATE(-2))	-0.193740	0.069947	-2.769830	0.0159
D(FDIPERGDP)	-0.027381	0.027154	-1.008389	0.3317
D(FDIPERGDP(-1))	-0.007225	0.023083	-0.312997	0.7592
D(FDIPERGDP(-2))	-0.048652	0.020825	-2.336179	0.0361
D(LITERATE)	-0.007108	0.012916	-0.550354	0.5914
D(GDPRATE)	-0.019408	0.025363	-0.765206	0.4578
D(GDPRATE(-1))	-0.035029	0.023451	-1.493667	0.1591
D(GDPRATE(-2))	0.009328	0.020767	0.449159	0.6607
D(GDPRATE(-3))	-0.058241	0.020359	-2.860667	0.0134
CointEq(-1)	-0.294776	0.037788	-7.800813	0.0000

Cointeq = EMPRATE - (0.2461*FDIPERGDP + 0.0407*LITERATE + 0.0833 *GDPRATE + 49.6191)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDIPERGDP	0.246093	0.159960	1.538467	0.1479
LITERATE	0.040664	0.017616	2.308317	0.0381
GDPRATE	0.083302	0.095438	0.872845	0.3986
C	49.619104	1.092891	45.401685	0.0000

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.279966	Prob. F(2,11)	0.3164
Obs*R-squared	5.286020	Prob. Chi-Square(2)	0.0711

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 08/26/19 Time: 14:58
Sample: 1990 2017
Included observations: 28
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMPRATE(-1)	0.031635	0.075828	0.417196	0.6846
EMPRATE(-2)	-0.027521	0.098516	-0.279355	0.7852
EMPRATE(-3)	0.008626	0.071472	0.120684	0.9061
FDIPERGDP	-0.012515	0.028352	-0.441438	0.6674
FDIPERGDP(-1)	-0.002778	0.025943	-0.107087	0.9166
FDIPERGDP(-2)	-0.002833	0.022847	-0.123991	0.9036
FDIPERGDP(-3)	-0.003153	0.020610	-0.152973	0.8812
LITERATE	0.009754	0.014627	0.666845	0.5186
LITERATE(-1)	-0.011660	0.016190	-0.720162	0.4864
GDPRATE	-0.001557	0.024858	-0.062655	0.9512
GDPRATE(-1)	-0.008570	0.028951	-0.296017	0.7727
GDPRATE(-2)	-0.005414	0.023507	-0.230333	0.8221
GDPRATE(-3)	0.005818	0.020688	0.281240	0.7837
GDPRATE(-4)	0.001860	0.020624	0.090171	0.9298
C	-0.530131	1.993797	-0.265890	0.7952
RESID(-1)	-0.580455	0.415078	-1.398424	0.1895
RESID(-2)	-0.056533	0.366893	-0.154085	0.8803

R-squared	0.188786	Mean dependent var	-4.06E-15
Adjusted R-squared	-0.991161	S.D. dependent var	0.125492
S.E. of regression	0.177080	Akaike info criterion	-0.344456
Sum squared resid	0.344930	Schwarz criterion	0.464382
Log likelihood	21.82239	Hannan-Quinn criter.	-0.097186
F-statistic	0.159996	Durbin-Watson stat	1.966876
Prob(F-statistic)	0.999425		

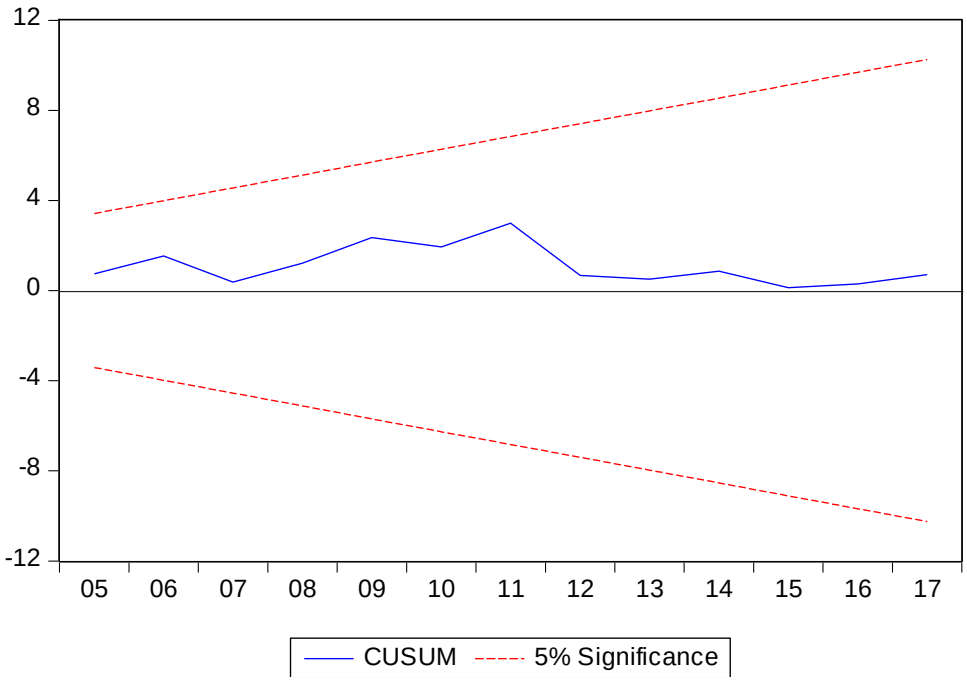
Heteroskedasticity Test: ARCH

F-statistic	0.999966	Prob. F(1,25)	0.3269
Obs*R-squared	1.038428	Prob. Chi-Square(1)	0.3082

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/26/19 Time: 15:00
Sample (adjusted): 1991 2017
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018714	0.005110	3.661928	0.0012
RESID^2(-1)	-0.196089	0.196092	-0.999983	0.3269

R-squared	0.038460	Mean dependent var	0.015647
Adjusted R-squared	-0.000001	S.D. dependent var	0.021239
S.E. of regression	0.021239	Akaike info criterion	-4.794759
Sum squared resid	0.011277	Schwarz criterion	-4.698771
Log likelihood	66.72924	Hannan-Quinn criter.	-4.766216
F-statistic	0.999966	Durbin-Watson stat	1.976494
Prob(F-statistic)	0.326900		


12
8
4
0
-4
-8
-12
05
06
07
08
09
10
11
12
13
14
15
16
17
CUSUM
5% Significance