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The Philip Curve Theory and the Nigeria Economy

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Abstract

This study examines the Phillips curve hypothesis (inflation and unemployment trade-off) applicability in Nigeria from 1980 to 2018. It applied the Autoregressive Distributed Lag (ARDL) bounds testing approach and Ordinary Least Squares (OLS). The results of the ARDL bounds testing, and OLS estimations indicate that there is no trade-off relationship between the variables. Based on the findings, this study recommends a very strong monetary and fiscal policy that can significantly reduce unemployment and inflation. Given that in combined eras, both the long-run and short-run ARDL results show that a negative relationship exists between inflation and unemployment but are not significant.

Keywords:
Philips Curve Theory, Inflation, Unemployment, Trade-off

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Background to the Study

Every nation in the world desires a simultaneous reduction to employment and inflation rates in order to achieve the macro-economic goals, hence, a stable economy. However, theoretically and practically, achieving simultaneous reduction in inflation and unemployment rate is not achievable. Philip (1958) stated that, there is a trade-off relationship between the two undesirables (inflation and unemployment). This means that there is a negative relationship between unemployment and inflation. Scholars, such as, Samuelson and Solow (1960), Phelps (1967), Friedman (1968), Lucas (1973) and Fischer (1977) empirically demonstrated that, there exists an inverse relationship between the variables of unemployment and inflation. That is, when unemployment rate increases, inflation will take a downward trend; but when unemployment rate decreases, inflation will invariably increase. Such a scenario entails a trade-off between the two variables and this becomes an issue of great concern to policy makers, as whether to accept a higher rate of inflation which will lower the rate of unemployment or vice-versa. Invariably, this situation entails that government cannot achieve the objectives of full employment and at the same time maintain price stability, rather such calls for the establishment of an appropriate threshold that could prevail as it becomes almost practically impossible to simultaneously maintain low inflation rate and low rate of unemployment.

Given the negative relationship of the Philip Curve Theory of inflation and unemployment on the economy of some developed economies like the United States (US) and United Kingdom (UK), it is imperative to ascertain the existence of these two indicators in Nigeria in order to guide policymakers on the steps to be taken in solving or reducing the problems. Despite, the high inflation and unemployment rates existing overtime, scholars in Nigeria, such as Ogujiuba & Abraham, 2013; Ojapinwa & Esan, 2013; Okafor, Chijindu, & Ugochukwu, 2016; Orji, Anthony-Orji, & Okafor, 2015; Umaru & Zubairu, 2012; Umoru & Anyiwe, 2013 and Abu 2019 have studied this trade-off relationship of inflation and unemployment and it applicability in Nigeria by applying different econometric methods like Auto-Regressive Distributed Lag bounds testing approach, Ordinary Least Squares, Vector Auto-Regression, linear and non-linear, Fully Modified Ordinary Least Squares, Dynamic Ordinary Least Squares etc. The main objective of this study is to examine the existence and applicability of the Philips curve hypothesis in Nigeria in three different eras: Keynesian, Monetarist and the combination of the two eras. The paper is organized as follow: The second section consists of the empirical literature review on inflation and unemployment, while the third section includes the model, econometric techniques and results. The fourth section includes the conclusion and recommendations from the study of this paper.

Literature Review

Concept of Unemployment

The concept of unemployment is seen, as a situation in which those who are able and willing to work at the prevailing wage rate do not find job. According to The International Labour Organisation (ILO), only those belonging to the age group of 15 to

65 years should be included in the labour force of a country. Unemployment may also be defined, as the gap between the potential full employment and the number of employed persons. Gyang, Anzaku, Iyakwari and Eze (2018) defined unemployment, as the difference between the amount of labour at current wage rate and working conditions and the amount of labour not hired at these levels. It is a situation in which people who are willing to work at the prevailing wage rate are unable to find jobs. National Bureau of Statistics (NBS) in Nigeria defined unemployment as the proportion of the labour force that is available for work, but did not work for at least thirty-nine (39) hours in the week preceding survey period.

According to Phillips (1958) in his study on unemployment and rate of money wage in the British economy noted that an increase in unemployment in the economy causes inflation to drop which he referred to as a trade-off between the variables. He concluded that, as employment level increases, inflation rises; but as unemployment increases, inflation falls as the purchasing power of the economy becomes weaker. Okun (1962) stated that as unemployment falls by 1%, Gross Domestic Product (GDP) increase by 3%, but this was criticized, because it holds for the United States only.

Concept of Inflation

Inflation has been defined as a persistent increase in the general price level of goods and services in a country over a long period of time. Inflation has been intrinsically linked to money, as captured by the often heard maxim "inflation is too much money chasing too few goods". Hamilton (2001) as cited by Gyang, Anzaku, Iyakwari and Eze (2018),described inflation as an economic situation where the increase in money supply is faster than the new production of goods and services in the same economy. Economists usually try to distinguish inflation from an economic phenomenon of a one-time increase in prices or when there are price increases in a narrow group of economic goods or services.

According to Ojo (2000) and Melberg (1992), the term inflation describes a general and persistent increase in the prices of goods and services in an economy. Inflation rate is measured as the percentage change in the price index (consumer price index, wholesale price index, producer price index etc). Essien (2002) explained that the consumer price index (CPI), for instance, measures the price of a representative basket of goods and services purchased by the average consumer and calculated on the basis of periodic survey of consumer prices. Owing to the different weights of the basket, changes in the price of some goods and services have an impact on measured inflation with varying degrees.

There are three dominant schools of thought on the causes of inflation; the neoclassical/monetarists, neo-Keynesian, and structure lists. The neoclassical/monetarists are of the opinion that, inflation is driven mainly by growth in quantum of money supply. The neo-Keynesian attributes inflation to diminishing returns of production. This occurs when there is an increase in the velocity of money and excess of current consumption over investment.

The structure lists attribute the cause of inflation to structural factors underlying characteristics of an economy (Adams, 2000). In a developing economy, for instance, the prevalent hoarding, individual expectation of future price increase and demand for goods and services are not only transactionary, but also precautionary which, in turn, creates artificial shortages of goods and reinforces inflationary pressures.

Theoretical Framework

The Philip Curve Theory was propounded by A. W. Philips, a British Economist in 1958. He gave a graphical illustration of the existence of an inverse relationship (tradeoff) between unemployment rate and inflation rate. The Philips curve identifies that decrease in unemployment rate (increased in employment rate) moves in reverse order with increases in the rate of inflation. That is, to say that, a lower rate of inflation will bring about an increase in the level of unemployment. The above scenario, which is a likely outcome, will most likely operate only in the short-run, but at the long run, other policies targeted at inflation may not guarantee such outcome.

Empirical Review

Blanchard (2016) estimated the Phillips curve for the United States since the 1960s. The author found that a 1 percentage decrease in unemployment for one quarter increases the inflation rate by 0.2 percentage points. He concluded that the Phillips curve is alive and well. Xu, Niu and Jiang. (2015) used combined classical quantile regression and a nonlinear method of analysis to examine the trade-off between the output gap and inflation for the United States over the 1952:1-2011:4 period. The empirical evidence suggests the existence of different nonlinear Phillips curve relationships across quantiles of the inflation distribution. In addition, the results indicate that the shape of the Phillips curve is nonlinear and asymmetric, and the relationship between the variables varies significantly across quantiles. The authors also found that increases in the output gap raises inflation and inflation uncertainty.

Tang and Lean (2007) employed the bounds testing approach to cointegration to examine the Phillips curve hypothesis and its stability in Malaysia from 1970 to 2005. The results demonstrate that inflation and unemployment (along with other determinants of inflation) are cointegrated. The results also reveal the existence of a trade-off Phillips curve, because a negative relationship was established between inflation and unemployment in the short-run and the long-run in Malaysia.

Ogbokor (2005) used a linear and logarithmic regression model to test the existence of a short-run Phillips curve relation in Namibia from 1991 to 2005. The results show that inflation and unemployment are positively related (stagflation) in Namibia. Welfe (2000) employed several techniques including cointegration and vector error correction to estimate an inflation model for Poland, using quarterly data from 1991 to 1996. The results suggest that unemployment is negatively related to inflation in the short-run, thus confirming the Phillips curve hypothesis.

In Nigeria, scholars such as Okafor, Chijindu, and Ugochukwu (2016) employed the error correction model and Johansen cointegration method to study the response of unemployment to variations in the price level in Nigeria from 1989 to 2014. The results indicate that unemployment and inflation (including money supply and exchange rate) have a long-run relationship, and inflation has a negative effect on unemployment. Orji, Anthony-Orji, and Okafor (2015) investigated the existence of the Phillips curve in Nigeria from 1970 to 2011 using the ARDL bounds testing approach. The empirical evidence demonstrates that unemployment has a positive and significant effect on inflation, and thus invalidates the Phillips curve proposition for Nigeria.

Ogujiuba and Abraham (2013) examined the existence of the Philips curve hypothesis in Nigeria over the 1970-2010 period by employing the generalized error correction model. The results illustrate that there is a negative but insignificant relationship between unemployment and inflation in the short-run. On the other hand, the results suggest that in the long-run, inflation and unemployment are positively related. Umaru and Zubairu (2012) assessed the inflation-unemployment relationship in Nigeria from 1977 to 2009 using the cointegration method and Granger causality test, and the ARCH and GARCH approaches to check the series' volatility. The results suggest that the variables are cointegrated, and inflation has a negative impact on unemployment. In addition, the results of the causality test show the absence of any causal relationship between inflation and unemployment.

Umoru and Ayinwe (2013) used the vector error correction technique to investigate the dynamics of inflation and unemployment in Nigeria from 1986 to 2012. The results indicate the presence of high inflation and unemployment rates (stagflation) in Nigeria, thus refuting the proposition of the short-run Phillips curve. Umaru et al. (2013) evaluated the effects of inflation and unemployment on Nigeria's economic growth using the ordinary least squares and cointegration methods, including Granger causality tests, over the 1984-2010 period. The results of the causality tests indicate that there is an absence of a causal relationship between inflation and unemployment.

Manu, Suleiman, Yakubu and Usman (2018) examined the relationship between inflation and unemployment within the context of Nigerian economy from 1961-2015. The study focuses on examining the existence and applicability of Philips curve theory or otherwise in Nigeria during the period understudy. The study applied augmented Dickey-Fuller and Philip Perron technique to examine the unit root property of the data. ARDL-bound testing approach was conducted to examine both long- and short-run relationship between inflation and unemployment in Nigeria. The result from bound testing reveals that there exist a long-run relationship between inflation and unemployment in Nigeria. The estimated long-run model reveals that there exist a positive and insignificant relationship between inflation and unemployment in Nigeria. That is to say that inflation has no significant impact on unemployment in Nigeria. This is contrary to the Philips curve theory, which postulates the trade-off between inflation and unemployment. Therefore, based on the empirical result, Philips curve theory or hypothesis does not hold or exists in the Nigerian economy.

Abu (2019) examined the Phillips curve hypothesis (inflation and unemployment trade-off) and its stability in Nigeria from 1980 to 2016 using the Autoregressive Distributed Lag (ARDL) bounds testing approach. Other estimation techniques including the Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), Static Ordinary Least Squares (OLS), and Canonical Cointegrating Regression (CCR) were employed to ascertain the consistency and robustness of the results that were generated using the ARDL bounds testing method. The results of the cointegration test revealed the existence of a long-run relationship between inflation and unemployment. The results of the ARDL bounds testing, FMOLS, DOLS, static OLS and CCR estimations indicate that there is a trade-off relationship between the variables, and higher unemployment leads to lower inflation in the long-run. The plots of the cumulative sum of squares of recursive residuals (CUSUMQ) confirm the stability of the long-run parameters. The results of the causality test using the standard Granger causality test and the Toda and Yamamoto approach demonstrate that there is unidirectional causality from inflation to unemployment.

In the case of this present study, the contribution to the literature on the Phillips curve is by assessing the connection between inflation and unemployment in Nigeria using the linear regression method for three different eras. The first era captures the period from 1980 to 1988 which is marked as the Keynesian Era Government full involvement. The second era is the period 1989 to 2018 is regarded as the monetarist era Private sector involvement (Iyeli, 2013). The third and final era is the combination of the two eras (1980 to 2018), which past studies in Nigeria failed to do.

Methodology

Data was collected from 1980 to 2018 from the Central Bank of Nigeria (CBN) for the variables inflation and unemployment rates.

Model Specification

The theoretical basis for this study is the Philip Curve Hypothesis, which states that a negative relationship between inflation and unemployment rates. The functional relationship for the study is stated as:

UNEMt = f (INFt,). This functional model is specified as a stochastic model, which is

$UNEMt = \beta 0 + \beta 1INFt + Ut$

Where:
UNEMt=Unemployment rate
INFt= Inflation rate
$\beta 0$ = constant intercept
$\beta 1$, = coefficient of the explanatory variable
Ut = error term
A priori expectation $\beta 1 < 0$

Estimation and Results
Results
Pre-diagnostic test

Table 1: Normality Test

Period (Era)	Era	Jarque-Bera	Remark
1980-1988	Keynesians	0.1993 (P-value 0.9051)	Normality distributed
1989-2018	Monetarists	0.7279 (P-value 0.6949)	Normality distributed
1980-2018	Combination	2.013 (P-value 0.3654)	Normality distributed

This study tested for data normality by applying the Jarque-Bera test. The result shows that since the p-values for the three eras are 0.9051, 0.6949 and 0.3654 are greater than 0.05 level of significance, the data is normally distributed and appropriate for a parametric analysis such as adopted in this study (Appendix I).

Consequently, Unit root tests were conducted to ascertain the level of stationarity of the data. (Appendix II). The Zivot and Andrews and KPSS methods of unit root were applied. Zivot and Andrews unit test considers structural break. It is a sequential test which utilizes the full sample and uses a different dummy variable for each possible break date. The result is presented in Table 2.

Table 2: Unit root Test with Zivot and Andrew with Structural Breaks and KPSS

Variables	Stationarity at level	Break Date	Stationarity at first difference	Break Date
Keynesian Era	1980-1988			
UNEM	I(0) **	-	I(1) **	-
INF	I(0)	-	I(1) **	-
Monetarist Era	1989-2018			
UNEM	I(0) 0.9801	2007	I(1) 0.0100**	2008
INF	I(0) 0.5907	2002	I(1) 0.0100**	2003
Combined Era	1980-2018			
UNEM	I(0)0.6240	2008	I(I) 0.0100**	1999
INF	I(0) 0.0107**	1995	I (I) 0.0100**	1996

Source: E views 10.0 Output ** = significance at 5%

Table 2, shows the unit root result of the variables used for this study. For the Keynesian era, Unemployment is stationary at level while inflation is stationary at first difference. For the monetarist era, both unemployment and inflation were stationary at first difference. Finally, for the combine era, inflation was found to be stationary at level while unemployment was found to be stationary at first difference. Therefore, the integration level shows that two methods were applied the ARDL (Keynesian era and the combine era) and the OLS (Monetarist era) methods.

Table 3: Co-integration result

Period	Era	Co-integration Value	Critical value	Remark
1980-1988	Keynesians	14.772	4.16	Co-integrated
1989-2018	Monetarists	16.49	15.49	Co-integrated
1980-2018	Combination	1.272	4.16	Not Co-integrated

Table 3, show result of the cointegration for the variables (inflation and unemployment). The result revealed that the Keyesian era in Nigeria and the monetarist era are cointegrated but the combined era has no cointegration.

Table 4: ARDL and OLS Result

Variables	Long Run		Short Run	
	Coefficient	P-value	Coefficient	P-value
Keynesian Era				
INF	-1.3590	0.6996	0.1039	0.0359**
Constant	43.165	0.6512	-3.3019	0.1679
Monetarist Era				
d(INF)	-		-0.0699	0.5891
Constant	-		0.6083	0.1815
Combined Era				
INF	-0.7627	0.3191	-0.0477	0.3568
Constant	33.51	0.1469	1.6016	0.0924

Dependent Variable: UNEM, ** = significance at 5%

From the result in Table 4, the following assertions were made:

a. The Keynesian Era (1980-1988) shows that in the long-run the relationship between inflation and unemployment is negative but insignificant. In the short-run, the relationship is positive and significant.
b. The monetarist Era (1989-2018) shows only the short-run result. It indicated that a negative and insignificant relationship exists between inflation and unemployment in Nigeria.
c. The Combine Era (1980-2018) shows that both in the long-run and short-run, there is a negative but insignificant relationship between inflation rate and unemployment rate in Nigeria.

Discussion of Findings

Based on the result of this study, the Keynesian era, monetarist era and the combination of the two, it can be seen that the Philips Curve Hypothesis of a negative and significant relationship between Inflation rate and Unemployment rate is not applicable to the Nigerian economy. This finding agrees with the work of Ogbokor (2005) who used a linear and logarithmic regression model to test the existence of a short-run Phillips curve relation in Namibia from 1991 to 2005. The results show that inflation and unemployment are positively related (stagflation) in Namibia.

Also, it was consistent with Umoru and Ayinwe (2013). They used the vector error correction technique to investigate the dynamics of inflation and unemployment in Nigeria from 1986 to 2012. The results indicate the presence of high inflation and unemployment rates (stagflation) in Nigeria, thus refuting the proposition of the short-run Phillips curve. The same goes to Manu, Suleiman, Yakubu and Usman (2018) examined the relationship between inflation and unemployment within the context of Nigerian economy from 1961-2015. Whose result is contrary to the Philips curve theory, which postulates the trade-off between inflation and unemployment. Therefore, based on the empirical result, Philips curve theory or hypothesis does not hold or exists in the Nigerian economy.

On the contrary, the result is not consistent with Abu (2019) who examined the Phillips curve hypothesis (inflation and unemployment trade-off) and its stability in Nigeria from 1980 to 2016 using the Autoregressive Distributed Lag (ARDL) bounds testing approach. The result indicated that there is a trade-off relationship between the variables, and higher unemployment leads to lower inflation in the long-run. Similarly, the result is not tandem with Blanchard (2016) who estimated the Phillips curve for the United States since the 1960s. The author found that a 1 percentage decrease in unemployment for one quarter increases the inflation rate by 0.2 percentage points. He concluded that the Phillips curve is alive and well.

Conclusion and Recommendations

The objective of this study is to examine the existence and applicability of the Philips curve theory in three different eras; Keynesian (1980-1988), Monetarists (1989-2018) and combination of the two eras (1980-2018). This study estimated the relationship between unemployment and inflation rates use the OLS and the ARDL as a result of the unit root test. The result revealed that for three eras, the Philip's curve theory failed to hold in Nigeria. This study recommends a very strong monetary and fiscal policy that can significantly reduce unemployment and inflation. Given that in both the long-run and short-run a negative relationship exists but are not significant.

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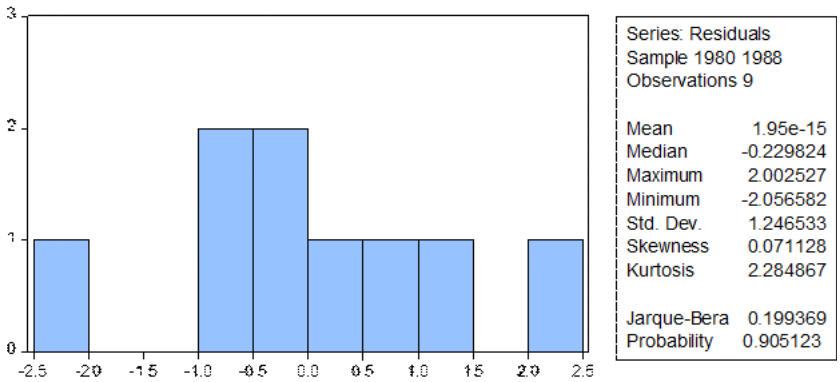
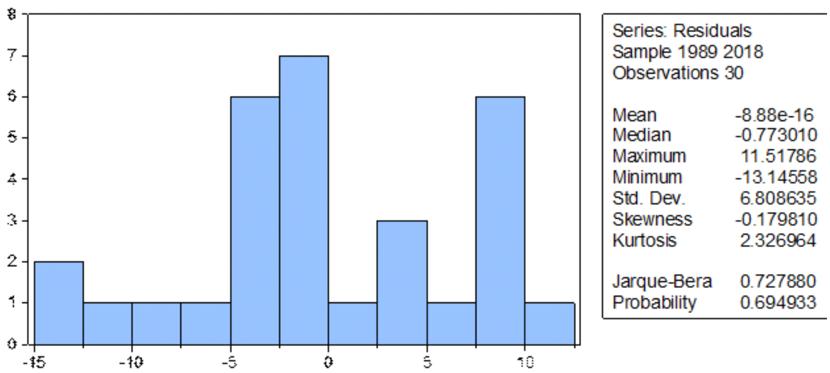
APPENDICES

APPENDIX I: Normality Test





APPENDIX II: Unit Root Test

Null Hypothesis: INFR is stationary
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.216880
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(INFR) is stationary
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.436012
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	235.9967
HAC corrected variance (Bartlett kernel)	235.9967

Null Hypothesis: UNER is stationary
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.414993
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Null Hypothesis: D(UNER) is stationary
Exogenous: Constant
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.500000
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(UNER)
Selected Model: ARDL(2, 0)
Case 2: Restricted Constant and No Trend
Date: 07/24/19 Time: 08:33
Sample: 1980 1988
Included observations: 7

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.301956	1.823550	-1.810729	0.1679
UNER(-1)*	0.076496	0.193497	0.395333	0.7190
INFR**	0.103962	0.028625	3.631896	0.0359
D(UNER(-1))	-2.721479	0.561594	-4.845992	0.0168

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFR	-1.359055	3.199327	-0.424794	0.6996
C	43.16530	86.25900	0.500415	0.6512

EC = UNER - (-1.3591*INFR + 43.1653)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	14.77722	10%	3.02	3.51
K	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58

Dependent Variable: UNER
Method: ARDL
Date: 07/24/19 Time: 08:37
Sample (adjusted): 1982 1988
Included observations: 7 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): INFR
Fixed regressors: C
Number of models evalulated: 6
Selected Model: ARDL(2, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
UNER(-1)	-1.644984	0.452701	-3.633712	0.0359
UNER(-2)	2.721479	0.561594	4.845992	0.0168
INFR	0.103962	0.028625	3.631896	0.0359
C	-3.301956	1.823550	-1.810729	0.1679

R-squared	0.939814	Mean dependent var	6.670000
Adjusted R-squared	0.879627	S.D. dependent var	1.044813
S.E. of regression	0.362495	Akaike info criterion	1.103948
Sum squared resid	0.394208	Schwarz criterion	1.073039
Log likelihood	0.136183	Hannan-Quinn criter.	0.721925
F-statistic	15.61508	Durbin-Watson stat	3.183093
Prob(F-statistic)	0.024609		

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

1989-2018

Null Hypothesis: INFR has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2002
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 4 (Automatic - based on F -statistic selection, lagpval=0.05,
maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.160620	0.5907
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(INFR) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2003
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 4 (Automatic - based on F -statistic selection, lagpval=0.05,
maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.284030	< 0.01
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: UNER has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2007
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on F -statistic selection, lagpval=0.05,
maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.046605	0.9801
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(UNER) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2008
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 7 (Automatic - based on F -statistic selection, lagpval=0.05,
maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.516270	< 0.01
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Dependent Variable: D(UNER)
Method: Least Squares
Date: 07/24/19 Time: 08:58
Sample (adjusted): 1990 2018
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFR)	-0.016996	0.031075	-0.546927	0.5891
ECM(-1)	-0.104465	0.067272	-1.552879	0.1325
C	0.608253	0.443085	1.372769	0.1815

R-squared	0.087407	Mean dependent var	0.658621
Adjusted R-squared	0.017208	S.D. dependent var	2.392924
S.E. of regression	2.372246	Akaike info criterion	4.663249
Sum squared resid	146.3163	Schwarz criterion	4.804693
Log likelihood	-64.61710	Hannan-Quinn criter.	4.707547
F-statistic	1.245127	Durbin-Watson stat	1.929609
Prob(F-statistic)	0.304510		

Date: 07/24/19 Time: 08:59
Sample (adjusted): 1991 2018
Included observations: 28 after adjustments
Trend assumption: Linear deterministic trend
Series: UNER INFR
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.434783	16.49161	15.49471	0.0353
At most 1	0.018271	0.516314	3.841466	0.4724

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.434783	15.97529	14.26460	0.0266
At most 1	0.018271	0.516314	3.841466	0.4724

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level

1980-2018

Null Hypothesis: INFR has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1995
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 7 (Automatic - based on F -statistic selection, lagpval=0.05, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.936421	0.0107
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(INFR) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1996
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 1 (Automatic - based on F -statistic selection, lagpval=0.05, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.432167	< 0.01
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: UNER has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2008
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 9 (Automatic - based on F -statistic selection, lagpval=0.05,
maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.105055	0.6240
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(UNER) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1999
Break Selection: Minimize Dickey-Fuller t-statistic
Lag Length: 0 (Automatic - based on F -statistic selection, lagpval=0.05,
maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.368227	< 0.01
Test critical values:	1% level	-4.949133	
	5% level	-4.443649	
	10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Dependent Variable: UNER
Method: ARDL
Date: 07/24/19 Time: 09:09
Sample (adjusted): 1981 2018
Included observations: 38 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): INFR
Fixed regressors: C
Number of models evalulated: 20
Selected Model: ARDL(1, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
UNER(-1)	0.952210	0.051180	18.60526	0.0000
INFR	-0.036454	0.022492	-1.620728	0.1141
C	1.601623	0.925763	1.730058	0.0924

R-squared	0.928093	Mean dependent var	11.98684
Adjusted R-squared	0.923984	S.D. dependent var	7.877569
S.E. of regression	2.171918	Akaike info criterion	4.464755
Sum squared resid	165.1030	Schwarz criterion	4.594038
Log likelihood	-81.83035	Hannan-Quinn criter.	4.510753
F-statistic	225.8713	Durbin-Watson stat	1.896362
Prob(F-statistic)	0.000000		

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

ARDL Long Run Form and Bounds Test
Dependent Variable: D(UNER)
Selected Model: ARDL(1, 0)
Case 2: Restricted Constant and No Trend
Date: 07/24/19 Time: 09:16
Sample: 1980 2018
Included observations: 38

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.601623	0.925763	1.730058	0.0924
UNER(-1)*	-0.047790	0.051180	-0.933766	0.3568
INFR**	-0.036454	0.022492	-1.620728	0.1141

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFR	-0.762799	0.754652	-1.010795	0.3191
C	33.51391	22.59435	1.483287	0.1469

EC = UNER - (-0.7628*INFR + 33.5139)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	1.272656	10%	3.02	3.51
K	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58
Actual Sample Size	38		Finite Sample: n=40	
		10%	3.21	3.73
		5%	3.937	4.523
		1%	5.593	6.333
			Finite Sample: n=35	
		10%	3.223	3.757
		5%	3.957	4.53
		1%	5.763	6.48

APPENDIX III: Data

YR	INFR	UNER
1980	21.5	9
1981	15.89	8.51
1982	10.28	8.02
1983	4.67	7.52
1984	9.37	7.02
1985	6.54	6.53
1986	5.72	5.3
1987	11.29	7
1988	54.51	5.3
1989	50.47	4
1990	7.36	3.5
1991	13.01	3.1
1992	44.59	3.4
1993	57.17	2.7
1994	57.03	2
1995	72.84	1.8
1996	29.27	3.8
1997	8.53	3.2
1998	10	8.2
1999	6.62	13.1
2000	6.93	13.1
2001	18.87	13.6
2002	12.88	12.6
2003	14.03	14.8
2004	15	13.4
2005	17.86	11.9
2006	8.24	12.3
2007	5.38	12.7
2008	11.58	14.9
2009	11.54	19.7
2010	13.72	21.1
2011	10.84	23.9
2012	12.22	24.4
2013	8.48	24.7
2014	8.06	25.1
2015	9.02	25.5
2016	15.7	25.9
2017	16.5	18.8
2018	12.09	23.1