IOSR Journal of Mathematics (IOSR-JM)
e-ISSN: 2278-5728, p-ISSN: 2319-765X. Volume 16, Issue 3 Ser. III (May – June 2020), PP 11-14
www.iosrjournals.org

Test for Stationarity on Inflation Rates in Nigeria using Augmented Dickey Fuller Test and Phillips-Persons Test.

[1]Ajewole K.P.,[2]Adejuwon S.O., [3]Jemilohun V.G.
[1]Department of Statistics, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria.
[2]Department of Mathematical Sciences, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria
[3]Department of Business Administration and Management, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria.

Abstract-*Price stability is one of the main objectives of every government as it is an important economic indicator that governments, politicians, economists and other stakeholders use as basis of argument when debating on the state of the economy (Suleman and Sarpong, 2012). In recent years, rising inflation has become one of the major economic challenges facing most countries in the world, especially developing countries such as Nigeria. David (2001) described inflation as a major focus of economic policy worldwide. This is rightly so as inflation is the frequently used economic indicator of the performance of a country's economy due to the fact that it has a direct effect on the state of the economy.Inflation is one of the major economic challenges facing most countries in the world especially those in Africa including Nigeria.*

Therefore, forecasting inflation rates in Nigeria becomes very important for the government to design economic strategies or effective monetary policies to combat any unexpected high inflation in the country.

This study utilizes Augmented Dickey Fuller Test and Phillips-Persons Test to test for stationarity on Inflation Rates in Nigeria. It was observed from the results of the findings that the augmented dickey fuller and Phillips-Persons test shows that that Nigerian Inflation rate is stationary at the first difference, that is $I(1)$ *at 1%, 5% and 10% levels of significance with* $p - value = 0.001$.

Date of Submission: 13-05-2020 Date of Acceptance: 25-05-2020

I. Introduction

It is believed that Nigeria is a developing country. Out of all the micro and macro economy variables which affect the growth of the economy, the effect of inflation is likely to be significant since inflation is created locally in the case of Nigeria (i.e. there is general rise in price of goods in Nigeria at the devaluation of naira) while we import inflation due to over reliance on imported goods from inflation affected countries.

Inflation is the rate at which the general level of prices for goods and services is rising and, consequently, the purchasing power of currency is falling. As prices rise, a single unit of currency loses value as it buys fewer goods and services. This loss of purchasing power impacts the general cost of living for the common public which ultimately leads to a deceleration in economic growth.In recent years, rising inflation has become one of the major economic challenges facing most countries in the world, especially developing countries such as Nigeria. David (2001) described inflation as a major focus of economic policy worldwide. This is rightly so as inflation is the frequently used economic indicator of the performance of a country's economy due to the fact that it has a direct effect on the state of the economy. Webster (2000) defined inflation as the persistent increase in the level of consumer prices or a persistent decline in the purchasing power of money. Hall (1982) also expresses inflation as a situation where the demand for goods and services exceeds their supply in the economy.

According to www.investopedia.com/terms/i/inflation.asp,The Central Bank in any country is empowered to perform duties that will ensure soundness of the financial and monetary system. In order to achieve the monetary stability, it is always confronted with the challenge of choosing the right strategy to apply in order to meet the envisaged end. Among the most popular strategies are exchange rate targeting, monetary targeting, Nominal GDP targeting and inflation targeting.

II. Materials and Methods

The relevant data needed for this work is monthly data on inflation rate (1999-2018). These data were obtained from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS).

A. Unit Root Test

For a univariate time series, the unit root test is frequently employed for testing stationarity. The test first poses the null hypothesis that the given time series has a unit root, which means that the time series is non-stationary and tests if the null hypothesis is to be statistically rejected in favour of the alternative hypothesis that the given time series is stationary. To detect whether a given series has non stationarity, let's assume that the relationship between current value (in time t) and last value (in time $t-1$) in the time series is as follows;

$$x_t = \emptyset x_{t-1} + w_t \qquad (1)$$

where,

x_t is an observation value at time t, w_t is a white noise process. This model is a first order autoregressive process. The time series x_t converges, as $t \to \infty$, to a stationary time series if $|\phi| < 1$. If $|\phi| = 1$ or > 1, the series x_t is not stationary and the variance of x_t is time dependent (Diebold et al., 2010). In other words, the series has a unit root. The unit root test subsequently tests the following one-sided hypothesis

H_0: $\phi = 1$ (has a unit root).

H_1: $\phi < 1$ (has root outside the unit circle).

The name, unit root, comes from the fact that the coefficient of x_{t-1} is unity, if the time series is non-stationary, and the unit root test, as the name suggests, tests if ϕ is unity or not. If x_{t-1} is subtracted from the right and left sides of the above equation, we get:

$$\nabla x_t = (\emptyset - 1)x_{t-1} + w_t \qquad (2)$$

This equation is expressed as a first order difference equation. If ϕ is taken as one in the equation (1), the effect of unit root can be removed from the actual series that has non stationarity via a first differencing. The tests above are valid only if w_t is a white noise. In particular, w_t is assumed not to be auto correlated, but would be so if there was autocorrelation in the dependent variable of the regression $\{x_t\}$ which has not been modeled. If this is the case, the test would be oversized, meaning that the true size of the test (the proportion of times a correct null hypothesis is incorrectly rejected) would be higher than the nominal size used (e.g. 5%). The solution is to augment the test using *p* lags of the dependent variable.

B. The Augmented Dickey-Fuller (ADF) Test

The presence of trends and unit roots can be detected from the slowly decaying autocorrelation function (ACF) in a univariate process, thus indicating non-stationary, but this has very little power to detect the process of trend or unit root.

Consider the AR (1) series

$$x_t = \phi x_{t-1} + w_t \qquad (3)$$

Since we know that if $-1 < \phi < 1$ then x_t is stationary

If $\phi = 1, x_t$ is not stationary

Hence the unit root hypothesis is

$$H_0: \phi = 1 \quad vs$$
$$H_1: \phi < 1 \qquad (4)$$

Subtract x_{t-1} from (3) we have

$$x_t - x_{t-1} = \phi x_{t-1} - x_{t-1} + w_t$$
$$\Delta x_t = (\phi - 1)x_{t-1} + w_t \qquad (5)$$

Let $\delta = \phi - 1, hence$

$\Delta x_t = \delta x_{t-1} + w_t$ (6)

Thus, testing for $\phi = 1$ is tantamount to testing for $\delta = 0$.

The Augmented Dickey Fuller (ADF) test involves checking through and testing the three sets of models:

$(i)\Delta x_t = (\lambda - 1)x_{t-1} + \sum_{j=1}^{t} \beta_j \, \Delta x_{t-j} + w_t$ (7)

$(ii)\Delta x_t = \alpha + (\lambda - 1)x_{t-1} + \sum_{j=1}^{t} \beta_j \, \Delta x_{t-j} + w_t$ (8)

$(iii)\Delta x_t = \alpha + \delta_t + (\lambda - 1)x_{t-1} + \sum_{j=1}^{t} \beta_j \, \Delta x_{t-j} + w_t$ (9)

Where equation (7) is a pure random walk model (A time series that has a unit root is known as random walk and a random walk is an example of a non-stationary time series). Equation (8)contains an intercept or drift term and equation(9) contains both the drift and linear time trend.

Unit root test involves one or more of the above equations and the associated standard errors and comparing the test statistic with the appropriate values in the Dickey Fuller table.

In practice, most economic time series are non-stationary. A univariate process that is non-stationary (contain trend) can be made stationary by differencing and the resulting series can be modeled using univariate Box-Jenkins methodology.

III. Results

In time series, a unit root test determines whether a time series variable is non-stationary using an autoregressive model. Augmented Dickey–Fuller test (ADF) and Phillips-Person is a test for a unit root test in our time series data is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence.

Table 1 below of the Augmented Dickey Fuller and Phillips-Persons test shows that Nigerian Inflation rate is stationary at the first difference, that is $I(1)$ at 1%, 5% and 10% levels of significance with $p - value = 0.001$. Since the order of integration of the difference population series is one (1), then $d = 1$.

Therefore, we denote from the two tables below that the data is stationary at (1).

Table 1: Stationarity Test (Augmented Dickey Fuller)

Null Hypothesis: D(INFLATION) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 2 (Automatic - based on AIC, maxlag=13)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.299166	0.0000
Test critical values:	1% level		-4.027959	
	5% level		-3.443704	
	10% level		-3.146604	

Table 2: Stationarity Test (Phillips-Persons)

Null Hypothesis: D(INFLATION) has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-9.796247	0.0000
Test critical values:	1% level		-4.026942	
	5% level		-3.443201	
	10% level		-3.146309	
*MacKinnon (1996) one-sided p-values.				

Diagnostic Checking

In this section, we shall assess how well the selected model fits Nigerian inflation rate. If the model fits the data well, the residuals of the fitted model are random (Chatfield, 1991). In ARIMA modeling, the selection of the best model to analyze data is directly related to how well the residual analysis performs (Kadri et al., 2005). Therefore, several diagnostic statistics and plots of the residuals can be used to examine the goodness of fit of the selected model to the data.

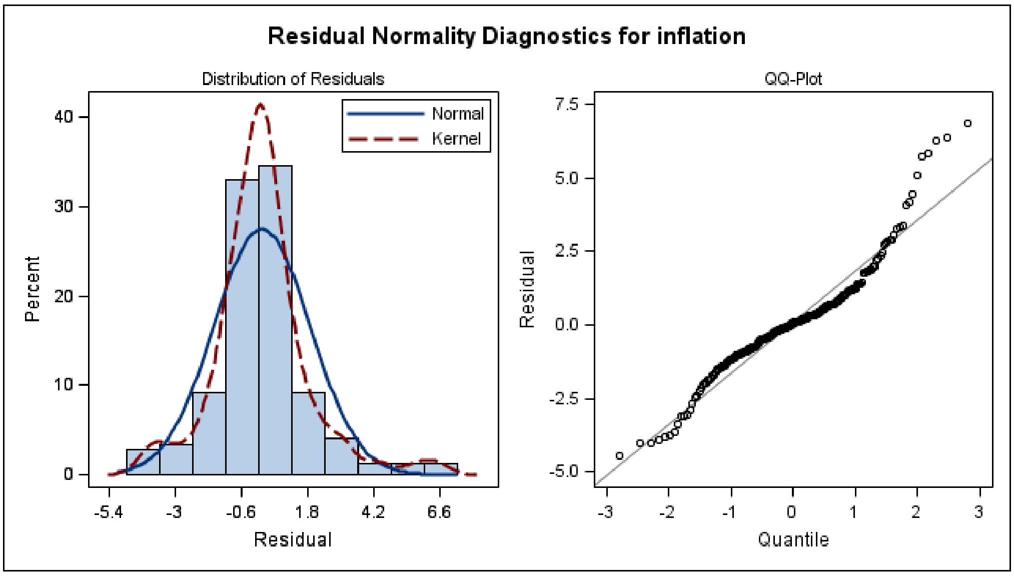

Figure 1

The figure above shows the histograms and QQ-plot of the residuals. As expected, the curves significantly reflect a normal distribution.

Test statistic values of the Breusch and Pagan (B-P) test for the homoscedasticity of the residuals are also presented. All calculated values are found to be smaller than the respective critical values, indicating that the residual variance is constant. Therefore, the hypothesis that the residuals are white noise cannot be rejected.

IV. Discussion

The purpose of this study is to analyze and test for stationarity on the structure and pattern of Nigeria monthly inflation rates from January 1999 – December 2018 using Augmented Dickey Fuller and Phillips-Pearson test. The aim and objectives of this research work are to examine and explore the monthly inflation rates in Nigeria by constructing and analyzing the model. We as well, forecast in-sample values and determine the forecast performance of the models used.

The finding from this study shows that the aim and objectives of this research were achieved and the findings are outlined below:

The time plots showed that each year there is upward increase in the trend and suggests that the given time series is non-stationary. The movement is secular in nature and expect a small shift in the movement in mid-2005.

The augmented dickey fuller and Phillips-Persons test shows that Nigeria Inflation rate is stationary at the first difference, that is$I(1)$.

V. Conclusion

This study has shown that the inflation rates in Nigeria are stationary. Monetary policy must be transparent and corruption must be properly checked. Nigerian government needs to give room to statistician to participate more in the planning and execution of government economic policies.

Reference

[1]. Asogu, J. O. (1991): An Econometric Analysis of the Nature and Causes of Inflation in Nigeria.CBN Economic and Financial Review, Vol.29, No.3, pp.239-254.
[2]. David F.H. (2001): Modeling UK inflation, 1875-1991.J. Appl. Economics., 16(3): 255-275.
[3]. Fakiyesi, O.M. (1996): Further Empirical analysis of Inflation in Nigeria. CBN Economic and Financial Review, 34(1), 489-500.
[4]. Hall, R., (1982): Inflation, Causes and Effects. Chicago University Press, Chicago.
[5]. Webster, D. (2000): Webster's New Universal Unabridged Dictionary. Barnes and Noble Books, New York.
[6]. Tegene, Abebayehu (1989): The Monetarist Explanation of Inflation: The Experience of Six African Countries. Journal of EconomicStudies,16 (March): 5-18.
[7]. Trumman, E. (2003): Inflation Targeting in the World Economy, Washington: Institute for International Economics.

Ajewole K.P, et. al. "Test for Stationarity on Inflation Rates in Nigeria using Augmented Dickey Fuller Test and Phillips-Persons Test." *IOSR Journal of Mathematics (IOSR-JM)*, 16(3), (2020): pp. 11-14.