Investigating the Causality between Unemployment Rate, Major Monetary Policy Indicators and Domestic Output using an Augmented Var Approach: A Case of Nigeria

Bada Olatunbosun

Received: 14 December 2018 Accepted: 3 January 2019 Published: 15 January 2019

Abstract

This paper is an investigation of causal relationships that exist between macroeconomic variables in Nigeria context. These variables are interest rate, inflation rate, exchange rate, real gross domestic product, and unemployment rate. Often, a variable can better be forecasted by introducing past and current values of some other variables in the ARMA model or its AR approximation. We achieved this by employing an augmented VAR approach, such as the procedure proposed by Toda-Yamamoto. This current work included a unit-root test with trend break functions without a priori information. Specifically, we employed the extended Augmented Dickey-Fuller test through innovational outlier and additive outlier models. The truncation parameter was selected using the t-sig and F-sig general to specific recursive techniques. Unknown breakpoints were observed, which indicates a strong connection with the data.

Index terms— toda-yamamoto, cointegration, innovational outlier, additive outlier, unit-root test, bounds test.

1 I. Introduction

he concept of Granger Causality has been extensively studied in the fields of finance and economics in recent times. The term is used to describe how possible it is to predict the future values of a variable using the past values of that variable and another variable in bivariate and multivariate settings.

Several methods have been proposed over the years. Granger (1969) was the first to present this type of relationship between two variables. However, this method suffered serious limitations, especially when any of the time series is non-stationary. This is because when some of the series are non-stationary, the Wald test on Granger causality with linear restrictions on the parameters of the vector autoregressive model (VAR) does not follow its usual asymptotic ? 2 -distribution under the null hypothesis. The presence of latent parameters which distort the test statistic's asymptotic distribution is produced. As a result of this limitation, modified tests have been proposed. Prominent are Toda and Yamamoto (1995), Dolado and Lütkepohl (1996), Saikkonen and Lütkepohl (1996) and more recently, Bauer and Maynard (2012). Toda-Yamamoto (1995) method involves determining the lag length p using the usual lag selection procedures and estimating a (p+d max)th order VAR where d max is the maximum order of integration of the model. Furthermore, the coefficients of the d max lagged vectors in the VAR are ignored. Dolado and Lütkepohl (1996) proposed a simple method which under general conditions guarantees that Wald test follows the asymptotic ? 2distribution by fitting a VAR(p+1) to a VAR(p) data and perform a Wald test on the coefficients of the first p lags. Saikkonen and Lütkepohl (1996) estimated cointegrated systems through autoregressive approximation by deriving the asymptotic properties of the estimated coefficients of the error correction model (ECM) and the pure VAR model under the assumption that the order of the autoregressive model tends to infinity with increasing sample size. Bauer and Maynard (2012) proposed a highly robust Granger causality test that accommodates VAR models with unknown integration orders by employing the surplus lag approach to an infinite order VARX framework. These modifications to the standard approach proposed by Granger in 1969 are needed to ensure that the Wald test statistic follows the asymptotic ? 2distribution under the null hypothesis.

2 Investigating the Causality between Unemployment Rate, Major Monetary Policy

Indicators and Domestic Output using an Augmented Var Approach: A Case of Nigeria II. Some Related Works Several studies have looked at the causality existing between macroeconomic variables around the world. Most of these works focus on the usual Wald test mainly because the macroeconomic variables involved are of the same order of integration. For instance, Gocmen (2016) periods, respectively. Their findings show that there exists causality from economic growth to money supply but not vice versa during the Pre-Deregulation era. On the other hand, no causality was found between these two variables during the Post-Deregulation era. Sulaiman & Migiro (2014) in their study were able to show that there is unidirectional causality from the monetary policy rate (MPR) to gross domestic product (GDP); from exchange rate to GDP; from interest rate to GDP but not vice versa. However, no causality could be established between cash reserve ratio (CRR) and GDP; money supply and GDP.

We observed that in all these earlier works, the macroeconomic variables' order of integration were based on regular unit-root tests. Rather than using tests such as Augmented Dickey-Fuller test, Phillips-Perron (PP) test and other regular tests, this current study involves unit-root tests with allowance for a shift in the intercept of the trend function and slope since most macroeconomic time series are interpreted as stationary around a deterministic trend function. We employed the extended Augmented Dickey-Fuller test through innovational outlier and additive outlier models as proposed by Perron (1989Perron (, 1997)).

3 III. Methodology, Analysis and Results

The monthly data used in this study is a secondary data extracted from the Central Bank of Nigeria between 2006 and 2018. The three monetary policy variables involved in the vector autoregressive (VAR) model comprise interest rate (ir) (proxy by Treasury bill rate), inflation rate (inf) and exchange rate (ex). Also, a real gross domestic product (rgdp) was used as the measure of the Domestic Output and lastly unemployment rate (um). Since the series have different frequencies, particularly real gdp, which is a quarterly data, we converted it to monthly series without loss of statistical properties using the cubic low to highfrequency conversion method. Furthermore, we transformed the original data into the natural log to ensure that the normality assumptions in the error term in the VAR model can be sustained.

4 a) Toda-Yamamoto Augmented VAR Approach

Toda and Yamamoto (1995) proposed a modified method which allows the application of the lag selection procedure to integrated or cointegrated VAR and satisfying the asymptotic theory as long as the order of integration does not exceed the true lag length of the model. This method involves determining the lag length p using the usual lag selection procedures and estimating a (p+d max)th order VAR where d max is the maximum order of integration of the model. Furthermore, the coefficients of the d max lagged vectors in the VAR are restricted to zero in the linear model. Theoretically, if two or more series are cointegrated, then there will exist causality between them but not conversely. We express the vector autoregressive VAR models under Toda Yamamoto as follow:t d p i i t t p i i t t d p i i t t p i i t t p i d p i i t t i t it p i d p i i t t i t it d p i i t t p i i t t t ir ir rgdp rgdp um um ex ex ex 5 1 2 1 1 1 2 1 1 1 1 2 1 1 2 1 2 1 1 0 max max max max max inf inf µ ? + ? ? ? ? ? ? ? + ? + ? ? ? ? ? ? ? ? + ? + ? ? ? ? ? ? ? ? + ? + ? ? ? ? ? ? ? ? + ? + ? ? ? ? ? ? ? ? + ? + = ? ? ? ? ? ? ? ? ? ? + = ? = ? + = ? = ? = + = ? ? = + = ? ? + = ? = ? Volume XIX Issue VI Version I (E) Year 2019 © 2019 Global Journals

Investigating the Causality between Unemployment Rate, Major Monetary Policy Indicators and Domestic Output Using an Augmented Var Approach: A Case of Nigeria

Where p is the optimal lag on the initial VAR and d max is the maximal order of integration on the five macroeconomic variables. We assumed that the variables could be approximated by the natural loglinear VAR (p) model to sustain the normality assumption. Firstly, we conducted tests for the presence of unit-root on the three macroeconomic variables. Depending on the order of integration, we select the maximum order, i.e. d max and specify an unrestricted VAR (p) model using the lag length criteria LR, FPE, AIC, SIC and HQIC. Stability checks were conducted on the adjusted VAR (p+d max) model through the autocorrelation LM test on the VAR residuals.

If two or more of the time series are of the same integration order, a test to see if they are cointegrated, using ARDL modeling approach, for example, is needed. We take the preferred VAR model and d max additional lags of each of the variables into each of the equations. Conclusions about the existence of long-run form (i.e., cointegration) do not affect this step but provide cross-check on the validity of our results at the end of the analysis. Test of Granger non-causality by testing the hypothesis that the coefficients of (only) the first p lagged values of real gdp, inflation rate, interest rate, and exchange rate are zero in the unemployment rate equation, using a standard Wald test. This test is repeated for the coefficients of the p lagged values of the monetary policy indicators and real gdp variable equations. The coefficients for the remaining d max lags were excluded when performing the Wald tests (i.e., they enter the models as deterministic terms alongside the intercept). This is to ensure that the Wald test statistics follow asymptotic chisquare distribution with p degrees of freedom, under the null hypothesis. Rejection of the null implies support of the presence of Granger causality. Finally, we revisit the conclusion made during the test of cointegration. Theoretically, Granger causality, either unidirectional or bidirectional, will exist between two or more cointegrated time series but not vice versa.

5 b) Unit-root tests using the Innovational Outlier and Additive Outlier Models

We begin the analysis by studying the stationarity of each of the series by conducting unit-root tests. An extended Augmented Dickey-Fuller test with innovational outlier and additive outlier breakpoints as proposed by Perron (1989Perron (, 1997))) (1 b t T t DU > = ,) 1 (1) (+ = = b t b T t T D , t T t DT b t) 1 (1 + > = and))((1 * b b t T t T t DT ? > =

. We test the null hypothesis that ? = 1 using the t-statistic The results of unit-root test reveal that unemployment rate, and real gdp are stationary of order one under the Innovational Outlier Model 1 and Additive Outlier Model respectively. The truncation lag lengths of k* = 12 were selected using the F-sig approach. The pvalue for the real gdp unit-root test is lower than that of the unemployment rate unit-root test. This is an indication that the Additive Outlier Model has more power than the Innovational Outlier Model 1 on these series. The remaining series, i.e. inflation rate, interest rate, and exchange rate are stationary at level under Additive Outlier model, Innovational Outlier Models 2, and 3 respectively. The k* = 13 for inflation rate and k* = 1 for interest rate and exchange rate were chosen using the t-sig recursive tehnique. The k max was chosen arbitrarily avoiding the problems of multicollinearity amongst the variables and loss of power usually associated with high values of k max. This quantity was 13 lags (for real gdp and inflation rate) and 5 lags (for both interest rate and exchange rate). Only the unemployment rate has a binding k max at 12 lags. The breakpoint dates correspond to significant periods of global economic and Nigerian government policy change shocks. The logarithms of the macroeconomic variables are as shown in Fig. **??** below. The breakpoints are selected to maximize the t-statistics (Table 1). for models 2 and 3, where* b T is such that |) , (| max) ( ) , 1 (* * ?k T t T t b T k T b b ? ? + ? = and |) , (| max) ( ) , 1 (* * ?k T t T t b T k T b b ? ? + ? =

. T b was selected by allowing this point to correlate with the data as much as possible although with some loss in power. This was done by imposing no restrictions on the sign of the change. The truncation parameter k* was selected using the t-sig and F-sig general to specific recursive procedures as proposed by Perron (1989). These procedures are particularly better than information criteria such as Akaike Information Criterion and Bayesian Information Criterion due to their size stability and better power (Perron, 1989) Firstly, there was a global financial crisis in 2007 when major financial institutions in the United States collapsed. The effect of the global financial crash was observed in Nigeria's real gdp in July of 2007. Secondly, Nigeria is known for its inflation targeting monetary policy. Under this policy, the Central Bank of Nigeria (CBN) uses the monetary policy rate (MPR) and cash reserve ratio (CRR) to control rate of inflation in the economy. Hence, the breakpoint of 2011:10 in inflation rate series is a consequence of the upward review of CBN's Minimum Rediscount Rate (MRR) from 9.25 percent to 12 percent in October 2011. Furthermore, in 2015, the Central Bank of Nigeria reduced the Monetary Policy Rate (MPR) from 13 percent to 11 per cent culminating into the September 2015 breakpoint date in the interest rate series. Thirdly, in October 2015, JP Morgan expelled Nigeria from its Global Bond Index-Emerging Market (GBI-EM). GBI-EM is an index which tracks local currency bonds by emerging market governments. This decision led to the efflux of foreign investors holdings in Nigeria bonds. The effect was revealed in a breakpoint of 2015:12 in the exchange rate series. Finally, there is a strong connection between economic growth and unemployment rate. According to the United Nations Development Programme 2016 annual report on Nigeria, the country's economy witnessed contraction (recession) for the first time in several decades. This resulted in an escalation of unemployment rate, especially amongst the youth, which led to the introduction of several government youth empowerment programmes to reverse the trend. The contraction was captured by the December 2016 breakpoint observed in the unemployment rate series. Thus, by introducing trend break functions in the unitroot tests without a priori information, we have been able to establish a good connection between the various breakpoints and the macroeconomic series. This is in line with previous works by Perron **??**1997)

6 c) Selecting the maximum lag length (p) of the Unrestricted VAR

We specify a level unrestricted VAR (p) model using the information criteria to select the lag length. Specifically, LR, FPE, and AIC criteria selected a lag of p = 7, while SIC and HQIC criteria chose p = 4 (Table **??**). However, the VAR (4) model seems to have stability problems and serious serial autocorrelations amongst the error terms. Thus, we set our p = 7 in the Toda and Yamamoto procedure.

7 Fig. 2: Stability Checks on VAR (7) model

The stability of the inverse roots of AR polynomial of the VAR (7) indicates no root lies outside the unit circle. Furthermore, the test of serial auto correlation on the error terms reveal no serious problem of serial autocorrelation at 5 percent and 10 percent levels. Thus, the VAR (7) model satisfies the two stability conditions (Fig. **??**). Before the conduct of the Granger non-causality test, we check the existence of long-run comovement (cointegration) using the bounds test with an autoregressive distributed lag model (ARDL). The choice of ARDL is because of its better performance especially when the finite sample size T is small and the inclusion of different lags of the variables in the model. Furthermore, this method is generally applicable to a mixture of I(0) and I(1) time series (Pesaran, Shin & Smith, 2001). Under this model, we establish a single cointegrated equation of the long-run relationships via ordinary least squares (OLS) by using a bounds testing procedure as proposed by Pesaran et al. (2001). We estimated the following differenced VAR (p) modelt t i j p o i i t j p i k j t t i t EC z t y y j ? + ? ? ? + ? + ? ? = ? ? = ? = = ? ? ? ? ? 1 * , ,**1 1 * 1*** 1 ? ? ? ?

One or more of the monetary policy indicators, unemployment rate and real gdp variables in the vector z j is fixed or static, ? is the first difference operator, Î?”y t is the interest rate (ir) at first difference,? = ? ? ? ? + + + = k j j t j t t z t c c y EC 1 1 , 1 0 1 1 ? ? , , ,

Determination of the number of lags was done using the BIC information criterion. This criterion selected an ARDL with three lags of interest rate, one lag of inflation rate, zero lag of exchange rate, one lag of real gdp and five lags of unemployment rate, i.e. ARDL (3,1,0,1,5). The result of the bounds test is presented in the Table 3 below. The cointegration test is crucial to the test of Granger non-causality because if two or more time series are cointegrated, there will exist a causality either unidirectional or bidirectional between them but not vice versa. Hence, the bounds test above is a mere check or confirmation of the presence of causality amongst the macroeconomic variables. Note that any of the macroeconomic variables could be used as the dependent variable in the cointegration analysis as long as the model is stable (i.e. the error terms do not have any serial autocorrelations and there are no unit roots in the autoregressive polynomial). Having established the existence of long-run relationships amongst the macroeconomic variables, we proceed to the test of Granger non-causality using the Toda-Yamamoto procedure as proposed by Toda & Yamamoto (1995). We conducted the procedure using p = 7. While inflation rate and real gdp are significant at all levels of significance with p-value = 0.0004 and 0.0021 respectively, exchange rate (p-value = 0.1043) and unemployment rate (p-value = 0.1665) are not significant in the long-run. However, ? = -0.36, which measures the speed of adjustment by the interest rate to disequilibrium caused by shocks on the remaining variables is negative and significant at all levels of significance. These shocks could be as a consequence of the various structural breaks observed in the unit-root tests above. For example, a breakpoint of 2011:10 was observed in the inflation rate series. A persistent rise in inflation leads to the review of the anchor interest rate downward in October 2011. The CBN's instantaneous adjustment in interest rate can be explained by the 36 percent speed of adjustment in the equilibrium correction form (Table 4). This model was well specified since there is no serial autocorrelation amongst the error terms. Breusch-Godfrey serial autocorrelation LM test F (5,130) = 1.17 (p-value = 0.3295) and ? 2 = 6.48 (pvalue = 0.2622). These results confirm the conclusions drawn by some earlier works, as outlined in this paper.

8 Volume XIX

9 IV. Conclusion

Firstly, by introducing trend break functions in the unit-root tests without a priori information, we have been able to establish a good connection between the various breakpoints and the macroeconomic series. These dates represent critical periods of policy changes by the government and external shocks. The unit-root tests with trend functions suggest that structural breaks in the macroeconomic variable series are very important and significant when formulating economic policies. The breakpoints can be included in a VAR model as deterministic terms to further improve the forecast/ prediction power without affecting the asymptotic properties of the test statistics involved in the analysis. However, the object of the unit-root test is just to establish the order of integration of the time series. Secondly, Granger non-causality tests via the Toda-Yamamoto procedure established bidirectional and unidirectional causal relationships amongst the macroeconomic variables. The existence of causality was confirmed using the bounds test with an interest rate autoregressive distributed lag model. Hence, this study further affirms the conclusions of several other research works that if two or more macroeconomic variables are cointegrated, there must be a unidirectional or bilateral causality amongst them but not vice versa. Therefore, we recommend that economic and financial policy makers consider including these macroeconomic variables in the models used for their forecasts.

10 Direction of causality

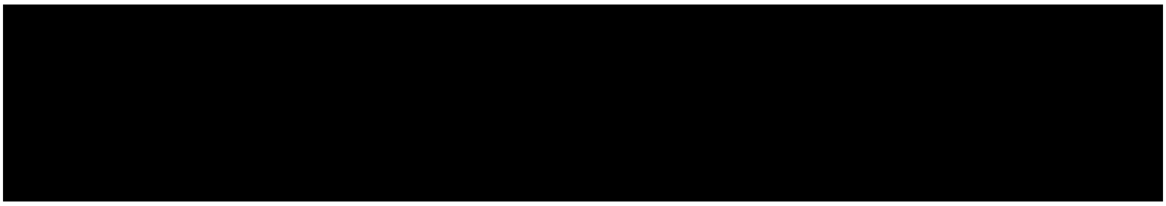

Figure 1: -

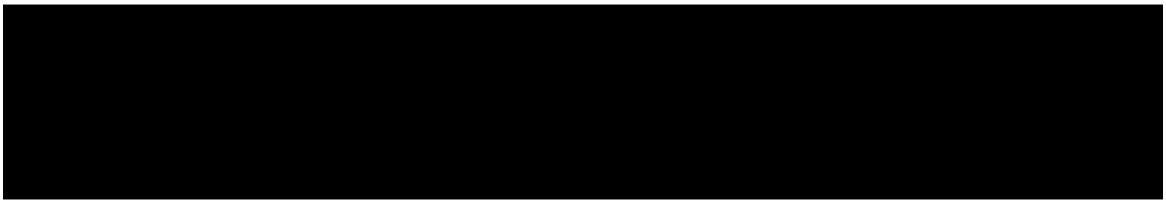

Figure 2: ,=

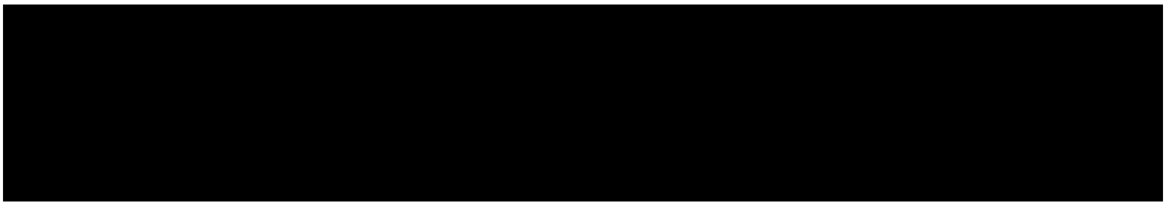

Figure 3: -

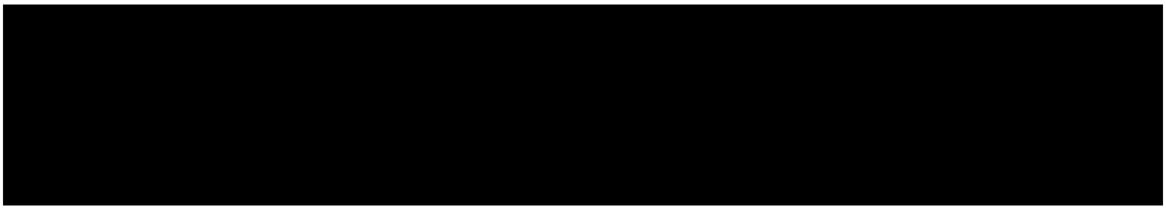

Figure 4:

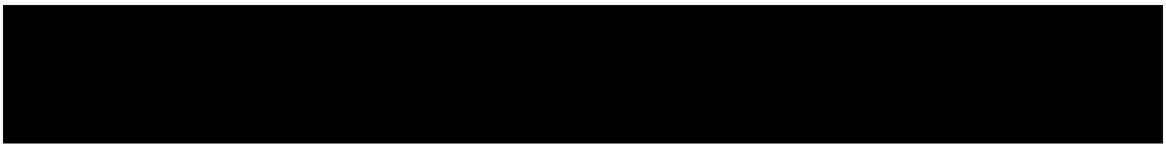

Figure 5:

Ojo & Alege (2014) conducted panel granger causality test as part of their study on the exchange fluctuation and macroeconomic performance in Nigeria and 39 other sub-Saharan African countries over 13 years. The macroeconomic variables included in the study are real gross domestic product, national exchange rate per US$, consumer price index, degree of openness, interest rate, government expenditure, and foreign direct investment. The study reveals no causality between the national exchange rate and real gross domestic product; government expenditure and national exchange rate; foreign direct investment and national exchange rate. Conversely, there exist bidirectional causality between the degree of openness and national exchange rate; consumer price index and national exchange rate; interest rate and national exchange rate in these sub-Saharan African countries. Olusanya & Akinade (2012) employed the usual Wald test to examine the causality between economic growth (proxy by GDP) and a major macroeconomic indicator such as money supply during the Pre-Deregulated and Post-Deregulated Nigerian economy. Essentially, the Pre-and Post-Deregulated periods are 1970:1985 and 1986:2009

Figure 6:

1

t -sig F -sig
p -value p -value
Source: Authors personal computation

Figure 7: Table 1 :

Volume XIX Issue VI Version I
E)
(
Global Journal of Human Social Science

Figure 8: test@ k max k * Breakpoint t -statistic

Year 2019

[Note: Fig. 1: Log exchange rate, log inflation rate, log real gdp, log interest rate and log unemployment rate for Nigeria between 2006 and 2018]

Figure 9:

3

Figure 10: Table 3 :

Inverse Roots of AR Characteristic Polynomial	p LM-Stat p -value
	1 35.2793 0.0833
	2 36.4804 0.0646
	3 33.4526 0.1201
	4 13.8500 0.9643
Year 2019	5 33.1339 0.1278 6 20.9649 0.6946 7 19.1256 0.7911
	8 18.7914 0.807
	Volume XIX Issue VI Version I
	E)
	(

I(0) Bound	I(1) Bound	F -stat k ?
3.03	4.06	6.24 4 10%
3.47	4.57	6.24 4 5%
4.4	5.72	6.24 4 1%
	Source: Authors personal computation	

Figure 11:

4

Figure 12: Table 4 :

Year 2019
Issue VI Version I
E)
(

Figure 13:

5

These results have implications for policy making. Theoretically, if the five macroeconomic variables have a common stochastic trend, it is expected that bivariate or multivariate causal relationships will exist between them, either unilaterally or bilaterally. Hence, the result of granger non-causality is in line with that of ARDL cointegration test. The test of Granger non-causality (Tables 5 & 6) reveals unidirectional causality amongst the macroeconomic variables except inflation rate and real gdp. These two macroeconomic variables cause each other (i.e. bidirectional causality exists among them).

Figure 14: Table 5 :

6

Figure 15: Table 6 :

Relation
Source: Authors personal computation
Volume XIX Issue VI Version I
E)
(

Figure 16:

[Olusanya and Akinade ()] 'Analysis of Causality between Monetary Policy and Economic Growth in Pre-and Post-Deregulated Nigeria Economy'. S O Olusanya , O M Akinade . *Asian Economic and Financial Review* 2012. 5 (5) p. .

[Narayan and Smyth ()] 'Are OECD stock prices characterized by a random walk? Evidence from sequential trend break and panel data models'. P K Narayan , R Smyth . *Applied Financial Economics* 2005. 15 p. .

[Arestis and Mariscal ()] P Arestis , I B F Mariscal . *OECD unemployment: structural breaks and stationarity*, 2000. 32 p. .

[Pesaran et al. ()] 'Bounds testing approaches to the analysis of level relationship'. M H Pesaran , Y Shin , R J Smith . *Journal of Applied Economics* 2001. 16 p. .

[Gocmen ()] 'Causal Relationship between Money and Inflation during high Inflation Period: The case of Turkey'. T Gocmen . *Journal of International Business and Economics* 2016. 4 (2) p. .

[Nawaz et al. ()] 'Correlation and Causality between Inflation and Selected Macroeconomic Variables: Empirical Evidence from Pakistan'. M Nawaz , M Naeem , S Ullah , S U Khan . *iBusiness*, 2017. 1990-2012. 9 p. .

[Khalid ()] 'Economic Growth, Inflation and Monetary Policy in Pakistan: Preliminary Empirical Estimates'. A M Khalid . *The Pakistan Development Review* 2005. 44 (4) p. .

[Umaru and Zubairu ()] 'Effect of Inflation on the Growth and Development of Nigeria Economy (An Empirical Analysis)'. A Umaru , A A Zubairu . *International Journal of Business and Social Science* 2012. 3 (10) p. .

[Ojo and Alege ()] 'Exchange rate fluctuations and Macroeconomic Performance in Sub-Saharan Africa: A dynamic Panel Cointegration Analysis'. A T Ojo , P O Alege . *Asian Economic and Financial Review* 2014. 4 (11) p. .

[Perron ()] 'Further evidence on breaking trend functions in macroeconomic variables'. P Perron . *Journal of Econometrics* 1997. 80 p. .

[Zivot and Andrews ()] 'Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis'. E Zivot , D W K Andrews . *Journal of Business & Economic Statistics* 1992. 10 p. .

[Saikkonen and Lütkepohl ()] 'Infinite Order Cointegrated Vector Autoregressive Processes, Estimation and Inference'. P Saikkonen , H Lütkepohl . *Econometric Theory* 1996. 12 (8) p. .

[Granger ()] 'Investigating causal relations by econometric models and cross-spectral methods'. C W J Granger . *Econometrica* 1969. 37 p. .

[Basher and Westerlund ()] 'Is there really a unit root in the inflation rate? More evidence from panel data models'. S A Basher , J Westerlund . *Applied Economics Letters* 2008. 15 p. .

[Abeeg and Alehile ()] 'Macroeconomic shocks and Fiscal Deficit Behaviour in Nigeria: A VECM Approach'. M O Abeeg , K S Alehile . *Economic and Financial Review* 2012. 5 (1) p. .

[Dolado and Lütkepohl ()] 'Making Wald Tests Work for Cointegrated VAR Systems'. J J Dolado , H Lütkepohl . *Econometric Reviews* 1996. 15 (4) p. .

[Lumsdaine and Papell ()] 'Multiple trend breaks and the unit-root hypothesis'. R L Lumsdaine , D H Papell . *Review of Economics and Statistics* 1997. 79 p. .

[Belka et al. ()] 'On the relationship between exchange rates and interest rates: Evidence from the Southern Cone'. A Belka , K Geisslreither , D Gross . *Cuadernos De Economics* 2004. 41 p. .

[Bauer and Maynard ()] 'Persistence-Robust surplus-lag Granger Causality testing'. D Bauer , A Maynard . *Journal of Econometrics* 2012. 169 (2) p. .

[Banerjee et al. ()] 'Recursive and Sequential Tests of the Unit-Root and Trend-Break Hypothesis: Theory and International Evidence'. A Banerjee , R L Lumsdaine , J H Stock . *Journal of Business & Economic Statistics* 1992. 10 (3) p. .

[Toda and Yamamoto ()] 'Statistical inference in vector auto regressions with possibly integrated processes'. H Y Toda , T Yamamoto . *Journal of Econometrics* 1995. 66 p. .

[Ling et al. ()] 'Testing for Unit Roots and Structural Breaks: Evidence from Selected ASEAN Macroeconomic Time Series'. T Y Ling , Mohd Nor A. H S , N A Saud , Z Ahmad . *International Journal of Trade, Economics and Finance* 2013. 4 (4) p. .

[Perron ()] 'The Great Crash, the oil price shock, and the unit root hypothesis'. P Perron . *Econometrica* 1989. 57 p. .

[Sulaiman and Migiro ()] 'The Nexus between Monetary Policy and Economic Growth in Nigeria: a causality test'. L A Sulaiman , S O Migiro . *Public and Municipal Finance* 2014. 3 (2) p. .

[Chiang and Ping ()] 'Trend stationary of inflation rates: evidence from LM unit root testing with a long span of historical data'. L C Chiang , C C Ping . *Applied Economics* 2008. 40 p. .

[Odo et al. ()] 'Understanding the Relationship between Unemployment and Inflation in Nigeria'. S I Odo , F O Elom-Obed , T O Okoro , J O Nwanchukwu . *Journal of Poverty, Investment and Development* 2017. 35 p. .

[Ewing and Wunnava ()] 'Unit roots and structural breaks in North American unemployment rates'. B T Ewing , P V Wunnava . *North American Journal of Economics & Finance* 2001. 12 p. 273.