Government Spending and Inflation in Nigeria: An Asymmetry Causality Test

David Oluseun Olayungbo

***Abstract*—**The paper, using annual data sourced from Statistical Bulletin published by Central Bank of Nigeria, examines asymmetry causal relationship between government spending and inflation in Nigeria from the period of 1970 to 2010. The asymmetry causality test shows that a uni-directional causality exists from negative government expenditure changes (low or contractionary government spending) to positive inflation changes (high inflation) in the Vector Autoregression (VAR) model. The finding implies that inflationary pressure in Nigeria is state dependent, that is high inflation is caused by low or contractionary government spending.

***Keywords*—**Asymmetry Causality Test, Inflation, Government spending, Nigeria.

I. Introduction

THE need for government spending varies from time to time. Government needs to spend in order to ensure stability of the economy, stimulate or enhance productivity or investment through direct public spending and investment according to the Keynesian view. Government also spends in order to redistribute income between the rich and poor. However, increase in government spending in form of intervention, going by the neo-Classical economists could result to high inflation outcomes given the full-employment assumption. Several theories have been advanced to explain this problem in different countries. Among them are Peacock and Wiseman hypothesis [35] of increasing state activities, critical-limit hypothesis Clark[11], [12], Leviathan hypothesis [7], differential productivity hypothesis [6], and the relative price hypothesis [3] and [34]. So, economic literature identified several determinants of public expenditure growth e.g inflation ([9]; [10]; [11]; [12]), debt service or burden ratio ([36]; [4]; [5]); [27]. In this paper, inflation is considered being the major driver of government spending and its implication on debt in Nigeria.

The problem of inflation has been on the increase in the Less Developed Countries (LDCs) of the world over decades with Nigeria inclusive. As depicted in Fig. 1, inflation rate in Nigeria has been fluctuating. It has been relatively high and low over the years. For instance, it was 33% and 39.6% in 1975 and 1984 respectively. In 1989 and 1992 it was 40.9% and 44.5%.

David Oluseun Olayungbo is with the Obafemi Awolowo University, dept of Economics Ile-Ife, Nigeria as a Lecturer II and a Ph.D student. (corresponding author's Phone:+234803534258; e-mail: doolayungbo@oauife.edu.ng and yinkadavey2k@yahoo.co.uk)

It was also high in 1993 with 57% and 72.8% was the highest so far in 1995 [8]. By 2010, the inflation rate fell back to 11.20% [37]. The trend of government expenditure in Nigeria has been an upward one from N903.9 million in 1970 to N8.8 billion in 1977 representing 876% increase. It fell to N8billion in 1978 indicating -9.3% decrease. It fell again to N7.4 billion in 1979 with a decrease of -7.4%. From then, the government expenditure of N14.9 billion in 1980 increased to N3.35trillion and N4.65trillion in 2009 and 2010 respectively. Given this background, this paper examines the asymmetry relationship between government spending and inflation.

Previously published papers on causality have assumed the same causal impact of negative and positive changes between government spending and inflation in Nigeria. This might be too restrictive assumption because in many cases there is potentially an asymmetric structure regarding the causal impacts [17]. In the United State for instance, tight monetary policy pursued during the years 1988 and 1989 slowed down the economy whereas in 1990 when the government eased the policy the economy did not respond accordingly [19].

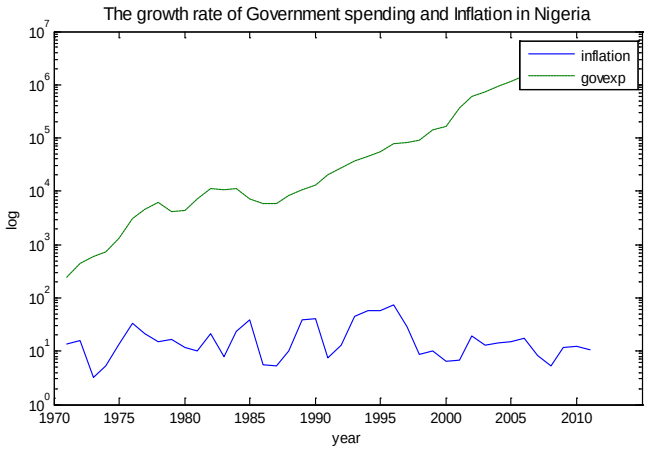

Fig. 1 The Growth Rate Of Government Spending And Inflation In Nigeria

This implies the effect is asymmetric with respect to the direction, size of the policy and the state of the economy. There are different results of contractionary and expansionary monetary policies when the nominal wages and prices are rigid downward and flexible in upward direction [38]. Moreover, the possibility of asymmetry causal effects could be linked to market asymmetry information of [2], [31] and [32].

On the empirical side, studies like [14] and [24] studied the relationship between growth rate of public spending and

inflation rate for the United States and Italy respectively. [26] analyzed budget deficits and inflation in high inflation economies. The prior studies in Nigeria have been on either the relationship between government spending and economic growth or the relationship between fiscal deficit and inflation rate. For instance, [15], [18], [29], [1] and [22], examined the relationship between government spending and economic growth in Nigeria. While studies like [23], and [20] examined causal relationship between fiscal deficit and inflation rate. [21] explored a trivariate causality test among economic growth, government expenditure and inflation rate in Nigeria.

This paper adds to the literature mainly because previous studies have only examined causal relationship and ignored asymmetry aspect of causality between government spending and inflation in Nigeria. The paper is structured as follows: section 2 deals with the data and the preliminary tests while section 3 discusses the classical causality. The asymmetry causality results are presented in Section 4. Finally, section 5 contains concluding remarks and implications.

II. Data And Methodology

Annual time series data on inflation (inf) and government expenditure (govt exp) are used for the analysis. The annual data covers 1970 to 2010. All the data were sourced from Statistical Bulletin, published by Central Bank of Nigeria [8] and expressed in real terms and in log linear form. The inflation rates are measured using the consumer price index. Government expenditure includes both recurrent expenditure of the government on administration, salaries transfer and capital expenditure on physical structures such as roads, hospitals, buildings and so on in Nigeria. Following [16] and [28], the cumulative sums of positive and negative change of the variables of interest were constructed. $govexp^+$ variable is equivalent to high or expansionary government spending, $govexp^-$ could also represent low or contractionary government spending while both inf^+ and inf^- represent high inflation and low inflation respectively. The choice of the sample period is due to data availability.

III. Unit- Root Test

The Augmented Dickey Fuller (Dickey and Fuller, 1979) (ADF) is used to determine the order of integration of the variables. After generating the data, the ADF unit root test is first carried out to know the order of integration of the cumulative sums of the positive and negative variables. The result presented in table 1 shows that $govexp^-$, inf^+ and inf^- which are positive cumulative sums of government expenditure, and inflation cumulative sums of positive variables are stationary at first difference, while $govexp^+$ is stationary in level.

In other to ensure a causal interaction between the variables, a Vector Autoregression (VAR) of order (k) for a system is written as:

$$y_t = \Pi + \sum_{j=1}^{k-1} \Gamma_j y_{t-j} + \varepsilon_t \quad (1)$$

TABLE I
UNITROOT TEST OF THE CUMULATIVE SUM OF POSITIVE AND NEGATIVE VARIABLES

VARIABLES	LEVELS	FIRST DIFF.
$govexp^-$	-1.6067	-3.9329
$govexp^+$	4.0659	-
inf^+	-0.7648	-5.2494
inf^-	-1.096	-5.0678

ADF critical values at levels for both the intercept and trend are -3.6067(1%), -2.9378(5%),-2.6069(10%) while that of the first difference are -3.6117(1%), -2.9378(5%) and -2.6069(10%).

Where y_t is a $k \times 1$, y_{t-j} is $k \times k$ lagged matrix of y_t and ε_t is a $k \times 1$ error term. The vector ordering of testing the asymmetry causality between government spending and inflation is:

$$y_t = [govexp^+ \ govexp^- \ inf^+ \ inf^-]' \quad (2)$$

A. The variable ordering in (2) is chosen based on the monetarist notion of the Quantity theory of Money that inflation is caused by increase in money supply with increase in government expenditure.

IV. Lag Length Selection

After the unit root test, the choice of the lag length in the VAR is determined. The Granger causality tests are sensitive to the lag length selection, Indeed, wrong lag order selection can cause spurious rejection or acceptance of no causality. The Akaike Information Criteria (AIC), Schwartz Bayesian Information Criterion (BIC), and Hannan-Quinn Criterion (HQC) alongside with the Likelihood Ratio (LR) proposed by Sims (1980) are used in the determination of the optimal lag length. The lag length of 1 is found to be optimal, minimal and robust. This is presented in table 2 and 3 respectively.

TABLE II
LAG LENGTH SELECTION CRITERIA

Lags	Loglikelihood	AIC	BIC	HQC
1	30.89152*	-558539*	0.294569*	-0.252451*
2	43.12641	-0.365457	1.170138	0.185501

*represents the optimal lag length

A. Asymmetry Causality Inference

Generating both the cumulative positive and negative changes was first adopted by [16], where the method was used for cointegration test called hidden cointegration. [17] extended it to causality test and referred to it as asymmetry causality testing. The causal relationship between two variables x_{1t} and x_{2t}, and following [16] and [17] are assumed to follow a random walk process such as:

$$x_{1t} = x_{1t-1} + \varepsilon_{1t} = x_{10} + \sum_{i=1}^{t} \varepsilon_{1i} \quad (4)$$
$$x_{2t} = x_{2t-1} + \varepsilon_{2t} = x_{20} + \sum_{i=1}^{t} \varepsilon_{2i} \quad (5)$$

TABLE III
LIKELIHOOD RATIO TEST

nlag	LR Statistic	Probability
8	-46.1735	-5.611e+0
7	228.1927	0
6	32.5983	0.00835
5	24.0152	0.08917
4	17.4901	0.3546
3	23.6001	0.09861
2	12.8446	0.6841
1	36.0924	0.002809*

The nearest significant p-value of lag length 1 is equally most optimal

Where $t = 1,2, \dots T$, the constants x_{10} and x_{20} are initial values while ε_{1i} and ε_{2i} are the error terms. The positive and negative changes are stated as: $\varepsilon_{1i}^{+} = \max(\varepsilon_{1i}, 0)$, $\varepsilon_{2i}^{+} = \max(\varepsilon_{2i}, 0)$, $\varepsilon_{1i}^{-} = \min(\varepsilon_{1i}, 0)$, $\varepsilon_{2i}^{-} = \min(\varepsilon_{2i}, 0)$, respectively. It follows that $\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ [1] and $\varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$. One can then write as follows:

$$x_{1t} = x_{1t-1} + \varepsilon_{1t} = x_{10} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-} \quad (6)$$
$$x_{2t} = x_{2t-1} + \varepsilon_{2t} = x_{20} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad (7)$$

The positive and negative changes of each variables are stated in a cumulative form as: $x_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+}$, $x_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}$, $x_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+}$, and $x_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-}$. One can then test the causal relationship between these generated series. For positive cumulative changes, $x_t^{+} = (x_{1t}^{+}, x_{2t}^{+})$, a univariate VAR model of order p can be stated as: $x_t^{+} = \gamma + B_1 x_{t-1}^{+} + \cdots + B_p x_{t-1}^{+} + \varepsilon_t^{+}$ (8)

In a bivariate VAR model the causal relationship between the positive cumulative changes x_{1t}^{+} and x_{2t}^{+} can be written as:
$$x_{1t}^{+} = c_1 + \sum_{i=1}^{T} \alpha_i x_{1t-i}^{+} + \sum_{i=1}^{T} \theta_i x_{2t-i}^{+} + \varepsilon_{1t}^{+} \quad (9)$$
$$x_{2t}^{+} = c_2 + \sum_{i=1}^{T} \beta_i x_{2t-i}^{+} + \sum_{i=1}^{T} \pi_i x_{1t-i}^{+} + \varepsilon_{2t}^{+} \quad (10)$$

The asymmetry causal relationship between government spending and inflation can be expressed as in equation (11) and (12) in VAR form as:
$$govexp_t^{+} = c_1 + \sum_{i=1}^{T} \alpha_i govexp_{t-i}^{+} + \sum_{i=1}^{T} \theta_i inf_{t-i}^{+} + \sum_{i=1}^{T} \mu_i inf_{t-i}^{-} + \varepsilon_1^{+} \quad (11)$$
$$inf_t^{+} = c_2 + \sum_{i=1}^{T} \beta_i inf_{t-i}^{+} + \sum_{i=1}^{T} \pi_i govexp_{t-i}^{+} + \sum_{i=1}^{T} \varphi_i govexp_{t-i}^{-} + \varepsilon_2^{+} \quad (12)$$

The graphs of the positive and negative cumulative sums of our variables of interest are presented in figure 2. The plots shows the high and low evolution of our variables of interest.

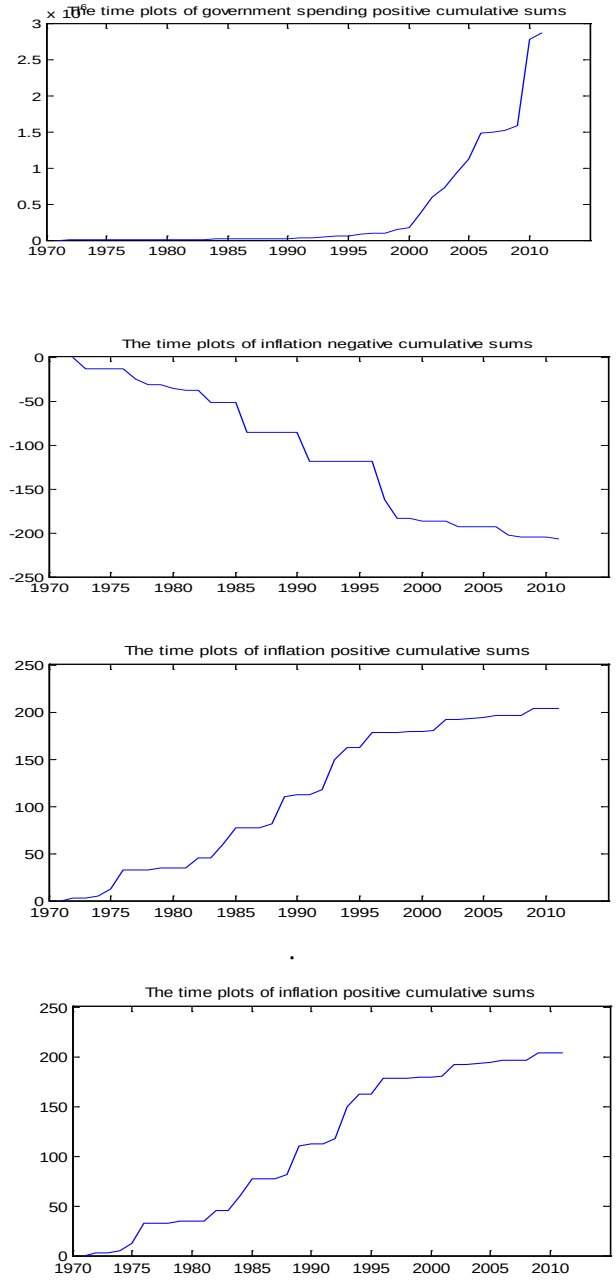

Fig. 2 Time Plots Of The Cumulative Sum Of Positive And Negative Variables

V. EMPIRICAL RESULT

Given the different order of integration of the variables as reported in table 1 and one lag length selection in table 2 and table 3, the asymmetry causality test is carried out for the positive and negative cumulative sum of government expenditure and inflation in the VAR system. As regards the asymmetry causality test, a [2]unidirectional causality running from negative government changes (low or contractionary government spending) to positive inflation rate (high inflation rates) significantly at 1% was found in table 4. This implies

[1] [16] and [28] were the pioneers of asymmetry and non-linear analysis.

[2] The matlab code used is available upon request.

the presence of asymmetry causality between government spending and inflation rate in Nigeria. The granger asymmetry causality probabilities also confirms this with the pair,[3] $govexp^-$ and inf^+, having the significance probability value of 0.10 (10%) in the second column and third row of table 5. [4] The finding suggests that high inflation is state dependent, which means contractionary government spending strongly drives high inflation rate in Nigeria. Reduction in government spending may lead to reduction in output and which may lead to rise in the prices of the few available goods.

TABLE IV
GRANGER CAUSALITY TEST OF CUMULATIVE SUM OF POSITIVE AND NEGATIVE VARIABLES: GOVERNMENT EXPENDITURE AND INFLATION

Dependent Variable	F-value			
	$govexp^-$	$govexp^+$	inf^+	inf^-
$govexp^-$	-	1.8765 (0.1631)	0.0038 (0.9997)	1.3569 (0.2819)
$govexp^+$	0.2873 (0.8369)	-	0.2002 (0.8951)	0.6658 (0.5819)
inf^+	6.0108 (0.0038*)	0.2592 (0.8540)	-	1.2601 (0.3124)
inf^-	0.3394 (0.7970)	1.4925 (0.2442)	0.0478 (0.9858)	-

* indicates significance level at 1%, Numbers in parenthesis denote p values. The optimal lag length i =1, based on both the lag length selection criteria and likelihood ratio is chosen.

TABLE V
GRANGER ASYMMETRY CAUSALITY PROBABILITIES OF POSITIVE AND NEGATIVE VARIABLES, A ROBUSTNESS CHECK: GOVERNMENT EXPENDITURE AND INFLATION

Variables	$govexp^-$	$govexp^+$	inf^+	inf^-
$govexp^-$	0.00	1.00	0.58	0.72
$govexp^+$	0.81	0.00	0.89	0.32
inf^+	0.10**	0.95	0.00	0.85
inf^-	0.17	0.95	0.02	0.02

**indicates 10% significance p- value.

VI. CONCLUSION AND IMPLICATIONS

This paper attempts to move beyond the outcomes of the classical causality test and allow asymmetry causal relationship between government spending and inflation rate for policy purpose in Nigeria. The idea of asymmetry causality is that positive and negative changes may have different causal impacts. The result shows a uni-directional causality running from low or contractionary government spending to high inflation in Nigeria. The[5] implications of this is that government show ensure a stable and steady level of spending that will keep the economy on the steady state path. Secondly, government should accumulate savings to eliminate any shock to its spending level. Borrowing may not be advisable for now given the state of the economy and debt profile of the country. The monetary authorities should coordinate and provide sound macroeconomic policies to ensure sustainable government spending. Finally, fiscal authorities should complement the efforts of the monetary authorities by monitoring the spending pattern of the government and providing fiscal measures to ensure prudent and fiscal discipline.

[3] The positive and negative cumulative time plots of the variables of interest are presented in figure 2.

[4] According to [33], cointegration is not a necessary condition for testing causality between integrated variables within the VAR framework as long as additional unrestricted lags are included in the model.

[5]The debt service in Nigeria increased from N286.65 billion to N517.07 billion between 2009 and 2010 representing a change of 82.3% [37].

ACKNOWLEDGMENT

D.O. Olayungbo, the Author, thanks the Linkages Office of Obafemi Awolowo University. Ile-Ife, Nigeria for providing the funding for the presentation of this paper.

REFERENCES

[1] Abu, N. and Abdullahi, U. 2010. Government Expenditure and Economic Growth in Nigeria. Business and Economic Journal Volume 2010. BEJ-4.
[2] Akerlof, G. A. 1970. The Market for Lemon, Quality, Uncertainty and Market Mechanism. *The Quarterly Journal of Economics*, 84 (3) 488-500..
[3] Balassa, B., 1964.The Purchasing Power Parity Doctrine: A reappraisal, Journal of Political Economy, 72 (6), 584-596.
[4] Barro, R.J.,1989. The Ricardian Approach to Budget Deficits, The Journal of Economic Perspectives, 3 (2), Spring.
[5] Barro, R.J., 1990. Government Spending in a Simple Model of Exogenenous Growth, Journal of Political Economy, 98(5), 103-125.
[6] Baumol, W.J., 1967. Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis, American Economic Review, June, 57(3), 415-426.
[7] Brennan, G and Buchanan, J., 1980. The Power to tax: *Analytical foundations of a fiscal constitution*, Cambrigde: Cambridge University Press.
[8] Central Bank of Nigeria, *Annual Report* 2010.
[9] Clark, C.,1933. The National Income and the Theory of Production, *Economic Journal*, 1933, June, 43, 170,205-216.
[10] Clark, C., 1937. National Income at Its Climax, *Economic Journal*, June, 47, 186, 308-320.
[11] Clark,C., 1945. Public Finance and Changes in the Value of Money, Economic Journal, December,371-389.
[12] Clark, C., 1964.Taxmanship: Principles and Proposals for the reform of taxation, *Hobart Paper*, 26, Institute of Economic Affairs, London.
[13] Dickey, D.A., and Fuller, W.A.,1979. Distribution of the Estimators for Autoregressive Time Series with a Unit Root. Journal of the American Statistical Association 74, 427-431.
[14] Ezirim, C.B., Muoghalu, M.I. and Elike, U. and Amuzie A.E, 2008. Public Expenditure Growth, Inflation and Cointegration. North America Journal of Finance. Vol.1 No1.
[15] Folorounso, B.A. and Olayeni O.R., 2006. Public Expenditure and Economic Growth: Causal Evidence from Nigeria. *Ife Social Sciences Review Volume 20* No1 pp 57-65.
[16] Granger, C.W., and Yoon, G.,2002. Hidden Cointegration. Department of Economics Working Paper. University of California, San Diego.
[17] Hatemi-J. A., 2011. Asymmetry Causality Tests with Application. Empir.Econ. DOI 10.1007/s00181-011-0484-x.
[18] Maku, O.E., 2009.Does Government Spending Spur Economic Growth in Nigeria? MPRA Paper No. 17941.October 2009/04:01.
[19] Morgan, D., 1993. Asymmetric effects of Monetary Policy. Federal Reserve Bank of Kansas City Economics Review 78, 21 -33.

[20] Oladipo, O.S. and Akinbobola, T.O., 2011. Inflation and Budget Deficit in Nigeria: A causal relationship. Journal of Emerging Trends in Economics and Management Sciences (JETEM) 2(1):1-8.
[21] Olaiya S,A, Nwosa, P.I., and Amassoma D., 2012. A Trivariate Causality Test among Economic Growth, Government Expenditure and Inflation Rate:Evidence from Nigeria. Research Journal of Finance and Accounting, Vol.3, No1,2012.
[22] Olayeni, O.R. (2010) Government Expenditure and Economic Growth in Nigeria. Evidence from Bayesian Approach. *Journal of Social and Managent Science* (Abraka). Volume 5 No.2 pp9-19.
[23] Olusoji, M.O. and Oderinde, L.O., 2011. Fiscal Deficit and Inflationary Trend in Nigeria: A Cross-Causal Analysis. Journal of Economic theory 5(2): 37-43, 2011.
[24] Magazzino, C. , 2010 The nexus between Public Expenditure and Inflation in the Mediterranean Countries, School of Political Sciences, Roma Tre University, *Italian Society of Economist (S.I.E), Royal, Economic society (R.E.S).*
[25] Peacock, A.T., and Wiseman, J., 1961. The Growth of Public Expenditure in the United Kingdom, *National Bureau of Economic Research*.
[26] Pekarski, S., 2010. Budget Deficit and Inflation Feedback, *Structural Change and Economic Dynamics.*
[27] Reinhart, C.M. and Rogoff, K.S., 2010 Growth in a Time of Debt, *American Economic Review,* May.
[28] Schorderet, Y.,2004. Asymmetry Cointegration. University of Geneva, Working Paper.
[29] Sevitenyi, L.N., 2012 Government Expenditure and Economic Growth in Nigeria: An Empirical Investigation. The Journal of Economic Analysis, Volume III, Issue I, Pg 38-51.
[30] Sims, C., 1980. Macroeconomics and Reality. Econometrica 48:1-48.
[31] Stiglitz, J. E., 1974. Incentive and risk sharing in sharecropping. *Rev Econ Stud* 41:219-255.
[32] Stiglitz, J.E., and Weiss, A., 1981. Credit Rationing in Market with Imperfect Information. The American Economic Review, Volume 71, Issue 3 (June,1981), 393-410.
[33] Toda, H.Y. and Yamamoto,T.1995.Statistical Inference in Vector Autoregressions with possibily Integrated Processes. J Econom 66:225-250.
[34] Samuelson, P.A., 1964. Theoretical Notes on Trade Problems, Review of Economics and Statistics, 46(2), 145-154.
[35] Wagner, A.H., 1912. *Les fondements de l'economie politique,* Paris: Girard and Briere, Vol III.
[36] Richardo, D., 1817. *On the Principles of Political Economy and Taxation, London:* J. Murray.
[37] World Economic Outlook Database (WEO). IMF 2010. P. O. Box, 92780, Washington, DC 20090, U.S.A.
[38] Zakir and Malik ., 2013. Are the Effects of Monetary Policy on Output Asymmetric in Pakistan. *Economic Modeling* 32 (2013) 1-9. Elsevier.