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Changes in Inventories, Capacity Utilisation Rate and Inflation Dynamics in Nigeria

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Abstract
The paper empirically examined the relationship existing among current inflation, expected future inflation, changes in inventories, manufacturing capacity utilisation rate, output gap, labour income share and trade openness in Nigeria using the annual time series data spanning from 1981 to 2015 by employing the Vector Autoregressive (VAR) Model. Stationarity, co-integration and causality tests were conducted on all the variables of interest in the study. *The* Block Exogeneity/WALD test result in the study confirms that changes in inventories and manufacturing capacity utilisation rate are exogenous variables while current inflation rate, expected future inflation, labour income share, output gap and trade openness are endogenous variables. The study finds that there is bi-directional causality running from current inflation to expected future inflation which implies that the anticipation of inflation can itself be the cause of inflation in Nigeria. There is also bi-directional causality running from current inflation to output gap indicating that current inflation granger causes output gap in Nigeria. There is also bi-directional causality running from manufacturing capcity utilisation rate to expected future inflation indicating that expected future inflation granger causes manufacturing capacity utilisation in Nigeria. The policy implication of the findings of the paper is that the policy makers should take into account the likely influence of changes in inventories, expected future inflation, manufacturing capcity utilisation rate,output gap,labour income share and trade openness on domestic prices of goods and services in formulating trade and economic policies in Nigeria.
Keywords: Changes in inventories, labour income share, inflation dynamics, manufacturing capacity utilisation rate, output gap and trade openness

1. INTRODUCTION

Inflation is defined as a generalized increase in the level of price sustained over a long period in an economy. Inflation is a household word in many market orientated economies. Although several people, producers, consumers, professional, non professionals, trade unionist workers and likes, talk frequently about inflation particularly as if the malady has assumed a clinic character (Adebayo, 1997). A continuous and persistent increase in the general level of prices(inflation) has in several times been characterized by an upsetting impact on economic well-being, since it causes the cost of living to rise and the value of investments to fall (Greenidge and Dacosta,2009). In fact, persistent inflation is one of the central problems facing most of the countries today. It results in a series of macroeconomic implications in an economy in form of contracting in savings, investment, imports and growth which ultimately leads to the macroeconomic instability (Abidemi and Maliq, 2010).

Inflation means that the buying power of currency decreases in an economy because the supply of currency has increased. While the factors that drive inflation are complex, its major effect is simple: prices increase across the board. The problem with predicting the effects of inflation on a business's inventory is that there are always two distinct factors to consider. First is the actual effect of inflation, which is to decrease buying (purchasing) power. The second is the effect expectations of inflation can have on the spending of both consumers and businesses. Essentially, whenever people anticipate having less buying power

In the near future, they want to buy things now while their money is still valuable. The increased demand then causes prices to increase, and that is how inflation starts. Put differently, the anticipation of inflation can itself be the cause of inflation (Stan, 2018). Inflation's effect on turnover ratio is greatly influenced by how you account for your inventory costs. Every time you add an item to your inventory, the value of inventory goes up by the cost you paid for that item. When inflation is high, meaning costs are rising rapidly, you will likely wind up with identical items in your inventory that you purchased at different costs. This creates a problem when you sell one of those items and have to deduct it from inventory and report it as cost of goods sold (Cam,2018).Consequently, knowledge about the factors originating inflation becomes one of major challenges for the central banks to implement monetary policy effectively (Haque and Qayyum, 2006).

Unemployment and inflation are two intricately linked economic concepts. Over the years, there have been a number of economists trying to interpret the relationship between the concepts of inflation and unemployment. There are two possible explanations of this relationship-one in the short run and another in the long run. In the short run, there is an inverse correlation between the two. As per this relation, when the unemployment is on the higher side, inflation is on the lower side and the inverse is true as well. In the short run, the Phillips curve happens to be a declining curve. The Phillips curve in the long run is separate from the Phillips curve in the short run. It has been observed by the economists that in the long run, the concepts of unemployment and inflation are not related (Aminu and Abdulrahaman, 2012). In the same vein, Garner (1994) suggested that capacity utilisation currently remains a reliable indicator of future changes in inflation. Franz and Gordon (1993) found that U.S. inflation depends more closely on the capacity utilisation rate than on the unemployment rate. However, their only stability analysis is a comparison of the 1962–72 periods with the 1973–90 periods, which concludes stability cannot be rejected. Cecchetti (1995) examined a number of inflation indicators, found evidence that capacity utilization rate added significant information to out-of-sample forecasts of inflation before 1982, but this information disappeared after 1982.

However, during the 1970s, the Phillips curve became badly discredited as a policy guide, as the experience of protracted stagflation unambiguously gave the lie to government attempts to exploit this supposed trade-off between inflation and unemployment, leading to more of both. It is thus somewhat curious that under the guise of the so-called Keynesian resurgence, the Phillips curve is again being invoked to justify expansionary monetary and fiscal policy (Muligan and Koopl, 2011).

According to Clarida, Gali, and Gertler (1999), an equation like the expectations-augmented Phillips curve also appears in many recent New Keynesian dynamic stochastic general equilibrium models. In these macroeconomics models with sticky prices, there is a positive relation between the rate of inflation and the level of demand, and therefore a negative relation between the rate of inflation and the rate of unemployment. This relationship is often called the "New Keynesian Phillips curve." Like the expectations-augmented Phillips curve, the New Keynesian Phillips curve implies that increased inflation can lower unemployment temporarily, but cannot lower it permanently. According to Aaron (2009), the New Keynesian Phillips curve (NKPC) is currently the most popular theory of inflation and seems to become the cornerstone in monetary policy analysis for inflation targeting central banks. New Keynesian Phillips curve (NKPC) describes how past inflation, expected future inflation, and a measure of real marginal cost or an output gap drive the current inflation rate.

The pure forward-looking basic NKPC model is usually not data consistent because of the failure of fully account for price rigidities. The basic NKPC model is therefore extended to incorporate a backward-looking component. The inclusion of the inertial component is an appendage to the interest of arriving at a realistic specification of the inflation equation. It is therefore assumed that a proportion of the firms that adjust their prices upon receipt of a random signal, actually adjust their prices using a backward-looking price adjustment rule while the remainder use a forward-looking rule. A typical hybrid NKPC model therefore has two terms, namely, a backward-looking expectations component reflecting the inertial effect in prices and a forward-looking component capturing optimal price adjustment. Assuming away the inertial effects in price adjustment means that the backward-looking component in the specification of the inflation equation drops out. However, the weight of the evidence in the empirical studies is that the backward-looking component is significant in spite of the predominance of the forward-looking component ((Dua and Gaur, 2010).

The amendment to the pure expectations Phillips curve was advanced by, among others, Gali and Gertler (1999) and Gali, Gertler and Lopez-Salido (2001). Inclusion of the backward-looking term in the inflation equation is for practical expediency. It explains empirical regularity often escaping capture by the pure forward-looking inflation model. The hybrid NKPC model nests the basic pure NKPC model and provides a good framework for verifying the inertial effects in the evolution of inflation. In the light of this, the question that arises is as follows: Is backward looking component or forward looking component more predominant in explaining dynamics of inflation in a developing country like Nigeria using a hybrid New Keynesian Phillips Curve (NKPC) model? This calls for comprehensive estimation of hybrid NKPC model in Nigerian economy.

However, the driving variable in the New Keynesian Phillips curve – real marginal cost – is unobservable and has to be proxied and captured by, for instance, real unit labour cost that is labour income share, output gap, capacity utilization rate (Cuirila and Murarasu,2008 and Lubik and Teo,2012). More importantly, Lubik and Teo (2012) introduced inventories into an otherwise standard New Keynesian model. They opined that inventory holdings were motivated as a means to generate sales for demand-constrained firms. Lubik and Teo (2012) derived various representations of the New Keynesian Phillips curve with inventories and showed that one of these specifications was observationally equivalent to the standard model with respect to the behaviour of inflation when the models cross-equation restrictions were imposed. Inventories are assumed to help facilitate sales as firms can rely on the stock of previously produced goods when demand rises. This can be motivated by firms desire to avoid stock-outs, in which case the firm would face marginal production cost or the loss of marginal revenue. Moreover, a larger stock can facilitate matching with potential buyers and thus increase sales. Nweze (2011) explains that inventory turnover is computed by dividing the cost of goods sold by the average inventory. An average inventory is determined by adding the beginning and ending inventories and dividing by two. Inventory change is the difference between last period ending inventory and the current period's ending inventory.

Lubik and Teo (2012) argued that the stock-sales ratio was linked to marginal cost. In their study, they estimated the various specifications of the New Keynesian Phillips curve using generalised method of moment (GMM). They revealed that predictive power of the inventory-specification outperformed that of the standard model, but did not improve upon it. In order to analyze inflation dynamics, because the real marginal cost is not statistically available at aggregate level, there is much controversy in the literature regarding the appropriate proxy for this variable (Cuirila and Murarasu, 2008). The question that arises from this knowledge gap is, does change in inventories drive inflation dynamics among other variables in Nigerian economy? This paper intends to bridge the identified gap.

2. THEORETICAL FRAMEWORK

Hybrid NKPC model nests the basic pure optimization NKPC model and provides a good framework for verifying the inertial effects in the evolution of inflation. From the literature, it is common to augment the standard NKPC with lagged inflation: both future and the past are relevant in determining the current inflation, see for instance, Furher and Moore (1995); Gali and Gertler (1999); and Gali, Gertler and Lopez-Salido (2001). According to the Hybrid NKPC, current inflation is determined by output gap (or real marginal cost), previous period's inflation and future expected inflation (Satti, Wasim and Ghulam, 2007).

Cuirila and Murarasu (2008) employed the classic version of the reduced form hybrid NKPC developed by Gali and Gertler (1999) and the hybrid NKPC is specified as follows:

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E[\pi_{t+1}] + \lambda mc_t + \varepsilon_t \text{---}(1)$$

Where,

π_t is inflation at time t , $E[\pi_{t+1}]$ is the rational expectation of inflation for the next period, mc_t is the real marginal cost and ε_t is the error term. The coefficient γ_b shows the inflation persistence or inflation inertia, while γ_f shows the relative importance of forward looking expectations in the formation of current inflation. They determined the appropriate variable describing aggregate economic activity by estimating equation (1) with different proxies for the real marginal cost: the output gap as a proxy for excess demand, the unemployment rate and change in unit labour costs, the rate of capacity utilization and the economic sentiment indicator.

Lubik and Teo (2012) extended the hybrid NKPC model with inventories which is specified as follows:

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E[\pi_{t+1}] + \lambda_{mc} mc_t - k_y y_t + \varepsilon_t \text{-------------------------------------}(2)$$

Where, y_t is the inventories measured by sales-stock ratio

The coefficient on expected inflation, $\gamma_f = ß/(1+ß\eta)$ while the coefficient on past, $\gamma_b = \eta/(1+ß\eta)$, the slope coefficient k=(E-1) where η=0, the specification reduces to the purely forward looking NKPC. Moreover, when ß=1, then $\gamma_f + \gamma_b = 1$.

3. MATERIALS AND METHODS

Sources of Data

Relevant secondary data were sourced from Central Bank of Nigeria (CBN) statistical bulletin of various issues covering the periods of 1981 to 2015.

Model Specification

Following Gali and Gertler (1999), Cuirila and Murarasu (2008) and Lubik and Teo(2012), the model for this study is the modified hybrid NKPC model extended with inventories, trade openness, output gap, labour income share and manufacturing capacity utilization rate specified as follows:

$$IFR_t = \gamma INF_t - \mu IVT_t + \beta LIS_t + \Omega MUR_t + \lambda OGP_t + ØTRP_t + \varepsilon_t \text{ ---------------------}(4)$$

Where IFR_t is inflation at time t, which depends on expected future inflation, INF_t which is the rational expectation of inflation for the next period, while the forcing variable is the real marginal cost, MC_t captured by labour income share,(LIS_t), manufacturing capacity utilisation rate,(MUR_t), output gap,(OGP_t) respectively since the real marginal cost is not statistically observable at aggregate level, IVT_t is the changes in inventories measured by sales-stock ratio and trade openness,(TRP_t) and ε_t is the error term.

A Priori Expectations

A priori signs of the explanatory variables are as follows;

The expected results on the coefficients are: $\gamma > 0$, $\mu < 0$, $\beta > 0$, $\Omega < 0$, $\lambda > 0$, $Ø < 0$.

Identification and Choice of Variables

IFR_t = Current inflation at time,t

INF_t = Expected future inflation which is the rational expectation of inflation for the next period measured as current inflation at time,t minus past inflation or previous period's inflation according to Ball.,Mankiw and Reis (2006). **i.e.** $\pi_t - \pi_{t-1} = \pi_{t+1}$

MC_t =Real Marginal cost measured with different proxies: the output gap (OGP_t) as a proxy for excess demand, the labour income share (LIS_t) and manufacturing capacity utilisation rate (MUR_t) as a measure of real economic activity according to Cuirila and Murarasu (2008) and Lubik and Teo (2012) .

IVT_t= change in inventories (inventory/sales) measured as sales-stock ratio according to Lubik and Teo (2012)

TRP_t = trade openness measured as imports + exports divided by the real gross domestic product according to Squali and Wilson (2006)
ε_t=Error term or stochastic term
γ, μ, β, Ω, λ, $\emptyset$ = Parameters to be estimated

Estimation Techniques

Following Reid and Du Rand (2013), the study employed Vector Autoregressive {VAR} model based methodology as the estimation techniques which are discussed as follows:

Vector Autoregressive (VAR) Model

i. Stationarity Test

In the literature, most macroeconomic time series variables have unit roots and regressing non stationary variables in the model might lead to spurious regression results (Granger, 1986). In this study, unit root test is conducted on all the variables in order to ascertain the stationary status of the variables. The first or second difference terms of most variables will usually be stationary (Ramanathan, 1992). The stochastic characteristics of each time series will be tested at levels for stationary in this study by considering their order of integration. The order of integration assisted us in determining the subsequent long run relationship among the variables. The study will use group unit root test. After conducting the stationarity test, we test for co-integration among the series. Co integration indicates the presence of a linear combination of non stationary variables that are stationary and the variable does not have a mean (drift) to which it returns. The presence of co integration however implies that a stationary long run relationship among the series is present.

The procedure adopted in this study is a representation of the approach of analysis of multivariate co integrated systems developed and expanded by Johansen and Juselius (1990 and 1994). Unlike the Engle granger static procedure, the Johansen vector autoregressive (VAR) procedure allows the simultaneous evaluation of multiple relationship and imposes no prior restrictions on the co integration space (Philips, 1987}. Peseran *et al* (2001) further asserts that this technique allows a mixture of 1(1) and 1(0) variables are regressors, that is, the order of integration of relevant variables may not necessarily be the same.

Following Pesaran *et al* (2001), the VAR of order p, denoted by VAR [p] can be constructed thus;

$$Z_t = \mu + \sum_{t=1}^{p}\beta_t Z_{t-1} + \varepsilon_t \quad \text{--} \quad (5)$$

Where Z_t = the vector of both X_t and Y_t where Y_t is the dependent variable and $X_t = f(INF_t, MC_t, IVT_t, TRP_t)$ which is the vector matrix that represents a set of explanatory variables. In this model, current inflation, Y_t is the dependent variable while expected future inflation, different proxies of marginal cost: output gap, the labour income share, manufacturing capacity utilisation rate, changes in inventories and trade openness are the explanatory variables, X_t. μ = {μy, μx} which is the vector of constraints {drifts} and ε is the stochastic term, t is a time or trend variable, β is a matrix VAR parameters for lag 1.

Following Gujarati and Porter (2009), we assume that each of equations 6 and 7 contains k lag values of Y and X where the υ's are the stochastic error terms, called impulses or innovations or shocks in the language of VAR. To explain how a VAR is estimated according to Gujarati and Porter (2009), one can estimate each of the following equations, 6 and 7 by OLS :

$$Y_t = \alpha + \sum_{J=1}^{K}\beta_j Y_{t-j} + \sum_{j=1}^{k}\gamma_j X_{t-j} + \upsilon_{1t} \quad \text{--} \quad (6)$$

$$X_t = \alpha + \sum_{J=1}^{K}\Theta_j Y_{t-j} + \sum_{j=1}^{k}\gamma_j X_{t-j} + \upsilon_{2t} \quad \text{---} \quad (7)$$

We assume that each of equations 6 and 7 contains k lag values of Y and X where the υ's are the stochastic error terms, called impulses or innovations or shocks in the language of VAR.

According to Persarran *et al* {2001}, Vector Error Correction Model {VECM} can be developed as follows:

$$Z_t = \mu + \alpha_t + Z_{t-1} + \sum_{t=1}^{P=1} Y_t \Delta Y_{t-1} + \sum_{i=0}^{P=1} Y_t \Delta X_{t-1} + \varepsilon_t \quad \text{--------------------------} \quad (8)$$

Where Δ is the first difference operator, the model in equation (8) is the vector error correction model for the co integrated series. In this case, the short run dynamics of the variables in the system are represented by the variables in levels.

ii. Impulse Response Function (IRF)

VAR model is the best method for investigating shocks transmission among variables. A shock to the i-th variable not directly affects the i-th variable but is also transmitted to all of the other endogenous variables through the dynamic {Lag} structure of the VAR. An impulse response function of the VAR traces the effect of a onetime shock to one of the innovations on current and future values of the endogenous variables.

iii. Forecasting Error Variance Decomposition(FEVD)

While impulse response function traces the effects of a shock to one endogenous variable to the other variable in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR.

4. RESULTS AND DISCUSSION

Table 1: Descriptive Analysis of the Data Set

	IFR	INF	IVT	LIS	MUR	OGP	TRP
Mean	21.25088	0.180312	200640.7	0.102059	46.34029	2.623235	6224.073
Median	12.80000	-0.259740	2510.100	0.055000	43.40000	1.860000	3845.540
Maximum	72.80000	3.419743	6482240.	0.280000	73.30000	11.36000	15262.12
Minimum	4.700000	-2.052936	-73.68000	0.020000	29.29000	0.000000	30.49000
Std. Dev.	18.90502	1.679510	1110052.	0.092957	10.84948	2.898233	5976.660
Skewness	1.291375	0.514546	5.568553	1.038860	0.234722	1.691278	0.387306
Kurtosis	3.350673	2.109028	32.01636	2.466222	2.343490	4.940474	1.510980
Jarque-Bera	9.624220	2.624890	1368.477	6.519269	0.922793	21.54342	3.991041
Probability	0.008131	0.269161	0.000000	0.038402	0.630403	0.000021	0.135943
Sum	722.5300	6.130592	6821783.	3.470000	1575.570	89.19000	211618.5
Sum Sq. Dev.	11794.19	93.08488	4.07E+13	0.285156	3884.473	277.1919	1.18E+09
Observations	34	34	34	34	34	34	34

Source:Authors'Computation(2018)

When two of these statistics are given, we can predict the nature of the distribution. From table 1, the arithmetic mean value and median value of MUR is symmetrical while those of IFR, INF, IVT, LIS, OGP and TRP are asymmetrical in their distribution. If the mean is less than the median, definitely the mode will be greater than the median and such distribution will be negatively skewed using one of the properties of a normal distribution.

The means of all the variables are greater than their median and mode, the distribution is asymmetrical and positively skewed with excess kurtosis. This is another property of the normal distribution. It shows the peakness or flatness of the normal curve. Kurtosis result in Table 1 confirms leptokurtic distribution which depicts highly peaked bell-shaped (skewed distribution) and asymmetrical distribution

Table 1 indicates that IFR, INF, IVT, MUR and TRP are widely dispersed around their means indicating that they are grossly affected by their extreme values while OGP and LIS are not widely dispersed around their means indicating that they are not grossly affected by their extreme values.

A P-value is the probability of obtaining the observed sample results (or a more extreme result) when the null hypothesis is actually true. If the P-value is very small, usually less than or equal to a threshold value previously chosen called the significance level (traditionally 5% or 1%), it suggests that the observed data is inconsistent with the assumption of null hypothesis of normality. Jarque-Bera (χ^2) null hypothesis is a joint hypothesis of skewness being zero and kurtosis being zero.

Table 1 reveals that the Jacque-Bera X^2 – statistics for normality in distribution of the residuals is significant for IFR, IVT, LIS, OGP and confirming that their distribution is asymmetrical and there is no normality in their distribution implying that the population from which the samples are drawn is skewed and has excess kurtosis while the Jacque-Bera X^2 – statistics for normality in distribution of the residuals is not significant for INF,MUR and TRP indicating that there is normality in their distribution implying that the population from which the samples are drawn is not skewed and has no excess kurtosis.

Hypothesis 1: There is no correlation among current inflation rate, expected future inflation, changes in inventories, labour income share, output gap, manufacturing capacity utilisation rate and trade openness in Nigeria

Table 2: Residual Correlation Matrix of the Selected Series

VARIABLE	IFR	INF	IVT	LIS	MUR	OGP	TRP
IFR	1.000000	0.482124	0.119425	-0.639112	-0.146962	-0.444579	0.139403
INF	0.482124	1.000000	0.043525	-0.299147	0.142762	-0.404298	0.055106
IV	0.119425	0.043525	1.000000	0.031727	-0.126917	-0.261060	-0.249731
LIS	-0.639112	-0.299147	0.031727	1.000000	0.147401	0.306648	-0.189276
MUR	-0.146962	0.142762	-0.126917	0.147401	1.000000	-0.164554	-0.189817
OGP	-0.444579	-0.404298	-0.261060	0.306648	-0.164554	1.000000	0.356772
TRP	0.139403	0.055106	-0.249731	-0.189276	-0.189817	0.356772	1.000000

Source: Authors 'Computation(2018)

The result in Table 2 gives us a preliminary idea of the relationship existing among the series indicates that LIS,MUR and OGP have negative correlation with IFR while INF, IVT and TRP shows sign of positive correlation with IFR. This result only gives an insight into the relationship among the variables. It gives us a preliminary idea of the relationship between IFR and each of the variables. It is inconclusive in itself because it does not measure the cause – effect relationship among the variables.

Hypothesis 2: There is no stationarity among current inflation rate, expected future inflation, changes in inventories, labour income share, output gap, manufacturing capacity utilisation rate and trade openness in Nigeria

Test for Stationary and Non-Stationary of the Selected Variables

Table 3: Group Unit Root Test Results

GROUP UNIT ROOT TESTS	AT LEVELS		1ST DIFFERENCE		2ND DIFFERENCE		LEVEL OF INTEGRATION
	Statistic	Prob.**	Statistic	Prob.**	Statistic	Prob.**	
Levin, Lin & Chu	-0.46804	0.3199	0.14869	0.5591	-3.43487	0.0003	1(2)
Im, Pesaran and Shin W-stat	-1.21686	0.1118	-1.98392	0.0236	-	-	1(1)
ADF - Fisher Chi-square	23.7874	0.0486	-	-	-	-	1(0)
PP - Fisher Chi-square	43.6728	0.0001	-	-	-	-	1(0)

Source:Authors'Computation(2018)

The result in Table 3 confirms that some variables are stationary at levels while some are integrated of order one and order two respectively which indicates that the condition for Johansen cointegration is not met.

Hypothesis 3: There is no long run relationship among current inflation rate, expected future inflation, changes in inventories, labour income share, output gap, manufacturing capacity utilisation rate and trade openness in Nigeria

Cointegration Test and Results

The cointegration tests were conducted using the reduced rank procedure developed by Johansen (1988) and Johansen and Juselius(1990).

Table 4: Johansen Cointegration Test and Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.930742	276.4531	125.6154	0.0000
At most 1 *	0.852497	191.0156	95.75366	0.0000
At most 2 *	0.807764	129.7707	69.81889	0.0000
At most 3 *	0.616470	77.00170	47.85613	0.0000
At most 4 *	0.548259	46.33490	29.79707	0.0003
At most 5 *	0.349981	20.90625	15.49471	0.0069
At most 6 *	0.199538	7.122134	3.841466	0.0076

Source:Authors'Computation(2018)

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

From Table 4 above the * denotes rejection of the hypothesis at the 0.05 level. The test statistics strongly accepts the null hypothesis of no co-integration at 5% level of significance. This confirms that there is no long run relationship existing among IFR, INF, IVT, LIS, OGP, MUR and TRP in Nigeria.

Hypothesis 4: There is no causality among current inflation rate, expected future inflation, changes in

inventories, labour income share, output gap, manufacturing capacity utilisation rate and trade openness in Nigeria

Table 5:Pairwise Granger Causality Tests Result

Null Hypothesis:	Obs	F-Statistic	Prob.
INF does not Granger Cause IFR	32	11.2493	7.E-05
IFR does not Granger Cause INF		34.0806	5.E-09
IVT does not Granger Cause IFR	32	0.30673	0.8203
IFR does not Granger Cause IVT		0.19205	0.9008
LIS does not Granger Cause IFR	32	0.27467	0.8431
IFR does not Granger Cause LIS		0.70499	0.5580
MUR does not Granger Cause IFR	32	1.49182	0.2410
IFR does not Granger Cause MUR		1.92501	0.1514
OGP does not Granger Cause IFR	31	5.76545	0.0041
IFR does not Granger Cause OGP		4.62775	0.0108
TRP does not Granger Cause IFR	32	3.21471	0.0400
IFR does not Granger Cause TRP		1.50278	0.2381
IVT does not Granger Cause INF	32	1.05417	0.3861
INF does not Granger Cause IVT		0.10820	0.9545
LIS does not Granger Cause INF	32	2.24219	0.1082
INF does not Granger Cause LIS		0.88891	0.4604
MUR does not Granger Cause INF	32	3.66145	0.0258
INF does not Granger Cause MUR		3.25631	0.0384
OGP does not Granger Cause INF	31	19.4021	1.E-06
INF does not Granger Cause OGP		1.68206	0.1974
TRP does not Granger Cause INF	32	7.01554	0.0014
INF does not Granger Cause TRP		0.71120	0.5545
LIS does not Granger Cause IVT	32	2.67291	0.0691
IVT does not Granger Cause LIS		1.03161	0.3956
MUR does not Granger Cause IVT	32	0.52396	0.6698
IVT does not Granger Cause MUR		0.29027	0.8320
OGP does not Granger Cause IVT	31	0.07958	0.9705
IVT does not Granger Cause OGP		0.21890	0.8823
TRP does not Granger Cause IVT	32	0.88516	0.4623
IVT does not Granger Cause TRP		1.29666	0.2975
MUR does not Granger Cause LIS	32	2.26531	0.1056
LIS does not Granger Cause MUR		0.65614	0.5867
OGP does not Granger Cause LIS	31	0.57793	0.6351
LIS does not Granger Cause OGP		0.56062	0.6462
TRP does not Granger Cause LIS	32	1.73206	0.1861
LIS does not Granger Cause TRP		2.44844	0.0872
OGP does not Granger Cause MUR	31	0.53143	0.6651

MUR does not Granger Cause OGP		0.25630	0.8561
TRP does not Granger Cause MUR	32	1.09687	0.3688
MUR does not Granger Cause TRP		2.86503	0.0568
TRP does not Granger Cause OGP	31	0.85511	0.4777
OGP does not Granger Cause TRP		3.19903	0.0414

Source: Authors' Computation (2018)

Results in Table 5 above indicate that there is bi-directional causality running from IFR to INF confirming that current inflation rate granger causes expected future inflation vice versa.. There is also bi-directional causality running from IFR to OGP confirming that current inflation rate granger causes output gap indicating that current inflation granger causes output gap vice versa. There is also bi-directional causality running from MUR to INF indicating that expected future inflation granger causes manufacturing capacity utilisation rate vice versa. There is unidirectional causality running from TRP to IFR indicating that trade openness granger causes current inflation rate in Nigeria. There is also unidirectional causality running from TRP to INF indicating that trade openness granger causes expected future inflation rate in Nigeria. There is also unidirectional causality running from MUR to TRP. There is also unidirectional causality running from OGP to TRP. Pairwise Granger Causality Tests results range from bi-directional causality, unidirectional and no-causality among the series.

Hypothesis 5: There is no dynamic and significant relationship existing among current inflation rate, expected future inflation, changes in inventories, labour income share, output gap, manufacturing capacity utilisation rate and trade openness in Nigeria

Table 6: Vector Autoregression Estimates

	IFR	INF	IVT	LIS	MUR	OGP	TRP
IFR(-1)	-0.396009	-0.007971	9054.529	-0.000433	0.083627	0.043678	13.74799
IFR(-2)	-0.561511	-0.006145	1170.371	-0.000346	-0.037482	0.142846	6.152891
INF(-1)	42.84578	2.178409	-198687.6	0.022399	-5.570677	-9.503280	-603.4195
INF(-2)	-51.46486	-1.311109	197348.0	-0.023466	6.390447	7.382189	841.8806
IVT(-1)	-0.000859	-2.24E-06	-128.8791	1.06E-05	8.47E-05	0.000112	0.231632
IVT(-2)	0.001078	1.92E-06	278.4735	-1.02E-05	-5.56E-05	-0.000123	-0.238525
LIS(-1)	-40.15408	-0.521604	-7710687.	0.393885	16.00595	7.313726	11620.88
LIS(-2)	-12.27762	-0.502574	-8346087.	0.097530	3.820734	5.638308	-393.6932
MUR**(-1)**	-0.931814	0.002864	-24650.17	0.000406	1.012592	-0.139299	-81.40745
MUR**(-2)**	0.798170	-0.003479	42718.10	0.000216	-0.231855	0.058374	220.6341
OGP**(-1)**	-1.989225	-0.015327	30027.60	0.000792	0.254392	-0.398681	-21.04557
OGP**(-2)**	-2.972661	-0.010867	17250.94	-0.002279	0.054718	-0.108580	-228.8577
TRP(-1)	-0.000983	8.05E-06	-146.5802	2.95E-06	-0.000468	-0.000216	0.652400
TRP**(-2)**	-0.000318	-1.95E-05	187.1278	-1.06E-06	0.000198	-0.000430	-0.163897
C	77.80805	0.615025	-765748.5	0.013767	6.819511	6.437229	-4833.346
R-squared	0.875628	0.998903	0.615378	0.937219	0.931974	0.764644	0.969121
Adj. R-squared	0.773204	0.998000	0.298630	0.885518	0.875953	0.570821	0.943691
F-statistic	8.549044	1105.799	1.942802	18.12746	16.63610	3.945070	38.10943
Akaike criterion	7.583123	-1.985211	30.68838	-3.713428	5.558663	4.433500	17.61086
Schwarz criterion	8.270186	-1.298148	31.37545	-3.026364	6.245727	5.120563	18.29793

Source: Authors' Computation (2018)

Comparing the results of R^2 and F-values in Table 6 above, it is concluded that there is strong and significant relationship existing among IFR, INF, IVT, LIS, MUR, OGP and TRP in Nigeria.

Table 7: VAR Granger Causality/Block Exogeneity Wald Tests

Variable	Chi square	Df	Probability
IFR	68.70436	12	0.0000
INF	120.6636	12	0.0000
IVT	8.153245	12	0.7730
LIS	23.32582	12	0.0251
MUR	11.52173	12	0.4848
OGP	45.83189	12	0.0000
TRP	41.68962	12	0.0000

Source: Authors' Computation (2018)

Block exogeneneity Wald tests results in Table 7 above confirm that IFR, INF, LIS, OGP and TRP are endogenous variables while IVT and MUR are exogenous variables in the model.

Impulse-Response Function results

The impulse-response function is used for predicting or forecasting the response of each variable in the series to a standard deviation change on all other variables.

Impulse-response curves in appendix ii indicates the following:

(I) A standard deviation change in IFR produced a relatively stable effect on other variables from 1st period to 9th period and began to decline till the 10th period.

(II) A standard deviation change in INF produced a relatively stable effect on other variables from 1st period to the 9th period and began to decline till the 10th period.

(III) A standard deviation change in IVT produced a relatively stable effect on other variables from 1st period to 8th period and declined continuously from the 9th period to the 10th period.

(IV) A standard deviation change in OGP produced a relatively stable effect on other variables from 1st period to 10th period.

(V) A standard deviation change in LIS produced a relatively stable effect on other variables from 1st period to 10th period.

(VI) A standard deviation change in MUR produced a relatively stable effect on other variables from 1st period to 10th period.

(VII) A standard deviation change in TRP produced a relatively stable effect on other variables from 1st period to 10th period.

Variance Decomposition Function Results

Variance decomposition function gives information about the relative importance of each of the random innovation (shocks) to the variables in the series. Variance decomposition function curves in appendix iii confirms the following:

(i) The total variation in IFR at the 2nd period was about 100% from its own lag and remained unchanged.

(ii) The total variation in INF at the 2nd period was about 70% from its own lag and remained unchanged.

(iii) The total variation in IVT from the 1st period to the 10th period was 100% from its own lag and remained unchanged throughout the periods.

(iv) The total variation in LIS at the 2nd period was about 100% from its own lag and remained unchanged.

(v) The total variation in MUR at the 2nd period was about 100% from its own lag and remained unchanged.

(vi) The total variation in OGP at the 2nd period was about 100% from its own lag and remained unchanged.

(vii) The total variation in TRP at the 2nd period was about 100% from its own lag and remained unchanged.

5. CONCLUSON

The study finds evidence that there is no long run relationship existing among IFR, INF, IVT, LIS, OGP, MUR and TRP in Nigerian economy. However, there is a strong and significant relationship existing among IFR, INF, IVT, LIS, MUR, OGP and TRP in Nigerian economy.

INF,IVT, LIS, OGP, MUR and TRP have significant predictive power for IFR in Nigeria which indicates that expected future inflation, changes in inventories, labour income share, manufacturing capacity utilisation rate, output gap and trade openness provide useful information about changes in inflation rate in Nigeria.

The study finds that current inflation rate has bi-directional cause-effect relationship with output gap in Nigeria. There is also bi-directional causality running from current inflation rate to expected future inflation vice versa in Nigeria which implies that the anticipation of inflation can itself be the cause of inflation in Nigeria. There is also bi-directional causality running from expected future inflation to output gap vice versa in Nigeria. There is also bi-directional causality running from expected future inflation to manufacturing capacity utilisation rate vice versa in Nigeria. In addition, trade openness has a unidirectional cause-effect relationship with current inflation rate in Nigeria. There is also a unidirectional causality running from trade openness to expected future inflation indicating that trade openness granger causes expected future inflation rate in Nigeria.

6. POLICY RECOMMENDATIONS

From demand side, policy makers in Nigeria should allow for more trade openness so as to reduce the country's inflation over time as this step is expected to reduce further price distortion in Nigeria.

The policy makers should focus on increasing the degree of openness,stimulating export oriented firms to facilitate the production of quality goods and services that can compete favourably well in the international market in order to maintain low level of inflation to enhance domestic price stability in Nigerian economy.

In addition, Ngeria needs to improve on her local production of comodities by improving her real sector so as to solve the problems emanating from the inflationary pressure occasioned by external shocks.

.Policy makers should take into account the likely influence of manufacturing capcity utilisation rate,output gap,labour income share, change in inventories and trade openness on domestic prices of goods and services in formulating trade and economic policies in Nigeria.

References

Aaron, J. & Muellbauer, J.N.(2007).Trade Openness and Inflation. MPRA Paper, 2145(1). Retrieved from http://mpra.ub.uni-mucnihen.De/2145/

Abidemi, O. I. & Malik, S.A.A. (2010). Analysis of Inflation and its determinant in Nigeria. *Pakistan journal of social sciences.* Retrieved from medwelljournals.com

Adebayo, A. (1997). Economics: A simplified approach, Volume II. Lagos: Harmony International Publisher Limited.

Aminu, U. & Abduraham, A. (2012). An Empirical Analysis of the Relationship between Unemployment and Inflation in Nigeria: 1977-2009. *Economics and Finance Review,1(12)42–61,February.*Available online at http://www.businessjournalz.org/efr

Ball, L., N., Mankiw,G. & Reis, R. (2005). Monetary Policy for Inattentive Economies. *Journal of Monetary Economics, (*52), 703-725.

Cam, M.(2018). What Is the Impact of Inflation in Inventory Turnover? *Small Business - Chron.com*,http://smallbusiness.chron.com/impact-inflation-inventory-turnover-66227.html. Accessed 22 March 2018.

Cecchetti, S. G. (1995). Inflation Indicators and Inflation Policy. *NBER Macroeconomics Annual,* 189–219.

Clarida, R., Gali, J. & Gertler, M. (1999). The Science of Monetary Policy: A New Keynesian Perspective. *Journal of Economic Literature,(XXXVII*), 16611707.

Cuirila, N.& Murarasu, B.(2008). Inflation Dynamics in Romania-A New Keynesian Perspective. European Research Studies,XI(4).

Dua, P.& Gaur, U. (2010). Determination of Inflation in an Open Economy Phillips Curve Framework: The Case of Developed and Developing Asian Countries. *Journal of Macroeconomics and Finance in Emerging Market Economies*,3(1), 33-51.

Franz, W. & Gordon, R.J. (1993), German and American Wage and Price Dynamics. *European Economic Review,* May, 719– 62

Fuhrer, J. C. & George, R. M.(1995). Inflation Persistence. *The Quarterly Journal of Economics,* 110,127-159.

Galí, J.& Gertler M. (1999). Inflation Dynamics: A Structural Econometric Analysis. *Journal of Monetary Economics*,195-222.

Gali, J., Gertler, M. & Lopez-Salido, J.D., (2001). A New Phillips Curve for Spain. *BIS `papers,*(3).

Garner, A.C. (1994). Capacity Utilisation and U.S. Inflation. *Federal Reserve Bank of Kansas City Economic Review,* Fourth Quarter, 1–21.

Granger, C.W.J. (1986). Development in the study of Co integrated Economic Variable. *Oxford Bulletin of Economics and Statistics.*48(3).
Greenidge, K. & Dacosta, D. (2009). Determinants of Inflation in Selected Caribbean Countries. *Business, Finance and Economics in Emerging Economies,* 4(2).
Gujaranti, D. N. & Porter,C.D.(2009). Basic Econometrics 4th Edition. New-York:McGraw-Hill.
Haque, N.U. & Qayyum, A. (2006). Inflation Everywhere is a Monetary Phenomenon: An Introductory Note. *The Pakistan Development Review.* 45(2), 179-183.
Johansen, S. & Juselius, K. (1990). Testing Structural Hypothesis in a Multivatiate Cointegration Analysis of the PP and the UIP for UK. *Journal of Economics, (53), 211 -244.*
Johansen, S. & Juselius, K. (1994). Identification of the Long-Run and Short-Run
Structure: An Application to the ISLM Model.*Journal of Economics,(63), 69-75.*
Lubik, T.A. & Teo, W. L.,(2012). Inventories, inflation dynamics and the New Keynesian Phillips curve. *European Economic Review*, 56(3),327-346.
Mulligan,R.F. & Koppl,R. (2011). Monetary policy regimes in macroeconomic data: An application of fractal analysis. *The Quarterly Review of Economics and Finance*.
Nweze, A. U. (2011). Profit Planning: A Quantitative Approach (3rd ed.). Enugu: M'Cal communications.
Pesaran, H.M.Y., Shin R.J.& Smith, (2001). Bounds Testing Approaches to the Analysis of Long-run relationships. *Journal of Applied Economics, (16),289-326.*
Philips, P.C.B, (1987). Towards a United Asymptotic Theory of Autoregressive.
Biometrika,(74),535-48.
Ramanathan, R.(1992). Introductory Econometrics with Applications,3rd ed. Fort Worth:Dryden Press.
Reid, M. & Du Rand, G.(2013). A Sticky Information Phillips Curve For South Africa. This version: Draft, March
Satti, A. H; Wasim, S. M & Gbulam, S. (2007). New Keynesian Philips Curve for Pakistan. *The Pakistan development Review,* 46: 4, Part 11 (Winter), 395-404.
Squali, J. & Wilson, K. (2006). New Approach to Measuring Trade Openness. *Working Paper Series*,06-07,47.
Stan,M.(2018). What Is the Effect of Inflation on Inventory Turnover Ratios? *Small Business Chron.com*, http://smallbusiness.chron.com/effect-inflation-inventory-turnover-ratios-72017.html. Accessed 22 March 2018.

Appendix i: Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 03/19/18 Time: 21:08
Sample (adjusted): 1984 2014
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
IFR(-1)	1.000000
INF(-1)	0.175606
	(0.62994)
	[0.27876]
IVT(-1)	0.000529
	(4.7E-05)
	[11.2824]
LIS(-1)	29.24775
	(14.6296)
	[1.99922]
MUR(-1)	0.131902
	(0.05484)
	[2.40537]
OGP(-1)	-3.683141
	(0.29088)

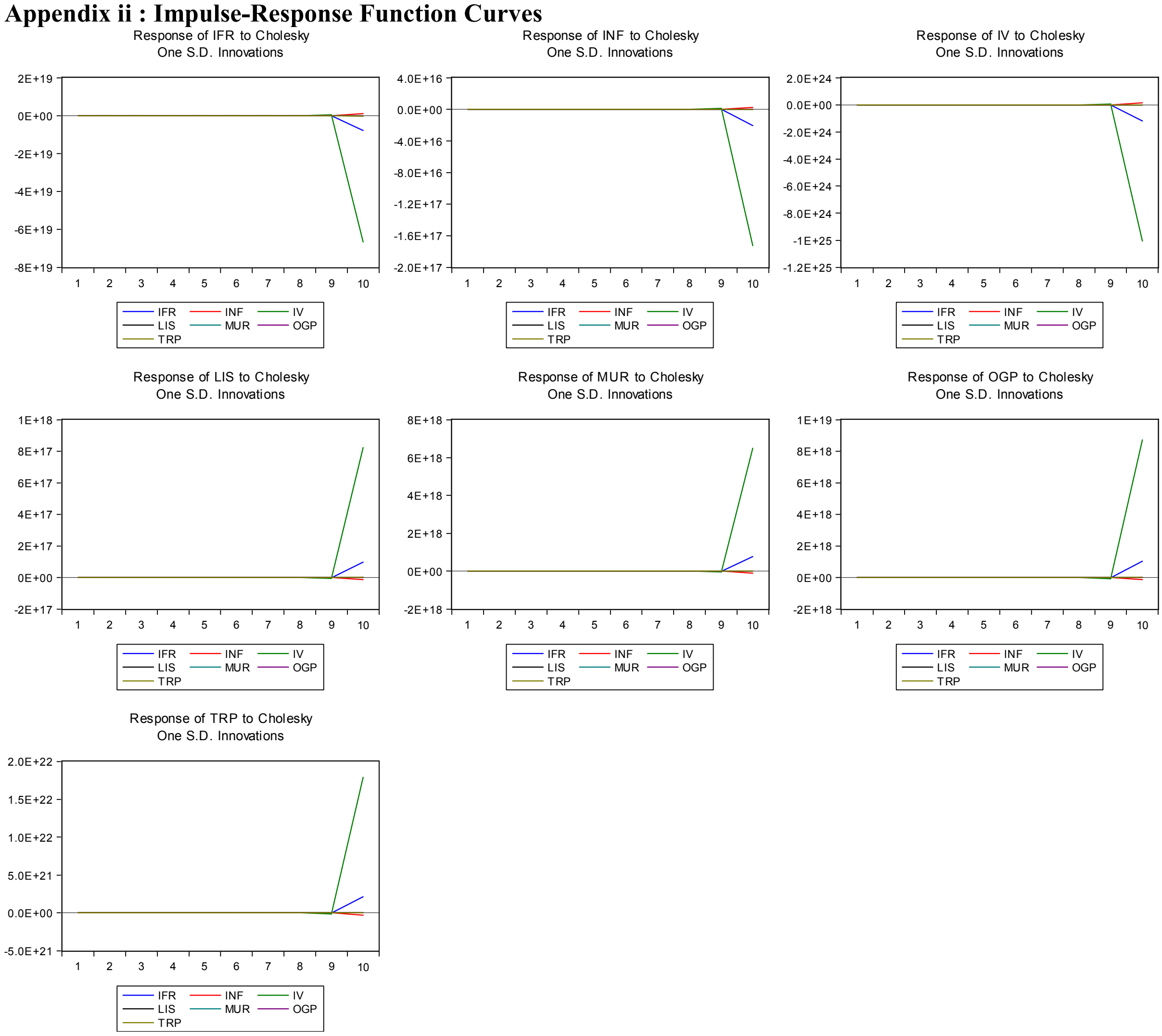
	[-12.6619]
TRP(-1)	0.000813 (0.00014) [5.62318]
C	-30.53145

Error Correction:	D(IFR)	D(INF)	D(IVT)	D(LIS)	D(MUR)	D(OGP)	D(TRP)
CointEq1	-0.134502 (0.28477) [-0.47232]	-0.005142 (0.00102) [-5.05828]	4600.896 (30190.3) [0.15240]	-0.000256 (0.00093) [-0.27531]	0.005705 (0.09886) [0.05771]	0.089297 (0.06166) [1.44834]	-55.71751 (45.0502) [-1.23679]
D(IFR(-1))	-0.371207 (0.38051) [-0.97554]	-0.001673 (0.00136) [-1.23142]	-280.3593 (40340.6) [-0.00695]	0.000151 (0.00124) [0.12141]	0.042299 (0.13209) [0.32022]	-0.055338 (0.08238) [-0.67171]	94.11098 (60.1965) [1.56340]
D(IFR(-2))	-0.492154 (0.23807) [-2.06731]	-0.001144 (0.00085) [-1.34581]	-2284.193 (25238.8) [-0.09050]	4.77E-06 (0.00078) [0.00613]	-0.027124 (0.08264) [-0.32821]	0.082296 (0.05154) [1.59663]	48.71896 (37.6616) [1.29360]
D(INF(-1))	49.77181 (23.0006) [2.16393]	1.879444 (0.08210) [22.8912]	-48467.17 (2438443) [-0.01988]	-0.008579 (0.07523) [-0.11404]	-6.552082 (7.98447) [-0.82060]	-6.319490 (4.97983) [-1.26902]	-3272.110 (3638.67) [-0.89926]
D(INF(-2))	-51.78768 (26.1364) [-1.98144]	-0.942833 (0.09330) [-10.1057]	-18842.74 (2770883) [-0.00680]	-0.001005 (0.08549) [-0.01175]	5.023879 (9.07302) [0.55372]	2.258448 (5.65875) [0.39911]	4828.659 (4134.74) [1.16783]
D(IVT(-1))	0.000398 (0.00105) [0.38077]	6.45E-06 (3.7E-06) [1.72807]	-72.79753 (110.857) [-0.65668]	5.73E-06 (3.4E-06) [1.67544]	-0.000107 (0.00036) [-0.29614]	-0.000156 (0.00023) [-0.68750]	0.203506 (0.16542) [1.23023]
D(IVT(-2))	0.000854 (0.00122) [0.70008]	1.15E-05 (4.4E-06) [2.62889]	330.6806 (129.371) [2.55607]	-3.86E-06 (4.0E-06) [-0.96683]	-0.000109 (0.00042) [-0.25835]	-0.000335 (0.00026) [-1.26627]	0.065638 (0.19305) [0.34001]
D(LIS(-1))	32.67608 (68.5755) [0.47650]	-0.258340 (0.24479) [-1.05536]	-12561309 (7270124) [-1.72780]	-0.204724 (0.22430) [-0.91270]	10.07911 (23.8054) [0.42340]	7.813462 (14.8472) [0.52626]	13448.50 (10848.5) [1.23966]
D(LIS(-2))	41.28156 (72.7823) [0.56719]	0.038139 (0.25980) [0.14680]	-9672722. (7716120) [-1.25357]	-0.246521 (0.23807) [-1.03552]	5.016529 (25.2658) [0.19855]	-2.288241 (15.7580) [-0.14521]	-6182.642 (11514.1) [-0.53696]
D(MUR(-1))	-0.650278 (0.68366) [-0.95118]	-0.002113 (0.00244) [-0.86570]	698.2854 (72478.8) [0.00963]	-0.000679 (0.00224) [-0.30353]	0.318432 (0.23733) [1.34175]	-0.084699 (0.14802) [-0.57222]	9.751272 (108.154) [0.09016]
D(MUR(-2))	0.676503 (0.64096) [1.05545]	-0.002355 (0.00229) [-1.02908]	7990.822 (67952.6) [0.11759]	0.000843 (0.00210) [0.40189]	0.122553 (0.22250) [0.55079]	0.071272 (0.13877) [0.51359]	132.9247 (101.399) [1.31090]
D(OGP(-1))	-1.418147 (0.89836) [-1.57859]	-0.015326 (0.00321) [-4.77926]	23824.31 (95241.3) [0.25015]	-0.000108 (0.00294) [-0.03682]	0.062438 (0.31186) [0.20021]	-0.553152 (0.19450) [-2.84392]	-9.436100 (142.120) [-0.06640]
D(OGP(-2))	-2.125014	-0.008340	31721.00	-0.002472	-0.058299	-0.258417	-258.4471

	(0.78401)	(0.00280)	(83118.2)	(0.00256)	(0.27216)	(0.16975)	(124.030)
	[-2.71043]	[-2.98011]	[0.38164]	[-0.96377]	[-0.21420]	[-1.52238]	[-2.08375]
D(TRP(-1))	-0.002182	-8.53E-06	-122.8737	4.45E-06	-0.000166	-4.36E-05	0.203714
	(0.00149)	(5.3E-06)	(158.322)	(4.9E-06)	(0.00052)	(0.00032)	(0.23625)
	[-1.46112]	[-1.60007]	[-0.77610]	[0.91010]	[-0.32036]	[-0.13493]	[0.86229]
D(TRP(-2))	-0.000383	1.31E-07	45.91899	3.50E-06	-3.49E-05	-0.000558	0.319716
	(0.00150)	(5.4E-06)	(159.078)	(4.9E-06)	(0.00052)	(0.00032)	(0.23738)
	[-0.25528]	[0.02448]	[0.28866]	[0.71312]	[-0.06699]	[-1.71827]	[1.34686]
C	-2.964098	-0.038944	-111019.4	0.004371	0.581492	0.962283	-507.7982
	(3.53457)	(0.01262)	(374722.)	(0.01156)	(1.22700)	(0.76526)	(559.164)
	[-0.83860]	[-3.08662]	[-0.29627]	[0.37805]	[0.47392]	[1.25745]	[-0.90814]
R-squared	0.801753	0.996548	0.476864	0.532927	0.412322	0.742852	0.686829
Adj. R-squared	0.603506	0.993096	-0.046272	0.065853	-0.175356	0.485704	0.373658
Sum sq. Resids	1856.932	0.023661	2.09E+13	0.019867	223.7740	87.04548	46473090
S.E. equation	11.12634	0.039717	1179575.	0.036393	3.862417	2.408948	1760.172
F-statistic	4.044213	288.6805	0.911548	1.140991	0.701613	2.888809	2.193144
Log likelihood	-107.4239	67.27039	-466.1357	69.97933	-74.62516	-59.98997	-264.4032
Akaike AIC	7.962829	-3.307767	31.10553	-3.482538	5.846785	4.902579	18.09053
Schwarz SC	8.702952	-2.567644	31.84565	-2.742415	6.586907	5.642701	18.83065
Mean dependent	-0.911935	-0.036631	209104.8	0.006129	0.191935	0.030645	-70.28452
S.D. dependent	17.66990	0.477989	1153196.	0.037654	3.562661	3.359083	2224.075

Determinant resid covariance (dof adj.)	8.13E+14
Determinant resid covariance	5.05E+12
Log likelihood	-761.2888
Akaike information criterion	56.79283
Schwarz criterion	62.29749

Appendix ii : Impulse-Response Function Curves



Appendix iii : Variance Decomposition Function Curves