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OIL PRICE, EXCHANGE RATE AND DISAGGREGATE CONSUMER PRICES: CAUSALITY, IMPULSE RESPONSE, AND VARIANCE DECOMPOSITION

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Abstract

This study attempts to examine whether the unpredictability causes of higher prices is connected with the changes in oil price and exchange rate. Since there are numerous consumer prices with are affected differently by the changes in oil price and exchange rate. The study used aggregate inflation and the disaggregated prices components annual data within the sample period of 1976-2015. Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) test were used to neutralize data and to free them from unit-root. The Johansen Juselius (JJ) Cointegration test was used to check if there is the prospect of long-run relation among the variables in the models. Then from the property of VAR model the models are express in VECM approach to ascertain the direction of a causal relationship both in the short-run and the long-run, generalized impulse response functions (IRFs) and Variance Decomposition. The results revealed that the causality between oil price, exchange rate are indirect related to inflation mostly through the money supply.

Keywords: oil price, exchange rate, disaggregate consumer price, causality, impulse response, variance decomposition

INTRODUCTION

The causes of inflation and the how a country are affected by the changes in oil prices and exchange become a major concern among policymakers. Most of the oil exporting countries are affected when oil price changes in the world market due to the nature of its fluctuation. The changes in oil price may cause the exchange rate to adjust defending whether oil price increase or decrease. Ordinarily, increases in oil price may lead to appreciation in the exchange rate in oil exporting countries while a decrease is the other way round. The adjustment of exchange rate may affect the general price especially a country which is highly depended on import. There is a lot of empirical studies on how exchange rate pass-through to inflation (Garcia 2001;Ghosh and Rajan 2009;Kara and Öğünç 2009;Jimborean 2013;Jiang and Kim 2013;Peón and Brindis 2014;Mirdala 2014). Some studies focus on the oil price pass-through to inflation (Hooker 2002; Gregorio et al. 2007; Chen 2009; Jongwanich and Park 2011; Ibrahim and Said 2012; Baumeister and Kilian 2014; Nazarian and Amiri 2014; Sakashita and Yoshizaki 2016; Hasanov et al. 2017). A country has a specific inflation target to maintain example single digit inflation in Nigeria. The country is able to maintain it a target when oil price increases as exchange rate appreciated. But it seems that when oil price decrease exchange rate depreciated inflation exceeded the central bank target. Essential the policy makers are concentrated on the general inflation targeting overlook the aggregate prices from various consumer prices which may have a different effect. Although, there are several interesting motivations that make the studies of energy prices and international finance interested especially through how oil price and exchange rate pass-through to inflation. Particularly to investigate the causal relationship between oil price, exchange rate, and inflation. Most of the studies of exchange rate pass-through are tried to look at the direct impact on economic performance, other studies on fluctuations of the exchange rate in international finance.

Some studies seeing that energy prices are among the most significant variable influences macroeconomic variables because changes in oil prices affect prices at all levels (Brahmasrene et al., 2014). Several empirical research reveals that the exchange rate pass-through to domestic prices in developed countries is insignificant (McCarthy, 1999; Campa and Goldberg, 2002). While the exchange rate pass-through to domestic prices in developing countries and emerging market is often discovered to be significant and well pronounced than in developed countries (Calvo and Reinhart, 2000; Choudhri and Hakura, 2006; Goldfajn and Werlang, 2000). The level of exchange rate pass-through is increasing especially when a country is highly dependent on import from abroad. Any changes from external shock will easily transmit to the domestic economy. Przystupa and Wróbel (2011) applied Polish data covers the period 1997Q1–2008Q1 proposes a complex analysis of the exchange rate pass-through in an open economy. Find that asymmetry is mostly visible after exogenous shocks and reject the hypothesis of an asymmetric reaction of prices in a high- and the low- inflation environment. Exchange rate shocks are transmitted into aggregate inflation at a much faster rate in emerging economies than in industrials economies (Choudhri, et al., 2005; Devereux and Yetman, 2002). Doğan, (2013) also found similar results in his study using Turkish time series data ranging from 2001:10 to 2011:3 of average nominal Turkish lira (TL) against the U.S. dollar, and the manufacturing industry producer price index (MPI). The pass-through is affected positively by the aggregate demand conditions. In particular, when the economy is growing, exchange rate changes are transmitted to prices to a larger extent than otherwise. María-Dolores, (2009) studies eleven NMSs in (Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and Turkey) used data from January 2000 to July 2007 applying vector autoregressive (VAR) model. Exchange rate pass-through is larger for these developing countries. Find the evidence of a larger response in energy than in manufacturing.

Chang and Tsong, (2010) in their analysis testify differently method comprises of bias-corrected (BC) approach, least square dummy variable (LSDV), and generalized method of moments (GMM). Utilized monthly data from 1996:M10 and extending up to 2004:M12. Cross-commodity evidence strongly supports the partial pass-through in the short run and the complete pass-through in the long run. Przystupa and Wróbel, (2011) the results show that pass-through is incomplete, even in the long run. Doyle, (2004) apply cointegration and error-correction modeling. The results indicate that for aggregate and sectoral unit values of Irish imports from the UK pass-through is incomplete in the short-run. Some of the studies of the impact of oil price on inflation Ibrahim and Said (2012) applied Phillips curve framework on Malaysian data on oil price and disaggregate inflation. Found that in the short run, the oil price changes have significant bearings on the consumer price. The same Author attempt to studied inflationary effects by oil price on Thailand economy Ibrahim and Chancharoenchai (2013) found that in the short run, all goods sectors are impacted significantly by oil price are detected. Also in recent, he studied oil price and food prices in Malaysian economy Ibrahim (2015) found that oil price increases affect food price in Malaysia, while decreases are not. Doroodian and Boyd (2003) studies US economy applied dynamic computable general equilibrium (CGE), model. Found that the aggregate prices level both (CPI and PPI) will fall over time as the level of technological advances rises under both growth scenarios. Nazarian and Amiri (2014) utilized monthly data range from 2003:3 to 2013:3 found that the pass through is absolutely huge also confirmed the asymmetric pass-through of oil price changes (positive and negative) into inflation. Cecchetti and Moessner (2008) Found that in recent year’s core inflation has not tended to revert to headline, which suggests that higher commodity prices have generally not produced strong effects on inflation.

RESEARCH METHODOLOGY

Econometric Method

In Standard Granger Causality (SGC) according to Granger's (1969) method, a variable Bis caused by a variable Aif Bcan be predicted better from past values of both Band Athan from past values of Balone. For a simple bivariate model, we can test if Ais Granger-causing Bby estimating Equation (1) and then test the null hypothesis in Equation (2) by using the standard Wald test.

$$A = \propto + \sum_{j=1}^{\rho} \gamma_{11j} Y_{t-j} + \sum_{j=1}^{\rho} \gamma_{12j} B_{t-j} + \mu_t \qquad (1)$$

$H_o\colon \gamma_{12j} = 0$ for j=1…..,p

$H_1\colon \gamma_{12j} \neq 0$ for at least one j

(2)

Where: $\propto$is a constant and$\mu_t$is a white noise process. The variable Bis said to Granger-cause variable Aif we reject the null hypothesis (2), where γ_{12} is the vector of the coefficients of the lagged values of the variable A. Similarly, we can test if B causes A by replacing B for A and vice versa in Equation (1). Let use the following vector autoregressive model of order P

$$A_t = \propto + X_1 A_t - 1 + \ldots + X_{P-1} A_{t-P} + \varepsilon_t \qquad (3)$$

Where: $A_t$represent the cointegration variables in 5× 1 vector

A_1= Disaggregate consumer prices

A_2= Oil price

A_3= Exchange rate

A_4= GDP

A_5= money supply

The study used five variables in each equation model disaggregate consumer prices, oil price, exchange rate, GDP and money supply. Is assume all the variables are *I*(1) the following with

Granger representation theorems hold if they are moving in the same direction toward the long-run equilibrium, the VAR model can be express as the following VECM model:

$$\Delta A_t = \propto + \Gamma_1 X_{t-1} + \ldots + \Gamma_{P-1}\, \Delta A_{t-P+1} + \Pi A_{t-1} + \varepsilon t \qquad (4)$$

Where Δ represent changes in operator, while εt represent white noise residual of the vector. When $\Pi$is assumed to be cointegrated between 1 <*r* < 5, and it can be decompressed like this $\Pi = \alpha\beta,$ where $\alpha(5xy)$ and $\beta(5xy),$ also the second equation will be re expressed in this foam:

$$\Delta A_t = \propto + \Gamma_1 A_{t-1} + \ldots + \Gamma_{P-1}\, \Delta A_{t-P+1} + \alpha(\beta' A_{t-1}) + \varepsilon t \qquad (5)$$

Where the β rowsremain the interpreted as different cointegration vectors, also the α's stand for the adjustment of coefficient showing the possible movement to the equilibrium in the long-run, and also linear combinations of $\beta' X_{t-1}$are stationary procedures then each of the variable in Equation three is in stationary foam. The cointegration methods of Johansen (1988) allowed to check also detects the possible amount of cointegrated equation among the non-stationary variables in technique through the procedure of a maximum likelihood.

Vector Error-correction Model (VECM) Causality Tests

The Granger causality is employed to examine the short-run and long-run causality relationship among the variables in the models are: aggregate consumer price (CPI), food prices (FP), tobacco price (TA), accommodation price (AP), household price (HP), transport price (TP), other prices (O), oil price (OP), exchange rate (EX), GDP, and money supply (M2) the models are made in accordance with the VECM (Pesaran et al. 1999). Considering the following technique of vector error-correction model (VECM) model, from the long-run equation will transform in as follows:

$$\Delta P *_{1t} = u_1 + \sum_{h=1}^{r} \alpha_{1,h,} ECT_{h.t-I} + \sum_{k=1}^{p-1} B_{11.k}\, \Delta P *_{5t-k} + \sum_{k=1}^{p-1} B_{12,k}\, \Delta OP_{1t-k} + \sum_{k=1}^{p-1} B_{13.k}\, \Delta EX_{4t-k} + \sum_{k=1}^{p-1} B_{14.k}\, \Delta GDP_{5t-k} + \sum_{k=1}^{p-1} B_{15,k}\, \Delta M2_{5t-k} + \mathcal{E}_{3t}$$

$$\Delta OP_{2t} = u_2 + \sum_{h=1}^{r} \alpha_{2,h,} ECT_{h.t-I} + \sum_{k=1}^{p-1} B_{21,k}\, \Delta OP_{1t-k} + \sum_{k=1}^{p-1} B_{22,k}\, \Delta EX_{2t-k} + \sum_{k=1}^{p-1} B_{23,k}\, \Delta GDP_{3t-k}$$
$$+ \sum_{k=1}^{p-1} B_{24.k}\, \Delta M2_{4t-k} + \sum_{k=1}^{p-1} B_{25,k}\, \Delta P *_{5t-k} + \mathcal{E}_{2t}$$

$$\Delta EX_{3t} = u_3 + \sum_{h=1}^{r} \alpha_{3,h,} ECT_{h.t-I} + \sum_{k=1}^{p-1} B_{31,k}\, \Delta EX_{1t-k} + \sum_{k=1}^{p-1} B_{32,k}\, \Delta GDP_{2t-k} + \sum_{k=1}^{p-1} B_{33,k}\, \Delta M2_{3t-k}$$
$$+ \sum_{k=1}^{p-1} B_{34.k}\, \Delta P *_{4t-k} + \sum_{k=1}^{p-1} B_{35,k}\, \Delta OP_{5t-k} + \mathcal{E}_{3t}$$

$$\Delta GDP_{4t} = u_4 + \sum_{h=1}^{r} \alpha_{4,h,} ECT_{h.t-I} + \sum_{k=1}^{p-1} B_{41,k}\, \Delta GDP_{1t-k} + \sum_{k=1}^{p-1} B_{42,k}\, \Delta M2_{2t-k} + \sum_{k=1}^{p-1} B_{43,k}\, \Delta P *_{3t-k}$$
$$+ \sum_{k=1}^{p-1} B_{44.k}\, \Delta OP_{4t-k} + \sum_{k=1}^{p-1} B_{45,k}\, \Delta EX_{5t-k} + \mathcal{E}_{3t}$$

$$\Delta M2_{4t} = u_4 + \sum_{h=1}^{r} \alpha_{5,h,} ECT_{h.t-I} + \sum_{k=1}^{p-1} B_{51,k}\, \Delta M2_{1t-k} + \sum_{k=1}^{p-1} B_{52,k}\, \Delta P *_{2t-k} + \sum_{k=1}^{p-1} B_{53,k}\, \Delta OP_{3t-k}$$
$$+ \sum_{k=1}^{p-1} B_{54.k}\, \Delta EX_{4t-k} + \sum_{k=1}^{p-1} B_{55,k}\, \Delta GDP_{5t-k} + \mathcal{E}_{3t}$$

Where the $ECT_{h,t-1}$ represent h^{th} the error correction term the residuals from the $h^{th}$of one lagged period of the cointegration equation, and $\beta_{ij,k}$ explains the effect of the k^{th} amount of lag in the variable $j$on the present amount of variable. Moreover, by generating the causal direction between the variables, VECM methodology differentiates the causality in two different ways (short-run causality and long-run causality). The above settings in the six equations, is a Granger causality in the long-run from variable $Y_i$to variable $X_j$in the presence of cointegration is estimated to examination the null hypothesis is $\alpha_{j,h} = 0$ for $h = 1, \ldots, r,$ however, the causality in the short-run from variable $Y_i$to variable $X_j$is estimated to examination the null hypothesis is $\beta_{ij,1} = \beta_{ij,\mathrm{p}-1} = 0,$by estimating the standard F-statistic. To accept or reject between the two null hypotheses, in accomplishing the variable Y_iGranger causes $X_j$variable.

The Data

The research applied Nigerian time series observation in annual basis ranging from 1976 to 2015. This is the period of oil boom in Nigerian Government, the increases in government revenue and expenditure pushed inflation rate to 23 percent between 1975 and 1976. The variables consist eight indicators of disaggregated consumer price indexes namely aggregate consumer price (CPI), food prices (FP), tobacco price (TA), accommodation price (AP), household price (HP), clothing price (CP), transport price (TP) and other prices (O). The official exchange rate was used as a proxy for the exchange rate (EX), the Nigerian oil price Bonny Light is used as a proxy oil price, GDP per capita constants US dollar is used as economic growth, money, and quasi-money (M2) as a percentage of GDP is used as a proxy money supply. The data are extracted from the Central Bank of Nigeria (CBN) Statistical bulletin and World Bank online database and converted into natural log format.

RESULTS AND DISCUSSION

The Unit root test table below displays the outcome of the variables. The study used two most common tests in the time series literatureknown as Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test. Based on their level or *I*(0), the result indicates that the null hypothesis has failed to reject or non-stationary both constant with and without trend. It is because all variables are not statistically significant at 1, 5, or at least 10 percent. Though the first differences or *I*(1), the result showed that all the variables at 1, 5 and 10 percent level are statistically significant. The test has processed the results of all the variables are stationary in first differences. Those variables are Log oil price, log of exchange rate, log of GDP, log of money supply, log of aggregate CPI, log of food prices, log of tobacco prices, log of accommodation price, log of household price, log of cloth price, log of transport price and log of other prices.

Table 1. Unit-root Test

	Augmented Dickey Fuller (ADF)		Philip Perron (PP)	
Variable	Constant without trend	Constant with trend	Constant without trend	Constant with trend
$lop I$(0)	-1.4911	-1.7998	-1.5242	-1.9049
I(1)	-5.2299***	-5.1416***	-5.2299***	-5.1445***
$lex I$(0)	-0.9528	-0.9661	-0.9462	-1.2222
I(1)	-5.1726***	-5.1901***	-5.1682***	-5.1901***
$lgdp I$(0)	0.0633	-1.1417	0.0130	-1.1217
I(1)	-5.5971***	-5.9904***	-5.5947***	-6.0033***
$lm2 I$(0)	-3.4526**	-3.5814**	-2.6045	-2.5897
I(1)	-5.2988***	-5.2235***	-7.0307***	-6.6604***

$lcpiI$(0)	-1.2054	-0.3857	-1.1494	-0.7341	Table 1...
I(1)	-2.3411	-2.3315	-4.0342***	-4.1762**	
$lfpI$(0)	-1.3331	-0.5489	-1.4100	-0.4037	
I(1)	-4.3684***	-4.5750***	-3.6601***	-3.5906**	
$ltaI$(0)	-1.0037	-1.0875	-1.2504	-0.5803	
I(1)	-3.2379**	-3.3208*	-3.2652**	-3.3760*	
$lafI$(0)	-0.5558	-0.9325	-0.5589	-1.3545	
I(1)	-4.5719***	-4.5250***	-4.5727***	-4.5233***	
$lhpI$(0)	-1.4933	-0.9091	-1.4188	-0.7161	
I(1)	-3.5690**	-3.8197**	-3.6300***	-3.8364**	
$lcpI$(0)	-1.8220	-1.3730	-17211	-0.6285	
I(1)	-2.6339*	-3.0438	-2.6252*	-3.1167	
$ltpI$(0)	-0.9210	-1.4367	-0.9622	-0.9831	
I(1)	-3.2034**	-3.2406*	-3.2200**	-3.2059*	
loI(0)	-1.1437	-1.2198	-1.2514	-0.7999	
I(1)	-4.2997***	-4.4006***	-42997***	-4.3944***	

Note: SIC is used to select the optimum lag order in ADF and PP test and *****, **** and ***** denote significance level at 1 percent, 5 percent, and 10 percent.

The next step is to determine the cointegration relationship between the oil price, exchange rate and the eight disaggregate consumer prices models. The Johansen cointegration test was used throughout the estimation of the long-run equations. The estimation consists two major statistics trace statistics (λtrace) and maximum eigenvalue statistics (λmax). The Johansen procedure was chosen because has the properties to detect more than one cointegrating relationship in the long-run model rather than the Philips Ouliaris method which can detect only one cointegration relationship in the models (Ssekuma, 2011). The results obtained from the Johansen cointegration test from the two statistics Trace statistics and Max-Eigen statistics are closely similar, usually, the results may show little dissimilarities when the sample size is small(Lutkepohl and NeiSunajev 2014).The study used Akaike Information criteria (AIC) in determining the optimum lags selection in the VAR model. Table 2 provides the cointegration of eight disaggregated consumer price models indicated the evidence of long-run relations. Model 1 with aggregate consumer price trace statistics indicated 2 cointegrated vectors and eigenvalue indicated 1 vector. Model 2 with food price trace statistics indicated 1 cointegration vectors and eigenvalue indicated 1 vector. Model 3 with tobacco price indicated the existence of 2 cointegration vectors and eigenvalue indicated 1 vector. Model 4 with accommodation price indicated the existence of 2 cointegration vectors and eigenvalue indicated 1 vector. Model 5 with household price indicated the existence of 1 cointegration vector and eigenvalue indicated 1 vector. Model 6 with cloth price indicated the existence of 2 cointegration vectors and eigenvalue indicated 1 vector. Model 7 with transport price indicated the existence of 1 cointegration vector and eigenvalue indicated 1 vector. Model 8 with other prices indicated the existence of 2 cointegration vectors and eigenvalue indicated 1 vector. All the models are chosen 2 lags has optimal lags as indicated in the table, the cointegration vectors are significance at 1 percent and 5 percent level.

Table 2. Cointegration Results Based on Trace and Eigenvalue Statistics

Variables	**λTrace (Trace Statistics)**							**λMax (Eigenvalue Statistics)**						
	r = 0	r = 1	r = 2	r = 3	r = 4	P	r	r = 0	r = 1	r = 2	r = 3	r = 4	P	r
CPI	96.39***	48.61**	28.34	10.02	1.63	2	2	47.77***	20.26	18.32	8.39	1.63	2	1
FP	99.83***	43.23	24.78	11.26	3.92	2	1	56.59***	18.45	13.52	7.33	3.92	2	1
LTA	56.59***	18.45**	13.52	7.33	3.92	2	2	39.26**	22.72	17.07	6.95	2.54	2	1
LAF	97.37***	51.02**	25.19	10.18	3.30	2	2	46.34***	25.83	15.01	6.87	3.30	2	1
LHP	88.95***	43.19	25.74	10.16	2.49	2	1	45.75***	17.44	15.58	7.67	2.49	2	1
LCP	96.39***	48.61**	28.34	10.02	1.63	2	2	47.77***	20.26	18.32	8.39	1.63	2	1
LTP	88.26***	42.97	26.22	10.52	3.07	2	1	45.28***	16.75	15.69	7.45	3.07	2	1
LO	90.14***	49.55**	25.89	13.81	3.76	2	2	40.58***	23.65	12.08	10.04	3.76	2	1

Note: *** and **: indicate significance at 1% and 5%, levels.

λtrace is the trace statistics value and .λmax is the maximum eigenvalue statistics. P indicates the optimal lag length based on AIC from the unrestricted VAR model. r is the number of cointegration vectors based on Johansen's method.

The confirmation the mutual relationship in the long-run has satisfied the requirement to testify the direction of Granger causality between oil price, exchange rate, and inflation. Since, when the variables are cointegrated, there must be a possibility of the existence of Granger causality of a minimum of one-way direction(Granger, 1988). Since the existence of cointegration does not an indication the direction of causal relationship among them. The only provide the evidence of the existence of Granger causality. The possible way to detect the causal relationship is to use the vector error correction model (VECM) which originated directly from the cointegration vectors.

Table 3 shows that the T-test and F-test outcomes concerning to the exclusion of the applicable variables from the VEC model. The null hypothesis is being usually stated that there is no existence of causality among the applicable variables. Since the methodology previously clarified the possibility of causality effects in two categories: the short-run and the long-run. The second column is for t-test while the third column is for F-test and both of them are to determine the either the null hypothesis is accepted or rejected. Therefore to avoid the spurious regression results problem, the model as a feature of error correction term to capture the variations related to the adjustment level in long-run. The study further estimated the VECM base causality tests by applying Johansen cointegration vectors. The direction of causality between the variables in the model with the aggregate CPI which indicate that in the short-run CPI is causes oil price, oil price causes oil price-exchange rate, money supply cause exchange rate, CPI cause money supply, oil price cause money supply, GDP cause money supply. While in the long-run exchange rate and money supply models are significant meanings that cause CPI in the long-run. The results reveal that in the short-run the impact of exchange rate on aggregate CPI is indirect through the other indicators in the model.

Table 4 to 10 presents the direction of causality with the disaggregated CPI. Table 4 present the result indicate that in the short-run oil price is causes exchange rate, food price, oil price, exchange rate and GDP are causes oil money supply. Whereas in the long-run model indicate that exchange rate and money supply is significant meanings that cause prices in the long-run. The results reveal that in the short-run the impact of exchange rate on aggregate CPI is indirect through the oil price and money supply. The other disaggregate prices has different long-run causality as indicate in the models.

Table 3. Granger causality exchange rate Aggregate CPI

Variable	ΔCPI	ΔOP	ΔE	ΔGDP	ΔM2	ECT_{it-1}
ΔCPI	-	0.1492	0.4652	3.1535	1.7111	0.0106
		(0.92)	(0.79)	(0.20)	(0.42)	(0.98)
ΔOP	8.08**	-	3.5121	1.4462	1.3348	-0.1429
	(0.01)		(0.17)	(0.48)	(0.51)	(-0.67)
ΔE	1.0540	19.26***	-	4.8240	6.38**	-0.04**
	(059)	(0.00)		(0.08)	(0.04)	(-2.33)
ΔGDP	3.0842	1.5774	2.6441	-	4.1418	0.31***
	(0.21)	(0.45)	(0.26)		(0.12)	(2.95)
ΔM2	11.14***	15.62***	4.2111	15.10***	-	-1.09***
	(0.00)	(0.00)	(0.12)	(0.00)		(-7.26)

Table 4. Granger causality exchange rate and Food CPI

Variable	ΔFP	ΔOP	ΔE	ΔGDP	ΔM2	ECT_{it-1}
ΔFP	-	0.8224	3.0864	0.6623	2.0638	-0.0127
		(0.66)	(0.21)	(0.71)	(0.35)	(-0.43)
ΔOP	0.8651	-	2.0553	0.2678	0.5169	-0.2685
	(0.64)		(0.35)	(0.87)	(0.77)	(-1.03)
ΔE	0.9358	15.40***	-	2.8375	3.6160	0.0252
	(0.62)	(0.00)		(0.24)	(0.16)	(1.83)
ΔGDP	2.3929	1.0986	1.2319	-	1.4681	0.3436
	(0.30)	(0.57)	(0.54)		(0.47)	(3.00)
ΔM2	6.45**	11.74***	6.05**	9.57***	-	-1.00***
	(0.03)	(0.00)	(0.04)	(0.00)		(-6.00)

Table 5. Granger causality exchange rate and Tobacco CPI

Variable	ΔTA	ΔOP	ΔE	ΔGDP	ΔM2	ECT_{it-1}
ΔTA	-	0.8412	4.76*	2.5021	0.0784	0.0030
		(0.65)	(0.09)	(0.28)	(0.96)	(0.40)
ΔOP	1.0777	-	1.5677	0.1064	1.7579	-0.3710
	(0.58)		(0.45)	(0.94)	(0.41)	(-1.63)
ΔE	0.3492	16.98***	-	4.1812	6.04**	-0.04**
	(0.83)	(0.00)		(0.12)	(0.04)	(-2.02)
ΔGDP	0.1589	1.2529	2.3289	-	4.3371	0.30***
	(0.92)	(0.53)	(0.31)		(0.11)	(3.29)
ΔM2	1.4523	10.67***	4.0095	10.21***	-	-1.00***
	(0.48)	(0.00)	(0.13)	(0.00)		(-6.06)

Table 6. Granger causality exchange rate and Accommodation CPI

Variable	ΔAF	ΔOP	ΔE	ΔGDP	ΔM2	ECT_{it-1}
ΔAF	-	0.338	1.618	0.507	0.150	0.008
		(0.84)	(0.44)	(0.77)	(0.92)	(0.52)
ΔOP	3.714	-	3.897	0.709	1.779	-0.35*
	(0.15)		(0.14)	(0.70)	(0.41)	(-1.82)
ΔE	1.7119	19.75***	-	5.44*	8.10**	0.29***
	(0.42)	(0.00)		(0.06)	(0.01)	(3.07)
ΔGDP	4.64*	1.1276	3.6699	-	2.9704	-0.12**
	(0.09)	(0.56)	(0.15)		(0.22)	(-2.27)
ΔM2	14.67***	8.38**	4.3852	8.94**	-	-0.82***
	(0.00)	(0.01)	(0.12)	(0.01)		(-6.23)

Table 7. Granger causality exchange rate and Household CPI

Variable	**ΔHP**	**ΔOP**	**ΔE**	**ΔGDP**	**ΔM2**	**ECT_{it-1}**
ΔHP	-	0.543	0.589	3.607	2.321	0.010
		(0.76)	(0.74)	(0.16)	(0.31)	(0.90)
ΔOP	3.2785	-	1.8030	0.4297	2.7177	-0.46*
	(0.19)		(0.40)	(0.80)	(0.25)	(-1.79)
ΔE	1.261	17.25***	-	3.18	5.21*	-0.05**
	(0.53)	(0.00)		(0.20)	(0.07)	(-2.09)
ΔGDP	0.8080	2.0010	2.5233	-	4.71*	0.42***
	(0.66)	(0.36)	(0.28)		(0.09)	(3.47)
	7.64**	14.37***	4.79*	8.90**	-	-1.05***
ΔM2	(0.02)	(0.00)	(0.09)	(0.01)		(-6.74)

Table 8. Granger causality exchange rate and Clothing CPI

Variable	**ΔCP**	**ΔOP**	**ΔE**	**ΔGDP**	**ΔM2**	**ECT_{it-1}**
ΔCP	-	0.149	0.465	3.153	1.711	0.010
		(0.92)	(0.79)	(0.20)	(0.42)	(0.98)
ΔOP	8.08**	-	3.5121	1.4462	1.3348	-0.1429
	(0.01)		(0.17)	(0.48)	(0.51)	(-0.67)
ΔE	1.0540	19.26***	-	4.82*	6.38**	-0.04**
	(0.59)	(0.00)		(0.08)	(0.04)	(-2.33)
ΔGDP	3.0842	1.5774	2.6441	-	4.1418	0.31***
	(0.21)	(0.45)	(0.26)		(0.12)	(2.95)
ΔM2	11.14***	15.62***	4.211	15.10***	-	-1.09***
	(0.00)	(0.00)	(0.12)	(0.00)		(-7.26)

Table 9. Granger causality exchange rate and Transport CPI

Variable	**ΔTP**	**ΔOP**	**ΔE**	**ΔGDP**	**ΔM2**	**ECT_{it-1}**
ΔTP	-	0.257	2.494	4.337	1.122	8.21
		(0.87)	(0.28)	(0.11)	(0.57)	(0.01)
ΔOP	2.5288	-	1.8707	0.3476	0.5515	-0.27
	(0.28)		(0.39)	(0.84)	(0.75)	(-1.24)
ΔE	1.7884	20.06***	-	4.0033	6.53**	-0.06**
	(0.40)	(0.00)		(0.13)	(0.03)	(2.21)
ΔGDP	4.85*	1.421	2.563	-	2.723	0.32***
	(0.08)	(0.49)	(0.27)		(0.25)	(3.32)
ΔM2	10.32***	13.28***	4.74*	12.81***		-1.01***
	(0.00)	(0.00)	(0.09)	(0.00)		(-6.81)

Table 10. Granger causality exchange rate and Others CPI

Variable	ΔO	ΔOP	ΔE	ΔGDP	ΔM2	ECT_{it-1}
ΔO	-	6.00**	3.490	4.085	1.534	-0.006
		(0.04)	(0.17)	(0.12)	(0.46)	(-1.23)
ΔOP	2.064	-	4.61*	0.435	4.584	-0.60***
	(0.35)		(0.09)	(0.80)	(0.10)	(-2.75)
ΔE	0.118	16.06***	-	3.7971	4.9416	-0.0859
	(0.94)	(0.00)		(0.14)	(0.08)	(-1.62)
ΔGDP	2.6585	1.5858	7.03**	-	7.85**	0.2926
	(0.26)	(0.45)	(0.02)		(0.01)	(4.01)
ΔM2	0.4641	7.34**	5.04*	6.87**	-	-0.88***
	(0.79)	(0.02)	(0.08)	(0.03)		(-4.92)

Note: ECT_{it-1} is the error correction term indicating the long-run causality

*, **, *** shows the significance levels at the 10%, 5%, and 1%, respectively.

The VECM causality test provides the direction of causality among the variables in the models but does not indicate how the variables respond to the changes of another variable when shock occurred. The generalized impulse response procedure developed by Koop et al. (1996) and Pesaran and Shin (1998) were used. The generalized method does not have this shortcoming of orthogonality critique that is his great advantage over the traditional approach. Since in the ordinary impulse response function, the response of one variable is sensitive to the order variables in the model. The generalized impulse response and variance decomposition (VDC) procedure are used to validate the relationship between oil price, exchange rate, and inflation reaction. In VECM model a particular variable to its own shock and the shock from other variables are examine by VDC approach. The impulse response function (IRF) is used to detect the exogenous shock of one variable to another variable in the long period impact. Therefore, the IRF is a procedure to explore the dynamic impact of oil price, the exchange rate of inflation. The results of impulse response shown in a positive one SD shock to the oil price, exchange rate lead to increase the rate of inflation in Nigeria more rapidly quarter by quarter. Generally, inflation rate response positively to the oil price and exchange rate. The result is Consistent with the expectation and the theory stated that an oil price, exchange rate shock increases the inflation rate in Nigeria. The disaggregate consumer prices are shown a different pattern of response to the shock as seen in graphs. In general, all the disaggregated consumer prices are response positively depending on how related to the shock. The DVC results show that the main variable affecting the inflation in Nigeria is interchangeable between GDP, exchange rate and oil price depending on the how the particular variable connected to the shock.

CONCLUSIONS AND POLICY IMPLICATIONS

The study examines the causality, impulse response and variance decomposition of oil price and exchange rate on disaggregated consumer prices in Nigeria. The study used aggregate inflation and the disaggregated prices components annual data within the sample period of 1976-2015. Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) test were used to neutralize data and to free them from unit-root. The Johansen Juselius (JJ) Cointegration test was used to check if there is the prospect of long-run relation among the variables in the models. Then from the property of VAR model the models are express in VECM approach to ascertain the direction of a causal relationship both in the short-run and the long-run, generalized impulse response functions (IRFs) and Variance Decomposition. The study concludes that the causality between oil price, exchange rate are indirect related to inflation mostly through the money supply. The results highlight the policymakers on numerous aspects that need additional care Firstly, the confirmation of indirect causality of oil price, exchange rate are giving the insight to use contractionary monetary policy to reduce the amount of money in circulation. Furthermore, in the disaggregated consumer prices, there is different causality direction that the policy makers need to consider during the policy formation to reduce inflation. The impact of oil price and exchange rate pass-through to inflation results has implications first for economic modeling based on disaggregate and for policymakers to target specific price among the consumer prices that will reduce the high level of inflation. For further research, it is recommended to explore the nonlinear impact of oil price and exchange rate changes on inflation.

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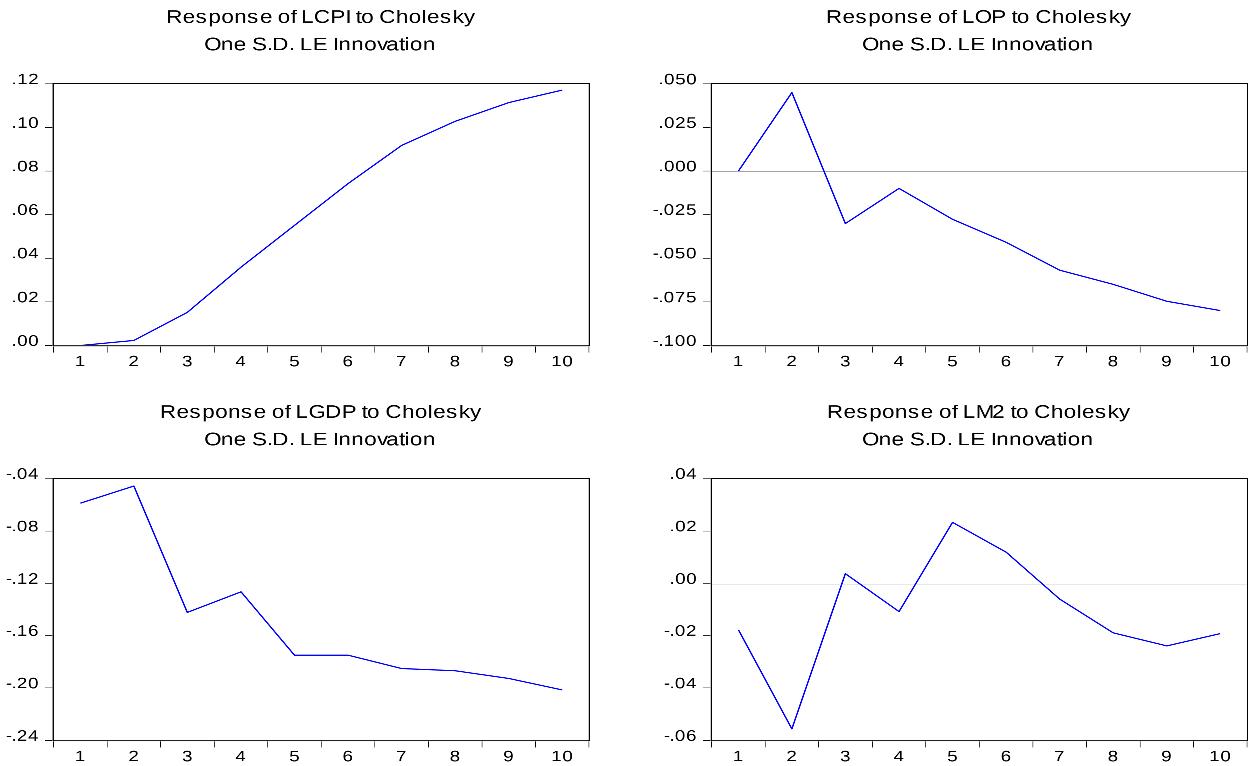
APPENDICES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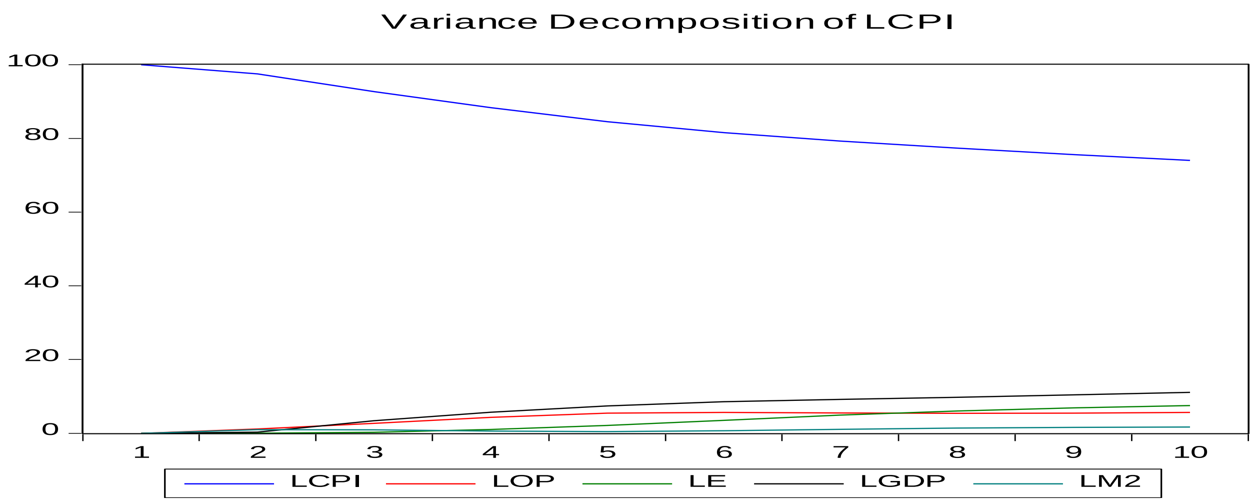
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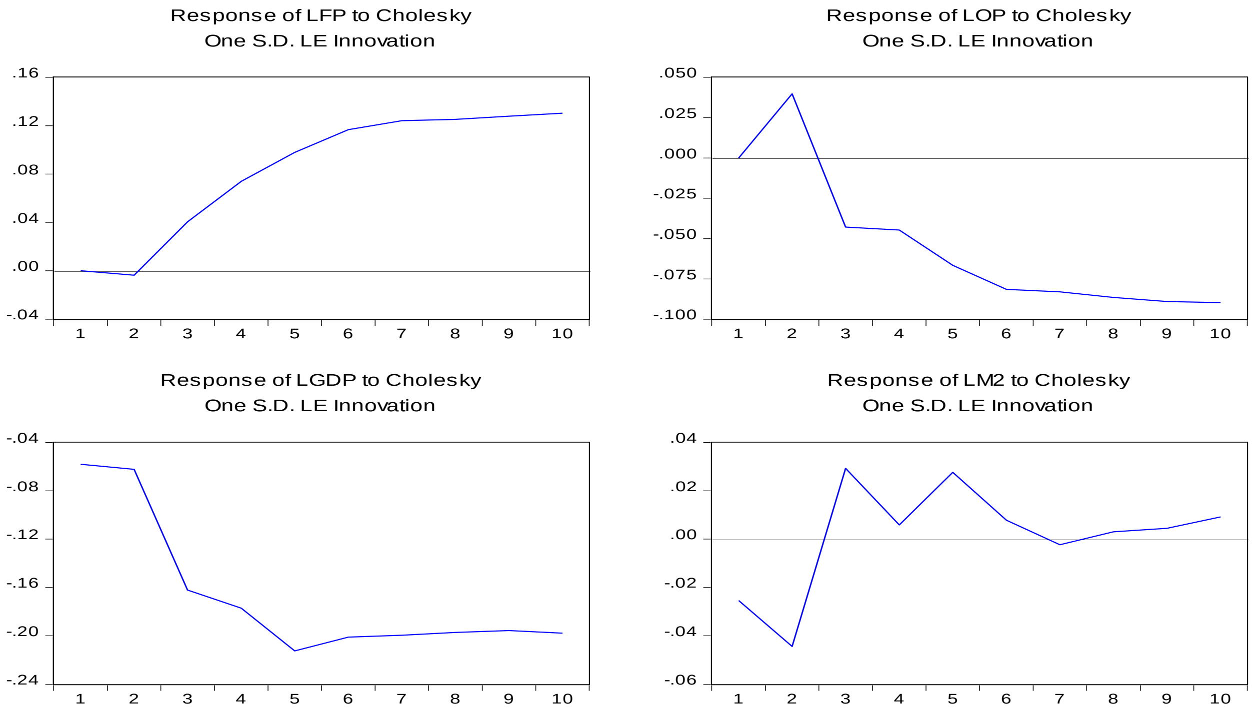
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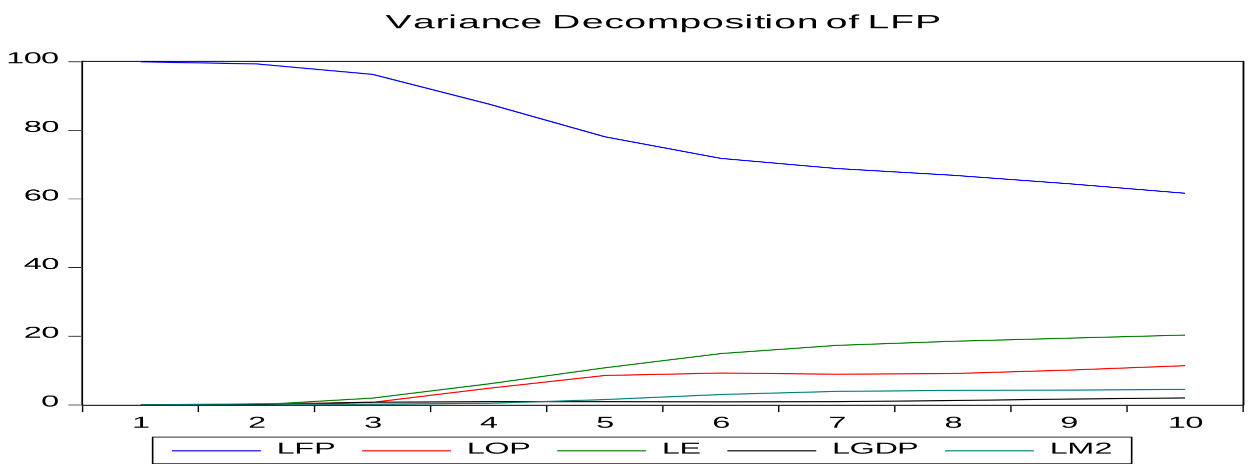
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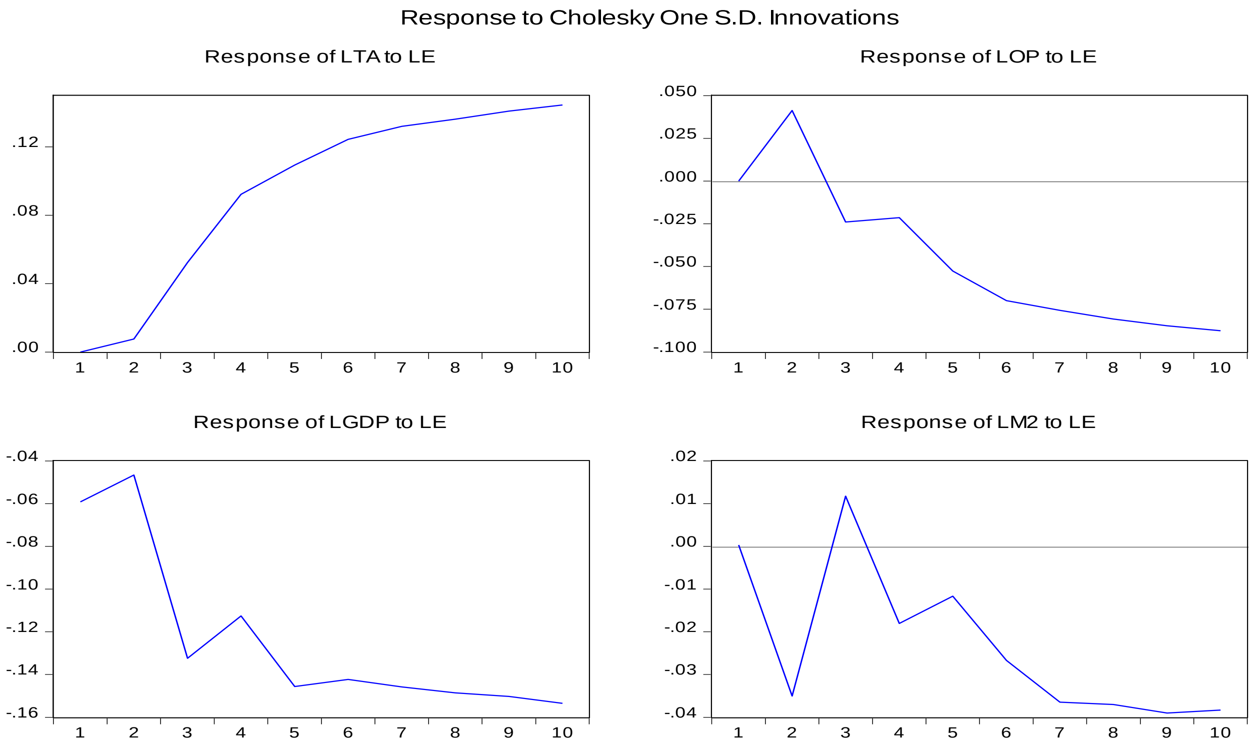
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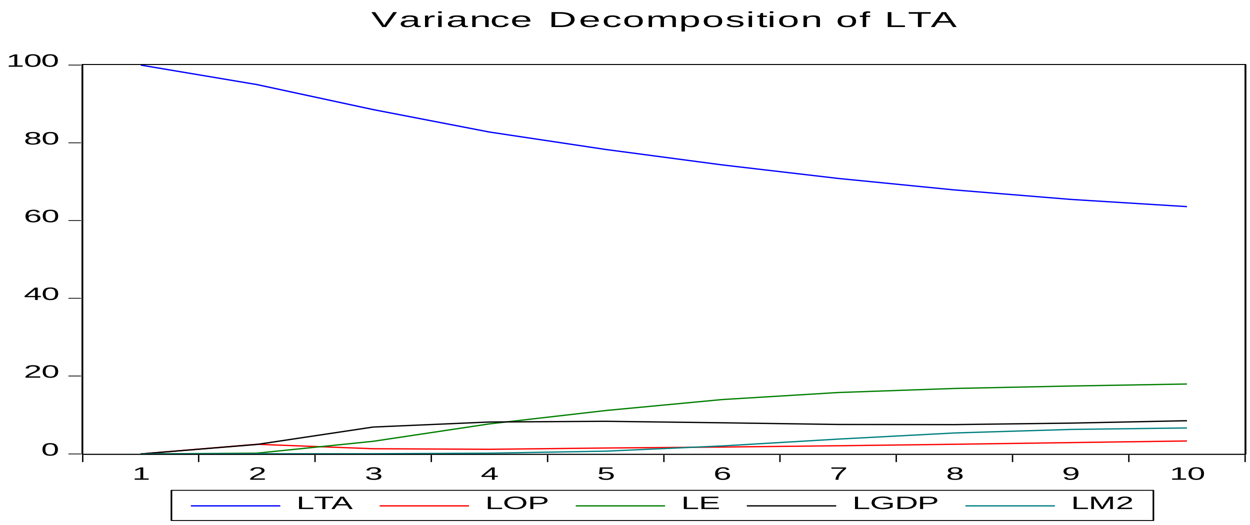
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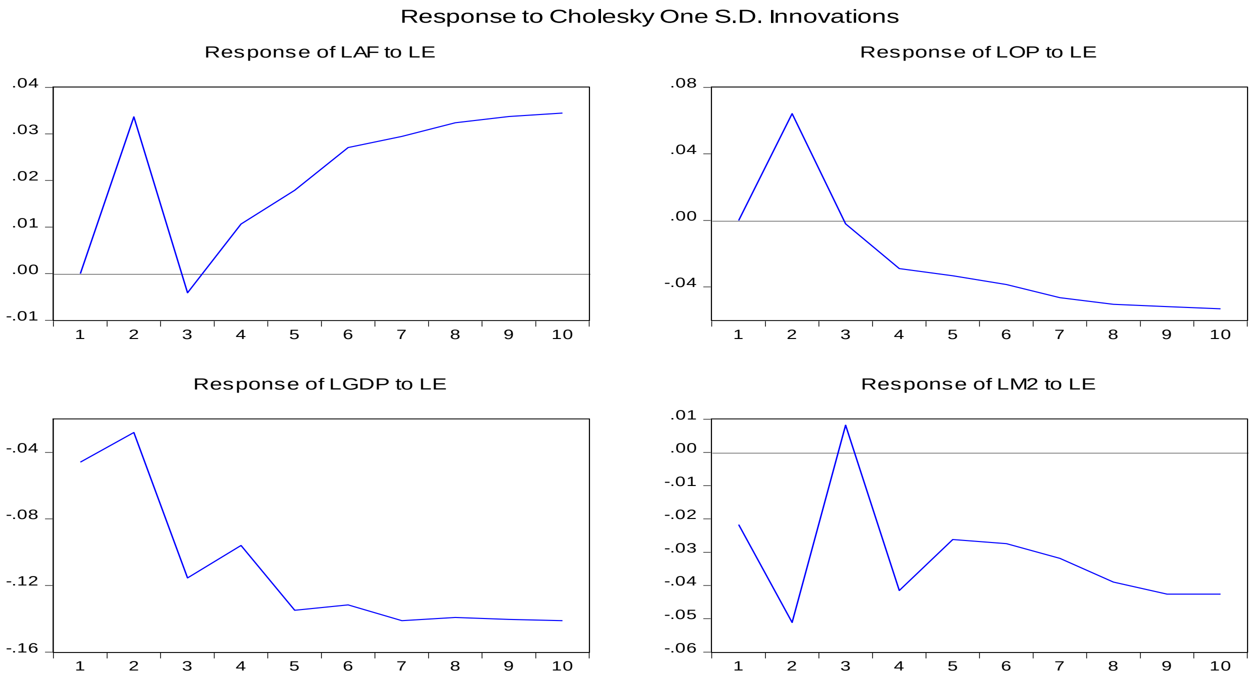
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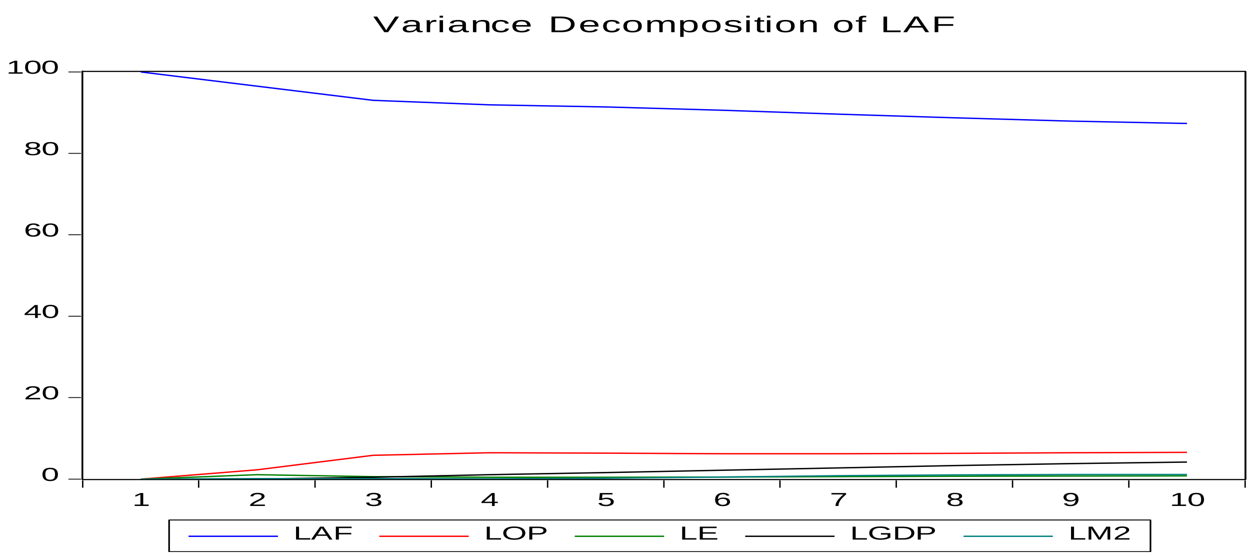
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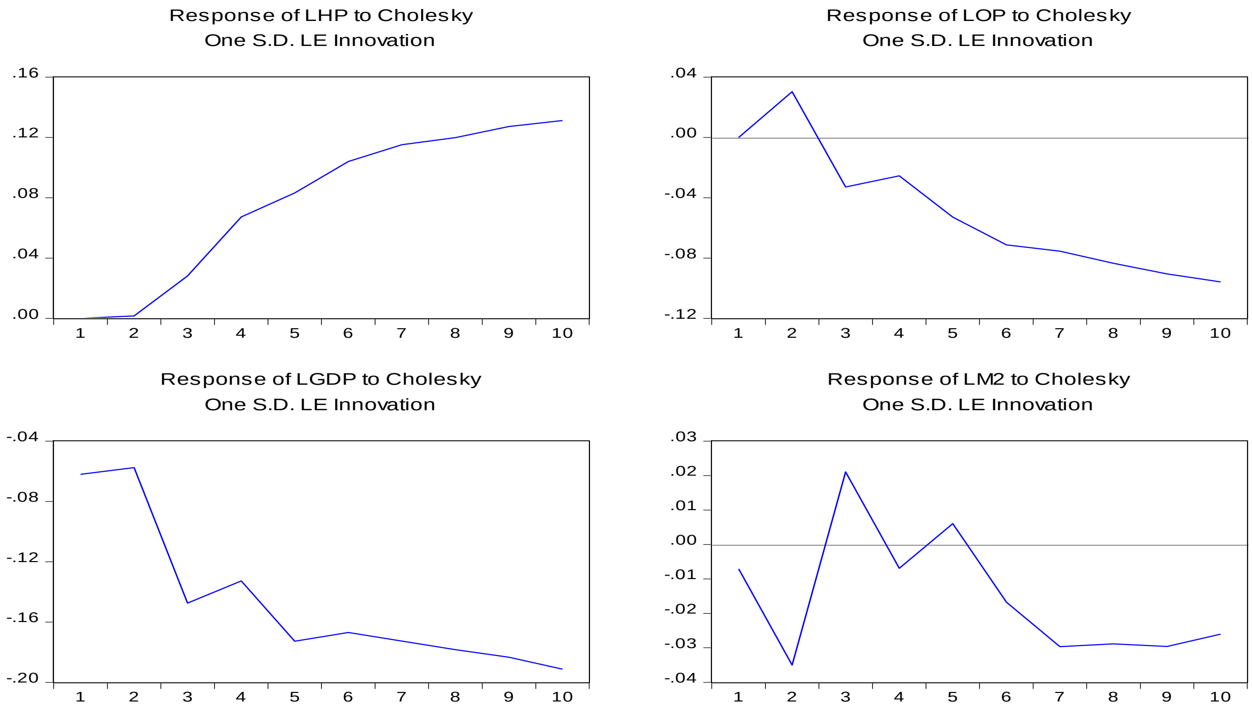
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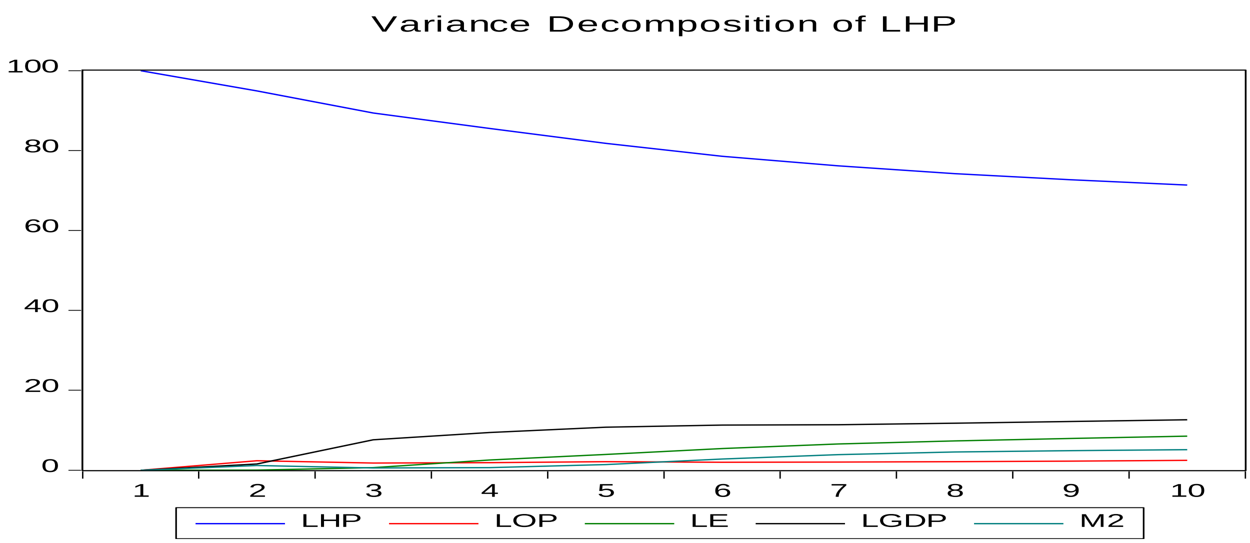
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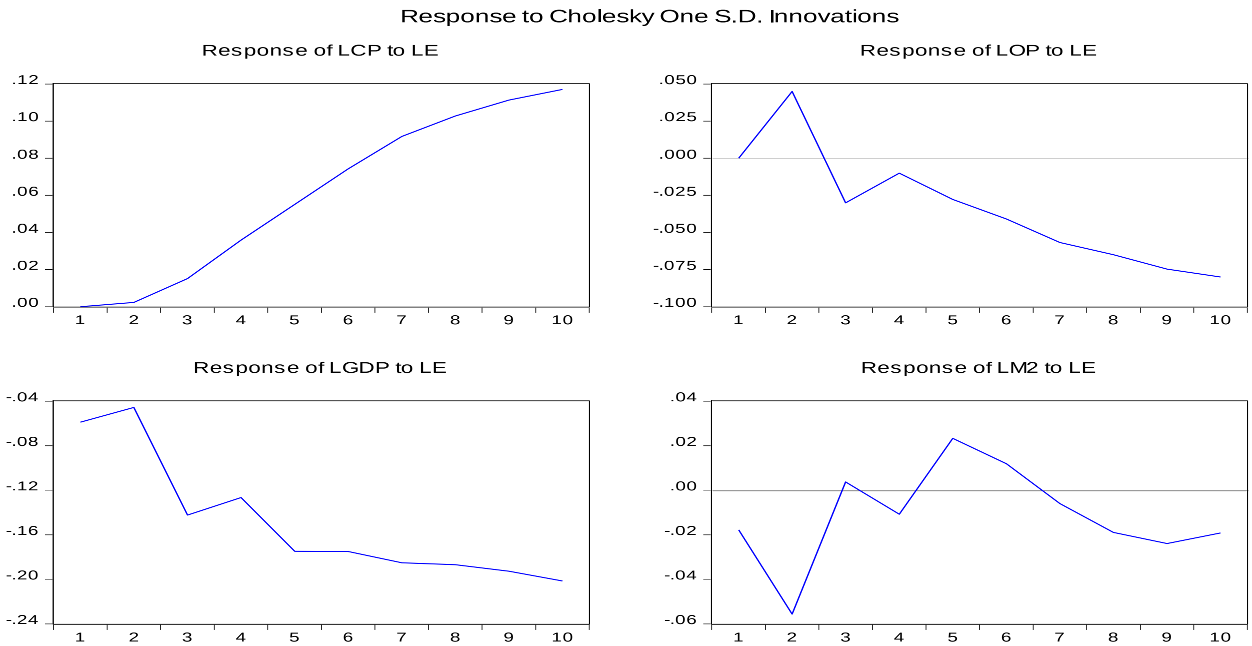
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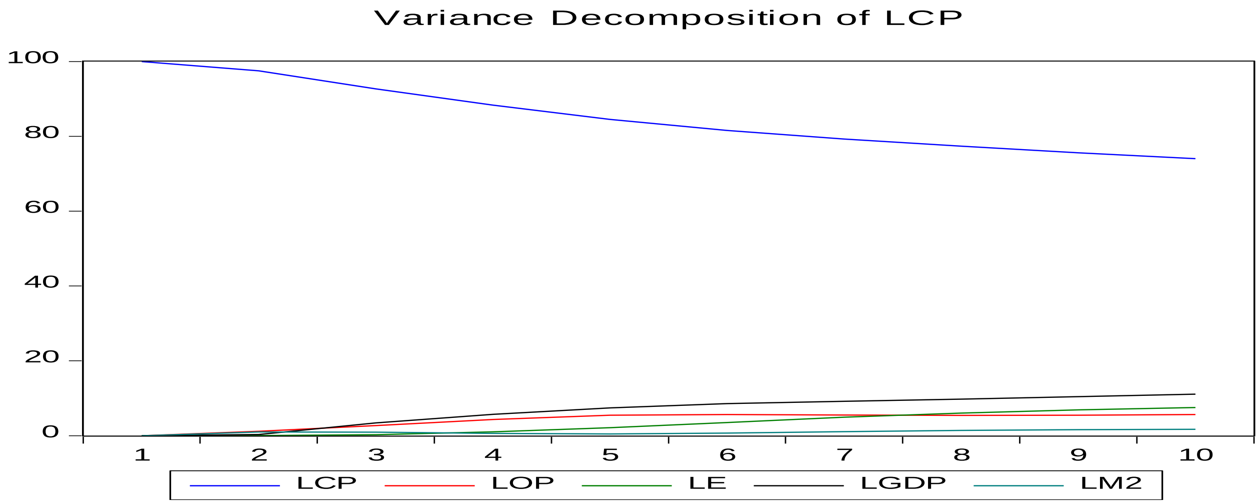
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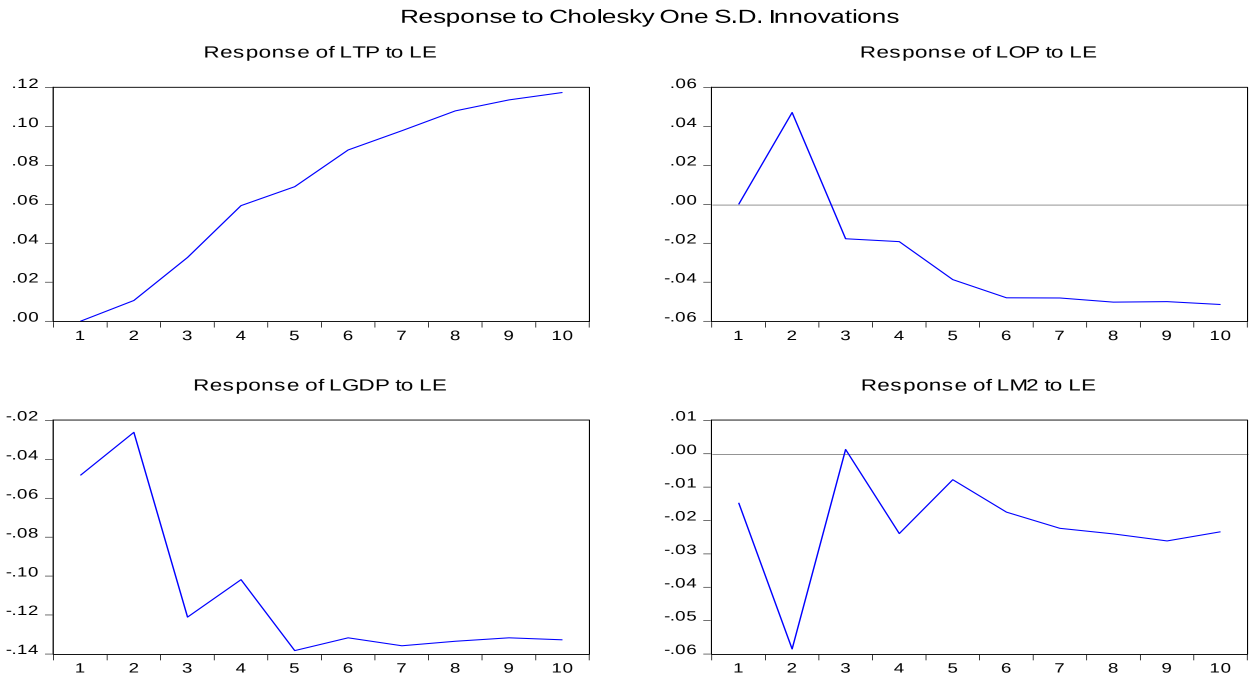
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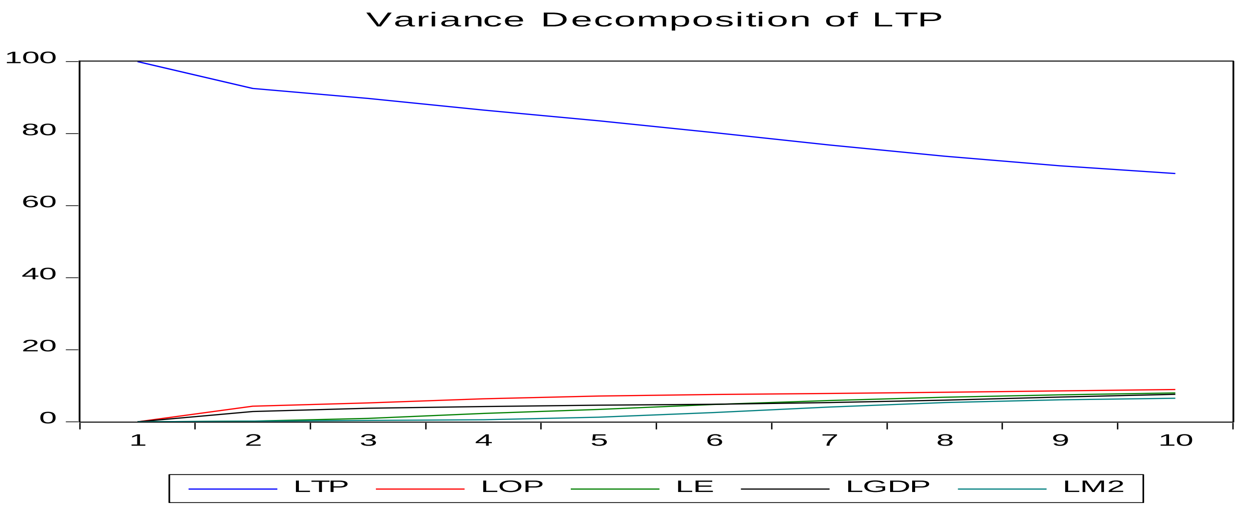
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