CLIMATE CHANGE VARIABILITY AND SUSTAINABLE DEVELOPMENT IN NIGERIA: AN APPLICATION OF VAR ANALYSIS.

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Abstract
The linkage between climate change variability and sustainable development has become topical in the past few decades. The aim of the paper is to examine empirically the impact of climate change on the level of sustainable development in Nigeria. To achieve the objective, two questions were posed: what is the relationship between climate change variability and sustainable development? Is carbon dioxide emission an impediment to sustainable development? The co-integration and VAR techniques were applied. This was commenced by conducting the unit root test and in this case the Augmented Dickey Fuller (ADF) unit root test was adopted. This was followed by estimating the long run static relationship by conducting the Johansen co-integration test. Relevant diagnostic checks were conducted as well as the forecast error variance decomposition. Both the long run statistic and short run dynamic results suggest that excessive rainfall has a negative and significant impact on the level of economic growth in Nigeria. This is an indication of the negative consequences of climate change on the level of sustainable development in Nigeria. Gas flaring, a source of carbon emission and hence a causative factor of climate change according to the results has a detrimental impact on the level of sustainable development in Nigeria. The result recommends concerted efforts to reduce the negative effect of climate change and put an end to gas flaring in Nigeria.

Keywords: *Climate change; rainfall; Gas flaring; Sustainable development; Co-integration; Vector autoregression.*

Background to the Study

Globally, climate change variability and its impact on the wellbeing of mankind has become a topical and polemical issue in contemporary times. Edame et al (2011) argued that climate change has been described as the most significant environmental threat of the 21st century. The stark manifestation of climate change variability spans all facets of human existence. Climate change variability has visibly manifested as sea-level rise with its negative impacts, desert encroachment, poverty, malnutrition, health, severe droughts in key-food-producing areas of the country, coastal erosion and collapse of irrigation system all of which hinders the realization of sustainable development. The climate change and sustainable development nexus in really appreciated in literature for its long term global concern.

Also, the implication of climate change variability is evidenced on low crop yields, deforestation, and high temperatures which threaten the economic wellbeing of Nigerians. The floods of October, 2012 were a clear manifestation of the reality of climate change. The United Nations Framework for Climate Change defines climate change as a change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which in addition to natural variability. The IPCC (2001) also defines climate change as any change in climate, whether to natural variability or as a result of human activity.

At the moment, Nigeria is in a vulnerable situation because she does not have the financial capacity and technology to protect it wisely from climate change variability. This above predicament put Nigeria in a precarious position.

In recent years, climate change variability issues have arrested the attention of stakeholders in the economic space of Nigeria. The importance of carbon dioxide emissions (an important factor in climate change), variation in temperature, precipitation and global warming are well documented in literature. Ever since the Earth summit in Rio and a follow up in Kyoto protocol mechanism, there has been concerted efforts to limit the emission of green house gases (GHGs) globally, yet the issue of global warming persists. Against this background, the objective of this paper is to investigate the relationship between climate change variability and sustainable development in Nigeria with a view to highlighting policy options for Nigeria. To realize the above objective the following questions are posed: what is the relationship between climate change and sustainable development? Is carbon emission an impediment to sustainable development? The rest of the paper in structure as follows. Following this introductory section is section two which is on theoretical framework and literature review. In section 3, we have methodology, section four is about presentation of results and findings. Section five concludes the paper.

Theoretical framework and Review of Literature

This paper explores one theory in Environmental Economics literature that explains growth –environmental quality trajectory. This is called Environmental Kuznets Curve. The hypothesis postulates an inverted U-shaped relationship between environmental quality and income per capital. The theoretical content of EKC hypothesis is revealing and appealing. At the early stages of industrialization, pollution grows more rapidly because people are interested in income than the environment. At the later stage of industrialization and as income increases, the concern for environmental quality increases than the desire for income and pollution starts to fall (Kijima, Nishide and Ohyama 2010). Against this backdrop, the theoretical underpinning of this study is couched on the Environmental Kuznets Curve hypothesis.

IPCC (2001), defined the climate system as anon-interactive system consisting of five major components: atmosphere, hydrosphere, land surface and biosphere. The system is being driven by continuous flow of energy from the sun. This flow must be sent back from the earth so as to maintain equilibrium. Ana and Fakunle (2010) argued that climate change is one of the most critical concerns of humanity today. Man has succeeded is harnessing natural resources to support the earth's inhabitants level to consumption. Industrial development is a major driver of fossil fuel usage in all modern economics. From the usage of fossil fuel comes a dangerous by product (green-house gases) which is the casual factor of World's climate change. Sustainable development as a concept is all about the allocation and the present human needs without affecting the ability of future generations to meet their needs. Ajie and Ewubare (2011) posited that the economics of sustainable development considers issues related to land use, demography, energy, the environmental and conservation of natural resources. In exploring the impact of climate change on sustainable development in Nigeria, we look at cost of climate change variability to the economy. Eboh et al as cited in Onuoha (2010) put the cost of gas flaring at about $2.5billion annually, 8% of grazing and savanna density have been lost in the past forty years and crop decline cost for the past 30 years has been estimated at about $3.1billion The goal of sustainable development involves the pursuit and realization of economic prosperity, environmental quality and social equity. Surveys and studies have shown that climate change variability impacts negatively on economic activity globally (Dell, Jones and Olken, 2008.Marzo, 2003; Nikerson, 2004). Empirical evidence on the nexus between economic growth and environmental quality is mixed, while some studies found a linear relationship between the two variables (see Fodha and Zaughduoled, De, Brauyn, etal, 1998 and Shafik, 1994), others found and inverted U-shaped relationship in line with Environmental Kuznets Curve hypothesis (for instance, Grooman & Krueger, 1995; Jalil and Mahmud, 2009). Yet others confirmed an N-shaped relationship (for example Friedl and Getzner, 2003).

Studies in Africa and specifically on Nigeria with respect to economic growth and environmental quality have also been mixed. See (Omojolaibi 2010), while Bello and Abimbola (2010) and Olusegun 2009 found a U-shaped relationship, Chuku (2011) confirmed an N-Shaped relationship. Drawing from the foregoing, this research effort is to add to the knowledge stock of climate change dynamics and sustainable development in Nigeria. Findings from the study will therefore provide information to guide policy makers on climate change-sustainable development issues. The above is therefore the justification for our study.

Methodology

To investigate the response of sustainable development to climate change varibility and innovations, an unrestricted Vector Autoregressive Model (VAR) is adopted. The VAR model provides a multivariate framework where changes in a particular variable (climate change variability (are related to changes in its own lags and to changes in other variables and the lags of those variables. The VAR treats all variables as endogenous and does not impose a priori restrictions on structural relationships i.e. it is atheoretic, VAR framework expresses the dependent variables in terms of predetermined lagged variables, framework a reduced-form model evolves. Once the VAR has been estimated, the relative importance of a variable in generating variations in its own value and in the value of other variables can be examined (Forecast Error Variance Decomposition (VDC)). FEDC assess the relative importance of climate change variables shocks in the volatility of other variables in the system. The dynamic response of climate change variables to innovations in a particular variable can also be traced out using the simulated responses of the estimated VAR system (Impulse Response Functions(IRF)). Thus, the IRF enables the determination of the dynamic effects of climate shocks on GDP. The unrestricted VAR model of order p is presented in equation (1).

$$Yt = A1Yt + \ldots.. + ApYt - p + Bzt + \varepsilon t \qquad (1)$$

Where yt is a vector of endogenous variables, zt is a vector of exogenous variables, Ai and B are coefficient matrices and p is the lag length. The innovation process et is an unobservable zero-mean white noise process with a time invariant positive-definitive variance – covariance matrix. The VAR system can be transformed into its moving average representation in order to analyze the system's response to real climate change variability.

$$Yt = \mu \Sigma yi\, \varepsilon t - 1 \qquad (2)$$

Where γo is the identity matrix, μ is the mean of the process. The moving average representation is used to obtain the forecast error variance decomposition and impulse response function.

In the restricted VAR models, the vector of endogenous variables, according to our first Cholesky ordering, consist of climate change variables such as temperature, rainfall, relative humidity, gas flaring and Real Gross Domestic Product:

$$RGDPt = (RFALL, RH, GASFL, TEMP) \qquad (3)$$

The innovations of current and past one-step ahead forecast errors are orthogonialised using Cholesky decomposition so that the resulting covariance matrix is diagonal. This assumes that the first variable in a pre-specified ordering has an immediate impact on all variables in the system, excluding the first variable and so on. In fact, pre-specified ordering of variables is important and can change the dynamics of a VAR system. The vector of exogenous variables is given by:

zt = (constant, B1, B2, B3, B4,) (3)

where B1 – B4 refers to all other important exogenous variables during the period 1980 – 2012.

LRGDP =0+1LRFALL + 2LRH + 3LGASFL + 4LTEMP +t

1, 2, 3<0, 4>0

Where:

RGDP = Real Gross Domestic Product

RFALL= Annual rainfall

RH = Relative humidity

GASFL= Total Gas flared in Nigeria

TEMP = Annual temperature
t = Error term
L = Natural logarithm

Sources of Data
The data were collected from the Central Bank of Nigeria statistical bulletin, world bank indicators for Nigeria and publications of the Niger Delta Development Commission (NDDC). The data covered the period between 1980 and 2012.

Results and Findings
The long run static result is shown in table 1 below:

Table 1: Long run static results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRFALL	-0.432808	0.173109	-2.500204	0.0223
LGASFL	-0.454316	0.167069	-2.719327	0.0105
LRH	0.587707	1.136547	0.517099	0.6114
LTEMP	2.257199	0.386645	5.837913	0.0000
C	4.118721	4.046184	1.017927	0.3222

R2= 0.86, adjusted R2= 0.84, Fstatistic =30.04

The result shows that rainfall in Nigeria has a significant and negative relationship with the level of economic grow in the Nigeria. The result shows that an increase in the annual rainfall by 1 percent reduced the level of economic growth by 43 percent. The result also shows that the total gas flared has negatively affected the level of economic growth in Nigeria. The result shows that an increase in gas flaring by 1 percent will reduce the level of economic growth by 45 percent. The relatively humidity and temperature did not constitute a serious threat to economic progress in Nigeria.

The Augmented Dickey Fuller (ADF) unit root test was used to ascertain whether the variables are stationary or not and their order of integration. The result of the ADF unit root test is shown in table 2 below:

Table2: Summary of ADF unit root test result

Variables	Level data	First difference	1 % CV	5 % CV	10% CV	Order of integration
GASFL	O.82	3.48*	-3.81	-3.01	2.65	I(1)
RGDP	-3.07**	-1.02	-3.81	-3.01	2.65	I(0)
TEMP	-1.42	-3.53**	-3.81	-3.01	2.65	I(1)
RH	-3.09*	-5.45	-3.81	-3.01	2.65	I(0)
RFALL	1.29	-4.85*	-3.81	-3.01	2.65	I(1)

*** indicates significance at the 1 percent level while ** indicates significance at 5 percent level**

The ADF result shows that with the exception of relative humidity and Real Gross Domestic Product which were stationary at the levels probably because they are ratio variables, the other variables were stationary after the first difference was taken. Thus, following Harris(1991) and Gujarrati(2003), both (1) and I(0) variables can be carried forward to test for cointegration which forms the next stage of the analysis.

Co integration test

The Johansen methodology which has the advantage amongst others for allowing for more than one cointegrating equations was used to test for possible long run relationship among the variables. The result of the Johansen cointegration test is shown in table3 below:

Table3: Summary of Johansen cointegration test result

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.838973	83.09273	68.52	76.07
At most 1	0.676799	44.74288	47.21	54.46
At most 2	0.486014	21.02377	29.68	35.65
At most 3	0.205477	7.047031	15.41	20.04
At most 4	0.100179	2.216747	3.76	6.65
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.838973	38.34985	33.46	38.77
At most 1	0.676799	23.71910	27.07	32.24
At most 2	0.486014	13.97674	20.97	25.52
At most 3	0.205477	4.830284	14.07	18.63
At most 4	0.100179	2.216747	3.76	6.65
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level				
Max-eigenvalue test indicates no cointegration at the 1% level				

Both the trace statistic and the Max-Eigen test indicate one cointegrating equation each at the 5 percent level. The existence of at least one cointegrating equation thus permits us to estimate the parsimonious and overparameterize ECM results.

The short run dynamic ECM result did not deviate from the long run static result. The result shows that both at the two period lags and current period, the level of rainfall has a negative and significant impact on the level of economic growth in Nigeria. The result shows that an increase in the rainfall level by 1 percent decreased the level of economic growth by 40 percent in the current period and 41 percent in the immediate past two periods. The gas flaring which is a major cause of climate change showed a negative, but significant relationship with the level of economic growth. This is an indication that gas flaring has a detrimental impact on the level of economic growth in Nigeria. The result further indicated temperature variability and changes in relative humidity did not constitute any threat to the level of economic growth in Nigeria. The result of the Jarque-bera normality test with probability of 0.92 ass shown in the appendix is an indicated that the residuals are normally distributed. The white heteroskedasticity test indicates the absence of serial correlation in the residuals and the white hetereskedasticity test indicates that the errors are homoskedastic as shown in the appendix. The Cumulative Sum of recursive Residuals(CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) shown in the appendix indicate model stability. The result of the vector autoregression indicates that in most of the cases, rainfall and gas flaring had negative impact on the level of economic growth in Nigeria. This result supports the long run static relationship and the short run dynamic specification.

Cholesky Ordering Variance decomposition

Table4vb: Cholesky variance decomposition

Variance Decomposition of LRGDP:						
Period	S.E.	LRGDP	LRFALL	LGASFL	LRH	LTEMP
1	0.047283	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.083418	83.55048	0.247742	1.652424	6.160856	8.388495
3	0.119029	75.35106	0.588848	0.956028	13.72349	9.380578
4	0.148157	75.94308	0.422219	0.815707	15.82352	6.995477
5	0.181878	77.56532	2.812940	0.752268	13.59085	5.278629
6	0.218856	77.65831	5.539340	0.845950	11.89637	4.060027
7	0.257081	77.55174	6.821136	1.016184	11.30107	3.309869
8	0.299117	77.78329	7.847254	1.017818	10.64420	2.707438
9	0.345809	77.80851	8.964751	1.018095	9.976954	2.231685
10	0.397583	77.70867	9.780311	1.038624	9.528234	1.944159
Variance Decomposition of LRFALL:						
Period	S.E.	LRGDP	LRFALL	LGASFL	LRH	LTEMP
1	0.192006	7.366483	92.63352	0.000000	0.000000	0.000000
2	0.215297	6.031972	74.76085	16.42805	2.772740	0.006390
3	0.228689	11.11411	68.73668	14.60214	3.032641	2.514427
4	0.255878	12.06716	67.33630	11.91755	3.060729	5.618259
5	0.270822	14.06029	64.94088	11.62692	3.014152	6.357750
6	0.277083	17.02571	62.24512	11.10956	3.533501	6.086107
7	0.284027	19.65852	60.02628	10.65195	3.587460	6.075791
8	0.298158	24.03490	57.12004	9.699219	3.392766	5.753074
9	0.309887	27.83100	53.88063	9.073274	3.824517	5.390586
10	0.322424	31.66101	50.27353	8.513110	4.487713	5.064640
Variance Decomposition of LGASFL:						
Period	S.E.	LRGDP	LRFALL	LGASFL	LRH	LTEMP
1	0.248837	5.253621	21.82983	72.91655	0.000000	0.000000
2	0.273286	4.715671	19.46619	74.86431	0.683101	0.270724
3	0.322741	3.637119	21.42787	55.60775	1.203186	18.12408

4	0.375356	2.769804	36.46514	42.80627	3.017720	14.94106
5	0.395851	2.611176	41.35537	38.87022	3.361168	13.80207
6	0.400943	2.740293	41.09465	38.22184	3.319571	14.62365
7	0.403760	2.703494	41.41439	37.69060	3.553538	14.63799
8	0.406373	2.671343	41.72821	37.21413	3.771657	14.61466
9	0.406796	2.799876	41.67727	37.15553	3.780081	14.58725
10	0.407130	2.901166	41.63900	37.10838	3.786970	14.56448
Variance Decomposition of LRH:						
Period	S.E.	LRGDP	LRFALL	LGASFL	LRH	LTEMP
1	0.016397	0.774255	32.95602	0.000210	66.26952	0.000000
2	0.018230	2.376753	27.13470	11.41665	56.68300	2.388896
3	0.027226	17.37801	29.82338	6.734319	33.35859	12.70570
4	0.030583	16.84984	37.76257	8.389154	26.45482	10.54362
5	0.032939	20.32536	33.20323	7.645340	25.03838	13.78769
6	0.034158	23.87150	30.87705	7.155143	24.27765	13.81866
7	0.035949	28.21243	30.59228	6.637736	22.07738	12.48018
8	0.038789	33.92588	29.62308	5.743050	19.36095	11.34705
9	0.040776	37.89101	27.36089	5.427074	19.01685	10.30417
10	0.043351	42.76559	25.07813	4.911280	17.97874	9.266269
Variance Decomposition of LTEMP:						
Period	S.E.	LRGDP	LRFALL	LGASFL	LRH	LTEMP
1	0.041677	13.51830	16.75748	0.361496	5.437731	63.92498
2	0.052996	14.83901	34.09902	1.625765	9.900451	39.53575
3	0.057031	18.74742	31.52825	1.773388	12.76772	35.18321
4	0.064761	30.90810	25.49394	1.417158	11.31930	30.86150
5	0.069623	37.00688	22.31160	1.568558	12.40055	26.71241
6	0.076210	43.50661	19.45675	1.708406	12.45980	22.86844
7	0.084941	50.61989	18.15871	1.427838	11.25412	18.53945
8	0.094054	55.17495	17.25311	1.534627	10.80849	15.22883
9	0.104999	59.49876	16.11534	1.460444	10.35913	12.56633
10	0.117060	63.23063	15.26579	1.348707	9.936945	10.21793
Cholesky Ordering: LRGDP LRFALL LGASFL LRH LTEMP						

The result of the variance decomposition shows that shocks the real level of economic growth explains about 100 percent of changes in itself in the first period. Shocks to rainfall explains about 3 percent of changes in economic growth in the fifth period which increased to about 10 percent in the last period. Shocks to gas flaring did not explain significant percentage of changes in economic growth in most of the study period. Rainfall explains about 93 percent of shocks to itself in the first period which decreased to about 50 percent in the last period. Shocks to gas flaring explains about 16 percent of changes in rainfall in the second period but reduced to 9 percent in the last period.

Conclusion & Recommendations

The impact of climate change on the Nigerian economy is becoming more glaring by each passing day. The excess rainfall in some parts of the country that has made thousands of people homeless and others to lose their lives are indications of the negative consequence of climate change on the Nigerian economy. The destruction of farmland and property which costs billions of naira has made lots of people jobless and has also affected the foreign exchange earnings of the country. The result shows that excessive rainfall has a negative and significant relationship with the level of economic growth in Nigeria. Gas flaring which is a causative factor of climate change and a contributory factor to carbon emissions has also negatively affected the level of economic progress in Nigeria. The result thus recommends that concerted efforts be made by both the Nigerian government and the international community to reduce gas flaring to the barest minimum and disaster management be taken more seriously to reduce the negative effect of climate change on the level of sustainable developmen in Nigeria

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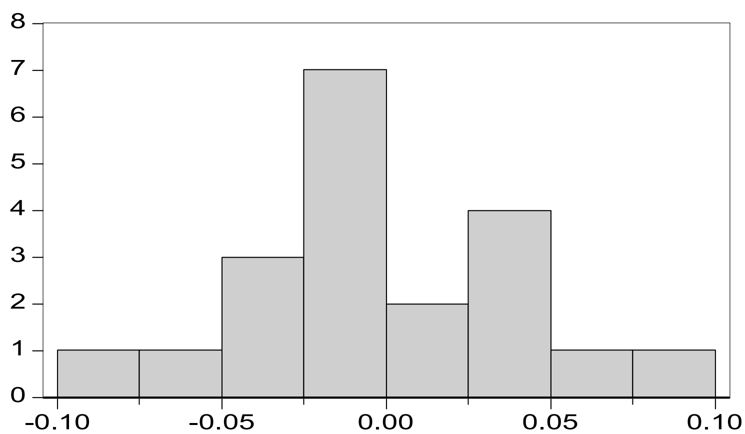
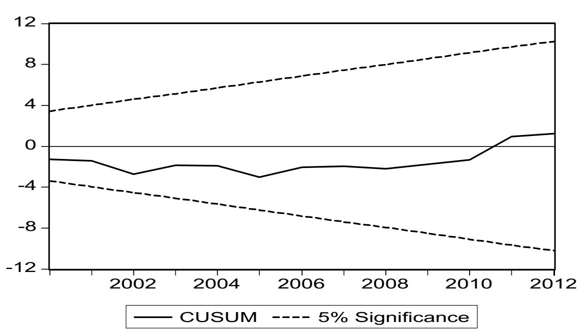
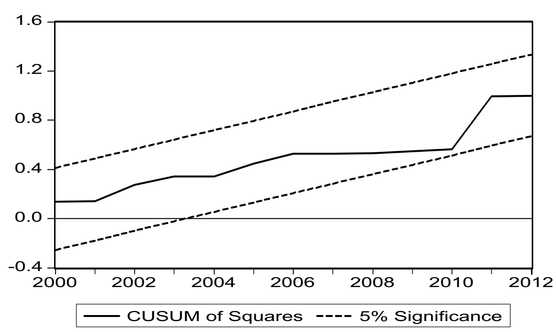
Appendix



Series: Residuals
Sample 1993 2012
Observations 20

Mean	-1.73E-17
Median	-0.003212
Maximum	0.088086
Minimum	-0.079658
Std. Dev.	0.039655
Skewness	0.219520
Kurtosis	2.982385
Jarque-Bera	0.160889
Probability	0.922706



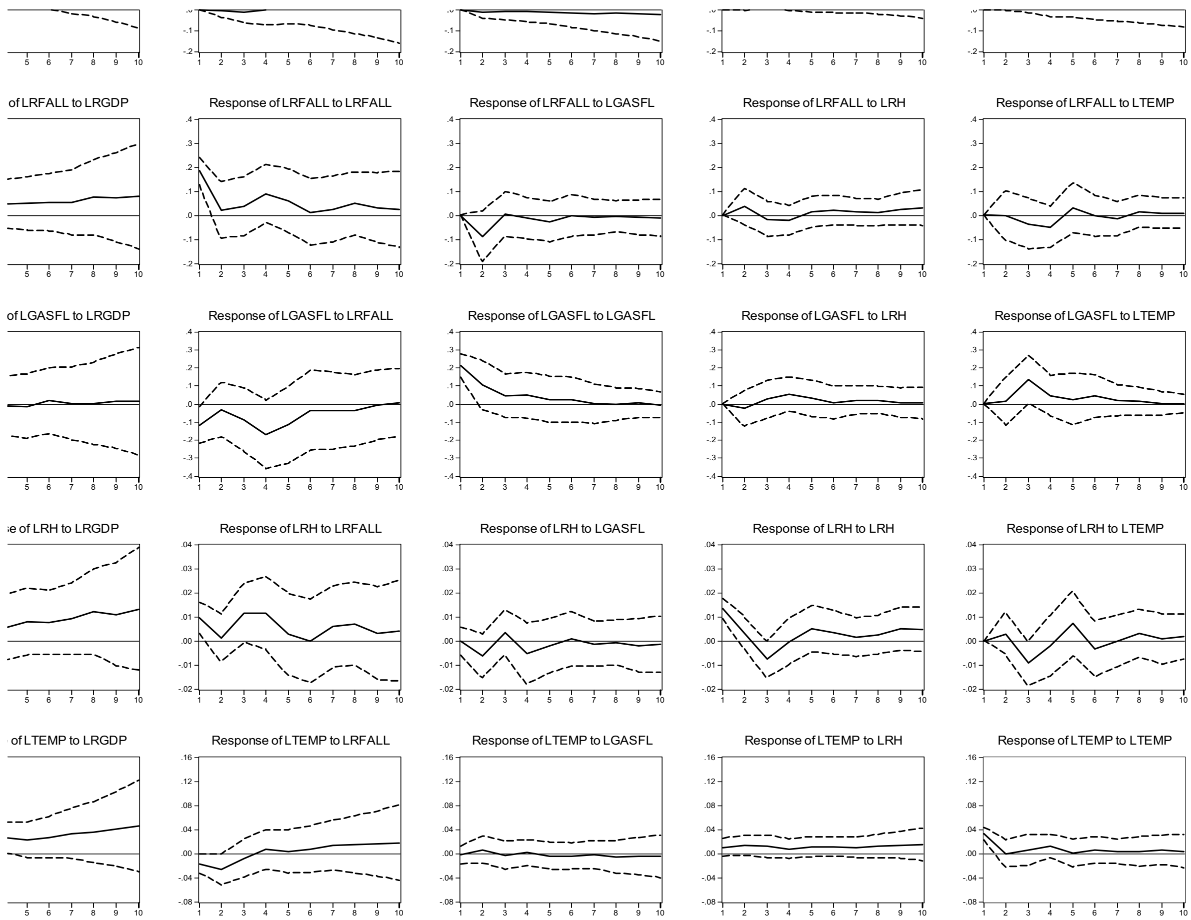


Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	1.020030	Probability		0.392303
Obs*R-squared	3.128913	Probability		0.209202
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLRFALL	-0.035516	0.063433	-0.559900	0.5868
DLRFALL(-2)	-0.017598	0.069873	-0.251856	0.8058
DLGASFL(-2)	-0.015119	0.061187	-0.247089	0.8094
DLRH(-2)	0.291386	0.536275	0.543352	0.5977
DLTEMP(-1)	0.117087	0.267129	0.438318	0.6696
ECM(-1)	0.141203	0.323432	0.436578	0.6709
C	0.000851	0.011632	0.073196	0.9430
RESID(-1)	-0.315516	0.410877	-0.767907	0.4587
RESID(-2)	0.435709	0.506470	0.860285	0.4080

White heteroskedasticity

F-statistic	2.441261	Probability		0.121479
Obs*R-squared	16.14273	Probability		0.184786
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000594	0.000735	0.808822	0.4452
DLRFALL	-0.009599	0.002907	-3.301659	0.0131
DLRFALL^2	0.006576	0.005969	1.101775	0.3070
DLRFALL(-2)	-2.67E-05	0.002848	-0.009382	0.9928
DLRFALL(-2)^2	0.006905	0.007393	0.933887	0.3814
DLGASFL(-2)	0.006690	0.002565	2.607836	0.0350
DLGASFL(-2)^2	0.000989	0.004468	0.221347	0.8311
DLRH(-2)	0.014609	0.020746	0.704170	0.5041
DLRH(-2)^2	-0.408507	0.586817	-0.696141	0.5088
DLTEMP(-1)	0.076757	0.033423	2.296522	0.0553
DLTEMP(-1)^2	-0.416330	0.256995	-1.619996	0.1493
ECM(-1)	0.026395	0.015309	1.724089	0.1284
ECM(-1)^2	0.119097	0.122223	0.974421	0.3623

Impulse response



The result of the overparameterize ECM is shown in table 4 below

Table 4: Summary of Overparameterize ECM result. Modeling GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLRFALL	-0.869035	0.165638	-5.246582	0.0000
DLRFALL(-1)	0.168775	0.093204	1.810815	0.1201
DLRFALL(-2)	-0.200699	0.093509	-2.146319	0.0755
DLGASFL	0.031816	0.049185	0.646857	0.5417
DLGASFL(-1)	-0.003582	0.046379	-0.077228	0.9410
DLGASFL(-2)	-0.967973	.0.146379	-6.612795	0.0000
DLRH	-0.949511	0.552908	-1.717303	0.1367
DLRH(-1)	-0.446698	0.443326	-1.007607	0.3525
DLRH(-2)	1.934841	0.371788	5.204155	0.0001
DLTEMP	0.491692	0.260126	1.890204	0.1076
DLTEMP(-1)	0.794500	0.197815	4.016370	0.0003
DLTEMP(-2)	0.334578	0.358051	0.934443	0.3861
ECM(-1)	-0.804358	0.089032	-9.034514	0.0000
C	0.023861	0.012110	1.970372	0.0963

R2= 0.62, Fstatistic = 42.62, AIC = 3.48, SC = 2.78, DW= 2.00,
The overparameterize ECM result included two lags of each independent variable. The parsimonious (preferred) ECM result was gotten by deleting insignificant variables from the overparameterize ECM result in table 4. the result of the parsimonious ECM result is shown in table5 below:

Table 5: Summary of Parsimonious ECM result. Modeling GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLRFALL	-0.396659	0.141286	-2.807485	0.0109
DLRFALL(-2)	-0.407183	0.059263	-6.870795	0.0000
DLGASFL(-2)	-0.483865	0.105695	-4.577960	0.0001
DLRH(-2)	0.377621	0.160274	2.356096	0.0260
DLTEMP(-1)	0.376539	0.187319	2.010144	0.0549
ECM(-1)	-0.578045	0.244427	-2.364901	0.0343
C	0.039586	0.011344	3.489639	0.0040

R2= 0.71, Fstatistic = 42.62, AIC = -2.97, SC = -2.62, DW= 2.14,

Vector Autoregression

Table 6: Vector autoregression

Vector Autoregression Estimates					
	LRGDP	LRFALL	LGASFL	LRH	LTEMP
LRGDP(-1)	1.149200	-0.715496	-0.754496	0.076063	0.471987
	(0.31804)	(1.29149)	(1.67375)	(0.11029)	(0.28033)
	[3.61340]	[-0.55401]	[-0.45078]	[0.68965]	[1.68366]
LRGDP(-2)	-0.350999	0.234228	-0.458639	0.072841	-0.112204
	(0.26703)	(1.08435)	(1.40531)	(0.09260)	(0.23537)
	[-1.31446]	[0.21601]	[-0.32636]	[0.78660]	[-0.47671]
LRFALL(-1)	-0.033950	-0.280672	-0.278668	-0.012063	-0.173056
	(0.10550)	(0.42842)	(0.55523)	(0.03659)	(0.09299)
	[-0.32179]	[-0.65513]	[-0.50190]	[-0.32969]	[-1.86093]

LRFALL(-2)	0.085236	-0.209929	-0.077346	0.087048	-0.104437
	(0.11418)	(0.46368)	(0.60092)	(0.03960)	(0.10065)
	[0.74648]	[-0.45275]	[-0.12871]	[2.19831]	[-1.03766]
LGASFL(-1)	-0.041800	-0.410984	-0.493047	-0.027971	0.029622
	(0.05920)	(0.24038)	(0.31153)	(0.02053)	(0.05218)
	[-0.70613]	[-1.70970]	[-1.58264]	[-1.36256]	[0.56772]
LGASFL(-2)	0.050469	-0.204038	-0.030461	0.027437	-0.051670
	(0.05635)	(0.22883)	(0.29656)	(0.01954)	(0.04967)
	[0.89563]	[-0.89167]	[-0.10272]	[1.40404]	[-1.04027]
LRH(-1)	1.023248	2.723357	-2.002817	0.177693	1.016650
	(0.66140)	(2.68583)	(3.48080)	(0.22937)	(0.58299)
	[1.54708]	[1.01397]	[-0.57539]	[0.77471]	[1.74385]
LRH(-2)	0.233920	-1.730144	-0.021166	-0.590540	0.619362
	(0.66187)	(2.68771)	(3.48323)	(0.22953)	(0.58340)
	[0.35343]	[-0.64372]	[-0.00608]	[-2.57283]	[1.06164]
LTEMP(-1)	0.725046	-0.051649	0.426723	0.084557	-0.002106
	(0.37988)	(1.54262)	(1.99921)	(0.13174)	(0.33484)
	[1.90861]	[-0.03348]	[0.21345]	[0.64186]	[-0.00629]
LTEMP(-2)	-0.082848	-1.675306	4.622481	-0.337374	-0.274838
	(0.39883)	(1.61959)	(2.09896)	(0.13831)	(0.35155)
	[-0.20773]	[-1.03440]	[2.20227]	[-2.43923]	[-0.78179]
C	-5.373078	-2.270780	6.028743	4.536312	-5.312586
	(3.03769)	(12.3355)	(15.9866)	(1.05344)	(2.67756)
	[-1.76880]	[-0.18409]	[0.37711]	[4.30618]	[-1.98411]
R-squared	0.982988	0.499735	0.754625	0.770094	0.867188
Adj. R-squared	0.965977	-0.000530	0.509249	0.540187	0.734375
F-statistic	57.78358	0.998941	3.075389	3.349595	6.529416
Log likelihood	42.07643	12.64744	7.202751	64.31619	44.72645
Akaike AIC	-2.959660	-0.156899	0.361643	-5.077733	-3.212043
Schwarz SC	-2.412530	0.390231	0.908774	-4.530602	-2.664912