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Time Series Analysis of Tax Report of Federal Inland Revenue Service

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ABSTRACT

This paper discussed the effect of Nigeria's company income tax on some of the indirect tax variables in Nigeria. The data used is a time series data that ranges between a period of ten years, from 2007 to 2016. The secondary data collected were analyzed and Augmented Dickey-fuller suggested that CIT, EDT and PIT variables are stationary at level while VAT and WT became stationary at the second difference after unit root test were carried out on individual variable. Vector Error Correction Model suggested that there's a long-run relationship between the variables and Granger causality test were also conducted to investigate the direction of relationship between the company income tax and other major indirect income taxes considered and the results show that there's almost a feedback system in the data set. the effect of Tax incomes on CIT with respect to shocks were forecasted into the future for the period of ten (10) years utilizing Forecast Error Variance Decomposition(FEVD) and in period 1 only 0% of the forecast error variance is explained by shocks to Withholding Tax (WT). This percentage subsequently increases and finally increased to 8. 92% for EDT, and in the same manner it increases to 15.91%, 34.52%, 10.44% by Period 10 for PIT, VAT, WTT respectively. Clearly, 100% of the forecast error variance in Period 1 is explained by momentum (variance in past values of CIT). This percentage declines to 30.21% of the variance by Period 10

Keywords: Co-integtration; Federal Inland Revenue Service; Forecast Error Decomposition; Granger Causality; Impulse Response Function; Tax Revenue.

1. INTRODUCTION

Taxation is one of the most volatile subjects in governance both in the developing and developed nations.(Appah and Oyandonghan, 2011) defined tax as a demand or levy made compulsory on a subject or placed on properties by a particular government for provision of social amenities, infrastructure, security, and the improvement of economic condition of the society. According to Nightingale (2001), "a tax is compulsory contribution, imposed by government, and while taxpayers may receive nothing identifiable in return for their contribution, they nevertheless have the benefit of living in a relatively educated, healthy and safe society". She further explains that taxation is part of the price to be paid for an organized society and identified six reasons for taxation: provision of public goods, redistribution of income and wealth, promotion of social and economic welfare, economic stability and harmonization and regulation

Imposition of tax is made majorly to regulate production of some goods and services, economic stability, curbing inflation, provision of social amenities, creation of wealth, etc. The economic,

political and social development of any country lies upon the amount of revenue generated for the creation of infrastructural development of that country (Ogbonna and Ebimobowei 2012). However, a well-structured tax system is one means for providing substantial amount of generating revenue. Tax system is an effective way of equipping any country's internal resources and it helps in providing conducive environment for promotion of economic growth. Tax system is a legal key source of creation of revenue to the Federal Government account.

The Nigeria government operate on fiscal federalism hence it fiscal power is based on a three tiered tax structure divided between Federal, state and Local government each of which has different tax jurisdiction (Odunsola, 2006). Meanwhile, the administration responsible for taxation payable to federal government is vested upon Federal Inland Revenue Service (FIRS) Oyedokun (2020). Taxes payable to the State Governments are through State Boards of Internal Revenue (SBIRs) while those that are payable to Local Governments are through their various councils (Strachan, 2018). There are good numbers of taxes payable by persons doing business in Nigeria. However, this study aims at investigating the reactions of individual tax variable to some external change. it also examins the relationship between these taxes payable to federal inland revenue service in Nigeria by persons or firms doing business in Nigeria; these include Company Income Tax (CIT), Personal Income Tax (PIT), Value-Added Tax (VAT), Education Income Tax (EDT) and Withholding Tax (WT).

Izedonmi and Okunbo (2014) employed a regression analysis to check the role of Value Added Tax in the Economic Growth of Nigeria, he found out that VAT Revenue and Total Revenue account for 92 percent of Variations in the GDP and their result showed that the component of VAT revenue and Total revenue are important determinant of economic growth. With the same techniques Onwuchekwa and Aruwa (2014) investigated the impact of value added tax on the economic growth of Nigeria and concluded that to boost tax revenue we need to close every VAT revenue leakage and sensitizing the managers of companies operating in Nigeria and to also give proper training to Federal Inland Revenue staffs. Furthermore, Ojong *et al.* (2016) conducted a study on the impact of Tax Revenue on Economic growth. Major findings of this study revealed that there is a significant relationship between Petroleum Profit Tax and the growth of the Nigerian economy; there was a significant relationship between Non Oil Revenue and Gross Domestic Product and there is no significant relationship between Company Income Tax and Gross Domestic Profit. Ogbona and Ebimobowei (2012) in their collective research recommended that the economy should be diversified to enhance revenue base of the country and to also ride away corruption from the system. according to Johansen co-integration test 1998 confirmed that a long run relationship exists between tax reforms and economic growth and the granger causality result also shows that Tax granger cause economic growth. Salami, Apelogun, Omodiya and Ojoye (2015) in their joint research on Taxation and Nigeria Economic Growth process, established relationships between Tax variables and economic growth. Both single and ordinary least square (OLS) regression analysis was used in their research. Meanwhile, if all the exogenous variable were tested individually on the economic growth, they show a significant impact individual on economic growth. Collectively, only PPT is statistically significant to economic growth,

An appraisal study was carried out by Okwori and Sule (2016) of Revenue Sources and Economic Growth in Nigeria and applied the Cointegration test and granger causality technique on time series data on the revenue components of OIL and NOIL revenue, domestic debt, external debt and Gross Domestic Product. Chude, Daniel and Nkiru (2015) examine the impact of Company Income Taxation on the profitability of companies in Nigeria. The Augmented Dickey-fuller (ADF) unit test were employed to test for stationarity in the data, Johansen co-integration test were also carried out to test for long run relationship between the variables and the explanatory variable (CIT). However, it was concluded that Nigeria has the potential to build a prosperous economy, reduce poverty significantly,

and provide the health, education, and infrastructure services to its population need.

One of the objectives of this study is to investigate the relationship between different tax variable.Several studies had been conducted on the impacts of tax variables or Tax reforms on the growth of the economy but there have not been much studies on the impacts of these tax variables on Company Income Tax in Nigeria, hence the aim of this study is to find the relationship between company income tax and other tax variables and the objectives are:

i. To observe the trend pattern of all the tax variables
ii. To check forCointegration and Granger Causality Test of the variables.
iii. Forecast Error Variance Decomposition (FEVD) and Impulse Response Function of company income tax.

2. Materials and methods

The basic procedures and methods used in this research as discussed earlier is being designed in this session. The methods of data collection, techniques and procedures for data analysis are being discussed. Hence, the various materials and methods applied in order to actualize the various objectives listed above are discussed.

3. Method of data collection

The data used in this research is a secondary data sourced from Federal Inland Revenue Service (FIRS) Abuja, Nigeria. The data is collected over a period of ten (10) years and the data consist of 40 observations. Hence, the major tax variables considered in this research includes Company Income Tax, Education Income Tax, Personal Income Tax, Value Added Tax and Withholding Tax.

3.1 Procedure for Data Analysis

The statistical tool used in analyzing the data is presented in this research work. The descriptive and inferential characteristics of this study are analyzed and interpreted. Vector Error Correction Model and granger causality Test were used to estimate both the long and short-run relationship between the tax variables. impulse response function and forecast error variance decomposition track the impact of any variables on the others in the system. Other test such as normality test and Residual assumption test were carried out. An updated EViews8 statistical package were used in carryout this analysis. The basic steps for data analysis in this study are

3.2 Augmented Dickey-fuller (ADF)

The ADF unit root test which is used to test each of the variables to determine their order of integration for which the null hypothesis is non stationary. The number of integration of k linear variables is the maximum (m) order of integration for the group. If some variables are found to be I(1) and the other are I(2), then m=2. If some are I(0) and others are I(1), then m=1.

The vector autoregressive (VAR) model is estimated with the variables at levels regardless of the order of integration of the various time series. The roots of the characteristic polynomial will be used to check the stability condition since stability implies stationarity. The optimum lag length p for the variables in the VAR is determined using several selection criteria and test for autocorrelation can be used to confirm that the VAR model is well specified by ensuring that there is no dependency in the residuals. If there is, the lag length (p) is increased until any autocorrelation issue is resolved.

3.3 Co-integration analysis (CA)

The starting point in Johansen's procedure (1988, 1991), in determining the number of cointegrating vectors, is the VAR representation of Yt. It is assumed a vector autoregressive model of order p and is expressed as follows:

$$Y_t = A_1Y_{t-1} + A_2Y_{t-2} + \ldots + A_pY_{t-p} + BX_t'\delta + \boldsymbol{\varepsilon_t} \quad \textbf{(1)}$$

Johansen (1988) proposed two tests for estimating the number of cointegrating vectors: the Trace statistics and Maximum Eigenvalue. Trace statistics investigate the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations

Since the variables are integrated of order one (1) and some at order two (2), we then proceed to test for co-integration. Johansen (1988) cointegration

test is applied at the predetermined lag 2. In these tests, Maximum Eigenvalue statistic or Trace statistic is compared to special critical values. The maximum eigenvalue and trace tests proceed sequentially from the first hypothesis –no cointegration– to an increasing number of cointegrating vectors.

If two or more of the variables have the same order of integration, the test of cointegration is carried out to verify the existence of long-run equilibrium relationship in the time series data using johansen's methodology based on VAR model. If there is cointegration, a vector error correction model (VECM) otherwise known as restricted VAR is appropriate, but if there is no cointegration, the VAR model is more appropriate.

3.4 Granger causality (GC)

$x_t$is said to be a granger causal for y_t with respect to $F_t$if the variance of the optimal linear predictor of y_{t+h} based on F_t has a small variance than the optimal predictor of y_{t+h}based on $z_t, z_{t-1}, \ldots\ldots -$ for any h. in other word x_t is Granger causal for y_t if x_t helps predict $y_t$at some stage in the future. Sorensen (2005).

Granger Causality test is used to provide the short-run causal relationship of the determinant variables. Using standard Wald test, the null hypothesis that the coefficients of the p lagged values of a determinant variable are zero. Rejection of the null hypothesis implies a rejection in granger causality. That is a rejection support the presence of granger causality between the response variable and the determinant variable. The wald test statistics is asymptotically chi square distributed with p degrees of freedom.

The residuals are tested for normality, independence and constant variance, if no assumption is violated, the fitted model is said to be valid. If the fitted model is valid and stable, the Impulse Response Function (IRF) and forecast Error Variance Decomposition (FEVD) can be estimated to check the causal impact of unexpected shocks in the model.

3.5 Results

Table 1 gives summation of all observation of each variable. The measures of central tendency, maximum and minimum values, and the standard deviation which provide the variability in the distribution. Company Income Tax (CIT), Education Income Tax (EDT), Personal Income Tax (PIT) are all positively skewed, while Value Added Tax (VAT), Withholding Tax (WT) are negatively skewed. Education income Tax and Personal Income Tax are highly skewed indicating a non- normal distribution. The Company income Tax(CIT) and the Value Added Tax have a kurtosis of about 3 which indicates a normal distribution while the Withholding Tax is platykurtic i.e. it has a kurtosis less than 3 which suggest that the distribution produces fewer and less extreme outliers than does the normal distribution. Education income Tax and Personal Income Tax are leptokurtic because they produce a distribution with a kurtosis greater than 3. The Jarque-Bera test suggests that education and personal income tax are non-normal at 0.05 significant level.

Figure 1 shows the trend of Company income tax from year 2007 to 2016.it also illustrates a steady increase from year 2007 to 2008 and peaked in the third quarter of year 2009 and subsequently fluctuates till the third quarter of 2011. It then reached its peak in the second quarter of 2012 and third quarter of 2015, afterward, it fall drastically in the fourth quarter of 2016.

Figure 2, illustrates the trend of Company income tax from year 2007 to 2016. The figure illustrate a steady increase from year 2007 till the second quarter of 2008, its then slightly peak in third quarter of 2008 and fluctuates steadily till first quarter of 2015 where it has it peak, after, it rapidly fall till fourth quarter of 2016

figure3, above shows the trend of Company income tax from year 2007 to 2016. There is an upward and downward movement of all the years. It drastically increased in the fourth quarter of 2012 and reached it peak in the fourth quarter of 2015 and fall drastically in the fourth quarter of 2016.

Figure 4 illustrates the trend of Company income tax from year 2007 to 2016.the series started from 4.0E+10 in the first quarter of 2007 and continue to

grow rapidly. The series then reached it peak between the fourth quarter of 2013 and fourth quarter of 2014.thereafter, it drastically drop below 2.0E+10 in the last quarter of 2016.

Figure 5 illustrates the trend of Company income tax from year 2007 to 2016.the series started above 2.0E+10 in the first quarter of 2007 and continue to grow rapidly and reached its peak in second quarter of 2013. Its slightly maintain it peak till 2014. Thereafter, it drastically drops below 2.0E+10 in the last quarter of 2016.

The results in Table 2 suggest that the null hypothesis cannot be rejected for VAT and WT at 5% level of significance. That is, the respective P-values are greater than the conventional significance level $\alpha = 0.05$. Therefore, indicating a presence of unit root and that the series is non-stationary. Meanwhile, the results suggest that three variables (CIT, EDT and PIT) are stationary at level. Since the null hypothesis cannot be rejected for some variables, in order to determine the order of integration of the non stationary time series, the same tests were applied to their first and second differences respectively.

The results in Table 3 indicates that the null hypothesis is rejected for the first difference of three variables (CIT, EDT, PIT) and it's also rejected for the second differences of two variables VAT and WT given that the p-values are less than 5% level of significance, whose results at levels indicates a non-stationary series. Therefore, all the variables are stationary at the second difference.

Table 4 shows the results of cointegrating test for CIT, EDT, PIT, VAT and WT. The trace statistic indicates 4 cointegrating equations at 0.05 level of significant since the corresponding vector of trace statistic (107.50, 62.65, 36.39, 16.53) > (69.82, 47.86, 29.80, 15.49) vectors of critical values. The maximum eigen value statistic is further employed inorder to cross check for identifying specific cointegrating vectors. This statistic reduced the cointegrating equation to one cointegrating relationship at 0.05 level of significant in this system (max-eigen statistic 44.85 > 33.88 critical value) at level.

The Autoregressive conditional heteroscedasticity (ARCH) test from table 5 assume no ARCH effect in the residual. The result shows that there is no heteroscedasticity in the residuals since the p-value 0.13 is greater than 0.05 level of significant.

Table 6 gives the residual autocorrelation test with the following p-values 0.06, 0.34, 0.19 for lag 1, 2 and 3 respectively. since the p-values are greater than 0.05 level of significant we do not reject null hypothesis and therefore conclude that there's no serial correlation at lag 1, 2 and 3 which makes all the lags appropriate for the analysis. Lag 2 will be adopted for subsequently analysis since it has the highest p-value.

Table 7 shows the Jarque-bera normality test and it reveals that EDT, PIT, and VAT are normally distributed since the null hypothesis that the process is normally distributed was not rejected at 0.05 critical level. Whereas, CIT and WT are non-normal at 0.05 critical level.

Results in Table 8 shows that the null hypotheses are rejected for some of the variables at 0.05 level of significant. therefore, EDT granger cause CIT, PIT granger cause CIT, VAT granger cause CIT, WT granger cause CIT, EDT granger cause PIT, VAT granger cause EDT, WT granger cause EDT, VAT granger cause PIT, VAT granger cause WT, Also at 0.05 level of significant WTT does not granger cause PIT and PIT does not granger cause WT vice versa. This implies that charges of EDT predicts charges of CIT, charges of PIT predicts charges of CIT, charges of VAT predicts charges of CIT, charges of WT predicts charges of CIT, charges of EDT predicts charges of PIT, charges of VAT predicts charges of EDT, charges of WT predicts charges of EDT, charges of VAT predicts charges of PIT, charges of VAT predicts charges of WT and charges of PIT does not predicts charges of WT vice versa.

Figure 7 gives the responses of company income tax to shocks on EDT, CIT, VAT, PIT, and WT. The figure reveals that a shock in CIT will lead to upward and downward positive increase in cit, shocks to EDT will lead to upward and downward positive movement of CIT but will slightly respond negatively in the fourth year, also shocks to PIT and

VAT will result to upward and downward movement in CIT but a negative movement in the fifth and ninth year respectively. Shocks to withholding tax will respond negatively to Company income tax but will respond positively in the fifth and ninth year respectively.

Table 9 suggested that at the projection of CIT to the next ten(10) periods into the future, in period 1 only 0% of the forecast error variance is explained by shocks to education income tax (EDT). This percentage increases to 8.92% by Period 10, also If CIT is projected for the next ten(10) periods into the future, in period 1 only 0% of the forecast error variance is explained by shocks to personal income tax (PIT). This percentage increases to 15.91% by Period 10, If CIT is projected for the next ten(10) periods into the future, in period 1 only 0% of the forecast error variance is explained by shocks to Value Added Tax (VAT). This percentage increases to 34.52% by period 10, if CIT is projected for the next ten(10) periods into the future, in period 1 only 0 % of the forecast error variance is explained by shocks to Withholding Tax (WT). This percentage subsequently increases and finally increased to 10.44% by Period 10, In contrast, 100 % of the forecast error variance in Period 1 is explained by momentum (variance in past values of CIT). This percentage declines to 30.21% of the variance by Period 10.

Conclusion

The study suggested that some of the variables are not stationary and were integrated at order I(1) and I(2) respectively. Also the Johansen cointegration test confirmed that there is at least one Cointegration vector, which describes the long run relationship between the charges of CIT, EDT, PIT, VAT, WT and the granger causality result shows tax variables granger cause one another.

The result in the study also suggests that all the Tax Variables has a positive effect on Company Income Tax variables except from Withholding tax which has a negative effect on Company Income Tax. Therefore, changes in EDT, PIT, VAT and WT are responsible for changes in CIT.

Results from this research help in understanding long-run effect of EDT, PIT, VAT and WT on Company Income Tax CIT in Nigeria. The study suggests a long run relationship between the Company income Tax and other Tax variables considered in this research.

It is evident from past studies that revenue generated from petroleum income tax has become the epic source of Nigeria income system and has being the major drive of revenue generated in Nigeria. It is because of this lopsided source of revenue and drops in crude oil prices that our dwindling traditional tax system has to be harnessed in order to improve the present economic woe in Nigeria. The study recommends a diversification of the economy through improvements, maintenance of tax system, has government can impacts a good change through implementation of good policies that bring about more establishments of industries, creation of employments and schools in Nigeria.

In conclusion, if the recommended points as discussed above are being considered without much ado, our dwindling traditional tax system will be improved drastically and will lead to an efficient tax system and a veritable tool of generating incomes in improving economy and infrastructural development of Nigeria.

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Table 1: Descriptive Statistics

	CIT	EDT	PIT	VAT	WT
Mean	5.62E+10	1.07E+10	1.27E+08	9.02E+10	7.09E+10
Median	4.14E+10	6.93E+09	1.08E+08	9.82E+10	7.58E+10
Maximum	1.56E+11	5.19E+10	3.75E+08	1.29E+11	1.10E+11
Minimum	3.31E+08	4.66E+08	4876078	1.73E+09	2.65E+09
Std. Dev	4.07E+10	9.83E+09	73460299	3.17E+10	2.61E+10
Skewness	0.882504	2.203585	1.393778	-0.758407	-0.520332
Kurtosis	2.839736	9.146031	5.253740	2.784391	2.473673
Jarque-Bera	5.234896	95.32808	21.41636	3.912015	2.266668
P-value	0.072989	0.000000	0.000022	0.141422	0.321958
Sum	2.25E+12	4.29E+11	5.07E+09	3.61E+12	2.84E+12
Observations	40	40	40	40	40

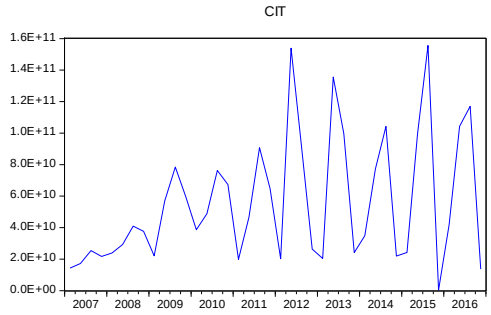

Figure 1: Time series Plot of Nigeria CIT

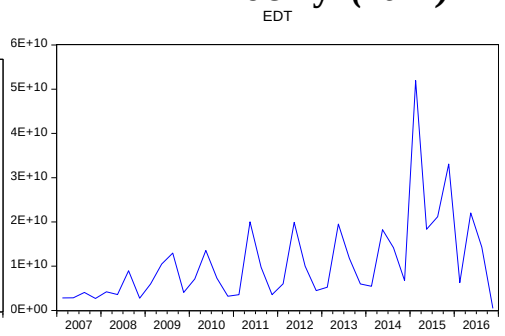

Figure 2: Time series Plot of Nigeria EDT

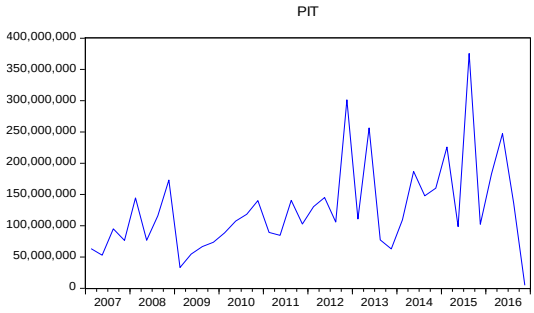

Fig. 3: Time Series Plot of Nigeria PIT

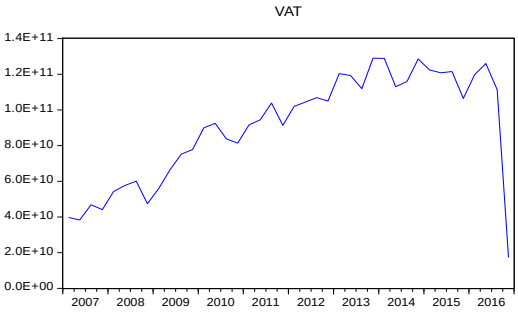

Fig. 4: Time Series Plot of Nigeria VAT

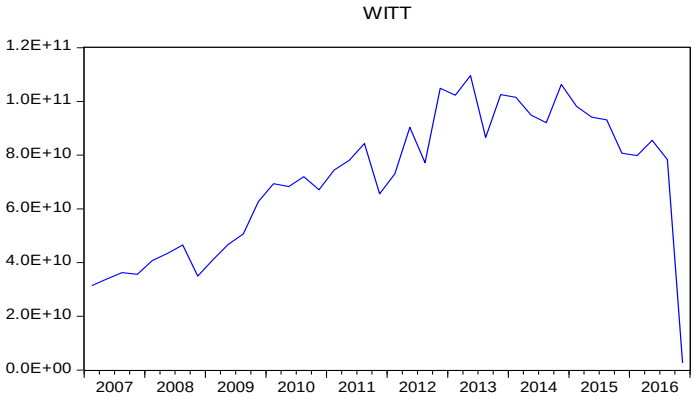

Fig. 5: Time Series Plot of Nigeria WITT

Table 2: Unit root test result (at level)

	Level with Intercept		**Level with Trend and Intercept**	
Series	**Test Statistic**	**P-value**	**Test Statistic**	**P-value**
CIT	-7.030007	0.0000	-9.386076	0.0000
EDT	-3.359060	0.0190	-4.583685	0.0039
PIT	-3.164397	0.0302	-3.833987	0.0254
VAT	-1.559615	0.4930	0.908350	0.9997
WITT	-1.233570	0.6498	1.368882	1.0000

Table 3: Unit root test result (After Difference)

Series	Difference with Intercept		Difference with Trend and Intercept	
	Test Statistic(ADF)	**P-value**	**Test Statistic(ADF)**	**P-value**
CIT(1^{ST} DIFFERENCE)	-10.72	0.00	10.59	0.00
EDT(1^{ST} DIFFERENCE)	-9.50	0.00	-9.42	0.00
PIT(1^{ST} DIFFERENCE)	-7.15	0.00	-7.13	0.00
VAT(2^{ND} DIFFERENCE)	-3.64	0.01	-3.77	0.03
WITT(2^{ND}DIFFERENCE)	-5.25	0.00	-5.32	0.00

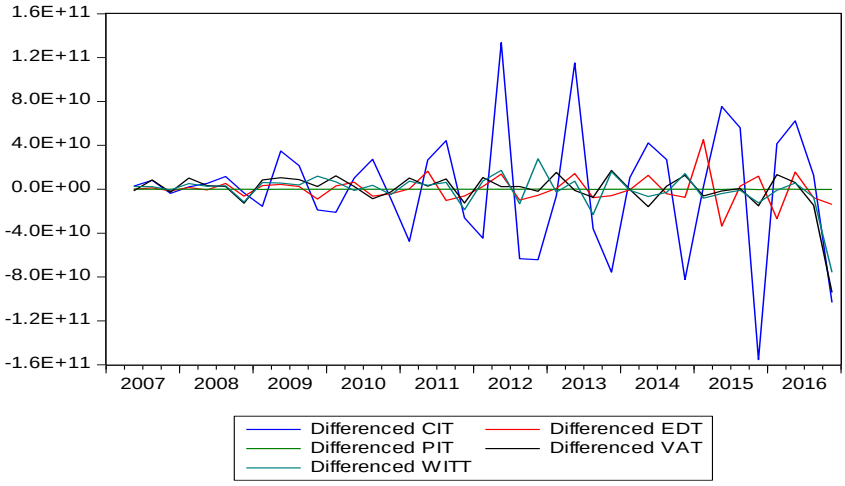

Fig. 6: Units root test result (After Difference)

Table 4: Cointegration Analysis

Number of Cointegrating Vector	Eigen value	Trace Test			Maximum Eigenvalue Test		
		Statistic	**0.05 Critical Value**	**Prob**	**Statistic**	**0.05 Critical Value**	**Prob**
None	0.71	107.50	69.82	0.00	44.85	33.88	0.00*
At most 1*	0.52	62.65	47.86	0.00	26.26	27.58	0.07
At most 2	0.42	36.39	29.80	0.01	19.85	21.13	0.07
At most 3*	0.33	16.53	15.49	0.03	14.28	14.26	0.05*
At most 4	0.06	2.25	3.84	0.13	2.25	3.84	0.13

Table 5: Residual Heteroscedaticity Test (Null hypothesis: constant variance (no heteroscedasticity) in the residuals)

Chi- square	Df	p-value
359.23	330	0.13

Table 6: Residual Autocorrelation Test

Lags	LM- Stat	P-value
1	36.93	0.06
2	27.25	0.34
3	30.99	0.19

Table 7: Residual Normality Test (Null Hypothesis: residuals are multivariate normal)

Series	Skewness	Kurtosis	Jarque-Bera	Prob
CIT	0.97	4.56	9.24	0.05
EDT	0.70	3.70	3.65	0.16
PIT	0.13	2.60	0.35	0.84
VAT	0.22	2.70	0.45	0.80
WTT	-0.94	5.46	14.39	0.05

Table 8: Pairwise Granger-Causality Test

Null Hypothesis:	Observation	F-Statistic	Prob.
EDT does not Granger Cause CIT	38	4.39	0.02
CIT does not Granger Cause EDT		0.24	0.78
PIT does not Granger Cause CIT	38	3.73	0.03
CIT does not Granger Cause PIT		0.24	0.79
VAT does not Granger Cause CIT	38	11.93	0.00
CIT does not Granger Cause VAT		1.03	0.37
WT does not Granger Cause CIT	38	8.47	0.00
CIT does not Granger Cause WT		2.03	0.15
PIT does not Granger Cause EDT	38	1.83	0.18
EDT does not Granger Cause PIT		5.33	0.01
VAT does not Granger Cause EDT	38	7.07	0.00
EDT does not Granger Cause VAT		0.04	0.96
WT does not Granger Cause EDT	38	3.99	0.03
EDT does not Granger Cause WT		0.70	0.50
VAT does not Granger Cause PIT	38	3.72	0.04
PIT does not Granger Cause VAT		0.04	0.96
WT does not Granger Cause PIT	38	2.77	0.08
PIT does not Granger Cause WT		1.32	0.28
WT does not Granger Cause VAT	38	3.26	0.05
VAT does not Granger Cause WT		5.34	0.01

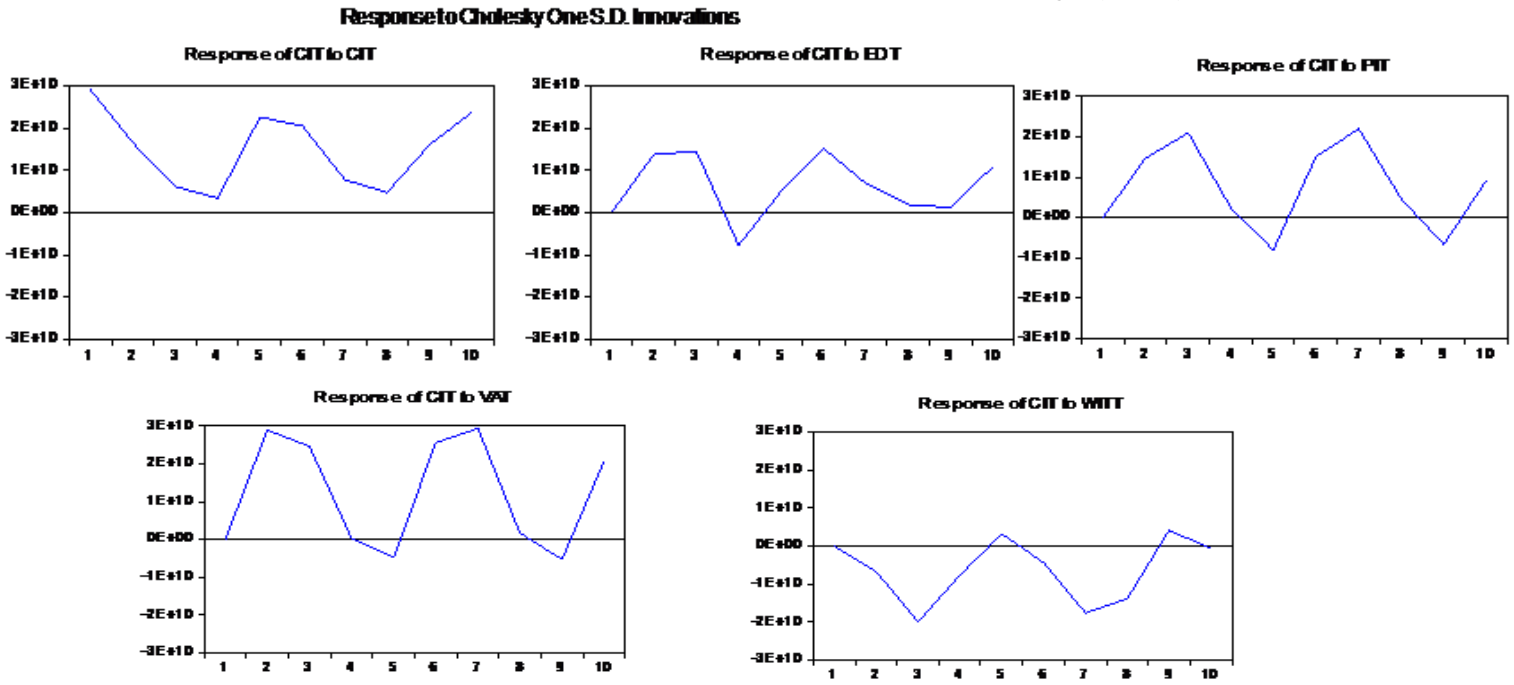

Fig. 7: Impulse Response Function

Table 9: Forecast Error Variance Decomposition (FEVD)

Period	S.E.	CIT	EDT	PIT	VAT	WITT
1	2.91E+10	100.00	0.00	0.00	0.00	0.00
2	4.91E+10	46.59	7.86	8.96	34.72	1.87
3	6.40E+10	28.30	9.79	15.98	35.18	10.75
4	6.51E+10	27.67	10.90	15.61	34.06	11.75
5	6.98E+10	34.58	10.00	14.90	30.09	10.44
6	8.02E+10	32.80	11.18	14.84	32.98	8.20
7	9.05E+10	26.49	9.36	17.54	36.42	10.18
8	9.18E+10	26.01	9.13	17.30	35.41	12.15
9	9.37E+10	27.92	8.79	17.12	34.32	11.87
10	9.99E+10	30.21	8.92	15.91	34.52	10.44