

Causality Between Valued Added Tax (VAT) and Nigerian Economy: An ECM Approach

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Abstract

This study used error correction model (ECM) to analyse the causality between Value Added Tax (VAT) and the Nigerian Economy proxied by GDP during the period 1994-2015. The data such as VAT and GDP were obtained from Central Bank of Nigeria (CBN) statistical bulletin and Federal Inland Revenue Services (FIRS). The results of the findings revealed that VAT exerts positive and significant influence on GDP while there was evidence of unidirectional causality running from VAT to GDP. Therefore, the researchers recommend that in order to enhance economic growth of Nigeria through VAT revenue, there is need to plug all the lapses identified in tax administration and educate the tax administrators as well as the entire populace on the relevant of VAT revenue to the economy.

Keywords: VAT; GDP; ECM; CBN.



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1. Introduction

Tax is a major player in every society of the world (Azubike, 2009). It is an essential part of a country's investment and growth plan (Salami *et al.*, 2015). Anyanwu (1997) sees taxation as the compulsory transfer or payment (or occasionally of goods and services) from private individuals, institutions or groups to the government. Tax is a compulsory levy imposed on a subject or upon his property by the government to provide security, social amenities and create conditions for the economic well-being of the society (Appah, 2004; Appah and K., 2011). The funds provided by tax are used by the states to support certain state obligations such as education systems, health care systems, and pensions for the elderly, unemployment benefits, and public transportation. Akhor and Uke (2016) asserted that taxation is a way of raising revenue for the day to day running of government activities. The main purpose of purpose of tax is to raise revenue to meet government expenditure and to redistribute wealth and management of the economy (Bhartia, 2009; Jhinghan, 2004; Ola, 2001).

Value Added Tax (VAT) was introduced into Nigeria's tax system as a means of increasing government revenue given the steadily rising costs of governance on one hand and the dwindling and erratic returns from petroleum which is Nigeria's principal source of revenue (Okoli and Afolayan, 2015). In Nigeria today, Value Added Tax (VAT) replaced the existing sales tax, which had been in operation under the Federal Government Legislated Decree No 7 of 1986. Value Added Tax is a consumption tax and it had been embraced by many countries world-wide. Almost hundred countries in the world today are operating the Value added Tax (Alan, 2003). But the interesting aspect of Nigeria's Value Added Tax is the very low single rate of 5% which is one of the lowest in the world today and even in the West African sub-region. Ghana has a rate of 10%, Republic of Benin 18% while Togo has multiple rates ranging from 5% to 30% (Bhatia, 1991; Olaoye, 2004) observed that Value Added Tax (VAT) is a family of sales tax. Adeleke (1995) posits that VAT is a tax on spending because it is borne by the final consumer of goods and services as it is included in the final price. Baiyewu (2000) regarded VAT as the policy thrust to raise higher revenue from non-oil tax sources particularly from consumption taxes (VAT and Duties) without jeopardizing the liberal tax policies. VAT is a consumption tax designed primarily to tax private consumption goods or services by individuals that are subject to tax (Muhammed, 1995). Bickley (1996) viewed VAT as a tax levied at each stage of production while Ogundele (1996) sees Value Added Tax as a multi-stage tax imposed on the value added to goods and services as they are processed through various stages of production and distribution and to the service as they are rendered.

Jhinghan (2005) posits that economic growth is a gradual and steady change in the long-run which comes about by a general increase in the rate of savings and population. Bencivenga and Smith (1991) asserted that economic growth will increase if more savings are channelled into the activity with high productivity while reducing the risk

associated with liquidity needs. An economy is said to be growing when it increases its productive capacity which later yield more in production of more goods and services (Jhinghan, 2003). It has also been described as a positive change in the level of production of goods and services by a country over a certain period of time (Salami *et al.*, 2015). Dwivedi (2006), economic growth implies that the rate of increase in total output must be greater than the rate of population growth. Economic growth is therefore a quantitative increase in output of an economy and it is measured by the increase in the amount of goods and services produced in a country.

The remaining part of this paper include: literature review; methodology; results and discussions; and conclusion.

2. Literature Review

This section comprises the brief history of VAT in Nigeria and the empirical literature.

2.1. Brief History of VAT in Nigeria

The history of VAT in Nigeria dates back to 1991 when the Federal Government felt there was a need to review the entire system of taxes in the country with a view to expanding the financial base for revenue generation (Abdul-Rahman *et al.*, 2013; Federal Inland Revenue Service (FRIS), 1999). Abdul-Rahman *et al.* (2013) further argued that this became necessary because sales tax could not guarantee wider and better tax administration, as many states were resentful of its uniform nature due to differences in their political orientation. Sanni (2012), in his own contribution, said “before the advent of VAT, sales tax was under the jurisdiction of the States and generally poorly administered with marginal contribution in terms of revenue”. Abdul-Rahman *et al.* (2013) opined that the rationale behind the adoption of VAT in Nigeria can be summarized as the need to achieve:

- a. Simplification of indirect tax system
- b. Enhancement of tax neutrality in international trade
- c. Reduction in tax evasion, and
- d. Expansion of tax base promotion and investment.

A committee was set up and charged with the responsibility of carrying out the review (Gyang, 2012; Soyode and Kajola, 2006; Unegbu and Ireferin, 2011). The committee completed its work on November 15, 1991 and made the following recommendation, among others:

- a. Government should introduce Modified Value Added Tax (MVAT) in Nigeria;
- b. Government should allow a lead time period of two years between 1991, when the study group submitted its report, and the time the MVAT will be implemented in Nigeria to allow for adequate preparation for the scheme;
- c. MVAT when introduced should:
 - a. Replace sales tax in its entirety;
 - b. Have a single rate;
 - c. Cover manufacturer’s and importer’s level in goods;
 - d. Cover professional services excluding medical and pharmaceutical services; and
 - e. Pay special attention to State-Federal fiscal relationship.

The Federal Government therefore, decided to abolish the sales tax and introduced the VAT system by virtue of Decree No. 102 of 1993, which took effect from January 1, 1994 (Okoye and Ezugwu, 2012).

2.2. Empirical Literature

Enokela (2010) conducted a study to explore the relationship between Value Added Tax and economic growth of Nigeria using secondary data and multiple regressions. He found out that Gross Domestic Product (GDP) is positive and statistically significant to Value Added Tax.

Adereti *et al.* (2011) investigated the impact of Value Added Tax on the economic growth of Nigeria using multiple regression technique. Time series data on the Gross Domestic Product (GDP), VAT revenue, Total Tax Revenue and Total Federal Government Revenue from 1994 to 2008 was collected for analysis. The findings showed that the ratio of VAT revenue to GDP averaged 1.3% compared to 4.5% in Indonesia and indicated a positive and significant correlation between VAT revenue and GDP. The study further revealed that no causality run from GDP to VAT revenue at a lag of two years.

Izedonmi and Okunbor (2014) assessed contribution of VAT to the development of the Nigerian economy using multiple regression for analyzing time series data on the Gross Domestic Product (GDP), VAT Revenue, Total Tax Revenue and Total Federal Government Revenue from 1994 to 2010. VAT revenue was found to have accounted for 92% variations in Nigeria’s GDP. There was a positive but insignificant correlation between VAT revenue and GDP.

Izedonmi and Okunbor (2014) studied the impact of value added tax (VAT) on the economic growth of Nigeria by applying Ordinary Least Square (OLS) technique to test the formulated hypotheses. VAT was found to have contributed significantly to the total tax revenue of government as well as the economic growth of Nigeria. VAT revenue was found to have grown consistently over the period under study.

Bakare (2013) examined effect of VAT on output growth in Nigeria by using Ordinary least Square regression technique. He found a positive and significant relationship between VAT and output growth in Nigeria. He further revealed that the past values of VAT could be used to predict the future behaviour of output growth in Nigeria.

Okoye and Ezugwu (2012) found that VAT is one of the bedrocks of Nigeria's economic development as it contributes significantly to the nation's GDP. In another study Unegbu and Ireferin (2011) found a significant VAT impact on economic and human development of Adamawa State from 2001 to 2009.

Okoye and Gbegi (2013) found that VAT has a significant influence on wealth creation in Nigeria and also that revenue generated from VAT has a significant effect on total tax revenue in Nigeria. Worlu and Nkoro (2012) also found that VAT revenue has contributed positively to the development of all sectors of the Lagos State economy.

Onalapo *et al.* (2013) examined VAT and its effect on revenue generation in Nigeria. The secondary data collected was analysed using stepwise regression analysis technique. Value Added Tax was found to have statistically significant effect on revenue generation in Nigeria.

Olaturji (2009) studied the effectiveness of the administration of VAT to improve government revenue and boost economic growth in Nigeria using simple percentage and chi-square for data analysis. The findings reveal that a positive correlation between VAT and GDP existed.

Salami *et al.* (2015) examined impact of taxation on the growth of the Nigerian economy from 1976-2006 using both simple and multiple linear regression analysis in the form of the ordinary least square method. All the exogenous variables, including VAT had significant impact on the economy proxied by RGDP.

Emmanuel (2013) examined the effects of VAT on economic growth and total tax revenue in Nigeria using data ranging from 1994 to 2010. He found out that VAT has significant effect on GDP and also on total tax revenue. This indicates that increase in value added tax would lead to increase in tax revenue and economic growth (GDP).

Unegbu and Ireferin (2011) examined the impact of VAT on economic and human developments of emerging Nations from 2001 to 2009, using regression, discriminant analysis and ANOVA, and found out that VAT allocations have a very significant impact on expenditure pattern of the state during the same period. They also revealed that, the perceptions citizens across the administrative areas of the state suggest that VAT has minimum impact level on the economic and human developments of Adamawa State from 2001 to 2009.

Owolabi and Okwu (2011) examined the contribution of Value Added Tax to Development of Lagos State Economy, using simple regression models as abstractions of the respective sectors considered in the study. The study considered a vector of development indicators as dependent variables and regressed each on VAT revenue proceeds to Lagos State for the study period. Development aspects considered included infrastructural development, environmental management, education sector development, youth and social development, agricultural sector development, health sector development and transportation sector development. The results showed that VAT revenue contributed positively to the development of the respective sectors. However, the positive contribution was statistically significant only in agricultural sector development. On the aggregate, the analysis showed that VAT revenue had a considerable contribution to development of the economy during the study period.

Naiyeju (1996) argued that the positive result received from any tax depends on the extent of how it is properly managed, the extent of how the tax law is interpreted and implemented as well as the publicity brought into it. All these will determine how a particular tax is able to meet its objectives.

3. Methodology

This section covers model specification and statistical techniques used to analyze the data like Augmented Dickey Fuller (ADF) test, Co-integration test, Vector Error Correction Model (VECM), and Granger Causality test.

3.1. Model Specification

The functional relationship between VAT and the economic growth of Nigeria proxied by Gross Domestic Product (GDP) is expressed thus:

$$GDP = f(VAT)$$

Obtaining the OLS model from the above expression, we had:

$$GDP = a_0 + a_1VAT + e_t$$

Where: GDP = Gross Domestic Product (proxy of economic growth)

VAT = Value Added Tax

e_t = Error Term

From the above model, it is expected that VAT and GDP has a positive relationship.i.e. $a_1 > 0$.

3.2. Augmented Dickey Fuller (ADF) Test

This is the pre Co-integration test. It is used to determine the order of integration of a variable that is how many times it has to be differenced or not to become stationary. It is to check for the presences of unit root in the variable i.e. whether the variable is stationary or not. The null hypothesis is that there is no unit root. This test is carried out using the Augmented Dickey Fuller (ADF) technique of estimation. The rule is that if the ADF test statistic is negatively greater than the 5 per cent critical value, we accept the null hypothesis i.e. the variable is stationary but if the ADF test statistic is negatively less than the 5 per cent critical value i.e. the variable is non-stationary, we reject the null hypothesis and go ahead to difference once. If the variable does not become stationary at first difference, we difference twice. However it is expected that the variable becomes stationary at first difference.

Augmented Dickey Fuller Unit root test is used to test the stationarity of the variables so as to avoid analysing inconsistent and spurious relationship. If the series is correlated at higher order lags, the assumption of white noise disturbance is violated and the ADF test makes a parametric correction by assuming that the series follows an AR(p)

process. The test methodology is then adjusted by adding lagged difference terms of the dependent variable Y to the right hand side of the regression. Thus,

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \delta_1 \Delta Y_{t-1} + \delta_2 \Delta Y_{t-2} + \dots + \delta_{p-1} \Delta Y_{t-p+1} + \varepsilon_t$$

The hypothesis for the augmented specification is tested thus;

$$H_0: \gamma = 0 \text{ and } H_1: \gamma < 0 \text{ where } \gamma = p - 1.$$

The VAR model in sigma notation to include constant and no trend or constant with trend.

$$\Delta Y_{t=\mu+\gamma Y_{t-1}} + \sum_{t-1}^n \delta \Delta Y_t + \varepsilon_1$$

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{t-1}^n \delta \Delta Y_t + \beta_t + \varepsilon_1$$

Where Δ is the first difference operator, ε_t s are random disturbances and n is the number of optimum lag length.

Where $\gamma = p - 1$ and $-1 \leq p \leq 1$, illustrates the test of stationarity or non-stationarity. That $p = 1$ is the case of unit root problem called a non-stationary stochastic process thus, p must be less than 1 for stationarity to be obtained. Stationarity implies that a series will return to a given value and no matter where we start from in the long-run we expect it to attain that value.

3.3. Co-integration Test

After the test for the order of integration, the next step is to test for co-integration. This test is used to check if long run relationship exists between the variables in the model (Ogundipe and Alege, 2013). This will be carried out using the Johansen co-integration technique.

To test for cointegration, Johansen (1989) method is to test the restrictions imposed by cointegration on the unrestricted vector autoregressions (VAR) involving the series. If the VAR is of order P, the starting equation can be stated as

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + B X_t + \varepsilon_t$$

Where Y_t is a K – vector of non-stationary I(1) variables, X_t is a d vector of deterministic variables and ε_t is a vector of innovations. The VAR can be re-written as:

$$\Delta Y_{t=} \Pi Y_{1-t} + \sum_{i-1}^{p-1} \Gamma_i \Delta Y_{t-1} + B X_t + \varepsilon_1$$

Where

$$\Pi = \sum_{i-1}^p A - I, \Gamma_i = - \sum_{j=i+1}^p A_j$$

This technique is used for long run relationship among variables. In this technique two statistics suggested by Johansen (1989) are firstly, trace statistic and secondly maximum eigenvalue statistic. The trace tests the null hypothesis that the number of distinct cointegrating vector is less than or equal to q against a general unrestricted alternatives $q = r$.

The test statistic is given by the formular:

$$\lambda \text{ trace } (r) = - T \Sigma \ln (1 - \lambda)$$

Where T is the number of usable observations, and λ is the estimated eigenvalue from the matrix. On the other hand, maximum eigenvalue test (λ max) given by

$\lambda \text{ max } (r, r + 1) = - T \ln (1 - \lambda r + 1)$ tests the null hypothesis that there is r co-integrating vectors against the alternative that there exists r + 1 co-integrating vector.

3.4. Error Correction Model (ECM)

The Vector Error Correction Model (VECM) shows the speed of adjustment from short-run to long run equilibrium. The a priori expectation is that the VECM coefficient must be negative and significant for errors to be corrected in the long run. The higher the VECM, the more the speed of adjustment.

The error correction model is designed to capture the short-run deviations that might have occurred in estimating the long-run co-integrating equation (Engle and Granger, 1987). Thus, the model is re-specified as follows to include an error correction term (ECT).

$$\Delta \text{GDP} = \alpha_0 + \alpha_1 \Delta \text{VAT}_{t-1} + \alpha_2 \text{ECT}_{t-1} + e_t$$

Where ECT = Error Correction Term

3.5. Causality Test

This is used to check for causality between two variables. In this case our aim is to test for a causal relationship between VAT and economic growth (GDP) in Nigeria. The rule states that if the probability value is between 0 and 0.05, there is a causal relationship.

Granger causality test answers the question of whether X causes Y or Y causes X. Y is said to be granger-caused by X if X helps in the prediction of Y, or equivalently if the coefficients of the lagged X's are statistically significant. Granger causality tests are conducted to determine whether the current and lagged values of one variable

affect another. In this study, the researchers want to verify whether VAT predicts economic growth (GDP). Or whether GDP predicts VAT. The Granger test is predicated in this case, on the following regression analysis:

$$Y_t = \beta_0 + \sum \alpha_i Y_{t-i} + \sum b_i \text{VAT}_{t-i} + \mu_{1t}$$

$$\text{VAT}_t = z_0 + \sum \Omega_i Y_{t-i} + \sum \delta_i \text{VAT}_{t-i} + \mu_{2t}$$

Where μ_{1t} and μ_{2t} are the idiosyncratic terms.

4. Results and Discussions

The results of the various tests are presented below:

Table-1. Augmented Dickey-Fuller (ADF) Unit Root Test

Variable	ADF test statistic	5% critical value	Order of integration
D(GDP)	-7.613076	-3.029970	2(1)
D(VAT)	-4.806313	-3.029970	2(1)

Source: Researchers' computation, 2017

Time series data are prone to spurious regression, to ensure their stationarity, Unit Root Test is carried out. The result is presented in the below table.

The result of the ADF test as presented in table 1, shows that the dependent variable (GDP) and the independent variables (VAT) are integrated of order one, lag one, 2(1), all at 5% level of significance. That is, they are integrated of the same order. In other words, GDP and VAT are found to be stationary at second difference. Thus, the model follows integrating process. Therefore, the null hypothesis of unit root is not accepted because the probability of the t-statistic is significant and the ADF test statistic for difference two (2) is more negative than the critical values at 5% level of significance.

Table-2. Johansen Co-integration Test Result

Date: 06/18/17 Time: 22:25
 Sample (adjusted): 1996 2015
 Included observations: 20 after adjustments
 Trend assumption: No deterministic trend
 Series: GDP VAT
 Lags interval (in first differences): 1 to 1
 Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.723637	29.59982	12.32090	0.0000
At most 1	0.176303	3.879046	4.129906	0.0580

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**Mackinnon *et al.* (1999) p-values

Source: Researchers' computation, 2017

The result in table 2 above indicates the presence of 1 co-integrating equation at 5% level of significance for the GDP model and therefore confirms the existence of long-run equilibrium relationship between GDP and its explanatory variable (VAT). The conclusion is based on the values of trace statistics against their critical values at 5% significance level.

Table-3. Parsimonious Error Correction Model Result

Dependent Variable: D(GDP)
 Method: Least Squares
 Date: 06/18/17 Time: 22:20
 Sample (adjusted): 1997 2015
 Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	0.253919	0.215752	1.176902	0.2603
D(VAT)	4.543304	34.85044	0.130366	0.8983
D(VAT(-1))	-108.2181	48.01610	-2.253787	0.0421
D(VAT(-2))	123.4424	36.21326	3.408763	0.0047
ECM(-1)	-0.696421	0.268933	-2.589568	0.0224
C	1795.215	1997.448	0.898754	0.3851
R-squared	0.756262	Mean dependent var		4742.772
Adjusted R-squared	0.662517	S.D. dependent var		6832.798
S.E. of regression	3969.398	Akaike info criterion		19.66271
Sum squared resid	2.05E+08	Schwarz criterion		19.96095
Log likelihood	-180.7957	Hannan-Quinn criter.		19.71318
F-statistic	8.067199	Durbin-Watson stat		2.480100
Prob(F-statistic)	0.001176			

Source: Researchers' computation, 2017

The parsimonious result in table 3 above shows that the model has a good-fit as the coefficient of determination (R-squared) is 76% with no autocorrelation as suggested by Durbin-Watson (D.W) statistic. Hence, the overall regression is also highly significant. The error correction model (ECM) coefficient is negatively signed and significant. This implies that about 70% deviation from the long-run equilibrium relationship between GDP and its determinant are corrected every one year. There is therefore empirical evidence that there exist a long-run relationship between GDP and VAT.

Table 4. Granger Causality Test Result

Pairwise Granger Causality Tests

Date: 06/19/17 Time: 10:43

Sample: 1994 2015

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
VAT does not Granger Cause GDP	20	19.4008	7.E-05
GDP does not Granger Cause VAT		2.08498	0.1589

Source: Researchers' computation, 2017

The causality test result in table 4 above shows that there is unidirectional causality between GDP and VAT as explained by the probability value. That is, VAT granger causes GDP, implying that VAT can be used to predict the future behaviour GDP of Nigeria.

A critical look at the results above reveals that VAT and GDP were negatively and significantly related at lag 1, indicating the first period of VAT introduction in Nigeria. While at lag 2, VAT exerts positive and significant effect on GDP suggesting the period of full application and implementation of VAT in Nigeria. This meets the a priori expectation that an increase in VAT leads to an increase in GDP. This contradicts the finding of [Izedonmi and Okunbor \(2014\)](#) who found that there was a positive but insignificant correlation between VAT revenue and GDP. But the result corroborates the findings of [Enokela \(2010\)](#), [Bakare \(2013\)](#), [Adereti et al. \(2011\)](#), and [Emmanuel \(2013\)](#) on the effect that VAT and GDP are positively and significantly related.

5. Summary and Conclusion

The thrust of this study is to analyse the causality between VAT and the Nigerian Economy proxied by GDP during the period 1994-2015 using error correction model (ECM). The study period was used because 1994 was the year VAT was officially implemented in Nigeria. Analysis from the estimation suggests that all the variables are stationary at second difference and there is a long-run relationship between VAT and the growth of the Nigerian economy (GDP). VAT exerts positive and significant influence on GDP at lag 1. This implies that as VAT revenue rises, GDP will also rises and vice versa. Therefore, the researchers recommend that in order to enhance economic growth of Nigeria through VAT revenue, there is need to plug all the lapses identified in tax administration and educate the tax administrators as well as the entire populace on the relevant of VAT revenue to the economy.

The results from the estimation also suggest that there is evidence of causality running from VAT to GDP. That is, VAT granger cause GDP and GDP does not granger cause VAT, indicating a unidirectional causality.

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Appendices

Table-5. ADF Result (GDP)

Null Hypothesis: D(GDP,2) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=1)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.613076	0.0000
Test critical values:	1% level		-3.831511	
	5% level		-3.029970	
	10% level		-2.655194	

*Mackinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDP,3)

Method: Least Squares

Date: 06/18/17 Time: 22:13

Sample (adjusted): 1997 2015

Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1),2)	-1.552617	0.203941	-7.613076	0.0000
C	425.7764	1718.542	0.247754	0.8073
R-squared	0.773209	Mean dependent var		-182.4737
Adjusted R-squared	0.759868	S.D. dependent var		15270.12
S.E. of regression	7482.851	Akaike info criterion		20.77792
Sum squared resid	9.52E+08	Schwarz criterion		20.87733
Log likelihood	-195.3902	Hannan-Quinn criter.		20.79474
F-statistic	57.95892	Durbin-Watson stat		2.306915
Prob(F-statistic)	0.000001			

Table-6. ADF Result (VAT)

Null Hypothesis: D(VAT,2) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=1)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.806313	0.0013
Test critical values:	1% level		-3.831511	
	5% level		-3.029970	
	10% level		-2.655194	

*Mackinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(VAT,3)

Method: Least Squares

Date: 06/18/17 Time: 22:13

Sample (adjusted): 1997 2015

Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(VAT(-1),2)	-1.183683	0.246277	-4.806313	0.0002
C	-2.545454	7.635765	-0.333359	0.7429
R-squared	0.576067	Mean dependent var		-1.723105
Adjusted R-squared	0.551129	S.D. dependent var		49.66606
S.E. of regression	33.27517	Akaike info criterion		9.946801
Sum squared resid	18823.03	Schwarz criterion		10.04622
Log likelihood	-92.49461	Hannan-Quinn criter.		9.963626
F-statistic	23.10065	Durbin-Watson stat		1.842350
Prob(F-statistic)	0.000165			

Table-7. Johansen Co-integration Test Result

Date: 06/18/17 Time: 22:25
 Sample (adjusted): 1996 2015
 Included observations: 20 after adjustments
 Trend assumption: No deterministic trend
 Series: GDP VAT
 Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.723637	29.59982	12.32090	0.0000
At most 1	0.176303	3.879046	4.129906	0.0580

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**Mackinnon *et al.* (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.723637	25.72078	11.22480	0.0001
At most 1	0.176303	3.879046	4.129906	0.0580

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**Mackinnon *et al.* (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b*S11*b=I):

GDP	VAT			
-0.000212	0.025327			
0.000130	-0.009645			
Unrestricted Adjustment Coefficients (alpha):				
D(GDP)	5148.434	42.30389		
D(VAT)	7.921663	-11.96989		
1 Cointegrating Equation(s):	Log likelihood	-285.1726		

Normalized cointegrating coefficients (standard error in parentheses)

GDP	VAT
1.000000	-119.6770
	(3.55479)

Adjustment coefficients (standard error in parentheses)

D(GDP)	-1.089543
	(0.16339)
D(VAT)	-0.001676
	(0.00148)