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OIL RESOURCE ABUNDANCE AND AGRICULTURAL PRODUCTIVITY IN NIGERIA: AN AUTOREGRESSIVE DISTRIBUTED LAG APPROACH

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ABSTRACT: *This paper analyzed and estimated the impact of oil abundance on agricultural productivity in Nigeria for the sample period of 1980 – 2018. The Autoregressive Distributed Lag model (ARDL) estimated with the Ordinary Least Square technique was used to examine the relationship among the variables. Findings from the model revealed that there was a negative and significant relationship between oil abundance and agricultural productivity in the short run while a negative and insignificant relationship existed in the long run. There was a direct and insignificant relationship between growth rate of GDP and agricultural productivity. The study therefore recommended subsidizing agricultural inputs and setting in place incentives that will keep people in the agricultural sector.*
KEYWORDS: Oil abundance, agricultural productivity, lending rate, exchange rate
Jel classification: O_{13}, Q_{43}

INTRODUCTION

Taking a look at the economic history of Nigeria, the Nigerian economy was agricultural driven from 1960 till the early 70s. The oil sector took dominance from the 1973-74 oil boom brought about by the Arab-Isreal conflict of 1973. Ever since, the oil sector became the main driver of the Nigerian economy to the extent that 91% of her foreign exchange is earned from the sector. Osigwe (2013) asserted that the oil boom of the 70s and 80s followed by excessive appreciation of the exchange rate reduced agricultural competitiveness and encourage rent seeking behavior in the

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economy. The Nigerian economy has, over the years, exhibited prolong economic stagnation, rising poverty levels, inequality and infrastructure decay and unemployment.

Globally, the relationship between resource abundance and economic growth has been the subject of a growing literature in recent years. Right from the 1950s, some development economists concluded that natural resource abundance would help underdeveloped countries to overcome their capital gaps and provide the needed revenues to their governments for public goods and thus, lifting citizens from the traps of poverty, inequality, unemployment and other socio-economic ills. However, since the 90s, a growing numbers of studies have established a link between resources abundance and a host of social economic challenges. Data on energy and mineral resources suggest that natural resource abundance has not been a significant determinant of economic growth over the period 1970-1989 (Ross, 2005). The observation that resource-poor economies can sometimes outperform resource-rich economies is not new in the field of economic history (Sachs and Warner, 1995; Ross, 2005; Breisinger, Diao and Weibelt, 2014). The exploration and exploitation of crude oil in Nigeria came with mixed outcome, having impacted both positively and negatively on the macro-economy. Huge revenue have been generated from the oil sector and has been the main source of government's financing of projects, provision of social infrastructure, meeting internal and external obligations, and running the economy generally. The sector has also contributed to the development of the industrial sector in the Nigerian economy. The refineries, petro-chemical companies, fertilizer manufacturing firms also sprang up from the oil industry. Part of the negative impacts included the over dependence of the economy on the sector, Dutch disease syndrome, resource curse and the vulnerability of the economy to oil price shocks. All the concerns and issues highlighted above render the Nigerian economy to external shocks and subject its development to multiple fractures (Ogunleye, 2008).

Experience gained thus far in Nigeria has shown that exporting primary products do not transform poor countries to affluent economies. It is expected that the benefits derived from the oil sector will propel the Nigerian economy to the path of sustainable economic development. The evidence on ground is not in tandem with the above assertion. There ought to be linkages between oil

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resource abundance and the agriculture sector. However, the Nigerian economy is yet to achieve desired economic diversification from the exportation of crude oil. From the foregoing, the objective of this paper is to estimate and analyze the effects of oil resource abundance on agricultural output in Nigeria. To achieve the aforestated objectives the following questions are relevant; What is the relationship between oil resource abundance and agricultural output in Nigeria? What is the magnitude of the effects of oil resource abundance on agricultural outputs in Nigeria? Following this introductory section, section 2 presents the literature review, section 3 gives the method of study employed by the paper. Results and discussion are presented in section 4 while section 5 concludes the paper.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This sub-section provides a survey of empirical findings on the effects of oil resource abundance on the performance of economies both aggregately and sectorally. There is an avalanche of literature on the relationship between resource abundance and several indicators of economic performance. Some of the literature focused on the negative correlation between several measures of mineral abundance, long-term and short term economic growth (Petkov, 2018; Kim and Lin, 2018). Specifically, the focus of oil on poverty was the centerpiece of the works of (Apergis and Katsaiti, 2018). Agriculture has been perceived as an important factor in sustaining economic growth.

At face value, resource abundance seems generally good for countries that are endowed with them. However, the issue is how well the resources are managed and employed for the welfare of the people. Resource curse is associated with resource abundance. Resource curse refers to the failure of many resource-rich countries to fully take advantage of their natural resource wealth in a positive way (Sapuan and Roly, 2020). This curse is also perceived as government failure to perform effectively to fulfill public welfare needs. From local experience it is remarkable to note that the usual expectation is for resource-rich countries to post stellar economic outcomes. However, the rich-resource tend to have higher rates of inequalities, autocracy, lower rates of

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economic stability and progress compared to non-resource countries. Scarce-resource countries always outperform resource-rich countries with because scarce resource countries are more competitive in industrialization with high saving rates, as well as strong economic and environmental sustainability. Scarce-resource countries tend to have strong formal institutions, institutional accountability and social capital, this has made their development policies more socially sustainable (Woolcock et.al., 2004).

In the early years of crude oil exploration and exploitation, natural resources abundance was considered an advantage by economists until 1980s. However, theoretical and empirical studies starting in the 80s till date concluded to the contrary. Findings revealed that natural resources abundance posed more economic problems, challenge, constraints and crises to host economies and might be an economic curse rather than a blessing (Sachs and Warner, 1995; Sala-I-Martin and Subramanian, 2003). For instance, Nigeria, Liberia, Sierra Leone and Democratic Republic of Congo have demonstrated instances where natural resources mismanagement has led to political instability, corruption and civil war. This is the reason why studies like Letiche (2010) suggested that the entire sub-Saharan African needs a total economic transformation.

According to Brunnschweiler and Bulte (2008) resource dependent countries have a lower long-run growth rates them countries with a more diversification export structure. Moradi (2007) analyzed the effects of oil resource abundance on two major macroeconomic variables; economic growth and income distribution in Iran using the data period 1968-2005. The adjusted R^2 values of 0.989 was reported, the results of the study confirmed the long run effect of oil abundance on GDP is positive and significant but the value of the estimated coefficient (0.005) was too small. The author concluded that the value of the estimated coefficients supported the hypothesis that oil abundance is not a blessing for Iran. In a study carried out on Nigeria and Columbia to examine, the macroeconomic and regional of oil abundance dependence (Perry et.al, 2011) found from their study that large and sudden oil rent inflows in the institutionally and economically weak regions lend to generate waste of resources and Dutch disease symptoms. The study concluded that the net growth effects depend on the quality of institutions and macroeconomic policies.

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Ogunleye (2005) estimated the long-run impact of the huge oil wealth accruing to Nigeria on its economic development. Per-capita GDP, household consumption, infrastructural development (electricity) and agricultural and manufacturing output growth rates were examined. The results revealed a position and significant long-run impact of per capital oil revenue on per capita household consumption and electricity generation, while a negative relationship was established for GDP, agriculture and manufacturing. This study intends to add value to the empirical discourse on oil resource abundance and agricultural output in Nigeria by exploring the behavior of other explanatory variables. It will also extend the coverage period from 1980-2018.

There are avalanche of theories in literature that explains the effects of oil resource abundance on the macroeconomy. Those include the mainstream theory, structural theory, rentier theory, the Dutch disease theory. For instance see (Ogbonna and Ebimobowei, 2012; Rotimi and Ngalawa, 2017) for overview. In addition, gold discoveries in Australia had Dutch disease effects on some Australia industries. Forsyth and Nicolas (1983) explained the consequences of the inflow of American treasure in the sixteenth century on the Spanish industry in terms of Dutch disease. Leaning on existing theoretical literatures, this study adopts the Dutch disease framework developed by (Corden and Neary, (1982). We chose this framework because it is capable of illuminating many historical episodes where there have been sectoral boom with adverse or favourable effects on other sectors. It also provides a systematic analysis of some aspects of structural changes in a small open economy.

MATERIAL AND METHODS

In the light of the discussion in the foregoing sections, we specify a simple multivariable econometric model that was designed to capture the impact of oil abundance on real sector performance. Thus the study developed the following model;

AGP = f(OILA, RGDPR, LENR, EXGR) ……………………………… 3.1

Where

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AGP	=	Growth rate of agriculture
OILA	=	Oil abundance
RGDPR	=	Growth rate of real GDP
LENR	=	Lending rate
EXGR	=	Exchange rate

The model in its economic form is gives as

AGP = $\alpha_0 + \alpha_1$OILA + α_2RGDPR+ α_3 LENR+ α_4EXGR+ Ut …………………… 3.2

Where α_0 to α_4 are the parameters to be estimated and U_t is the error term.

Recall

AGP = $\alpha_0 + \alpha_1$OILA + α_2RGDPR+ α_3 LENR+ α_4EXGR+ Ut

Then

$\Delta AGP = \alpha_0 + \alpha_1 AGP_{t-1} + \alpha_2 OILA_{t-1} + \alpha_3 RGPGRR_{t-1} + \alpha_4 LENR_{t-1} + \alpha_5 EXGR_{t-1} +$

$$\sum_{i=0}^{K} \beta_2 \Delta OILA_{t-1} + \ldots + \sum_{i=0}^{K} \beta_2 \Delta RGDPR_{t-1} + \sum_{j=0}^{K} \beta_3 \Delta LENR_{t-1} + \sum_{i=0}^{K} \beta_4 \Delta EXCHR_{t-1} + Ut \ldots\ldots 3.3$$

Error Correction Model:

$$\Delta AGP = \beta_0 + \beta_1 \sum_{i=0}^{K} \beta_1 \Delta AGP_{t-1} + \sum_{i=0}^{K} \beta_2 \Delta OILA_{t-1} + \ldots + \sum_{i=0}^{K} \beta_3 \Delta RGDPR_{t-1} +$$

$$\sum_{i=0}^{K} \beta_4 \Delta LENR_{t-1} + \sum_{i=0}^{K} \beta_5 \Delta EXGR_{t-1} + Ut$$

Δ is the first difference operator. An advantage of this model is that it can be applied irrespective of whether the underlying regressors are stationary at I(0) or I(1) or a mixture of both. Also, it has a small sample property and provides an unbiased estimate of the long-run model as well as valid t-statistics even when some of the regressors are endogenous.The Granger representation theorem states that in the presence of cointegration among variables, there is a mechanism (captured by an

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error correction model) that describes the adjustment of the cointegrated variables towards equilibrium. On this basis, the error correction model for equation **(2)** is specified as:

$$\sum_{j=0}^{p} \varphi_1 \Delta AGP_{t-j} + \sum_{j=0}^{p} \varphi_2 \Delta OILA_{t-j} + \sum_{j=0}^{p} \varphi_3 \Delta RGDPR_{t-j} + \sum_{j=0}^{p} \varphi_4 \Delta LENR_{t-j} +$$

$$\sum_{j=0}^{p} \varphi_5 \Delta EXGR_{2t-j} + \varphi_6 \, ECM_{t-1} \quad \text{———} \quad (3.4)$$

Where is the error correction term.

The ARDL model suggests that once the order of the ARDL is determined, the relationship can be estimated using the ordinary least squares (OLS) technique. The OLS technique is the best linear and unbiased estimator (BLUE).

RESULT PRESENTATION AND ANALYSIS

With the chosen method of analysis, ARDL, stationarity tests were carried out using the Augmented Dickey Fuller (ADF) and Philips Perron (PP) unit root test in order to ensure that none of the variables is integrated at second difference. The result is as presented in Table 4.1

Table I: Summary of Unit root Test

Variables	ADF	PP	Order of Integration
AGP	4.45*	4.32*	I(0)
OILA D(OILA)	0.94 5.69*	0.67 11.02*	1(1)
LNDR D(LENR)	2.29 5.54*	2.22 6.95*	I(1)
RGDPR D(RGDPR)	3.18 7.59*	3.16 20.07*	I(1)
EXGR D(EXGR)	1.95 4.54*	1.12 4.37*	I(1)

Source: Researchers' computation using Eviews

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Note: (i) D is the first difference operator (ii) (ii) * signifies stationarity at 1%, (iii) ADF and PP critical values at 1%, 5% and 10% levels are 4.24, 3.54 and 3.2 respectively. (iv) All values were reported in their absolute term From the result in Table I, the growth rate of agricultural output (AGP) is integrated at level {I(0)}, while oil abundance (OILA), lending rate (LENR), growth rate of real GDP (RGDPR), and exchange rate (EXGR) are stationary at first difference {I(1)}. The combination of variables that are integrated at level and at first difference provides the justification for the use of ARDL. From an estimated generic ARDL, coefficient diagnostic for bound test was carried out to check for the existence of long run equilibrium relationship among the variables of the model. The result is as presented in Table II

Table II: Summary of ARDL Bound Test

F-statistic	1% Critical Value		5% Critical Value	
	Upper Bound	Lower Bound	Upper Bound	Lower Bound
10.26	4.37	3.29	3.49	2.56

Researchers' computation using Eviews

From the ARDL bound test in Table II, the value of the F-statistic is greater than the values of the upper and lower bounds at 1% and 5% critical values. This indicates the existence of long-run equilibrium among the variables of the model. Further diagnostic checks were also carried out for the long-run estimates and the error correction form (ECM), which is the short-run analysis. The results are presented in Table III and Table IV respectively

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Table III: Long-run Estimate
Dependent Variable: AGP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDPR	1.563007	1.164049	1.342733	0.2007
LENR	2.360755	0.700159	3.371743	0.0046
OILA	-14.94563	12.09723	-1.235458	0.2370
EXGR	-0.216570	0.095808	-2.260446	0.0403
C	24.35157	15.94360	1.527357	0.1489

Source: Researchers' computation using Eviews

From Table IV, the growth rate of real GDP has positive insignificant impact, and a unit change in its value will bring about 1.34 changes in the dependent variable. Lending rate has positive significant impact on agricultural productivity and a unit change in its value will lead to a change of 3.37 on agricultural productivity. While oil abundance has a negative insignificant impact on the dependent variable, exchange rate on the other hand exerts a negative significant impact. A unit change in their respective values will induce 1.24 and 2.26 change in the dependent variables..

Table IV: ECM Regression
Dependent Variable: AGP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AGP(-1))	0.338460	0.113118	2.992102	0.0097
D(RGDPR)	0.563919	0.606545	0.929724	0.3683
D(RGDPR(-1))	-2.627022	0.606474	-4.331631	0.0007
D(RGDPR(-2))	-1.510143	0.550459	-2.743425	0.0158
D(LENR)	0.305219	0.699973	0.436044	0.6695
D(LENR(-1))	-2.509311	0.789753	-3.177338	0.0067
D(OILA)	-82.20919	16.86580	-4.874313	0.0002

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D(OILA(-1))	-55.48171	17.50164	-3.170086	0.0068
D(OILA(-2))	-61.19886	18.44705	-3.317542	0.0051
D(OIL(-3))	-61.00555	17.71358	-3.443999	0.0040
D(EXGR)	-0.386764	0.118247	-3.270819	0.0056
D(EXGR(-1))	0.012309	0.130834	0.094083	0.9264
D(EXGR(-2))	0.283977	0.128014	2.218331	0.0436
D(EXGR(-3))	0.944375	0.157233	6.006194	0.0000
CointEq(-1)*	-1.355731	0.148361	-9.138077	0.0000

R^2 = 0.92. DW = 2.22
Source: Researchers' computation using Eviews

From Table III, one period lag of agricultural productivity has positive significant impact on its current performance. A unit change in it will bring about 2.99 change in its current performance. The growth rate of real GDP has a positive insignificant impact on the dependent variable. A unit change in it will bring about 0.93 change in the dependent variable. However, its first and second period lags have negative significant impact on the dependent variable. A unit change in both will bring about 4.33 and 2.74 changes on the dependent variable respectively. While the current value of lending rate has positive insignificant impact on the dependent variable, its one period lag exerts negative significant impact. Furthermore, a unit change in their respective values can induce 0.43 and 3.18 change in the dependent variable. Oil abundance (OILA) has negative significant impact on the dependent variable. A unit change in its current value, one period, two period lag, and three period lag will lead to 4.87, 3.17, 3.32, and 3.44 change in the dependent variable respectively. While the current value of exchange rate has negative significant impact on the dependent variable, its two period and three period lags exert positive significant impact. However, its second period lag has positive insignificant impact. A unit change in the current value of exchange rate, its first, second and third period lags will induce 3.27, 0.1, 2.22, and 6.01 change on the dependent variable respectively. The ECM factor {CointEq(-1)*} is negative and significant, thus, indicating a satisfactory speed of adjustment. Coefficient of correlation (R^2) of 0.92 is an indication that 92% of changes in the dependent variable is accounted for by changes in the independent variables all-together.

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The findings of negative and significant effects of oil abundance on agricultural productivity in the short run on the one hand and the negative and insignificant effects in the long run on the other hand is expected and in tandem with the rentier theory, resource curse and the Dutch disease hypotheses. The result is consistent with the empirical findings of (Osigwe, 2013). One can safely asserted that the huge revenue accrued to the Nigerian economy over the years has visited underdevelopment to the agricultural sector. In the same vein the findings of negative and significant effects of exchange rate on agricultural productivity also contributed to the problems in the sector as commodity prices are foreign exchange denominated.

In order to confirm the reliability of the model for policy making, residual diagnostics and stability tests were also carried out. The results indicates that; the model does not suffer from heteroscedasticity (see Figure III), that the residual is normally distributed (see Figure I), that there is no problem of serial correlation (see Figure II),and that the model is stable (see Figure IV)

CONCLUSION AND RECOMMENDATIONS

The study has analyzed and estimated the impact of oil abundance on agricultural productivity in Nigeria for the period 1970 to 2018. The analysis was carried out using the Autoregressive Distributed Lag (ARDL) model.

The result of the cointegration test based on the bounds testing approach showed that the variables are mutually co-integrated which suggested a long-run relationship between them. The results of the long-run estimates showed that lending rate and growth rate of the GDP had positive long-run relationship with agricultural productivity. Lending rate had significant relationship with agricultural productivity while growth rate of the GDP had insignificant relationship with agricultural productivity. The results of the short-run impact on agricultural productivity indicated that all the regressors had both positive and negative relationship significant relationship with

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agricultural productivity. We conclude that agricultural productivity is highly responsive to changes in oil abundance, lending rate, exchange rate and growth rate of the GDP.

RECOMMENDATIONS

Based on the results obtained, the study recommended the following:

(i) Policy makers should formulate policies that enhance the growth of agricultural productivity such as subsidizing agricultural inputs.

(ii) There is a need to further diversify the economy away from oil sector activities.

(iii) There should right policy mix in the context of \macroeconomic stability, efficient management of oil revenue and building of enduring institutional structures.

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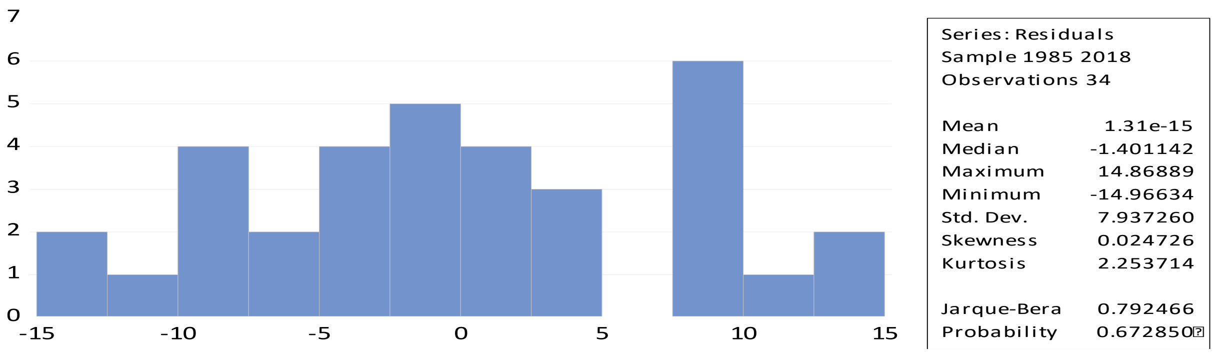
APPENDIX



Appendix I: Residual Normality Test

Appendix II: Breusch-Godfrey Seial Correlation LM Test

F-statistic	1.325087	Prob. F(2,12)	0.3020
Obs*R-squared	6.150501	Prob. Chi-Square(2)	0.1462

Appendix III: Heteroskedasticity Test (Breusch-Pagan Godfrey

F-statistic	0.735820	Prob. F(19,14)	0.7374
Obs*R-squared	16.98820	Prob. Chi-Square(19)	0.5907
Scaled explained SS	1.805569	Prob. Chi-Square(19)	1.0000

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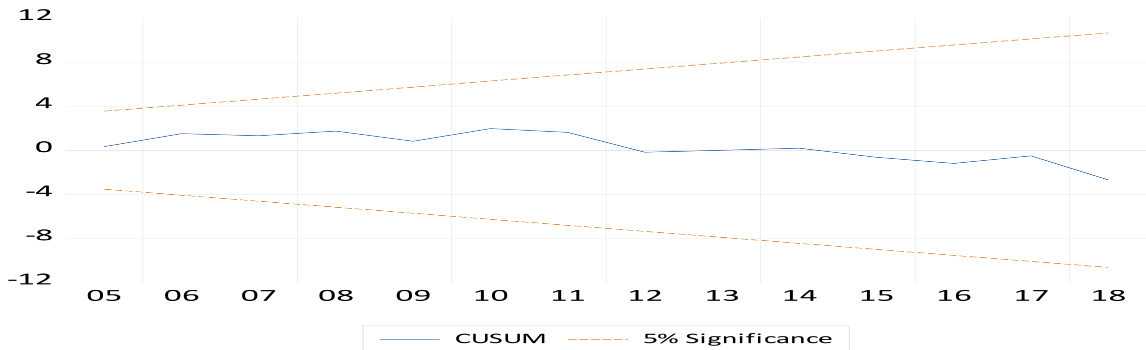
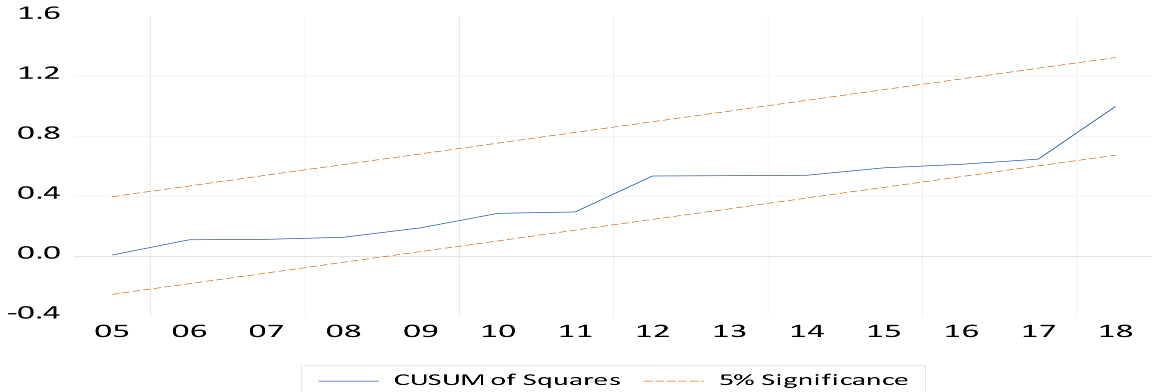


Appendix IV: Stability Tests (CUSUM)



Appendix V: Stability Tests (CUSUM of Squares)