Oil Price Volatility And External Debt Management In Nigeria: Empirical Evidence

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ABSTRACT

Oil price volatility effect on macroeconomic indices globally has been a long debate among scholars. This study examined the impact of oil price volatility on external debt management in Nigeria. The study employs the use of secondary data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin, 2018, World Bank, International Debt Statistics and Debt Management Office of Nigeria. The data were subjected to ADF test, Johansen co-integration test, Granger Causality test and Vector Auto-Regression (systems model) to estimate parameters and test outlined hypotheses using Wald Test Chi-square outcome. The empirical results of the study evidenced a significant impact of oil price volatility on capital investments, while external debt servicing and aggregate external debt was impacted insignificantly for same period under study. The study therefore, recommends; Debt Management Office of Nigeria to be empowered more constitutionally to create a centralized unit within its operations as an institutional strategy to monitor the practical aspects of the execution of external debt and setting up of follow-up team with feedback measures to ensure that such borrowed funds are utilized for designed purposes.

Keywords: Oil price, volatility, external debt, management.

I.0 INTRODUCTION

The global financial crisis dated in 2008 which also led to the down turn of oil price and other essential commodities, crashed the crude oil price in particular from over 140 dollars per barrel to as low as 39 dollars per barrel within (Adeniyi *et al.*, 2015). Fortunately, previous administrators comprising of former president Olusegun Obasanjo, and the then economic team:

Ngozi Okonjo-Iweala and Chukwuma Soludo had accumulated foreign reserves amounted to 53 billion dollars and also had some savings in the excess crude account despite the insistence from state Governors in disbursing it in disguise of financing capital budgets. Thus, with the significant slide of revenue in the system, Nigeria was able to go through the period without the economy going into spin (Adedipe, 2004). Alternative measures were suggested and some were adopted to help the system (Nigeria) to curtail this ups and down syndrome. Thereafter, oil prices rebound; the country again relaxed and went back to business as usual. Within the last three years, upstream oil companies have faced over 75 percent dip in their revenues as barrel prices dipped from $100 to below $30 per barrel (Englama *et al.,* 2010). And for the commodity producers that depend on import of raw materials seem to struggle with the exchange rate dilemma orchestrated by oil price volatility. According to Adedipe (2004), country like Nigeria that depends solely on crude oil proceeds, the retrogressive impact of recent oil prices cannot be overemphasized in view of sustainable economic development and survival of allied industries and its debt management capabilities.

The country has seen crude oil prices increase from $113 to $147 per barrel and then retreat to the current level under $54 per barrel. Thus, Government established the Petroleum Support Fund (PSF) to reduce the shocks from the oil price decline in 2006. Which main objective is to stabilize the domestic effect of fluctuations in crude oil prices in the international crude oil markets, but how well the Petroleum Support Fund (PSF) has materialized this objective remains unveiled (Nwanna & Eyedayi, 2014). Adedipe (2004) also argued that the attendant problems associated with oil price volatility in Nigeria is inability of the institutions to finance its fiscal projects, decrease in standard of living and persistent rise in its debts profile.

The current standard of living in Nigeria exhibited that 60% of our populace live below one dollar per day. The resulting decline in the non-oil sector reinforces and there is also sharp decline in economic performance due to imbalance in sales of crude oil (Ibrahim, Ayodele, Hakeem & Yinka, 2014).

Notably, sustainability of any economic performance is anchored largely to the diversification of such economy. For instance, in developed economy like Canada, oil price volatility does not necessary posed severe threat as several measures are been put in place to combat such occurrences (Ibrahim *el tal.*, 2014). Ayoola (2013) argues that Nigeria as a mono-product economy remains susceptible to the movements in international crude oil prices. Yusuf (2015) also contends that oil price plays a critical role in Nigeria in the conduct of fiscal and monetary policies because it accounts for average of 80% of government revenue, 90-95% of the foreign exchange earnings and 12% of the real gross domestic product. However, despite the windfall from oil prices doing boom eras, Nigeria still has an increasing proportion of impoverished population and experienced continue stagnation of the economy (Okonjo-Iweala and Osafo-Kwaako, 2007).

Nevertheless, the consistent fall in the purchasing power of the naira and the rising poor standards of living amongst Nigerians cannot be avoided in an economy that depends solely on proceeds of crude oil. The effects of oil price volatility seem to be very significant and destabilizing especially in the area of external debt management strategy (Omotola & Saliu 2009).

In view of the above, it pings in the heart of many; home and abroad to question the true position of Nigerian external debt profile in respect to the recent down turn on oil prices volatility globally.

Therefore, the broad objective of this study is to investigate the impact of oil price volatility on external debt management in Nigeria. However, target objectives of the study are:

I. To examine the influence of oil price volatility on capital investments in Nigeria.

II. To determine the effect of oil price volatility on external debt servicing in Nigeria.

III. To examine the effect of oil price volatility on aggregate external debt in Nigeria.

This study will illuminate the fact that external debt management in Nigeria is anchored on the trend of oil price volatility. Therefore, this study will stimulate research of specific objective of oil price volatility and external debt management strategies. It will also come up with policy option for regulatory authorities and the Nigerian government to redesign effective measures (diversification) to suite the current polity geared towards achieving sustainable economic growth in Nigeria.

The rest of the study is subdivided into: Review of related literatures, methodology, analyses and interpretation of data, summary, concluding remarks and recommendations.

2.0 REVIEW OF RELATED LITERATURES

2.1 CONCEPTUAL FRAME WORK

This section is mainly concerned with the clarifications, conceptual linkages and historical perspective of the major components of the study.

BACKGROUND OF GLOBAL OIL PRICE TREND: Records shows that as from the early 1940s to the late 1970s the international oil price was relatively stable having only little or no changes. Then from the late 1970 to the early 1980s the price of oil increased reasonably with respect to the establishment of OPEC and the intermittent bridges in the supply of crude oil. OPEC first exercised its oil controlling power during Yom Kippor War which started in 1973 by

imposing an oil restriction on western countries as a result of U.S and the Europe support for Israel. Production of Oil was reduced by five million barrels a day, this cut back amounted to about seven percent of the world production and the price of oil increased 400 percent in six months. From 1974 to 1978 crude oil prices were relatively stable ranging from $12 to $14 per barrel. Then between 1979 and 1980 during the Iranian revolution and Iraq war, the world oil production fell by 10% and caused the increase in crude oil price from $14 to $35 per barrel.

Increasing oil prices forced leading consumers and firms to adopt a more conserve energy, people purchased cars that could manage fuel and organizations purchased machine that were more fuel efficient (Sharma 1998). Increased oil price also enlarged search and production by nations that were not members of OPEC. Beginning from 1982 to 1985 OPEC wanted to stabilize the price of oil through production of quotas, but safeguarding efforts, global economic downturn and wrongful quotas produced by OPEC member countries contributed to the plunging of oil prices beneath $10 per barrel.

From the Mid-1980s the volitlity in the price of oil has occurred more frequent than the past. OPEC has continually been trying to influence oil price to ensure its stability through allocation of production quotas to its member countries but has been unable to stabilize it; as OPEC share of the world oil production has fallen from 55 percent in 1976 to 42 percent today**.**

Oil prices matter in the economy in various ways; changes in oil price directly affect transportation costs, heating bills and the prices of goods made with petroleum products. Oil price spikes induce greater uncertainty about the future, which affects households and firms spending and investments decisions.

HISTORICAL CHECKS ON OIL DISCOVERY AND PRODUCTION IN NIGERIA

Quest for oil began in 1900s by a German company named Nigeria Bitumen Corporation, but there was no success until 1955 when oil was discovered in Oloibiri in the Niger delta region (now Bayelsa State) by shell-BP. Nigeria started exporting crude oil in 1958 but in major quantity in 1965, after the establishment of the bonny island on the coast of Atlantic and the pipeline to link the terminal.

In 1970, as the Biafra war ends, there was an increase in world oil price and Nigeria benefited immensely from this rise. Nigeria became a member of Organization of petroleum exporting countries (OPEC) in 1971 and the Nigerian National Petroleum company (NNPC) which is a government owned and controlled company was established in 1977. By the late 1960s and early 1970s, Nigeria had attained a production level of over 2 million barrels of crude oil a day. Although there was a decline in production of crude oil in the 1980s due to economic down turn, by 2004 Nigeria bounced back producing 2.5 million barrels per day, but the Niger delta crisis and the global financial crises in 2008 reduced Nigeria oil production and the world oil price.

The discovery of oil brought in the eastern and mid-eastern regions of Nigeria, this brought hope of a brighter future for Nigeria in terms of economic development as Nigeria became independent, but there were also grave consequences of the oil industry; as it fuelled already existing ethnic and political tension. The tension reached its peak with the civil war and reflected the impact and fate of the oil industry. Nigeria survived the war and was able to recover mainly from the huge revenue gained from oil in the 1970s. The Nigeria gained wholesomely from the nearly 36 months oil boom, the boom generates a lot of funds needed to meet all development need but the oil revenue which was supposed to be a blessing became a curse due to its misappropriation of windfall gain from oil.

The enormous impact of the oil shock on Nigeria grabbed the attention of scholars who tried to analyze the effect of oil price on economic sustainability, as well as its ability to manage inherent external debt profile. A set of radical oriented writers were interested in the nationalization that took place during the oil shock as well as the linkages between oil and an activist foreign policy. Regarding the latter, the emphasis was on OPEC, Nigeria's strategic alliance formation within Africa, the vigorous efforts to establish the Economic Community of West African States (ECOWAS), and the country's attempts to use oil as a political weapon, especially in the liberation of South Africa from apartheid. Many people had hoped that Nigeria will become an industrial nation and a prosperous nation from the benefits of oil but they were greatly disappointed when we Nigeria hit a major financial crisis that led to the restructuring of the economy (Odularu, 2007).

THE CONCEPT OF EXTERNAL DEBT IN NIGERIA

External debt according to World Bank (2004) is defined as debt owed by the government to non-residents repayable in terms of foreign currency, goods or service. External debt is one of the sources of financing capital formation in any economy. It is generally expected that Nigeria and other developing countries, facing paucity of capital, will acquire external debt to augment domestic saving (Pattito, poirson & Ricci, 2010). The main lesson of oil price volatility with external debt management literature is that a country should borrow abroad as long as the capital acquired produces a rate of return that is higher than the cost of the foreign borrowing. Although there is nothing wrong in borrowing, the utilization of the borrowed fund is what matters. The incidence of the debt crises in Nigeria hampers economic performance because a large portion of the country’s oil proceeds is required to service the debt. Thus, the net

crude oil earnings were grossly inadequate to effectively finance developmental projects after servicing such debts.

In consonance, external debt refers to the resources of fund in use in a country which is not generated internally and does not in any way come from any local citizens, whether corporate or individual. External debt is the portion of a country's debt that was borrowed from foreign lenders including commercial banks, government or international financial institutions. On the other hand, debt management is the scope of technical and institutional arrangement of liabilities of a given country so as to pragmatically check its burden within sustainable limit. The technical aspect is concerned with the determination of the amount of debt the economy can sustain and that the conditions of borrowing are favorable and consistent with future debt servicing ability. While, the institutional aspect includes the administrative, organizational, legislative, accounting and monitoring aspect of managing both new and old stock of debt. In both aspects, more attention is given to reducing the debt service burden.

It is no exaggeration to claim that Nigeria's huge foreign debt burden was one of the hard knots of the Structural Adjustment Programme (SAP) introduced in 1986 (Ojo, 1989). Prior to the $18 billion debt cancellation granted to Nigeria in 2005 by the Paris Club, the country had external debt of close to $40 billion with over $30 billion of the amount being owned to Paris Club alone (Semenitari, 2005). The history of Nigerian's huge debts can hardly be separated from its decades of continued recklessness of its rulers. Nigeria's debt stock in 1971 was $1 billion (Semenitari, 2005). by 1991, it risen to $33.4 billion, and rather than decrease, it has been on the increase, particularly with the insurmountable regime of debt servicing and the insatiable desire of political leaders to obtain loans for the execution of dubious projects (Semenitari,

2005). The huge debt was too much burden on the country, in terms of its servicing, leaving it with little to perform her constitutional obligations to the citizenry.

Debt crisis is a serious problem facing the third world countries today, and Nigeria is not an exception. This problem could be traced from the era of colonization and as a result of incorporation of Nigeria into the third world capitalist system. This problem experienced by these economies has created doubt as to whether development is indeed possible in these nations. Though, there is nothing wrong in a country going into borrowing, what matters is the proper management of the debt. For a country to grow, it needs capital and where this is not available, it poses huge problem for economic performance and development of the said economy. A country finds itself in debt when there exist a vast gap between domestic savings, investment and export earning in absolute term over time.

The debt crisis experienced by Nigeria has created quite a number of problems which has slowed down the pace of economic performance in the country, but what can be done about this situation we find ourselves into? Nigeria's position gets worse as the gap widens and debt cumulate side by side with perpetual accumulation of interest rates. That notwithstanding, Nigeria has maintained a constant flow of net import and this is why the country is compelled to borrow externally thereby inhibiting its developmental strives.

Thus, African countries have acquired a large sum of external debt overtime to bridge the gap between domestic savings and investment. This process was influenced by the act of the traditional concept of bridging the savings investment gap in order to accelerate the process of economic performance. This conventional undertone was that the gap between savings and investment can be bridged either by reducing domestic savings or augmenting domestic savings

with borrowed external funds. In the former case, economic performance would either exacerbate, decline or stagnate and income would be depressed, while in the latter, economic performance would accelerate if the external funding (debt) were optimally deployed to finance viable projects.

However, the entire numerous problems facing Nigeria today, the external debt burden is obviously not sea paged and very pernicious and malignant one. Debt as many would imagine, constitute a very large and big hindrance to the development process especially within the context of a dependent capitalist formation. In a debt ridden economy, for instance, economic benefit which would have been channeled into social profitable investment outlet was diverted into debt servicing. A sustainable external debt service position depends on among other things, the deployment of external borrowing in productive investment.

In order to resolve the debt problem facing the economy today, the Federal Government embarked on various policy measures aimed at resolving the debt crisis. One of such policy was the Structural Adjustment Programme introduced in July 1986. SAP was expected to remove all the problems in Nigeria economy. But unfortunately, SAP created more problems than it came to solve. Other strategies are, debt cancellation, debt exchange swaps, debt conversion, debt repudiating, and debt restructuring.

After the Nigeria civil war, there has been a decline in the relative position of agriculture in the country with the advent of crude oil production. Irrespective of the oil boom, Federal Government has embarked on non-productive project that do not have the capacity to grow the economy. This is against the economic idea of investing in productive ventures basically to have other sources of foreign earnings to the national treasury. Consequently, exacerbate the country's

external debt profile.. No doubt, external debt is good and bad depending on the management and application of the said debts.

AIMS AND STRATEGIES OF EXTERNAL DEBT MANAGEMENT IN NIGERIA

Nigeria's external debt management strategies have varied from time to time since the early 1980's when the debt crisis became looming. However, this comprehensive following policy objective upholds:

- To evolve strategies for increasing crude oil earnings thereby reducing the need for external borrowing.
- To stipulate the criteria for borrowing from external sources and determine the type of projects for which external fund may be obtained.
- To outline the mechanism for servicing external debt of the public and private sector.
- To define the roles and responsibility of the various organs of the federal and state government as well as the private sector in the management of external debt.

The following managerial strategies were issued as regards to external funding in Nigeria:

- Economic sector projects should have positive internal rate of return as to offset cost of borrowing in the long run
- Social services or infrastructure would be ranked on the basis of their cost/benefit ratio.
- Projects to be financed with external funds (debt) should be supported with feasibility studies, which include debt (loan) acquisition, deployment and retirement schedule.

- External debt for private and public sector with quick returns should be sourced from international capital markets while debt for social services could be sourced from conventional financial institutions.
- Borrowing by state government, parastatals and agencies should receive approval from the federal government to ensure that the borrowing conforms to national objectives. While approvals granted to the private sector should not constitute federal government guarantee of foreign currency undertaking.
- The state government's borrowing proposals should be submitted to the Federal Ministry of Finance and Central Bank of Nigeria (CBN) for consideration before they are incorporated in the final public sector borrowing for the annual budgets.
- State government and their agencies as well as, Federal parastatals should device their debts through the foreign exchange Market (FEM) and inform the Federal Ministry of Finances for record purpose. For failure to service their debts the naira equivalents would be deducted at source before the balance of their statutory allocations are allotted.

2.2 THEORETICAL FRAMEWORK

This study is moored on the theoretical linkage of dependency and debt overhang theories.

DEPENDENCY THEORY: Dependency theory holds that "the condition of underdevelopment is precisely the result of the incorporation of the Third World economies into the capitalist world system which is dominated by the West and North America" (Randall and Theobald 1998), hence in managerial studies, dependency implies a situation in which a particular country or region relies on another for support, survival and general economic performance.

The third world countries are the economically underdeveloped countries of Asia, Africa, Oceania, and Latin America, considered as an entity with common characteristics, such as poverty, high birthrates, and economic dependence on the advanced countries. The term therefore implies that the third world is exploited, and that its destiny is a revolutionary one.

Distinctively, the underdevelopment of the third world is marked by a number of common traits; distorted and highly dependent economies devoted to producing primary products for the developed world and to provide markets for their finished goods; traditional, rural social structures; high population and widespread poverty. Despite the widespread poverty these countries, the ruling elites of most third world countries are outrageously wealthy (Woldu, 2000). The wind of change of the late 60s and early 70s with the advent of crude oil had liberated most of the third worlds, Africa and Nigeria, thus rendering whatever differences in the rate of development a peculiarity to the specific country concerned.

In the Nigerian perspective, to answer correctly the question; is it environment or is it in our nature; that we failed or refused to develop, is necessary as it has been rendered impossible by the current political atmosphere fueled by some kind of anti-colonialism; now turned into anti-imperialism, which forecloses all discussions by insisting that “we are our own”. This posturing had not only dissuaded us to ask this basic question but had indeed put thick blinkers into our eyes that we cannot see in reality, even though we are living in the thick of our unpalatable reality of underdevelopment (Kyari, 2008).

DEBT OVERHANG THEORY: One of the theories linking external debt management is debt overhang theory. Krugman (2009) sees debt overhang as a situation in which the expected repayment on foreign debt falls short of the contractual value of the debt and showed that there is a limit at which accumulated debt will distort investment and economic performance. The same

way, Borenszten (2009) argued that the debt overhang crisis is a situation in which the debtor country benefits very little from the returns on any additional investment because of the debt service obligation. In line with these, Desta (2015) found that a negative relationship existed between external debt and economic growth which justified the existence of debt overhang hypothesis. Similarly, Iyoha (2009) found that in sub-Saharan African countries the external debt to Gross National Product (GNP) ratio is high and creates debt overhang problems which consequently affect investment and growth negatively. This is based on the premise that, if debt will exceed the countries repayment ability, there is tendency of future expected debts service to likely effects the country's output level. And as such, future returns on any investment accrue to the creditor for bigger debt servicing. This may discourage capital accumulation and promotes capital flight (Elbadawi & John, 2014)

2.3 EMPIRICAL REVIEW

Oil price volatility has received significant considerations for itsr perceived key role in macroeconomic indices dynamism. The consequences of the vast oil price volatility on macroeconomic indices has been a great concern among policy makers, as well as the entire populace of Nigeria considering the major oil price shocks that hits the global economy. However, the followings are related verified empirical works of the studied phenomenon.

According to Trung and Vinh (2011) there are two reasons why macroeconomic indices should be affected by oil shocks. First, increase in price of oil leads to lower aggregate demand given that income is redistributed between net oil import and export countries. Oil price spikes could alter economic activity because household income is spent more on energy consumption, and firms reduce the amount of crude oil it purchases which then leads to underutilization of the factors of production like: labor and capital. Secondly, the supply side effects are related to the

fact that crude oil is considered as the basic input to production process. A rise in oil price will lead to a decline in supply of oil due to the fact that a rise in cost of crude oil production will lead to a decline in potential output. Basically, five of the last seven United States of America recessions were preceded by significant increases in the price of crude oil (Sill, 2009).

According to Amano and Norden (1998) many researchers suggest that oil price volatility has a significant consequence on economic activity and the effect differ for both crude oil exporting countries and crude oil importing countries. It benefits the crude oil exporting countries when the international oil price increases but it poses a hiccups for the crude oil importing countries.

Plante (2008), posits theoretically that the immediate positive effect of oil price volatility is the increase in the cost of product for oil importing countries, this is likely to reduce output and the magnitude of this will depends on the demand side for crude oil. Higher oil prices lower disposable income which then leads to a reduction in consumption. Once the increase in oil price is believed to be permanent, private investments will decrease. But if the oil price volatility is perceived as transitory, oil is used less in production and the productivity of labor and capital will decline and potential output will fall.

Kutan and Wyzan (2005) using an extended version of the Balassa-Samuelson model finds evidence that oil price volatility had a significant effect on the real exchange rate during 1996 to 2003 and that the Balassa- Samuelson working through productivity changes may be present though its economic significance may not be large.

Cashin *et al.,* (2004) carried out a study on over 50 commodities exporting developing countries and found a long-run relationship between exchange rate and the exported commodity's price in one third of their sample.

In a recent study, Ozsoz and Akinkunmi (2011) also demonstrated the positive effects of international oil prices on Nigeria's exchange rate.

Olomola (2006) investigated the impact of oil price shocks on aggregate economic activity in Nigeria using quarterly data from 1970 to 2003. He discovered that contrary to previous empirical findings, oil price shocks do not affect output and inflation in Nigeria significantly. However oil price shocks were found to significantly influence stock of external debt.

From the empirical purr view of studies examined globally and within the national hedge on the studied phenomenon, external debt management as not been holistically examined as an explained variable in respect to oil price volatility in Nigeria. Thus, it is imperative therefore to examine oil price volatility impact on external debt management in Nigeria. This is because external debt rate in Nigeria is becoming an economic evil that affects basic macroeconomic indices in the economy.

3.0 METHODOLOGY OF THE STUDY

This study adopts the *ex-post facto* research design. This research design is adopted because of its strength and it is the most appropriate to use when it is practically impossible to manipulate variables employed.

RESEARCH HYPOTHESES

The research hypotheses in this study are formulated in the null form in order to bring fort clarity of purpose.

$H0_1$: Oil price volatility has no significant impact on capital investment in Nigeria.

$H0_2$: Oil price volatility has no significant impact on external debt servicing in Nigeria.

$H0_3$: Oil price volatility has no significant influence on aggregate external debt in Nigeria.

REQUIRED DATA AND SOURCES

Considering a study of this nature, it is imperative to choose data that will permit the estimation and testing of the hypotheses formulated. International crude oil prices (ICOP) as the explanatory variable (oil price volatility) while capital investments (PINV), external debt servicing (EXDS) and aggregate external debts (EXDA) values are used as explained variables (external debt management) independently for the period under study.

The average monthly data are employed for this study, span within June, 2017 to December, 2018. The data were obtained from Central Bank of Nigeria (CBN) statistical bulletin 2018, World Bank, International Debt Statistics, 2019 and Debt Management Office of Nigeria.

METHOD OF DATA ANALYSIS

Basic econometric tools such as: (a). Unit root test, using Augmented Dickey Fuller (ADF) Approach. (b). Co-integration test with Johansen Approach (c) Granger Causality test and (d) Vector Auto-Regression (system models) shall be employed for the analysis of the data-set and the estimation of the models.

SPECIFICATION OF MODEL

In accordance with the formulated hypotheses in this study, the models will be built as: capital investment (PINV), external debt servicing (EXDS) and aggregate external debts (EXDA) as determinant for external debt management, which are the explained variables while International crude oil prices (ICOP) is the explanatory variable employed in the study. Specifications of these econometric models are based on economic theory relating to the studied phenomenon that requires basically:

1. Determination of the explained and the explanatory variables.
2. Theoretical apriori expectation and signs of functional parameters relationships.
3. Determination of the mathematical form of model (Gujarati, 2004).

In analyzing the studied phenomenon we adopt and modified an empirical model of Nwoba, Nwonu & Agbaeze (2017). Their model was used to examine the impact of fallen oil price on the Nigeria economy.

Their model will be adjusted to reflect the current study showing the functional relationship of the variables employed.

$PINV = f(ICOP)$……*Eqn1*

$EXDS = f(ICOP)$……*Eqn2*

$EXDA = f(ICOP)$……*Eqn3*

Where,

PINV = Capital investment.

EXDS = External debt servicing

EXDA = Aggregate external debt

ICOP = International crude oil prices

The econometric specification of the explicit form of the regression models is given as follows;

$PINV_t = a_o + a_1 ICOP_t + Ue_t$..... *Eqn(4)*

$EXDS_t = a_o + a_1 ICOPS_t + Ue_t$..... *Eqn(5)*

$EXDA_t = a_o + a_1 ICOPS_t + Ue_t$..... *Eqn(6)*

Where:

a_0 = Intercept

a_1 = Coefficient of the explanatory variable to be estimated. It measures the effect of a unit change in oil price on external debt management in Nigeria.

Ue_t = Error term of the models. It account for other variables not attended to in the models.

A-priori Expectation of the Study

Thus, it is expected that the coefficients of variables in the study should be greater than zero. I.e, $Eq_4a_1>0$, $Eq_5a_1>0$ $Eq_6a_1>0$

Decision Rule: Inference about the hypotheses is made by considering chi-square outcomes in absolute terms and the critical values (probabilities) associated with individual variables. In this study the decision rule is to reject the null hypotheses (H0) if the critical values (probabilities) are less than 5% significance level.

4.0 ANALYSIS AND INTERPRETATION OF DATA

Table 1.1 Unit Root Test Results

Variables	ADF t-Statistics	Critical Value @5%	Order of Integration
ICOP	-3.871286	-1.962813	1(1)
PINV	-6.858708	-3.065585	1(1)
EXDS	-2.523855	-1.962813	1(1)
EXDA	-3.946888	-3.733200	1(1)

Source: E-view 9 output

Table 1.1 shows unit root test results for specified variables in the study. The results revealed stationarity of variables (integrated) at first difference, symbolized by: 1(1) at 5% significant level. This implies that variables have no unit root problem. A variable is said to have no unit root problem if the test statistics is greater than the critical value in absolute terms. This means that variables employed can be used for meaningful decision making.

Table 1.2 Johansen Cointegration Test Results

Date: 12/12/19 Time: 10:10
Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: PINV EXDS EXDA ICOP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.975265	131.7913	63.87610	0.0000
At most 1 *	0.937077	68.89926	42.91525	0.0000
At most 2	0.591926	21.88003	25.87211	0.1450
At most 3	0.323453	6.642796	12.51798	0.3833

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: E-view 9 output.

Table 1.2 evidenced the Johansen cointegration test result that indicates the existence of two cointegrating equations. This implies that, there exists a long run relationship among variables

employed in this study. We arrive at this conclusion by comparing the trace statistic against the Critical Values at 5% significant level.

Table 1.3 Granger Causality Test Results

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 12/12/19 Time: 17:28
Sample: 2017M06 2018M12
Included observations: 17

Dependent variable: PINV

Excluded	Chi-sq	Df	Prob.
EXDS	12.29113	2	0.0021
EXDA	4.464118	2	0.1073
ICOP	10.40832	2	0.0055
All	24.67460	6	0.0004

Dependent variable: EXDS

Excluded	Chi-sq	df	Prob.
PINV	52.75349	2	0.0000
EXDA	7.639730	2	0.0219
ICOP	0.210209	2	0.9002
All	85.47901	6	0.0000

Dependent variable: EXDA

Excluded	Chi-sq	df	Prob.
PINV	1.353366	2	0.5083
EXDS	2.681495	2	0.2617
ICOP	1.650465	2	0.4381

All	3.075777	6	0.7993

Source: Author's computation: E-view 9 output

Table 1.3 portrays the causal relationship among variables employed. The p-value of 0.0055 of international crude oil prices (ICOP) in respect to capital investment (PINV) is less than 5% significant level, which means that there exist a causal relationship between the two variables, while the p-values of international crude oil prices in respect to external debt serving (EXDS) and aggregate external debt (EXDA) of 0.9002 and 0.4381 respectively are greater than 5% significant level, which means that there exist no causal relationship between international crude oil prices and external debt servicing and aggregate external debt in Nigeria.

Table 1.4 First System Model Results

Dependent Variable: PINV
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 12/12/19 Time: 17:34
Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments
PINV = C(1)*PINV(-1) + C(2)*PINV(-2) + C(3)*EXDS(-1) + C(4)*EXDS(-2) +
C(5)*EXDA(-1) + C(6)*EXDA(-2) + C(7)*ICOP(-1) + C(8)*ICOP(-2) + C(9)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.602460	0.283220	2.127182	0.0661
C(2)	-0.046264	0.283781	-0.163028	0.8745
C(3)	0.005009	0.001665	3.008742	0.0168
C(4)	-0.002640	0.002546	-1.037131	0.3300
C(5)	-1.887274	24.15857	-0.078120	0.9397
C(6)	-26.73021	20.88612	-1.279807	0.2365
C(7)	33.73645	19.50288	1.729819	0.1219
C(8)	-57.06248	23.48189	-2.430064	0.0412
C(9)	2116.316	1824.979	1.159639	0.2796

R-squared	0.854840	Mean dependent var	1097.406
Adjusted R-squared	0.709680	S.D. dependent var	740.9674

S.E. of regression	399.2432	Akaike info criterion	15.12207
Sum squared resid	1275161.	Schwarz criterion	15.56318
Log likelihood	-119.5376	Hannan-Quinn criter.	15.16592
F-statistic	5.888950	Durbin-Watson stat	2.333928
Prob(F-statistic)	0.010754		

Wald Test:
Equation: Untitled

Test Statistic	Value	Df	Probability
F-statistic	5.204161	(2, 8)	0.0357
Chi-square	10.40832	2	0.0055

Null Hypothesis: C(7)=C(8)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(7)	33.73645	19.50288
C(8)	-57.06248	23.48189

Restrictions are linear in coefficients.
source: Author's computation: E-view 9 output.

Table 1.5 Second System Model Results

Dependent Variable: EXDS
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 12/12/19 Time: 17:39
Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments
EXDS = C(10)*PINV(-1) + C(11)*PINV(-2) + C(12)*EXDS(-1) + C(13)*EXDS(
-2) + C(14)*EXDA(-1) + C(15)*EXDA(-2) + C(16)*ICOP(-1) + C(17)
*ICOP(-2) + C(18)

	Coefficient	Std. Error	t-Statistic	Prob.
C(10)	-50.00837	24.94005	-2.005143	0.0799

C(11)	174.7305	24.98943	6.992176	0.0001
C(12)	0.901693	0.146599	6.150725	0.0003
C(13)	0.492102	0.224168	2.195234	0.0594
C(14)	-1258.635	2127.378	-0.591637	0.5704
C(15)	3992.772	1839.210	2.170917	0.0617
C(16)	547.4842	1717.403	0.318786	0.7581
C(17)	773.2981	2067.790	0.373973	0.7181
C(18)	-189235.6	160705.7	-1.177529	0.2728

R-squared	0.982425	Mean dependent var	82715.77
Adjusted R-squared	0.964851	S.D. dependent var	187522.4
S.E. of regression	35156.93	Akaike info criterion	24.07808
Sum squared resid	9.89E+09	Schwarz criterion	24.51920
Log likelihood	-195.6637	Hannan-Quinn criter.	24.12193
F-statistic	55.90029	Durbin-Watson stat	2.156107
Prob(F-statistic)	0.000003		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.105104	(2, 8)	0.9015
Chi-square	0.210209	2	0.9002

Null Hypothesis: C(16)=C(17)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(16)	547.4842	1717.403
C(17)	773.2981	2067.790

Restrictions are linear in coefficients.
Source: Author's computation: E-view 9 output.

Table 1.6 Third System Model Results

Dependent Variable: EXDA
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 12/12/19 Time: 17:43

Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments
EXDA = C(19)*PINV(-1) + C(20)*PINV(-2) + C(21)*EXDS(-1) + C(22)*EXDS(
-2) + C(23)*EXDA(-1) + C(24)*EXDA(-2) + C(25)*ICOP(-1) + C(26)
*ICOP(-2) + C(27)

	Coefficient	Std. Error	t-Statistic	Prob.
C(19)	0.003504	0.003781	0.926682	0.3812
C(20)	0.002644	0.003788	0.698019	0.5049
C(21)	3.51E-05	2.22E-05	1.580349	0.1527
C(22)	-4.97E-05	3.40E-05	-1.462631	0.1817
C(23)	0.988213	0.322503	3.064201	0.0155
C(24)	-0.384562	0.278817	-1.379260	0.2051
C(25)	-0.304805	0.260352	-1.170744	0.2754
C(26)	-0.219454	0.313469	-0.700081	0.5037
C(27)	30.38048	24.36239	1.247023	0.2477

R-squared	0.833363	Mean dependent var	11.91176
Adjusted R-squared	0.666726	S.D. dependent var	9.232069
S.E. of regression	5.329661	Akaike info criterion	6.489504
Sum squared resid	227.2423	Schwarz criterion	6.930617
Log likelihood	-46.16079	Hannan-Quinn criter.	6.533352
F-statistic	5.001073	Durbin-Watson stat	2.281143
Prob(F-statistic)	0.017621		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.825233	(2, 8)	0.4722
Chi-square	1.650465	2	0.4381

Null Hypothesis: C(25)=C(26)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.

C(25)	-0.304805	0.260352
C(26)	-0.219454	0.313469

Restrictions are linear in coefficients.
Source: Author's computation: E-view 9 output.

The system models from table 1.4 to 1.6 portray the lags collective impact of oil price volatility on external debt management in Nigeria. The chi-square outputs from the Wald Test will be used to test the hypotheses formulated in the study.

Using the a priori criteria of evaluating the parameters, the variables met a priori expectations hence fulfilling the economic criterion of the models.

The results also show that ICOP is statistically significant to PINV, while ICOP is statistically insignificant to EXDS and EXDA respectively both in short and in the long run. Furthermore, the results of the test of the overall significance of the models using the F-statistics show that all models are statistically significant. We arrive at this conclusion because the F-statistics are greater than the F-probabilities of each model. Coefficient of determinations (R^2) indicates that 85% of total variation in PINV is explained by the explanatory variable (ICOP) in the first system model as well as 98%, and 83% in the second and third system models. Finally, the Durbin-Watson statistics falls within the acceptance region of 2, thus, indicating the absence of first order autocorrelation.

TEST OF HYPOTHESES

Table 1.4, 1.5 and 1.6 above reveals that international prices of crude oil (ICOP), as proxy of oil price volatility has an associated chi-square probabilities values of 0.0055, 0.9002 and 0.4381 at 5% significant level respectively. This implies that oil price volatility has a significant impact on capital investment in Nigeria for the period under study. Hence the null hypothesis is

rejected. While oil price volatility has an insignificant impact on external debt servicing and aggregate external debt, hence their null hypotheses are accepted. Therefore, we conclude that oil price volatility has no significant impact on external debt servicing and aggregate external debt in Nigeria for the period under study.

4.1 DISCUSSIONS OF FINDINGS

The outcome of the system models (VAR) reveals that oil price volatility evidenced from monthly data sourced has a significant impact on capital investment in Nigeria, while oil price volatility in respect to external debt servicing and aggregate external debt shows an insignificant impact for the same period under.

However, the first lag coefficients of oil price volatility; C (5) and C (16) to capital investment (PINV) and external debt servicing (EXDS) are linear (positive) despite oil price volatility insignificant relationship with external debt servicing. This implies that increase in price of crude oil by a percentage also increases capital investment and the amount used to offsets external debt in Nigeria by 33% and 5% respectively within same period of study. Conversely, the first lag coefficient of oil price volatility, C (25) to aggregate external debt (EXDA) is non-linear (negative) and insignificant in relationship. Implying that, an increase in price of crude oil by a percentage will reduce the stock of external debt recorded in Nigeria by 30% for the period under study.

This finding conforms to the findings of Amano & Norden (1998), according to him; oil price volatility has a significant consequence on economic activity and its effect differ for both crude oil exporting countries and crude oil importing countries. However, it benefits the exporting countries when the international oil price increases but it poses a hiccups for the importing countries.

4.0 CONCLUDING REMARKS

Oil price volatility and external debt management has been a contemporary issue in the Nigerian economy. This study evidenced that oil price volatility has impacted significantly on capital investments in Nigeria for the period under study. However, the explanatory variable employed in the study (international prices of crude oil) also reveals contrary that, oil price volatility does not have a significant impact on external debt servicing and aggregate external debt in Nigeria for the period under study.

Our conclusion therefore, is that oil price volatility do necessarily determined the extent to which Nigeria external debt profile is rising and it requires a proactive and effective administration to curtail it.

Based on the empirical findings of this study, we recommend that:

Debt management office of Nigeria should be empowered more constitutionally as to create a centralized unit within its operations as an institutional strategy to monitor the practical aspects of the execution of external debt and setting up of follow-up team with feedback measures to ensure that such funds are utilized for designed purposes.

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APPENDIX

DATA EMPLOYED

Monthly Crude Oil Prices from June, 2017 to December, 2018 (ICOP)$	Capital Investment Values (PINV)$	External Debt Servicing Values (EXDS)$	Aggregate External Debt Values (EXDA)$
46.17	239.45	131.05	1,479,235,000
47.66	438.7	155.42	1,358,911,000
49.94	321.38	163.81	1,494,837,00
52.95	241.69	363.51	15,514,450.000
54.92	351.25	382.5	17,560,270,000
59.93	519.47	393.96	10,799760,000
61.19	552.39	249.33	2,015,364,000
66.28	759.28	213.73	2,554,868,000
63.46	960.89	381.2	2,977,080,000
64.17	1,152.80	251.79	3,499,549,000
68.79	883.87	415.66	4,341,668,000
51.83	918.55	527.18	5,207,497,000
50.36	874.84	679.3	5,993,035,000
72.67	1,108.39	828.1	7,023,393,000
71.08	2,681.08	941.7	7,897,637,000
75.36	1,496.71	1,060.60	8,876,188,000
76.73	1,061.01	353,093.54	9,760,884,000
62.32	2,451.20	464,047.50	18,913.44,000
53.96	2,321.10	582,174.70	18,792.83,000

Source: Central Bank of Nigeria (CBN) Statistical bulletin 2018, World Bank, International Debt Statistics, 2019.
And Debt Management Office of Nigeria.

Unit Root Test Result for ICOP

Null Hypothesis: D(ICOP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.871286	0.0007
Test critical values:	1% level	-2.708094	
	5% level	-1.962813	
	10% level	-1.606129	

*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 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ICOP,2)
Method: Least Squares
Date: 12/11/19 Time: 23:30
Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ICOP(-1))	-0.996608	0.257436	-3.871286	0.0014

R-squared	0.482368	Mean dependent var	-0.579412
Adjusted R-squared	0.482368	S.D. dependent var	11.97835
S.E. of regression	8.618015	Akaike info criterion	7.202609
Sum squared resid	1188.323	Schwarz criterion	7.251622
Log likelihood	-60.22218	Hannan-Quinn criter.	7.207481
Durbin-Watson stat	1.941308		

Unit Root Test Result for PINV

Null Hypothesis: D(PINV) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.858708	0.0000
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

*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 16
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PINV,2)
Method: Least Squares
Date: 12/11/19 Time: 23:35
Sample (adjusted): 2017M09 2018M12
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PINV(-1))	-2.387867	0.348151	-6.858708	0.0000
D(PINV(-1),2)	0.831626	0.230843	3.602563	0.0032
C	237.6491	118.2075	2.010440	0.0656

R-squared	0.831379	Mean dependent var	-0.798750
Adjusted R-squared	0.805437	S.D. dependent var	1035.286
S.E. of regression	456.6572	Akaike info criterion	15.25310
Sum squared resid	2710965.	Schwarz criterion	15.39796
Log likelihood	-119.0248	Hannan-Quinn criter.	15.26052
F-statistic	32.04798	Durbin-Watson stat	2.201037
Prob(F-statistic)	0.00v0009		

Unit Root Test Result for EXDS

Null Hypothesis: D(EXDS) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.523855	0.0151
Test critical values:	1% level	-2.708094	
	5% level	-1.962813	
	10% level	-1.606129	

*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 17
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXDS,2)
Method: Least Squares
Date: 12/11/19 Time: 23:42
Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXDS(-1))	-0.616789	0.244384	-2.523855	0.0226

R-squared	0.281513	Mean dependent var	6947.225
Adjusted R-squared	0.281513	S.D. dependent var	106417.2

S.E. of regression	90203.07	Akaike info criterion	25.71454
Sum squared resid	1.30E+11	Schwarz criterion	25.76355
Log likelihood	-217.5736	Hannan-Quinn criter.	25.71941
Durbin-Watson stat	2.113004		

Unit Root Test Result for EXDA

Null Hypothesis: D(EXDA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.946888	0.0348
Test critical values:	1% level	-4.667883	
	5% level	-3.733200	
	10% level	-3.310349	

*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 16

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXDA,2)
Method: Least Squares
Date: 12/12/19 Time: 09:43
Sample (adjusted): 2017M09 2018M12
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXDA(-1))	-1.115679	0.282673	-3.946888	0.0019
D(EXDA(-1),2)	0.470757	0.242159	1.944002	0.0757
C	-7.376017	3.304807	-2.231905	0.0455
@TREND("2017M06")	0.599722	0.284607	2.107191	0.0568

R-squared	0.570103	Mean dependent var	-0.162500
Adjusted R-squared	0.462628	S.D. dependent var	6.391127
S.E. of regression	4.685057	Akaike info criterion	6.138951
Sum squared resid	263.3971	Schwarz criterion	6.332098
Log likelihood	-45.11161	Hannan-Quinn criter.	6.148842
F-statistic	5.304545	Durbin-Watson stat	2.223392
Prob(F-statistic)	0.014698		

Johansen co-integration test results

Date: 12/12/19 Time: 10:10
Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments

Trend assumption: Linear deterministic trend (restricted)
Series: PINV EXDS EXDA ICOP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.975265	131.7913	63.87610	0.0000
At most 1 *	0.937077	68.89926	42.91525	0.0000
At most 2	0.591926	21.88003	25.87211	0.1450
At most 3	0.323453	6.642796	12.51798	0.3833

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.975265	62.89207	32.11832	0.0000
At most 1 *	0.937077	47.01923	25.82321	0.0000
At most 2	0.591926	15.23723	19.38704	0.1811
At most 3	0.323453	6.642796	12.51798	0.3833

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

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

PINV	EXDS	EXDA	ICOP	@TREND(17M07)
-0.001941	-5.43E-06	-0.045435	-0.082593	0.149576
-0.006169	4.32E-06	0.150588	0.280457	0.449692
0.000167	8.71E-06	-0.069187	-0.156359	0.228863
-0.000641	4.90E-06	-0.097320	0.108063	-0.211084

Unrestricted Adjustment Coefficients (alpha):

D(PINV)	259.6195	201.5125	166.1496	29.49187
D(EXDS)	-67335.64	-8788.612	18928.14	-6183.278
D(EXDA)	0.127597	-3.450908	0.753466	1.755586
D(ICOP)	2.456525	-3.325184	1.493228	-3.083173

1 Cointegrating Equation(s): Log likelihood -414.8500

Normalized cointegrating coefficients (standard error in parentheses)

PINV	EXDS	EXDA	ICOP	@TREND(17 M07)
1.000000	0.002799	23.40785	42.55149	-77.06101
	(0.00045)	(3.93751)	(5.87043)	(10.3689)

Adjustment coefficients (standard error in parentheses)

D(PINV)	-0.503923
	(0.17978)
D(EXDS)	130.6989
	(17.7597)
D(EXDA)	-0.000248
	(0.00282)
D(ICOP)	-0.004768
	(0.00393)

2 Cointegrating Equation(s): Log likelihood -391.3404

Normalized cointegrating coefficients (standard error in parentheses)

PINV	EXDS	EXDA	ICOP	@TREND(17 M07)
1.000000	0.000000	-14.83395	-27.83605	-73.72866
		(1.69082)	(2.67454)	(4.50458)
0.000000	1.000000	13663.31	25148.58	-1190.605
		(1190.84)	(1883.68)	(3172.57)

Adjustment coefficients (standard error in parentheses)

D(PINV)	-1.747075	-0.000539
	(0.45213)	(0.00049)
D(EXDS)	184.9168	0.327810
	(56.6377)	(0.06081)
D(EXDA)	0.021041	-1.56E-05
	(0.00655)	(7.0E-06)
D(ICOP)	0.015745	-2.77E-05
	(0.01138)	(1.2E-05)

3 Cointegrating Equation(s): Log likelihood -383.7218

Normalized cointegrating coefficients (standard error in parentheses)

PINV	EXDS	EXDA	ICOP	@TREND(17 M07)
1.000000	0.000000	0.000000	1.778320	-93.82786
			(5.05513)	(9.24032)
0.000000	1.000000	0.000000	-2128.748	17322.44
			(3986.87)	(7287.64)
0.000000	0.000000	1.000000	1.996392	-1.354946
			(0.29913)	(0.54679)

Adjustment coefficients (standard error in parentheses)

D(PINV)	-1.719295	0.000907	7.054163
	(0.31547)	(0.00054)	(8.37933)
D(EXDS)	188.0816	0.492595	426.3484
	(42.9743)	(0.07397)	(1141.46)
D(EXDA)	0.021167	-9.05E-06	-0.577591
	(0.00639)	(1.1E-05)	(0.16964)
D(ICOP)	0.015995	-1.47E-05	-0.715655
	(0.01100)	(1.9E-05)	(0.29227)

Vector Autoregression Estimates
Date: 12/12/19 Time: 17:23
Sample (adjusted): 2017M08 2018M12
Included observations: 17 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	PINV	EXDS	EXDA	ICOP
PINV(-1)	0.602460	-50.00837	0.003504	0.010328
	(0.28322)	(24.9401)	(0.00378)	(0.00489)
	[2.12718]	[-2.00514]	[0.92668]	[2.11253]
PINV(-2)	-0.046264	174.7305	0.002644	0.006557
	(0.28378)	(24.9894)	(0.00379)	(0.00490)
	[-0.16303]	[6.99218]	[0.69802]	[1.33851]
EXDS(-1)	0.005009	0.901693	3.51E-05	1.28E-05
	(0.00166)	(0.14660)	(2.2E-05)	(2.9E-05)
	[3.00874]	[6.15072]	[1.58035]	[0.44583]
EXDS(-2)	-0.002640	0.492102	-4.97E-05	-4.38E-05
	(0.00255)	(0.22417)	(3.4E-05)	(4.4E-05)
	[-1.03713]	[2.19523]	[-1.46263]	[-0.99570]
EXDA(-1)	-1.887274	-1258.635	0.988213	-0.507789
	(24.1586)	(2127.38)	(0.32250)	(0.41702)
	[-0.07812]	[-0.59164]	[3.06420]	[-1.21765]
EXDA(-2)	-26.73021	3992.772	-0.384562	0.119715
	(20.8861)	(1839.21)	(0.27882)	(0.36053)
	[-1.27981]	[2.17092]	[-1.37926]	[0.33205]
ICOP(-1)	33.73645	547.4842	-0.304805	0.114590
	(19.5029)	(1717.40)	(0.26035)	(0.33666)
	[1.72982]	[0.31879]	[-1.17074]	[0.34038]
ICOP(-2)	-57.06248	773.2981	-0.219454	-0.786828
	(23.4819)	(2067.79)	(0.31347)	(0.40534)
	[-2.43006]	[0.37397]	[-0.70008]	[-1.94115]
C	2116.316	-189235.6	30.38048	92.15675
	(1824.98)	(160706.)	(24.3624)	(31.5026)

	[1.15964]	[-1.17753]	[1.24702]	[2.92537]
R-squared	0.854840	0.982425	0.833363	0.695756
Adj. R-squared	0.709680	0.964851	0.666726	0.391512
Sum sq. resids	1275161.	9.89E+09	227.2423	379.9631
S.E. equation	399.2432	35156.93	5.329661	6.891690
F-statistic	5.888950	55.90029	5.001073	2.286833
Log likelihood	-119.5376	-195.6637	-46.16079	-50.53027
Akaike AIC	15.12207	24.07808	6.489504	7.003561
Schwarz SC	15.56318	24.51920	6.930617	7.444674
Mean dependent	1097.406	82715.77	11.91176	62.11412
S.D. dependent	740.9674	187522.4	9.232069	8.834858

Determinant resid covariance (dof adj.)	5.644416
Determinant resid covariance	2.775615
Log likelihood	-398.7217
Akaike information criterion	51.14373
Schwarz criterion	52.90818