The determinants of current account balance in an oil-rich exporting country: the case of Nigeria

Uneze, Eberechukwu and Ekor, Maxwell

2012

The determinants of current account balance in an oil-rich exporting country: the case of Nigeria

Eberechukwu Uneze* and Maxwell Ekor**

*Director of Research, Centre for the Study of Economies of Africa, 4 Dep Street, Off Danube Street,Abuja FCT, Nigeria. Email: euneze@cseaafrica.org

**Research Fellow, Centre for the Study of Economies of Africa, Abuja, Nigeria. Email:mekor@cseaafrica.org

Abstract

This paper examines the determinants of current accounts balance in Nigeria with emphasis on oil-related variables using the Johansen–Julius vector error correction estimation approach, the impulse response function and the variance decomposition analysis. The results showed that oil price, oil balance and oil revenue are positively related with the current account, with only oil wealth having a significant negative impact in the long run. We find that the impact of oil price on the current balance is only significant in the short run. The variance decomposition analysis indicated that the variance in the current account is better explained by shocks to itself followed by shocks to oil price, oil balance and fiscal balance.

1. Introduction

The current account balance (CAB) is a key macroeconomic indicator, and reasons have been provided in both the theoretical and empirical literature on the importance of investigating its determinants. One of such reasons is that the CAB reflects an economy's inter- national competitiveness and the extent to which a country is living within its resources. The CAB also guides foreign investors in making investment decisions as it helps to predict threats to macroeconomic stability. Another relevance of the CAB is that it aids policymakers in assessing the compatibility of macroeconomic policies with the goal of ensuring a sustainable external position. In sum, the CAB is a key indicator used in measuring the external sector performance and the overall health of an economy.

Given the relevance of the CAB, questions regarding its determinants have attracted attention since the Latin American debt crisis of the 1980s. The interest in the CAB in the 1980s also arose partly as a result of the gradual slide of the United States from an international creditor nation to the world's biggest debtor. The rising global imbalances have also sparked a wave of interest in the sustainability of the current account deficit in many countries. A number of factors then make this study necessary for Nigeria. Firstly, is the frequent swing in the CAB, which in many cases, exhibited a feature that is characteristic of many oil-producing and -exporting countries. For example, since the oil boom days of the early 1970s and the most recent oil price (OP) rise (2000–2007), Nigeria has witnessed both positive and negative balances in its current account. Secondly is the 2008/2009 global recession, which is widely believed to have been partly caused by (or manifested) in large current account imbalances. Therefore, with

Nigeria's economy, its key sectors and indeed individual companies getting more globalized, it is important that a critical assessment of the determinants of the CAB is carried out. Also, the empirical literature on determinants of the CAB has been criticized for focusing too much on cross-country studies and including only a few oil-producing countries (Galinec, 2007; Morsy, 2009).

This study is therefore motivated by a number of factors. First, most of the available evidence on the CAB is based on cross-country studies, thereby limiting the ability of these studies to give far-reaching country-specific recommendations that will be useful for policymaking. Second, a large amount of the cross-country studies focuses mainly on non- oil producing countries, with a few concentrating on oil-exporting countries. Third, less attention is given to oil-based variables such as oil wealth (OW) and oil balance (OB). For example, studies on the CAB in Nigeria have included mainly OP in their studies, hardly capturing the impact of other oil variables such as OW and OB.

This study makes an important contribution to the literature by examining the relationship between a number of oil- related variables and the CAB, however, from a country level perspective, and in this case, Nigeria. Therefore, the objective of this paper is to contribute to the literature on current account by examining the relationship between a number of oil-related variables and the CAB for Nigeria, drawing largely on the lead provided by Morsy (2009). Specifically, the study attempts to examine if there is a long-run relationship between the CAB and oil variables such as OW, OB and oil revenue (OR) using the Johansen–Julius maximum likelihood (ML) cointegration method. The study also highlights the extent to which the CAB responds to shocks to other variables using the impulse response functions as well as the extent to which the variables contribute to the variation in the CAB by means of the variance decomposition technique.

The remaining part of the study is organized as follows: section 2 presents the literature, while the methodological approach is treated in section 3. The empirical results are presented in section 4, whereas section 5 concludes and provides some policy implications of the findings.

2. Literature review

2.1. Theoretical review

Several theories have been put forward in an attempt to explain the CAB. One of the earliest is the Keynesian elasticity approach, which explains that the current account depends on the price elasticity of demand for imports and demand for exports, vis-à-vis movements in the exchange rate. Another approach is the absorption model, which considers the CAB as a function of what is produced and consumed in the economy. There is the Mundell– Fleming model, which emphasizes the exchange rate and interest rate regimes as well as the national output, positing that through the combination of monetary and fiscal policy, the CAB may eventually be determined by the exchange rate regime in place. Also, the monetary approach has been used to explain changes in the CAB. The idea behind the monetary model is that any disequilibrium in the money market produces an effect on the aggregate expenditure. Proponents of the monetary model therefore argue that surplus in the balance of payments results from an excess in the stock of money demand that is not met by the monetary authorities. The portfolio–balance approach expands the monetary model by incorporating financial instruments. The approach postulates that the current account adjustment may operate through changes in the size of the portfolio or through changes in the composition of the country portfolio.

The different approaches described earlier have been criticized for not providing micro-foundations for explaining the CAB. The inter-temporal approach is therefore an attempt to fill this gap. This model considers the outcome of forward-looking dynamic saving and investment decisions of economic agents. Specifically, the model suggests that the CAB is the outcome of economic agents' collective optimization behaviour based on the expected values of various macroeconomic factors under the inter-temporal budget constraint. There are different variants of the inter-temporal model, but the overlapping generations' inter-temporal model assumes that the consumption of infinitely lived individuals depends on resources available to the economy. The implication of this is that eco- nomic agents prefer a stable level of consumption, meaning that national savings and the level of investment will determine the CAB. The key message of the overlapping generations' model is the role of the demographic structure of the population on the current account. The model highlights that a low dependency ratio correlates with a larger current account surplus and vice versa. The underlying assumption is therefore that finitely lived individuals and households smooth their consumption through youth, middle age and retirement.

Given the theoretical position of the overlapping generations' model, oil-exporting countries are said to present a special case in the CAB literature. This is because oil is considered an exhaustible resource and income generated seen as transitory, making it imperative for such countries to save part of their OW for the future generations, therefore reflecting in the behaviour of the current account. The main foundations of the overlapping generations' model will therefore form the basis of the present study. This is justified given that Nigeria is in the process of establishing a sovereign wealth fund (SWF), which aims to save part of its current oil earnings for future generations. The SWF will also enable the country to withstand negative shocks to the economy, thereby protecting the interest of future generations. Therefore, in line with the postulation of the overlapping generations model, the empirical review section will discuss findings in the literature with particular emphasis on oil-exporting countries. In addition, focusing on findings from oil-exporting countries will facilitate comparison with those of the present study.

2.2. Empirical review

Key studies in the CAB literature such as Debelle and Faruqee (1996), Chinn and Prasad (2003) and Chinn and Ito (2006) have provided insights from cross-country perspective, with very few oil-exporting countries included. It has, however, been argued that there is need to take a closer look at the CAB conditions in oil-exporting countries given their roles in global liquidity flows. This is because most cross-country studies are said to include a few oil-exporting countries, limiting the understanding of dynamics of the CAB in such countries (Morsy, 2009). Therefore, in line with this view, some studies have attempted to focus on the current account dynamics in oil-exporting countries. Bems and Filho (2009), e.g., argue that oil-exporting countries are different from other countries in several dimensions with respect to current account condition. Their reasons are that fiscal balance (FB) in oil-exporting countries is dominated by fluctuations in ORs, while the exhaustible nature of ORs brings to the fore issues of intergenerational consumption smoothing. Morsy (2009) examined the determinants of CAB for 28 oil-exporting countries noting that previous works included a very limited number of such countries in their samples. The study also highlighted that previous studies fail to capture the impacts of OW and the degree of maturity in oil production on the CAB. Therefore, the study estimated the equilibrium relationship between the CAB and some set of explanatory variables (FB, demographic factors, net foreign assets, OB, economic growth, OW and degree of maturity in oil production. Using dynamic panel estimation techniques, the study finds that the key determinants of the CAB for the oil-exporting economies are FB, OB, OW, age dependency and degree of maturity in oil production.

The approach by Arezki and Hasanov (2009) was to explore oil exporters' role in the understanding of global current account imbalances. The study estimated the current account dynamics for oil-exporting countries and the rest of the world and found that fiscal policy has a much stronger effect on the current account of oil exporters than on current account of other countries. In another study, Thomas and Bayoumi (2009) found that long- term wealth considerations and changes in the return on OW provide significant explanatory power to the CAB. They also show that the private sector is more forward-looking than the public sector in the oil-exporting economies. This, according to them, under- scores the importance of considering inter-temporal decisions when analyzing movements in macroeconomic aggregates of most major oil-exporting countries. Focusing on oil-producing countries in Sub-Saharan Africa, Takebe and York (2011) estimated the long-run external CAB for each of the selected countries, and one of the main findings is the evidence of a causal link from fiscal sustainability to external sustainability, con- firming the twin deficit hypothesis in the countries. Beidas-Strom and Cashin (2011) employed a dynamic panel regression in their estimation of the medium-term current account position for oil exporters, emerging markets and low-income and fragile economies. Among the findings is that an improvement in the FB increases the CAB of net oil exporters, while the CAB responds positively to OB, which is calculated as the ratio of oil trade balance to gross domestic product (GDP). In addition, they found that the effects of demographics are most felt for the oil-exporting countries, where the population is relatively young and old age dependency ratios are low.

A review of the empirical literature on Nigeria shows that apart from the traditional variables such as FB, exchange rate and OP, some important oil variables tend to be ignored by researchers. For example, Egwaikhide (1997) focused on the relationship between budget deficit and the CAB in Nigeria between 1973 and 1993. Using a macroeconometric model that captures the interrelationships between government budgetary developments, credit creation and the CAB, the study found that a budget deficit leads to a deterioration of the current account. Egwaikhide et al. (2002) extended the work by Egwaikhide (1997) by investigating the relationship between government budget deficit or surplus and CAB using a group of African countries including Nigeria. The main finding was that causality runs from the CAB to the budget balance. The cointegration and error correction technique together with the vector autoregression methodology were applied by Chete (2001) to examine the factors driving current account behaviour in Nigeria. The study found that while relative income, inflation, the degree of openness and the growth rate of industrialized countries are negatively correlated with the CAB, net foreign assets, budget deficit and exports show a positive association with the CAB. Okojie (2005) showed that the key determinants of the CAB in Nigeria are the exchange rate, the domes- tic interest rate as well as the trade balance to export ratio. The study further found that Nigeria's current account deficits were caused by rising investment income going to foreigners, rising imports relative to exports and a deficit on the balance of trade in services. Olumuyiwa (2008) used the inter-temporal model of the current account to examine the sustainability of Nigeria's current account over the period 1960 to 2003. The study found that excessive reliance on ORs and structural weaknesses contribute to unsustainable current account deficits and external crisis.

On their part, Chuku et al. (2011) used a structural vector autoregression technique to identify OP shocks and to evaluate its net effect on Nigeria's CAB. After introducing three control variables (output gap, real exchange rate misalignment and the lagged values of current account ratio), they found that OP shocks have a significant short-run effect on CAB for Nigeria. Enang (2011) adopted the Granger causality test, the cointegration test and the variance decomposition and impulse response function to investigate the impact of macroeconomic policy, non-policy and financial sector variables on Nigeria's CAB. The results show that exchange rate, monetary policy credibility and budget deficit are the important macroeconomic variables that influence current account movement in Nigeria. Given the previous findings for oil-exporting countries, in general, and for Nigeria, in particular, this study will be making an important contribution to the literature by examining the relationship between a number of oil-related variables and the CAB, drawing largely on the lead provided by Morsy (2009).

3. Methodology

3.1. Estimation technique

The estimation technique for this study follows the multivariate VAR cointegration approach developed by Johansen (1988, 1991) and further extended by Johansen and Juselius (1990, 1992). The approach is based on the ML estimation method and has been used in several comparative studies. This allows for estimation of the equilibrium long-run and short-run relationships between the CAB and other variables in the VAR model. In this technique, all the variables are assumed to be endogenous. Consider a VAR with p lags in the form in the next section:

$$y_t = v + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + \varepsilon_t \tag{1}$$

where y_t is a K ¥ 1 vector of endogenous variables, v is K ¥ 1 vector of parameters, $A_1 - A_p$ are K ¥ K matrices of parameters and e_t is K ¥ 1 vector of disturbance terms. This VAR canbe re-specified as a vector error correction model as:

$$\Delta y_t = v + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t. \tag{2}$$

where $\Pi = \sum_{j=1}^{j=p} A_j - I_k$, $\Gamma_i = -\sum_{j=i+1}^{j=p} A_j$.

As shown by Engle and Granger (1987), if the variables y_t are first-difference stationary—I(1), the matrix II in equation (2) has a rank $0 \leq r < K$, where r is the number of linearly independent cointegrating vectors and K is the number of included variables (potential endogenous variables). With a reduced rank $0 < r < K$, II can be expressed as ab so that equation (2) is represented as:

$$\Delta y_t = v + \alpha\beta\, y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t, \tag{3}$$

where a and b are both K ¥ r matrices of rank r. Two tests, the trace test and the maximum eigenvalue test, are usually used in determining the number of linearly independent cointegrating vectors. For the trace test, the null hypothesis is that the number of cointegrating vectors is less than or equal to r, where $r = 0, 1, 2 \ldots k - 1$. In each case, the null is tested against the relevant alternative. In the maximum eigenvalue test, the alternative hypothesis for $r = 0$ is that $r = 1$, while $r = 1$ null is tested against the alternative of $r = 2$, etc.

Given the previous specification, we estimate two equations, the baseline model with the current account indicator and oil variables, and the second a mix of the oil variables and a non-oil variable. Specifically, the baseline equation with the following endogenous variables (see Appendix 1 for description of variables) is estimated.

$$CAB_t = (OP_t, OW_t, OB_t, OR_t), \tag{4}$$

where CAB is the CAB, OP is OP, OW is OW and OB is OB and OR is OR. For our second VAR equation, we dropped OR and instead included FB in order to capture the effect of a non-oil variable in the estimation. The choice of the FB as against variables such as real GDP, trade balance, exchange rate, etc. is because fiscal policy in oil-exporting countries is closely linked with oil receipts.

Before examining equation (4) for cointegration, it is important to first determine the time series properties of the variables. This then means that the data must be tested for stationarity. There are various techniques, but this study will rely on the augmented Dickey–Fuller (ADF) test. The decision rule is that if the calculated ADF *t*-statistic is greater that the critical values, we do not reject the null hypothesis of existence of a unit root. On the other hand, if the calculated ADF *t*-statistic is less than the critical values, we reject the null hypothesis that unit root exist in the series.

Following the ADF test is the selection of the appropriate lag length using the relevant criteria such as the Akaike information criterion, the Bayesian information criterion and the Schwarz information criterion. Once the appropriate lag order is determined, the cointegration test is conducted so that the cointegrating vectors are identified. In addition, weemploy of the impulse response function to trace out the impact of a shock to the oil variables and the FB on the CAB. Following Lutkepohl (1991), the impulse response can be obtained from an infinite moving average representation of a K-dimensional VAR modelas follows:

$$Y_t = A_1 Y_{t-1} + ...+ A_p Y_{t-p} + \upsilon_t \tag{5}$$

and

$$\theta_n(\varphi_{ik,n}) = \sum_{j=1}^{n} \theta_{n-j} A_j \tag{6}$$

where n = 1, 2 . . . •, q 0 = Ik, Aj = 0 for j > p and Øik, n (the ikth element of $Ø_n$) represents the response of variable Yi to a shock in variable k, n periods ago. The orthogonalized impulse responses, which depend on the way in which variables are ordered in the system, are applied and this shows how the CAB will respond to shocks to other variables.

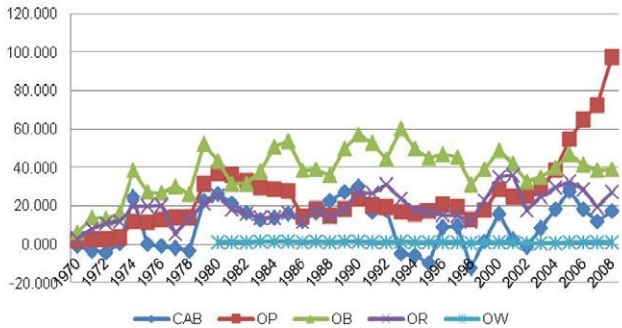


Figure 1 Trends in current account balance and oil variables.

3.2. Variables and data

The definition of variables and sources of data are provided in Table A1 of Appendix 1. Similarly, the summary statistics and correlation analysis are presented in Tables A2 and A3 of Appendix 1. The CAB is measured as percentage of the GDP, while OP is the average crude price for Organization of Petroleum Exporting Countries. OW is calculated as oil reserves at each year valued at OP of the relevant year relative to the GDP, and OB is the ratio of oil trade balance to GDP. Similarly, the OR variable is taken to be the ratio of total OR to GDP, while FB is also the ratio of FB to GDP.

An analysis of the trend of the variables is shown in Fig. 1 and depicts that the CAB was negative between 1970 and 1972, averaging -3.026 per cent in the period. However, it was in surplus between 1973 and 1975, owing to the positive shock in the global oil market of the 1970s. Although the CAB was again in deficit for the next 3 years, the period 1979 to 1992 saw Nigeria experiencing surplus in the CAB. While the surplus between 1990 and 1992 could be attributed to the increase in OP due to the first gulf war, the 1980s was a period when Nigeria had the structural adjustment programme, which partly helped check importation and consequently foreign exchange outflow. Thus, the CAB averaged 9.8733 per cent in the review period and reached a peak of 29.83 per cent. For the oil variables, OP averaged $25.14/b, while OW, OB and OR averaged 1.05 per cent, 38.33 per cent and 19.35 per cent, respectively. However, OP has the highest standard deviation of 19.31 per cent from the mean, confirming the volatility associated with crude OPs (see summary statistics in Appendix 1).

The FB averaged -4.016 per cent in the review period, implying that Nigeria may have operated a large fiscal deficit during this period. In terms of the relationship between the CAB and the oil variables, Fig. 1 shows that the CAB and the oil variables (except for OW) move in the same direction. This preliminary finding is supported by correlation results, showing that positive relationships exist between the CAB and all the oil variables but are much weaker with OW.

Table 1 Augmented Dickey–Fuller (ADF) test

Variable	At level ADF *t*-statistic	At level Critical value (5%)*	First difference ADF *t*-statistic	First difference Critical value (5%)*	Order of integration
CAB	–3.282	–4.260	–6.806	–1.950	I(1)
OP	1.351	–3.548	–3.569	–1.950	I(1)
OW	3.545	–4.352	–5.561	–1.950	I(1)
OB	–3.460	–4.260	–7.213	–1.950	I(1)
OR	–3.984	–4.260	–6.167	–1.950	I(1)
FB	–3.807	–4.260	–3.846	–1.688	I(1)

*Critical values simulated from MacKinnon (1991) approximate *P*-value.

Table 2 Lag order selection

Lags	Model 1 AIC	Model 1 SBIC	Model 1 HQIC	Model 2 AIC	Model 2 SBIC	Model 2 HQIC
1	24.787946*	26.239596*	25.205969*	23.482276*	24.933926*	23.900299*
2	25.404193	28.065551	26.170567	23.681180	26.342539	24.447555

*Means lag length 1 is appropriate.

AIC, Akaike information criterion; HQIC, Hannan–Quinn information criterion; SBIC, Schwarz Bayesian information criterion.

4. Empirical results

4.1. Unit root, lag selection and cointegration

We first check the time series properties of the variables using the ADF test statistic. The results presented in Table 1 show that all the variables have unit root but become stationary after first difference. This means that the variables are all integrated of order one and are therefore I(1) series, making them appropriate for inclusion in our VAR estimations. Selection of the appropriate lag order is the next important step and all the selection criteria, as shown in Table 2, indicate a lag length of 1.

Given that the time series properties of the variables have been determined and the appropriate lag selected, we proceed to conducting the cointegration test using the Johansen–Julius technique. The number of cointegrating vectors is determined using the trace statistic and the eigenvalue test. Table 3 shows the eigenvalues and trace statistics indicating one cointegrating vector at 5 per cent level of significance in the model with only oil variables and two cointegrating vectors in the model that include a non-oil variable. Since cointegrating vectors were found in the two models, we therefore proceed to identify the cointegrating vectors or the long-run models.

Table 3 Johansen cointegration rank tests

	Model 1		Model 2	
Maximum rank	Eigenvalue	Trace statistics	Eigenvalue	Trace statistics
0	0.76602	108.44	0.76823	126.77
1	*0.64415*	*69.225**	0.63098	85.829
2	0.57203	41.327	*0.55780*	*57.916*†
3	0.48965	18.412	0.51137	35.068
4	0.0092104	0.24983	0.41508	15.016

*Means presence of only 1 cointegrating vector.
†Means presence of 2 cointegrating vector.

4.2. Identifying the long-run models

To establish if long-run relationship exists among the variables in the cointegrating vector in the model with only oil variables as well as in the model with non-oil variable, we normalize and impose restrictions on the models. The restrictions also ensure that we are able to interpret the economic and structural relationships among the variables in the two models. In the baseline model where only one cointegrating vector exists, we impose only one restriction because normalizing on one of the coefficients is sufficient to identify the parameters of the single cointegrating vector. In a situation of more than one cointegrating equation as obtained in the second model, more restrictions will then be required. We therefore place two restrictions in the second model.

In the model with only oil variables, when Johansen normalization restriction is imposed on the CAB, we are able to establish that a long-run relationship exists between CAB and all the oil variables. Furthermore, rather than imposing over-identifying restrictions, we stick to the just identified model because over-identifying restrictions are some- times ‘unnecessary either for forecasting or for certain types of policy analyses, therefore the system dynamics should be left completely free’ (Sims, 1980). For example, when M’Amanja et al. (2007) imposed over-identifying restrictions in their analysis, they noted that the outcome did not make economic sense and was statistically rejected by the likelihood ratio test. We therefore proceed to explain the results of the just-identified model presented in Table 4.

The results as shown in Table 4 indicate that a long-run relationship exists between CAB and all the oil variables. The long-run current account equation with the t-statistics in parenthesis is therefore stated as follows;

$$CAB = \underset{(0.383)}{0.0828OP} - \underset{(-5.733)}{72.084\,OW} + \underset{(4.452)}{1.3310\,OB} + \underset{(0.614}{0.12951OR}$$

Table 4 Identification of the long-run model 1

Variables	Beta (b)	Alpha (a)
CAB	1.0000	–0.74784
OP	*–0.08279*	*–0.292404*
OW	72.084	–0.006850
OB	–1.3310	–0.087149
OR	–0.12951	–0.08289

In terms of the economic and structural relationship between the CAB and the oil variables, the long-run equation shows that a significant negative relationship exists between CAB and OW in the long run. This implies that as OW depletes, the impact on the CAB will be negative, giving credence to the findings in the literature as well as confirming that oil is an exhaustible resource. In the long run therefore, oil will play a less significant role in the broader economy in general and current account position in particular as the non-oil economy grows. This result informs the reason why oil-exporting countries make effort to save part of their oil earnings for the future and also develop key infrastructures to boost the non-oil economy. The result is in line with the findings in the literature, e.g., Thomas and Bayoumi (2009) found that OW provides a significant explanatory power to the CAB. The result also shows that in the long-run economic relationship between CAB and OP, on one hand, and between CAB and OR, on the other hand, is not significant, though positive. The estimated alpha of the long-run equation is -0.74784 for the normalized current account variable, and this shows that the cointegrating vector in the baseline model is error correcting. In other words, in the event of a shock, the speed of adjustment back to equilibrium will be fast.

We further estimated a model that includes a non-oil variable, FB, OP, OW, OB and the CAB. The rationale for this is to ascertain the impact of the non-oil variable on the CAB when combined with the oil variables. The Johansen–Julius cointegration test results presented in Table 3 shows that two cointegrating vectors exist in the model. To determine the long-run equilibrium relationship among the variables, two restrictions are therefore placed on the two cointegrating vectors. From the results shown in Table 5, when the CAB is normalized in the first cointegrating vector, a long-run relationship was established between the CAB and the oil variables OP, OW and OB, with only OW having a significant impact on CAB. However, the zero coefficient of the FB variable means that there is no long-run relationship between the CAB and FB. In contrast to the model with only oil variables, there is a significant positive relationship between CAB and OP.

From Table 5 earlier, the long-run current account and FB equations with the *t*-statistics in parenthesis are stated as follows.

$$CAB = \underset{(2.682)}{0.50434}\,OP - \underset{(-5.542)}{77.081}\,OW + \underset{(7.359)}{2.2519}\,OB$$

$$FB = \underset{(0.029)}{0.0292}\,OP + \underset{(2.672)}{19.547}\,OW - \underset{(-1.416)}{0.2278}\,OB$$

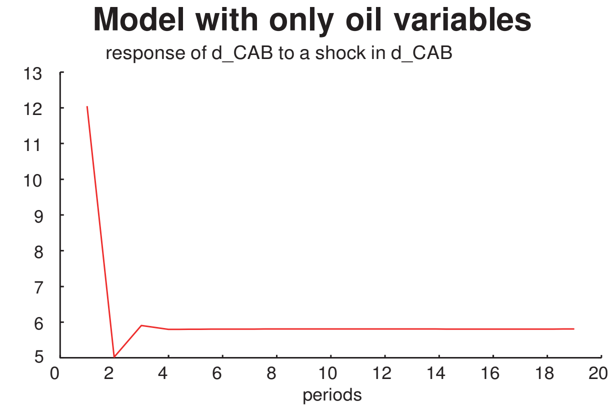
Table 5 Identification of the long-run model 2

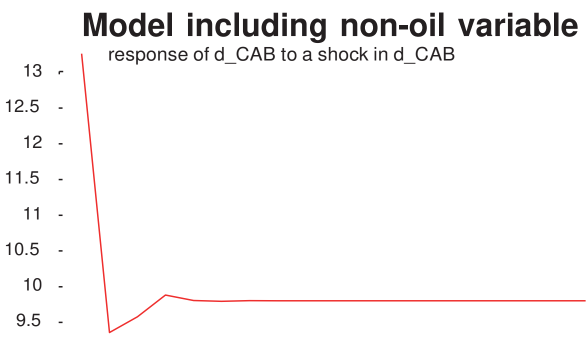
	First cointegrating vector		Second cointegrating vector	
Variables	Beta (b)	Alpha (a)	Beta (b)	Alpha (a)
CAB	1.0000	–0.30841	0.0000	–0.59105
FB	*0.0000*	*0.03376*	*1.0000*	*–0.87300*
OP	–0.5043	0.03030	0.02922	–1.07460
OW	77.0810	0.01038	19.5470	–0.03039
OB	–2.2519	0.65527	–0.22780	–0.90155

The estimated alpha of -0.30841 in the first cointegrating vector confirms that the cointegrating vector is error correcting. However, in contrast to our baseline model, the error correction term of -0.30841 means that the speed of adjustment back to equilibrium in the event of a shock is slower in this equation. The implication therefore is that the speed of adjustment of the CAB back to equilibrium in the event of a shock is faster in the model with only oil variables, further confirming the relevant role that the oil variables play in Nigeria's external balance. In the second cointegrating vector where restriction is placed on the FB, there is no long-run relationship between FB and the CAB. This confirms the failure of the twin deficit hypothesis for Nigeria. However, a long-run relationship exists between FB and the oil variables while the speed of adjustment of this cointegrating vector to equilibrium is faster with an estimated error term of -0.87300. This also confirms the view in the literature concerning the relationship between fiscal policy in oil-exporting countries and oil receipts. In periods of positive OP shocks and consequently high OR, the fiscal policies of oil-exporting countries tend to adjust quickly to expansionary position.

4.3. Impulse response and variance decomposition of the long-run models

In order to trace out the time path of the effect of a shock to the oil variables and FB on the current account, we apply the impulse response function. Although the impulse response analysis has been criticized for a number of reasons including the sensitivity to variables ordering and distortions in results if important variables are omitted from the model, it remains an essential tool in the empirical analysis of the causal relationship between variables. Therefore, using the impulse response analysis, we seek to ascertain the effect of a one standard error shock to the variables on the current account. As shown in Fig. 2, the response of the CAB to a one-standard error disturbance to itself in the two models is positive and above the long-run equilibrium positions. Specifically, in the model with only oil variables, the effect becomes flat and permanent after the fourth year as against the sixth year in the model with non-oil variable. This means that the shock in the model with a non-oil variable has a higher effect on the CAB when compared with the model with onlyoil variables, suggesting that a disturbance to the CAB will take longer time to correct inthe model with the non-oil variable.





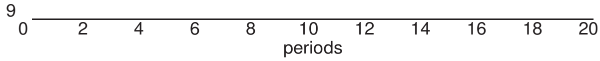
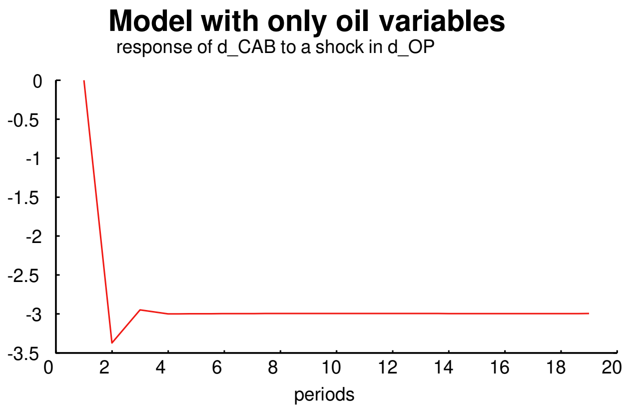


Figure 2 Response of CAB to a one-standard error shock to CAB.

As shown in Fig. 3, the response of the CAB to a one-standard error disturbance to OP is more pronounced in the model with FB. This highlights the implications of OP volatility to the fiscal regimes of oil-exporting countries. In the model with only oil variables, the effect of OP shock on the CAB becomes flat and permanent after the fourth year. On the other hand, the effect of OP shock on the CAB in the model with FB starts to die out after the fifth year. Again, this means that the CAB in our baseline model will revert back to equilibrium quicker than in the model with the non-oil variable. This further underscore the importance of the oil variables in explaining the current account position in Nigeria.



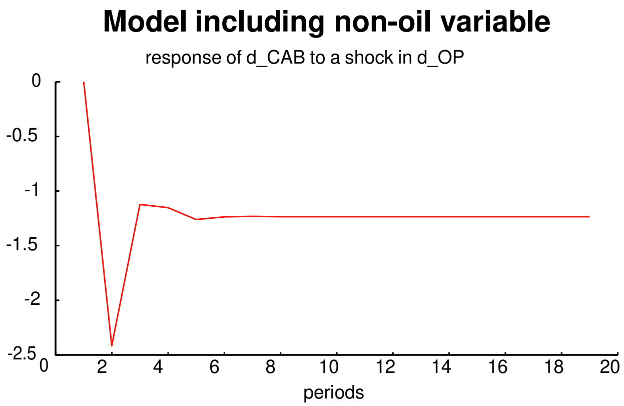


Figure 3 Response of CAB to a one-standard error shock to oil price.

The response of the CAB to a one-standard error shock to OW is positive in the first year in the baseline model and becomes negative thereafter. This means that a shock to OW (e.g., a negative shock) will have permanent negative effect on the current account from year 2 when only oil variables are included in our model. The implication of this is that the current account is affected negatively when OW starts to deplete. Besides, if the country resorts to external borrowing due to declining OW so as to bridge the gap between domes- tic saving and investment needs, this will further push the current account into deficit. However, should the non-oil economy become more productive, and export revenue from other sources improves in the long-run, oil contribution to GDP and to export revenue will diminish. In the model with non-oil variable however, a one-standard error shock to OW results in a greater response in the current account position, leading to a slower reversion to equilibrium (Fig. 4).

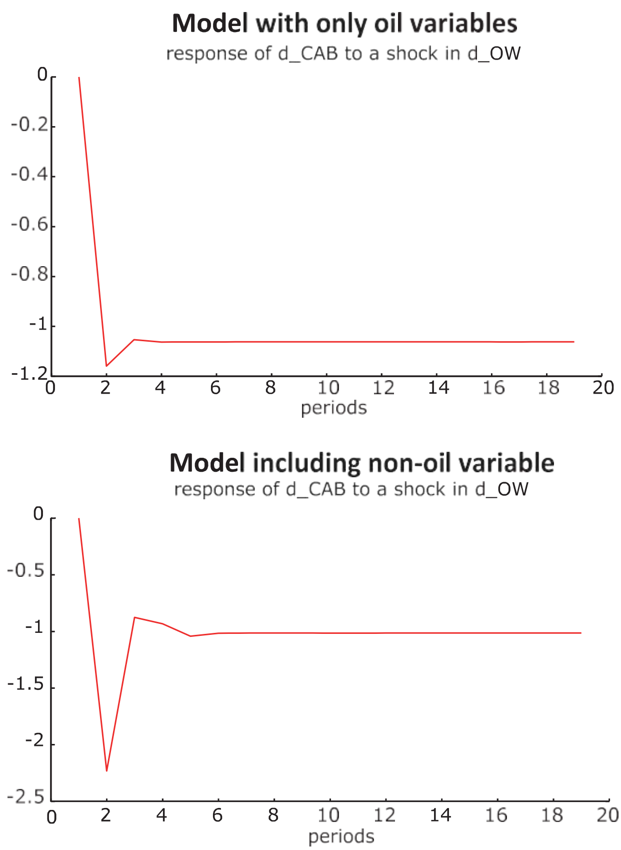


Figure 4 Response of CAB to a one-standard error shock to oil wealth.

The response of the CAB to shocks to OB in the two models is positive and above the long-run equilibrium position. However, in the baseline model, the effect of the shock is lower, implying that the CAB reverts faster to equilibrium when compared with the model with the non-oil variable. Specifically, while the impact of the shock on OB becomes flat from the sixth year, the impact increased in the model with FB from the first year to the eighth year and remained flat thereafter (Fig. 5).

Furthermore, the response of the CAB to a one-standard error shock to OR is also positive and above the long-run equilibrium. In other words, the effect is positive and permanent throughout the period. The economic implication of this is that as OR increases, the current account tends to remain in surplus. This is reasonable because oil-exporting countries benefit from positive shocks to the oil market. However, this is true only if imports and other expenditure do not increase faster than OR. With respect to the response of the CAB to a one-standard error shock to FB, our impulse response analysis shows that the effect is more pronounced in the first year than the rest of the period (Fig. 6).

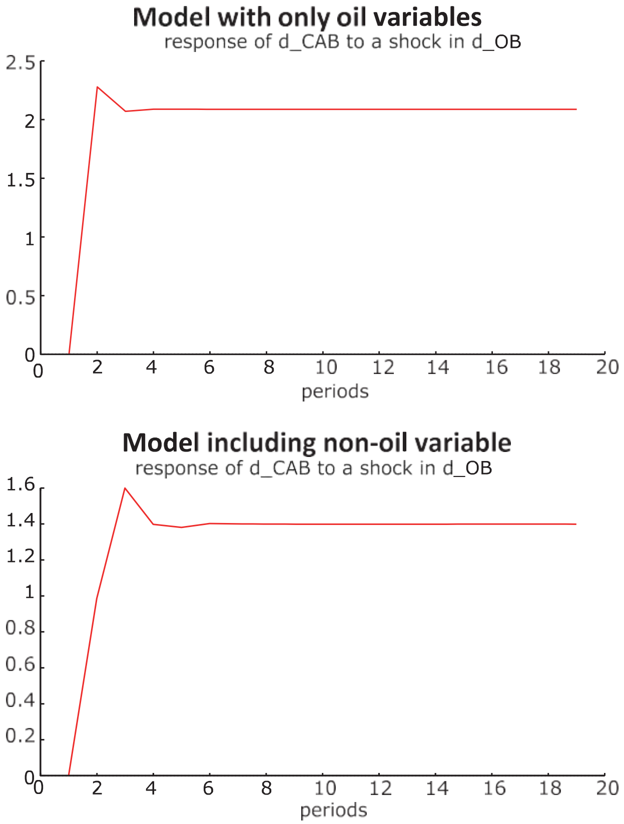


Figure 5 Response of CAB to a one-standard error shock to oil balance.

CAB to a one-standard error shock to FB, our impulse response analysis shows that the effect is more pronounced in the first year than the rest of the period (Fig. 6).

Another set of results that we discuss is the findings of the variance decomposition analysis. The results as reflected in the figures in Appendix 2 show that the variance in CAB is better explained by shocks to itself followed by OP and OB. In particular, around 86 per cent and 91 per cent of the variance in the CAB is better explained by its own shock in the model with only oil variables and the model with a non-oil variable, respectively. Similarly, around 7 per cent and 6 per cent of the variance in the CAB is explained by shocks to OP in the two models, respectively. The variance in the CAB is explained by shocks to OB by around 5 per cent and 2 per cent each in the two models, while OW explains 1 per cent and 0.04 per cent of the variance in CAB in the two models. OR explains an average of 0.4 per cent of the variance in CAB while FB explains around 1 per cent in CAB.

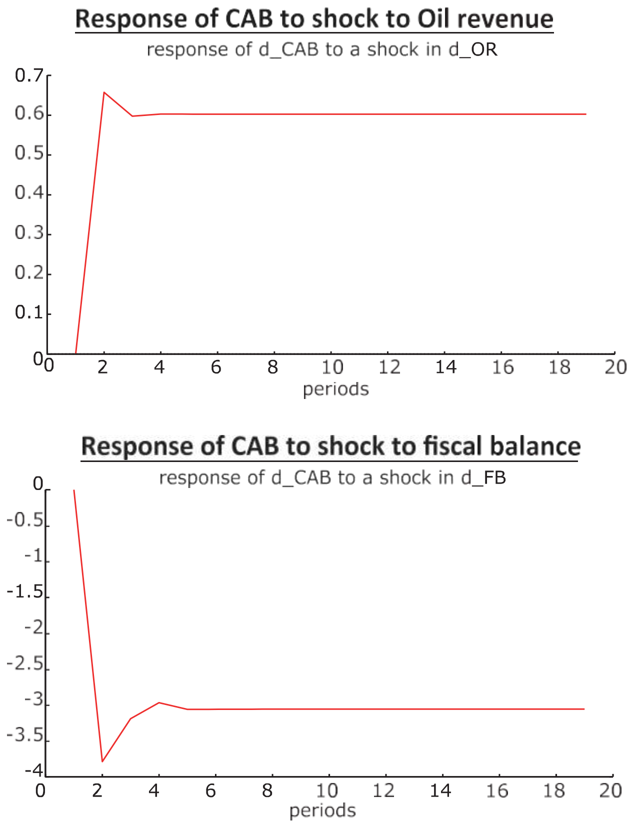


Figure 6 Response of CAB to a one-standard error shock to OR and FB.

Having identified the long-run model, the impulse response analysis and variance decomposition, we proceed to examine the short-run dynamics of the CAB in the two models. As shown in Appendix 3, OP has a significant effect on the CAB, while OB, OR and OW have no short-term significant effect on the CAB in the baseline model. The error correction term has negative and significant sign, implying that the current account equation will revert to equilibrium in the short-term in the event of a shock to the system. However, the speed of adjustment is slow and around -0.2497. The current account equation in the two models confirms the significance of OP in the short term. On the other hand, FB, OW and OB all have insignificant effect on the CAB. Nevertheless, the positive sign of OW in this model means that in the short run, the CAB will respond positively to OW, but in the long run, as OW depletes, the impact becomes negative. In contrast to the baseline model where the speed of adjustment is -0.2497, the error correction term in the model with the non-oil variable is also negative but with a very low speed of adjustment of -0.0045.

In conclusion, results from our baseline model as well as the model with the non-oil variable support the findings in the empirical literature on the role of oil variables in explaining the current account position in oil-exporting countries. Specifically, the results confirm the findings of previous studies on Nigeria that OP is able to explain long-run dynamics of current account position. However, given that previous studies on Nigeria did not include other oil variables such as OW, OB and OR, the present result may have a higher explanatory power in terms of the current account movement in Nigeria. The results are in line with Morsy (2009), who found that oil variables explain the long-run current account position in oil-exporting countries.

4.4. Post-estimation tests

In order to confirm the validity of our results, post-estimations tests were carried out for the models. To test for the stability of the results, we plotted the residuals for the two models. The objective is to determine whether the residuals are stationary or not, and Fig. 7 shows that the residuals are stationary. The stationarity of the residuals therefore implies that the estimated parameters valid.

Table 6 shows the results for other tests that were carried out. First, using the Jarque–Bera tests for normality, the results show that we fail to reject the null hypothesis that the errors in our models are normally distributed. Second, the Lagrange multiplier (LM) test was used to test for the presence of serial correlation in the models, and the outcome also confirms that we failed to reject the null hypothesis of no presence of autocorrelation in the two models. Third, the LM test for heteroscedasticity also shows that the null hypothesis of no heteroscedasticity is not rejected in the two models.

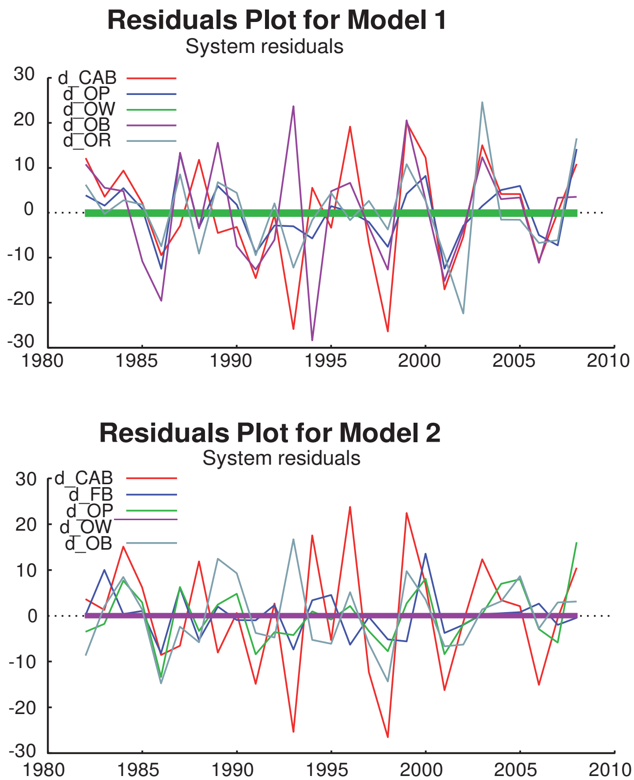


Figure 7 Residuals plot for the two models.

Table 6 Results of the post-estimation tests

Tests	Null hypotheses	Test statistic	*P*-value
Normality (model 1)	Error is normally distributed	Chi-square(2) = 9.330	0.5011
Normality (model 2)	Error is normally distributed	Chi-square(2) = 11.393	0.3277
Autocorrelation (model 1)	Autocorrelation not present	LM = 21.8391	0.6450
Autocorrelation (model 2)	Autocorrelation not present	LM = 18.1689	0.8351
Heteroscedasticity (model 1)	No presence of heteroscedasticity	LM = 0.07777	0.7803
Heteroscedasticity (model 2)	No presence of heteroscedasticity	LM = 0.1021	0.7493

5. Conclusion and policy implications of findings

This study has examined the determinants of Nigeria's CAB between 1970 and 2008 using the Johansen–Julius ML cointegration approach, the impulse response function and variance decomposition technique. The study provides additional insight into the determinants of CAB at the country level given the strong dominance of cross-country studies in the literature. The policy recommendations that often emerge from such studies usually have little or no country-specific relevance. Again, empirical studies on the CAB for Nigeria have included mainly OP and OR in their studies, thereby ignoring the impact of other oil variables such as OW and OB. These variables have ramifications for the current account movement in Nigeria.

The key finding of the study is that oil variables play a key role in explaining the current account position in Nigeria in the long run. Specifically, OW is the main variable affecting the CAB—it has a significant negative relationship with the CAB in the long run. The results also show that OP is the key variable explaining CAB in the short run. However, we found no evidence of long-run relationship between the current account and FB in Nigeria. The results of the impulse response analyses show that the current account tends to adjust faster to equilibrium in the model that includes only oil variables than in the model that includes the non-oil variable (FB). For the variance decomposition analysis, the results indicate that the variance in the CAB is better explained by shocks to OP, OB and FB.

The key policy implication of the findings is that given the impact of the oil variables on FB both in the short run and in the long run, prudent management of oil resources must be pursued. This will help reduce the volatility often associated with fiscal policy in oil- exporting countries such as Nigeria. It therefore implies that the policy measures aimed at ensuring effective and efficient management of oil earnings through the creation of the SWF is in order. Again, since a country's external balance is one of the key indicators that foreign investors consider when investing in a particular economy, prudent management of oil receipts will result in improved confidence in the economy. The prudent management of oil receipts apart from helping to make the economy more productive in the long run by way infrastructure provision and reduced debt burden on future generations will help check the volatility in fiscal policy in the short run. More so, since OW depletes over time and consequently affects the current account negatively, there is a need to revamp the non-oil economy in order to broaden the base of export revenue. The evidence of no long-run relationship between the FB and the CAB has two policy implications. Firstly, fiscal policy affects the external sector through changes in the government's consumption or investment demand for tradable goods. However, government consumption in Nigeria has been dominated by recurrent spending financed by domestic borrowing. Therefore, the long-run impact of such spending pattern in general and on the CAB in particular becomes insignificant.

References

Arezki, R. and Hasanov, F., 2009. Global imbalances and petrodollars. IMF Working Paper No. 89. Washington, DC: International Monetary Fund.

Beidas-Strom, S. and Cashin, P., 2011. Are Middle Eastern current account imbalances excessive? IMF Working Paper No. 195. Washington, DC: International Monetary Fund.

Bems, R. and Filho, I., 2009. The current account and precautionary savings for exporters of exhaustible resources. IMF Working Paper No. 33. Washington, DC: International Monetary Fund.

Chete, L.N., 2001. Explaining current account behavior in Nigeria. *Nigerian Journal of Economic and Social Studies* 43, 2, 25–40.

Chinn, M.D. and Ito, H., 2006. An update on medium-term determinants of current account balances: the 'savings glut' hypothesis examined. URL http://www.ssc.wisc.edu/~mchinn/Chinn_Ito_CAmemo.pdf [accessed 22 November 2011].

Chinn, M.D. and Prasad, E.S., 2003. Medium-term determinants of current accounts in industrial and developing countries: an empirical exploration. *Journal of International Economics* 59, 47–76.

Chuku, A., Akpan, U., Ndifreke, R. and Effiong, E., 2011. Oil price shocks and dynamics of current account balance in Nigeria. *OPEC Energy Review* 35, 2, 119–139.

Debelle, G. and Faruqee, H., 1996. What determines the current account? A cross-sectional and panel approach. IMF Working Paper No.58. Washington, DC: International Monetary Fund.

Egwaikhide, F., 1997. Effects of budget deficit on the current account balance in Nigeria: a simulation exercise. AERC Research Paper, No. 70. African Research Economic Consortium, Nairobi, Kenya.

Egwaikhide, F., Oyeranti, O., Ayodele, O. and Tchokote, J., 2002. Causality between budget deficit and the current account balance in African countries. *West African Journal of Monetary and Economic Integration* 2, 2, 10–41.

Enang, B., 2011. Adjustment policies and current account behavior: empirical evidence from Nigeria. *European Journal of Humanities and Social Sciences* 6, 1, 1–16.

Engle, R.F. and Granger, C.W., 1987. Cointegration and error correction: representation, estimation and testing. *Econometrica* 55, 251–276.

Galinec, D., 2007. The financing and sustainability of current account deficits in Croatian balance of payments, Doctoral thesis, Faculty of Economics, Zagreb, University of Zagreb, Croatia.

Johansen, S., 1988. Statistical analysis of cointegrating vectors. *Journal of Economic Dynamic and Control* 12, 231–254.

Johansen, S., 1991. Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica* 59, 1551–1580.

Johansen, S. and Juselius, K., 1990. The full information maximum likelihood procedure for inference on cointegration with application to the demand of money. *Oxford Bulletin of Economics and Statistics* 52, 169–210.

Johansen, S. and Juselius, K. 1992. Testing structural hypotheses in a multivariate analysis of the PPP and UIP for UK. *Journal of Econometrics* 53, 211–244.

Lutkepohl, H., 1991. *Introduction to Multiple Time Series Analysis*. Springer-Verlag, Berlin.

M'Amanja, D., Lloyd, T. and Morrissey, O., 2007. Fiscal aggregates, aid and growth in Kenya: a

vector autoregressive (VAR) analysis. Credit Research Paper, No. 7. Centre for Research in Economic Development and International Trade, University of Nottingham, Nottingham.
Mackinnon, J., 1991. *Critical values for cointegration tests, in long-run economic relationships*. Reading in cointegration, ed. Queen's Working Paper No. 1227. Kingston, Ontario: Queen's University.
Morsy, H., 2009. Current account determinants for oil-exporting countries. IMF Working Paper No. 28. Washington, DC: International Monetary Fund.
Okojie, C.E., 2005. Capital flows and current account sustainability in Nigeria. United Nations Economic Commission for Africa Workshop, 21–22 September, Accra, Ghana.
Olumuyiwa, A., 2008. The size and sustainability of Nigerian current account deficit. IMF Working Paper No. 81. Washington, DC: International Monetary Fund.
Sims, C.A., 1980. Macroeconomics and reality. *Econometrica* 48, 1, 1–48.
Takebe, M. and York, R., 2011. External sustainability of oil-producing Sub-Saharan African countries. IMF Working Paper, No. 207. Washington, DC: International Monetary Fund.
Thomas, A. and Bayoumi, T., 2009. *Today versus tomorrow: the sensitivity of the non-oil current account balance to permanent and current income*. IMF Working Paper No. 248. Washington, DC: International Monetary Fund.

Appendix 1

Table A1 Variables definition and source

Variables	Description	Source
Current Account Balance	Current Account/GDP	CBN
Oil Price	Ave. OPEC Crude Basket	OPEC
Oil Wealth	Oil reserves at each year valued at oil price of the relevant year to GDP.	Own Calculation
Oil Balance	Oil trade balance/GDP	Own Calculation
Oil Revenue	Total oil revenue/GDP	CBN
Fiscal Balance	Fiscal balance/GDP	CBN

Table A2 Summary statistics

Variables	Mean	Std. Dev.	Min	Max
CAB	9.87	11.67	–12.24	29.83
OP	25.14	19.32	1.80	97.26
OW	1.05	0.28	0.66	1.67
OB	38.33	12.31	5.68	60.24
OR	19.35	7.79	3.15	36.14
FB	–4.02	4.69	–12.44	9.54

Table A3 Correlation analysis

Variables	CAB	OP	OW	OB	OR	FB
CAB	1.000					
OP	0.452	1.000				
OW	0.219	–0.347	1.000			
OB	0.461	0.324	0.584	1.000		
OR	0.446	0.497	–0.323	0.568	1.000	
FB	0.018	0.140	–0.442	–0.123	0.029	1.000

Appendix 2

Figure 1 Trends Variance decomposition

Appendix 3: VECM equations for the CAB

$$\Delta CAB_t = \alpha_0 + \alpha_2 ECT_{t-1} + \sum_{i=1}^{n}\lambda_{1i}\Delta CAB_{t-1} + \sum_{i=0}^{n}\lambda_{2i}\Delta OR_{t-i} + \sum_{i=0}^{n}\lambda_{3i}\Delta OW_{t-1} + \sum_{i-0}^{n}\lambda_{4i}\Delta OB_{t-1} + \sum_{i=1}^{n}\lambda_{1i}\Delta OP_{t-1} + \varepsilon_{1t}$$

$$\Delta CAB_t = \alpha_0 + \alpha_2 ECT_{t-1} + \sum_{i=1}^{n}\lambda_{1i}\Delta CAB_{t-1} + \sum_{i=0}^{n}\lambda_{2i}\Delta FB_{t-i} + \sum_{i=0}^{n}\lambda_{3i}\Delta OP_{t-1} + \sum_{i-0}^{n}\lambda_{4i}\Delta OW_{t-1} + \sum_{i=1}^{n}\lambda_{1i}\Delta OB_{t-1} + \varepsilon_{1t}$$

Table A4 Short-run results

CAB equation for model 1		CAB equation for model 2	
const.	–0.1672 (0.934)	const.	0.1939 (0.937)
CABt-1	–0.3651 (0.250)	CABt-1	0.0403 (0.908)
OPt-1	1.8762 (0.041)	FBt-1	0.0593 (0.946)
OWt-1	–36.4507 (0.193)	OPt-1	0.2728 (0.025)
OBt-1	0.5844 (0.315)	OWt-1	10.3999 (0.683)
ORt-1	0.5610 (0.152)	OBt-1	–0.2124 (0.720)
ECTt-1	–0.2497 (0.011)	ECTt-1	–0.0045 (0.959)

Note: *P*-values are in parenthesis.