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OIL REVENUES, INSTITUTIONS AND MACROECONOMIC PERFORMANCE IN NIGERIA

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Abstract

The influx of massive revenues during periods of abnormally high oil prices creates enormous challenges for policymakers in oil producing countries. In Nigeria, the prudent utilisation of oil revenues has remained elusive for policymakers over time. While the country has earned sizeable oil revenues from its natural endowment, poverty and income inequality have been persistent. This study offers an elaborate econometric analysis which tests the sensitivity of a number of key macroeconomic indicators to oil revenue shocks, using the Impulse Response Functions (IRFs) and Variance Decomposition (VDC) techniques within a Vector Autoregressive (VAR) framework. The sensitivity analysis offers a novel contribution to the academic and policy literature on the macroeconomic responses to oil windfalls in Nigeria by testing for an 'institutional quality' variable. The inclusion of this variable is in recognition of the important role played by the domestic institutional context in shaping the policy responses adopted by successive Nigerian governments to oil windfalls over time. The sensitivity analysis supports the general view that fluctuations in oil revenues have resulted in inflation, lower output growth and real exchange rate appreciation in Nigeria. Importantly, the institutional variable was found to be significant. This finding is consistent with the general assessment of fiscal performance in Nigeria during oil windfalls as being driven by domestic institutional dynamics, as ostentatious public consumption widened fiscal deficits, and government spending was highly pro-cyclical during windfall episodes. In conclusion, the study offers appropriate policy recommendations, which involve a combination of economic, socio-political and institutional actions that may be adopted to enhance the management of future oil windfalls in Nigeria.

JEL Classification: Q13; Q32; Q33:F10; C10

Keywords: Resource rents; Institutions; Impulse response functions; Variance Decomposition; Nigeria

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1 Introduction

Natural resource abundance, and specifically oil dependence has often been associated with poor growth, poverty and underdevelopment. Nigeria is considered to be a classic example of the contradiction between natural resource abundance and perverse economic development outcomes (or the *paradox of plenty*). It is Africa's highest oil exporter, and the world's tenth largest oil producing country. It has realised over US$ 600 billion in oil revenues since 1960, a figure greater than the

resources used by the Marshall Plan in rebuilding Europe after World War II, and is currently the 8th highest net oil exporter in the world. Nigeria's economy is heavily dependent on natural resources: oil and gas constitutes 98% of total exports, 80% of government revenues and around 20% of GDP (CBN, 2010). In spite of the enormous economic potentials in Nigeria, it has largely failed to live up to the ambitious growth projections that followed the first oil boom in the 1970s. Also, social indicators have displayed no specific tendency towards improvement such that in 2010, Nigeria was ranked 142nd out of 169 countries by the United Nations Human Development Index. Furthermore, up to 70% of Nigerians are considered to be 'poor' – subsisting below the national poverty line (NBS, 2012).

It thus goes without saying that Nigeria has evidently grappled with the *paradox of plenty*. The negative impacts of resource abundance include; a decline in the competitiveness of other economic sectors (caused by appreciation of the real exchange rate), volatility of revenues from the natural resource sector due to exposure to global commodity market swings, government mismanagement of resource revenues, weak, ineffectual and corrupt institutions. In addition, this massive inflow of revenue fuels greed and jostling for resources, both of which serve as the bedrock for crises, conflicts and violence that have come to epitomise most resource-rich countries (Nigeria inclusive). However, the deleterious economic effects embedded in the foregoing perverse outcomes have been argued to be muted within the ambit of well functioning institutions and their accompanying structures and mechanisms.

Along this line of thought, the seminal work of Rodrik (1999a,b, 2002) on the role of institutions in economic growth and development has contributed to the recognition of the role played by the quality of domestic institutions in shaping policy responses to exogenous shocks (including oil windfalls), and the redistribution of wealth to reduce poverty and drive economic growth.[1] In an application of this important thesis to Nigeria, the well-known study by Sala-i-Martin and Subramanian (2003) introduces a measure of 'institutional quality' – defined as the mortality rates of colonial settlers, and the fraction of the population speaking English and other European languages – within an Instrumental Variable model of a cross-country econometric analysis, to arrive at the conclusion that crude oil has a negative and non-linear impact on growth in Nigeria, through the deleterious impact on domestic institutions. The implication of this finding is that the adverse impact of oil windfalls in Nigeria could have been mitigated by stronger domestic institutions.

This important and largely neglected finding will be given rigorous treatment in this study, as we examine the contribution of institutional quality to the macroeconomic impact of oil windfalls in Nigeria. However, we approach the concept of 'institutional quality' differently to the definition adopted by Sala-i-Martin and Subramanian (2003). Thus, our conceptualisation of institutional quality embodies property rights, the rule of law, and freedom of private enterprise. Using the Economic Freedom of the World Index (EFW), our institutional quality variable is a composite of the following indicators: size of government expenditures and taxes; legal structure and security of property rights; access to sound money; freedom of international trade; as well as regulation of domestic credit, labour and business environments. Thus, by using this broader definition of institutional quality, we expect that the analysis will sufficiently capture the various dimensions of Nigeria's domestic institutional context, and the role

[1] Rodrik argues that economic growth greatly depends on the presence and nature of institutions which protect property rights and individual freedoms, engender participatory political processes, guarantee protection from external shocks, and allow for a reasonable degree of policy experimentation. Similarly, the relationship between endowments, geography, institutions and long-run economic performance has also been examined by Engerman and Sokoloff (2002), Easterly and Levine (2002), and Acemoglu, Johnson and Robinson (2001).

played by domestic institutions in determining macroeconomic and fiscal policy performance, given the substantial oil revenues earned by Nigeria over time.

There is already a plethora of academic literature on the challenges associated with managing oil windfalls in resource-rich countries. Existing studies on Nigeria's experience with oil booms have also tackled the macroeconomic implications of the Dutch disease (see for instance, Bienen (1983), Subramanian and Sala-i-Martin (2003)). This study, however, aims to contribute to the policy and academic discourse on the management of oil windfalls in Nigeria on two main fronts. One, offering novel empirical evidence – using institutional soundness - on the response of key macroeconomic indicators to oil revenue shocks. Two, drawing on the lessons learnt to proffer suggestions to policymakers, to help in the design of appropriate policies to cope with future oil windfalls. While the extant studies on the subject with specific focus on Nigeria have hinged on the macroeconomic policy reaction to oil windfalls, the institutional setting has scarcely ever been given any attention, with the notable exception of Sala-i-Martin and Subramanian (2003). Importantly, the study by these authors uses a definition of institutional quality that relies on colonialism, geography, and linguistic fractionalisation as indicators of institutional performance, and does not directly capture the strength or weakness of domestic institutional structures. This study approaches the question of the role of institutions in the management of oil revenues in oil-producing countries by introducing a measure of the rule of law, property rights enforcement and freedom of private enterprise. In this way, the institutional variable is a novel contribution to the academic and policy literature on the management of oil revenues in Nigeria. To this end, the econometric analysis will capture the contribution of *institutional quality* to the macroeconomic responses to oil windfalls in Nigeria.

On the basis of the foregoing, the following pertinent questions arise namely: (i) How did key macroeconomic indicators – output, exchange rate and inflation – respond to fluctuations in oil revenues in Nigeria over time?; (ii) How did changes in institutional arrangements influence the outcomes in (i); and (iii) What are the lessons that can be adopted for more effective management of oil windfalls in Nigeria?

The study adopts econometric techniques in addressing these research questions. Using quantitative data on the macroeconomic variables that have been identified from the literature, time series econometric analysis of the sensitivity of these variables to oil revenue shocks over time is carried out. The sensitivity analysis is done using Impulse Response Functions (IRFs) and the Variance Decomposition (VDC) technique within a Vector Autoregressive (VAR) framework. In addition, the sensitivity analysis offers some evidence on the relationship between the domestic institutional context and macroeconomic policy outcomes by testing for an 'institutional quality' variable. The analysis tests the long-run relationship between the macroeconomic variables and oil revenue shocks from 1970 to 2008. The study relies on secondary data obtained from the Central Bank of Nigeria and the Fraser Institute's database.

The first section of the study provides a general introduction. This sets out the key issue to be addressed, poses the research questions and briefly describes the methodology employed. The second section provides a terse review of the economic theory that underlies the *Dutch disease* arising from management of windfalls in natural resource-abundant countries. Section three deals with data and methodology issues, while section four presents the econometric analysis of the relationship between fluctuations in oil revenue and selected macroeconomic indicators in Nigeria. The fifth and final section offers suggestions to policymakers for the management of future oil windfalls.

2. Resource Windfalls and Economic Outcomes: Concise Review on the Dutch Disease

Economic theory posits that resource abundant countries tend to grow more slowly than countries with fewer resources. The theoretical channels of causation are threefold; firstly natural resources generate rents which lead to predatory rent-seeking activities, natural resources expose countries to commodity price volatility and, lastly, there is greater susceptibility to the Dutch Disease – an overvaluation of the real exchange rate due to commodity price 'booms' and the contraction of the non-booming tradable sector.[2]

The bulk of the problems confronting oil producing developing countries can be grouped into – the Dutch disease and macroeconomic volatility; rent-seeking and weak governance; and conflicts and political instability. The most relevant element of the resource curse, given the objectives of this project, is the Dutch Disease. The Dutch Disease is most significant and challenging for oil producing developing countries to grapple with in the short term. In spite of its frequent use in the international media and policy circles, the theoretical framework underlying this concept is often overlooked. We will explain the theory of the Dutch disease below, in order to provide a balanced view of the debates on the management of oil windfalls.

The impact of the discovery of significant natural resource deposits and the sudden increase in international commodity prices (or booms) is seen to have negative effects on the non-tradable sector, including agriculture and manufacturing. This adverse effect of commodity price windfalls on the output and productivity of domestic industry is widely referred to as the 'Dutch Disease'. The term was first used by The Economist in 1977 to describe the impact of booming natural gas production from the Groningen fields in the Netherlands on the non-booming tradable sector. Formal models of the 'Dutch Disease' by Corden and Neary (1982), van Wijnbergen (1984), Neary and van Wijnbergen (1986) have illustrated two important effects of commodity price windfalls, namely a *resource movement effect* and a *spending effect*. Firstly, the booming sector attracts capital and labour resources from agriculture and manufacturing, and results in an appreciation of the real exchange rate. Furthermore, booming commodity exports make imports cheaper for domestic consumers, leading to import dependence and a displacement of domestic industry.[3]

Of particular interest to this study, however, is the analytical significance of the 'Dutch Disease' hypothesis to the peculiarities of oil production and export, which is generally assumed to occur in isolation of the rest of the economy, with weak sectoral linkages being developed. Accordingly, a strand of the literature has argued that, since oil production occurs in an enclave, there is likely to be no resource movement effect, and the spending effect will likely result in the growth of the booming non-tradables at the expense of the non-boom tradables.[4] A number of country case studies on oil producing

[2] Isham *et al.* (2003) provide theoretical arguments on the causative channels through which natural resource export structures affect economic growth in resource-rich developing countries.

[3] Other extensions of the Dutch Disease model include Bruno and Sachs (1982) which incorporates perfect foresight and shows the long run effect of the decline in manufacturing, and those studies that model the relationship between increasing returns to scale and learning-by-doing on structural adjustment following the 'Dutch Disease' such as Sachs and Warner (1995, 1999), Stijns (2000) and Gylafson, Herbertson and Zoega (1997). Furthermore, sophisticated modeling of the Dutch Disease introducing the gravity effects of trade, relating to fluctuations in international energy prices has been carried out by Stijns (2002) and Devlin and Lewin (2004).

[4] See for instance, van Wijnbergen (1984). An alternative channel of transmission for the resource curse is provided by Hausmann and Rigobon (2002) who argue that with the contraction of the non-resource tradables following the Dutch Disease, financial market asymmetries attenuate the exposure of petroleum exporting countries to exogenous shocks.

countries provide credible empirical evidence which supports the 'Dutch Disease' thesis.[5] The Dutch disease effect is just one of the manifestations of the resource curse, and other channels of causation between resource abundance and poor economic performance include the increased demands for protection and import-substituting industrialisation by powerful 'vested' interests in manufacturing industry (Krugman 1987, Auty 1994); the heightened vulnerability of economies with shrinking non-tradable sectors to exogenous price shocks (Auty 1993); irrational, exuberant government spending based on overly optimistic projections of future revenues, leading to the accumulation of debt, and economic recession (Gelb 1988); and finally, across the literature, it is argued that the increased agitation for wealth redistribution due to the structural effects of a booming minerals sector may compel the state to distribute revenues among various claimants, leading to distortionary rent-seeking with implications for efficiency and productivity growth (Gelb 1988).

The preceding discussion shows that there is a sound economic theory underlying the Dutch disease. Furthermore, the Dutch disease is not inevitable - in the long run, the impact of the Dutch disease on the economy could be said to be ambiguous, depending on the specific macroeconomic conditions of the country and the policy responses of the authorities. Nevertheless, in the short run, the importance of robust coherent macroeconomic, fiscal and industrial policies which reduce volatility, entrench fiscal prudence and protect agriculture and non-oil manufacturing cannot be overstated. Hence, the specific empirical assessment of these theoretical propositions is what the rest of this paper delves into.

3. Data Issues and Methodology

This study uses annual time series data on key macroeconomic indicators for the Nigerian economy over the period from 1970 to 2008. The three central variables in the sensitivity analysis are the growth of real output, inflation and the real exchange rate (relative price of tradables to non-tradables). The other variables include oil revenues and fiscal deficit (both as a percentage of GDP), money supply (M2) growth, interest rate as well as an index to capture institutional quality. While fiscal deficit is a summary measure of fiscal policy, interest rate and money growth are the indicators of monetary policy stance. The novel variable – institutional quality – is a composite index of several indicators which are broadly grouped into five areas. These areas are size of government expenditures and taxes, legal structure and security of property rights, access to sound money, freedom of international trade as well as regulation of domestic credit, labour and business environments. All data were obtained from various issues of the Central Bank of Nigeria (CBN) statistical bulletin, while the measure of institutional quality is the Fraser Institute's Economic Freedom of the World (EFW) index. This choice is predicated on the fact that unlike the majority of available institutional indices, the EFW has scores dating back to 1970 thus matching the starting point of the other variables.

In terms of analysis, the entry point following the time series econometrics literature is formal testing of the stationarity of variables in order to avoid spurious regression estimates. This was conducted using the Augmented Dickey Fuller and Phillips-Perron tests. Next, the resulting order of integration necessitated applying the Johansen cointegration technique to ascertain the existence of a long-run

[5] Rodriguez and Sachs (2000) on Venezuela, Auty and Evia (2001) on Bolivia, Auty (1994) on Mexico, Brazil and Venezuela, Mikesell (1997) on Venezuela and Peru, Fardmanesh (1991) on Algeria, Ecuador, Indonesia, Nigeria and Venezuela, Timmer (1994) on Indonesia, and Bienen (1983) on Nigeria. For the recent entries into the league of *petro-states*, see Frynas, Wood and Oliveira (2003) on the on-going structural transformation in Sao Tome and Principe. Auty (1997) provides some evidence of distortions due to the booming oil sector in Kazakhstan.

relationship among the variables. Finally, since the core objective of this study is to gauge the sensitivity of key macroeconomic variables to oil revenue shocks, the Vector Autoregression (VAR) framework is adopted. The VAR, through the Impulse Response Functions (IRF's) and forecast error Variance Decomposition (VD), is well suited for our purpose. This is largely because with the IRF's, the dynamic response of output, exchange rate and inflation to shocks to oil revenues can be examined. In addition, the VD helps as a quantitative gauge of the relative importance of oil revenue innovations in the volatility of the other variables within the system.

The VAR model with order k used in the analysis has the following formal representation:

$$q_t = \sum_{i=1}^{p} Ci\, q_{t-i} + \varepsilon_t \qquad (1)$$

Where q_t is the vector of endogenous variables, C_i is the matrix of coefficients and p is the optimal lag order for the model. In each of our VAR models – namely output, exchange rate and inflation – the typical Cholesky ordering was followed. In the baseline unrestricted VAR model, the vector of endogenous variables is as follows:

$y_t =$ [*oil revenues, institutional quality, fiscal indicator, monetary indicator, output*] (2)

As equation 2 makes evident, each ordering, of course, had oil revenues as the first variable. Oil revenues can be argued to be the least endogenous as both its price and quantity components are subject to the vagaries of external oil market cum exogenous economic conditions. On the price side, global economic activity, environmental concerns, oil substitution in advanced oil importers amid a host of other factors outside the Nigerian economy are responsible for price determination. In terms of production, OPEC determined quotas, technological advancement (mostly originating from richer countries) and the uncertainties with regards oil sector investments influence the level of oil production in Nigeria. Put together, therefore, oil revenue is chiefly exogenous and merits its first place. The indicators of macroeconomic policy – especially fiscal and monetary – are ordered next with the fiscal measures immediately preceding the indicators of monetary policy. This appears a fruitful way to proceed since in the Nigerian case the revenues that accrue from oil get into the hands of the federal government first. Monetary variables are placed next before the macroeconomic outcome (indicator) variables which are accordingly ordered last. As a novelty to the present study we also include a measure of institutional quality. Although the theory appears silent on the specific position of this variable in the ordering scheme, we reckon that the policy responses to oil windfall would depend quite considerably on the prevailing institutional context. Therefore, we enter institutional quality next to oil revenues and just before the macroeconomic policy measures.

4. Empirical Results and Discussion

In line with the standard time-series econometrics practice, the variables of interest to the study are tested for their time-series properties. The Augmented Dickey-Fuller (ADF) as well as the Phillips-Perron unit root test were used to query the order of integration of each of the variables in the models. Tables 1 and 2 below display the result for the stationarity test which shows that oil revenue as a share of GDP, fiscal deficit-GDP ratio, output growth, inflation as well as the growth of money supply do not require differencing to attain stationarity i.e. I(0). On the other hand the interest rate, exchange rate and institutional index are I (1) series.

Table 1: Augmented Dickey-Fuller (ADF) Test Results

Variable	Augmented Dickey-Fuller Test Statistic			Conclusion
		With Drift	With Drift and Trend	
Exch	Level	0.0789	-1.5760	I(1)
	1st Diff	-5.1593**	-5.2301**	
Rgdp	Level	-5.1623**	-5.3821**	I(0)
Infl	Level	-3.7297**	-3.6587*	I(0)
Oilrev	Level	-4.6123**	-4.9110**	I(0)
Fisdef	Level	-3.2442*	-4.8769**	I(0)
Int	Level	-2.2312	-3.1491	I(1)
	1st Diff	-7.4151**	-7.4079**	
M2grw	Level	-3.6597**	-3.5447*	I(0)
INST	Level	-0.2077	-1.3838	I(1)
	1st Diff	-6.2024**	-6.6274**	
*(**) implies a rejection of the null hypothesis of non-stationarity at 5 %(1%) respectively.				

Notes: Exch designates the exchange rate, Rgdp is real output growth, Infl is inflation, Oilrev connotes oil revenue as a percent of GDP, Fisdef is fiscal deficit as a share of GDP and Int is the interest rate. Also, M2grw and INST represent money supply growth and institutional quality index respectively.

Table 2: Phillips-Perron (PP) Test Results

Variable		Phillips-Perron Test Statistic		Conclusion
		With Drift	With Drift and Trend	
Exch	Level	-0.0769	-1.6660	I(1)
	1st Diff	-5.1759**	-5.2282**	
Rgdp	Level	-5.0968**	-5.6808**	I(0)
Infl	Level	-3.6835**	-3.6051*	I(0)
Oilrev	Level	-4.6071**	-4.9007**	I(0)
Fisdef	Level	-3.2111*	-4.7349**	I(0)
Int	Level	-2.0741	-3.2745	I(1)
	1st Diff	-9.1830**	-9.1413**	
M2grw	Level	-3.6213**	-3.5556*	I(0)
INST	Level	-0.2423	-1.3838	I(1)
	1st Diff	-6.2074**	-6.6269**	
***(**)** implies a rejection of the null hypothesis of non-stationarity at 5%(1%) respectively				

Notes: Exch designates the exchange rate, Rgdp is real output growth, Infl is inflation, Oilrev connotes oil revenue as a percent of GDP, Fisdef is fiscal deficit as a share of GDP and Int is the interest rate. Also, M2grw and INST represent money supply growth and institutional quality index respectively.

From the foregoing statistics in Tables 1 and 2, both the tendency towards mean-reversion and drifting away from the mean are observed in the behavior of the series. In other words, there is a mixture of I(0) and I(1) variables. Therefore, with a view to establishing a long-run relationship among the variables, a formal test of cointegration has to be conducted. The intuition is that even for individually non-stationary variables, some linear combination of them might be stationary implying the possibility of long-run co movement of the variables. To pursue this line of reasoning further, the Johansen maximum likelihood cointegration approach is employed. This method has been proposed as an improvement over residual based approaches like the Engle-Granger two step (EGTS) procedure. Table 3 contains the results for the test for co-integration among the variables. Specifically, on the basis of the trace statistics, the existence of one co-integrating equation is implied at the five per cent level of significance. The result, not reported here for want of space, using the complimentary maximum Eigen statistics is similar. Ultimately, since the result supports the existence of cointegration, this suggests that causality should run in at least one direction.

Table 3: Johansen Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.604197	72.17519	69.81889	0.0320
At most 1	0.413238	37.88217	47.85613	0.3072
At most 2	0.278064	18.15612	29.79707	0.5545
At most 3	0.150830	6.100835	15.49471	0.6836
At most 4	0.001391	0.051502	3.841466	0.8204

Notes: Trace test indicates 1 cointegrating equation at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level and **MacKinnon-Haug-Michelis (1999) p-values. CE stands for cointegrating equation.

4.1 Impulse Response Results

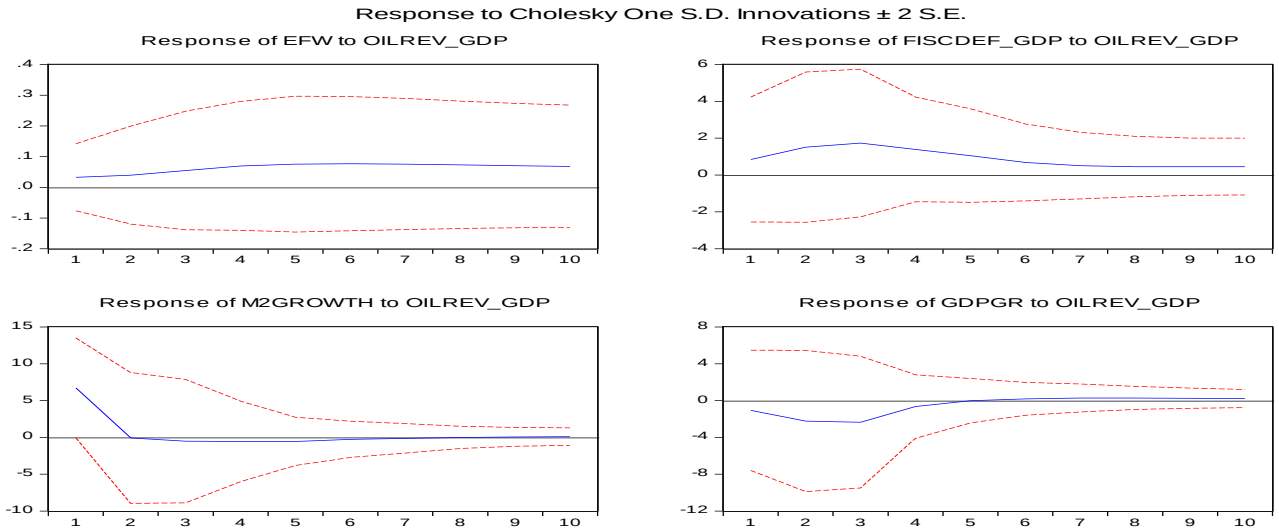
As mentioned previously, the impulse response functions help in tracking the contemporaneous and future paths of the key response variables to a one standard deviation increase in the current value of the stimulus variable. In the specific case of this study, output growth, exchange rate and inflation are the key response variables, while oil revenue is the major forcing factor. In what ensues, therefore, impulse responses to the oil revenue shocks derived from the standard Cholesky factorization for each of the macroeconomic indicator models are displayed and discussed in turn starting with the output model.

4.1.1 Output Models

Figure 4 displays the impulse response of output to a one standard deviation shock to oil revenue. Output is observed to decline on impact and this downward trend persists for about three years before a convergence to the steady state growth path is subsequently attained. The plausibly arises owing to the fiscal policy stance adopted in the wake of the oil revenue rise. It is clear from the figure that fiscal deficit as a ratio of GDP jumped on impact.

This implies that volatile and lopsided spending, particularly on unproductive ventures, results in poor growth performance since key sectors that ordinarily should have driven output growth are neglected in budgeting and development planning. Also, this appears to be sustained over the next six years suggestive of the asymmetry of government behaviour to oil related boom and bust cycles. Particularly, while driving up expenditures in "good times" is fairly easy, cutting down on spending during "bad times" is more often than not daunting. In theory, government can easily increase consumption spending on salaries, transfers and critical social sectors in the wake of an oil boom, while its ability to adjust fiscal policy when revenues fall short may be limited. This plausibly is due to the influence of heightened public expectations about future revenue streams and the attendant political difficulties involved with subsequently scaling back expenditures. The response of money supply growth, which rises significantly over the initial two years, is indicative of accommodating monetary policy. In other words, expansionary monetary policy is often deployed as a tool for financing growing deficits which ultimately serves as a drag on economic growth as evident from Figure 4. The index of institutional quality, however, does not seem to portend any specific pattern.

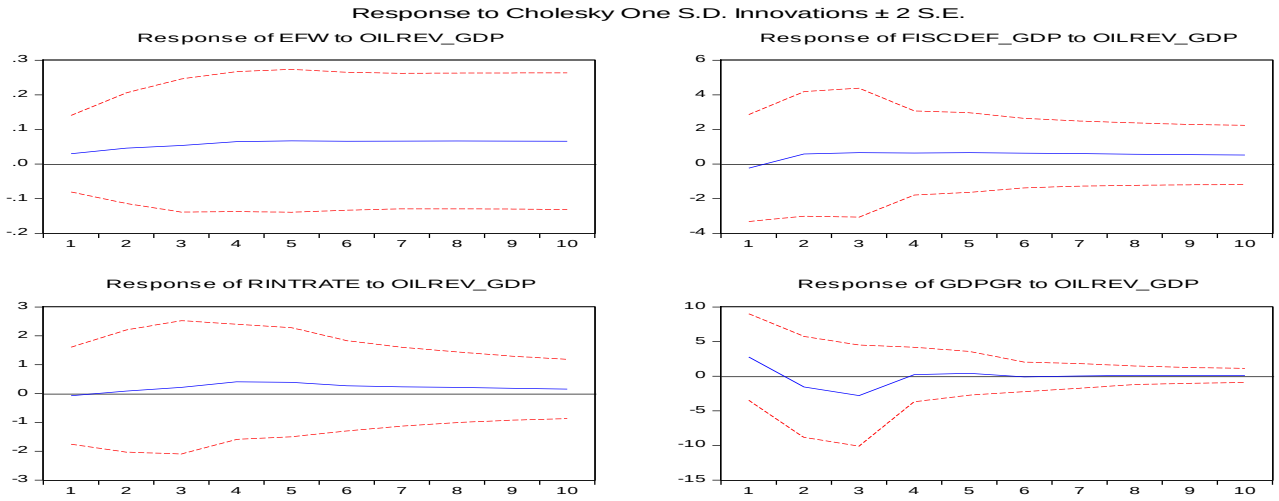
Figure 4: Impulse responses to one standard deviation shock in oil revenues



Note: The graphs display the impulse responses of the key macroeconomic indicator (output), fiscal policy, monetary policy (money supply growth) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

In contrast, Figure 5 which shows the impulse responses when a different indicator of monetary policy(interest rate) is used is indicative of an initial rise in output following the same one standard deviation shock to oil revenue. For oil exporting countries, as the results suggest here, it is expected that higher oil revenues should result in better growth performance by stimulating the components of aggregate demand. This influence remains palpable up to the second year but starts to wane during the third and fourth years possibly owing to the relatively moderate increase in fiscal deficits. Here, unlike in Figure 4, the index that captures the quality of institution appears to have risen particularly between the third and fourth years. This arguably may have worked through both fiscal and monetary policies to account for the somewhat better output response in this case. In other words, if the notion is that oil revenue increases display the tendency to undermine domestic institutions, then better institutional capacity should register positively on economic growth.

Figure 5: Impulse responses to one standard deviation shock in oil revenues

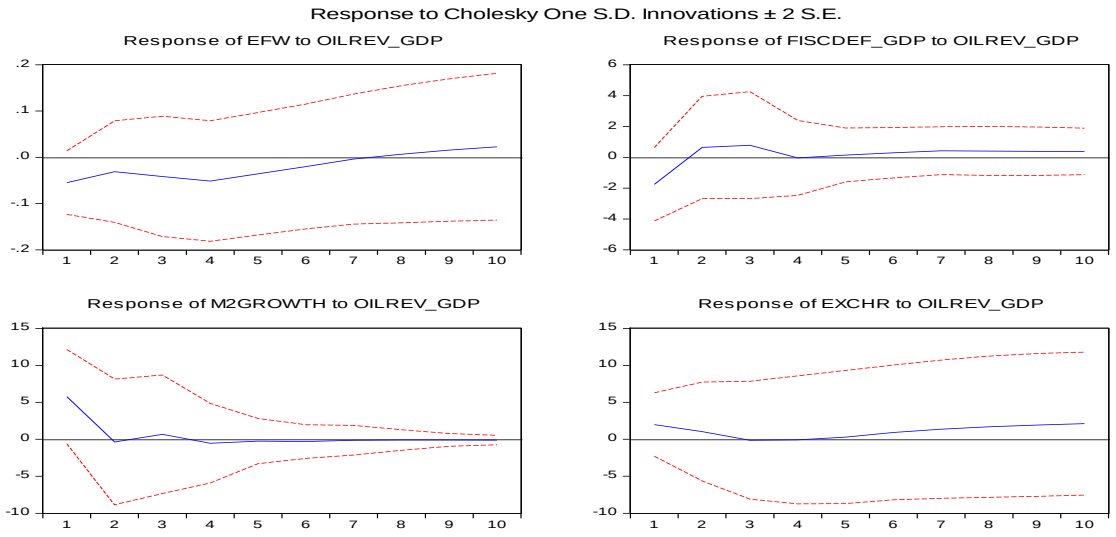


Note: The graphs display the impulse responses of the key macroeconomic indicator (output), fiscal policy, monetary policy (interest rate) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

4.1.2 Exchange Rate Models

As displayed in Figure 6, there is a striking jump in money supply growth on impact. This interestingly coincides with the observed deterioration in institutional quality. Also, there seems to be no clear improvement in institutional arrangements over the opening six years. This in part accounts for the marginal but noticeably persistent rise in fiscal burden from the second to the fourth years in that order. Of course, in the absence of the appropriate institutional environment it is expected that fiscal and monetary policy choices are more likely to be pro-cyclical thereby fostering perverse economic outcomes as reflected in the tendency towards continued real appreciation from around the sixth year. Unsurprisingly, the exchange rate is seen to appreciate on impact with a fleeting muted effect in years three to four, while the initial Dutch disease type pattern of appreciation resumes from the fifth to tenth year. This is not rocket science as theoretically, the resource movement effect of a real appreciation further stymies growth in key sectors like agriculture and manufacturing by diverting productive resources into booming sector activity. Even the subsequent improvement, from year seven, in the institutional index does not appear to change this pattern. This holds despite the seeming neutrality displayed by both fiscal and monetary policies over the second half of the time horizon.

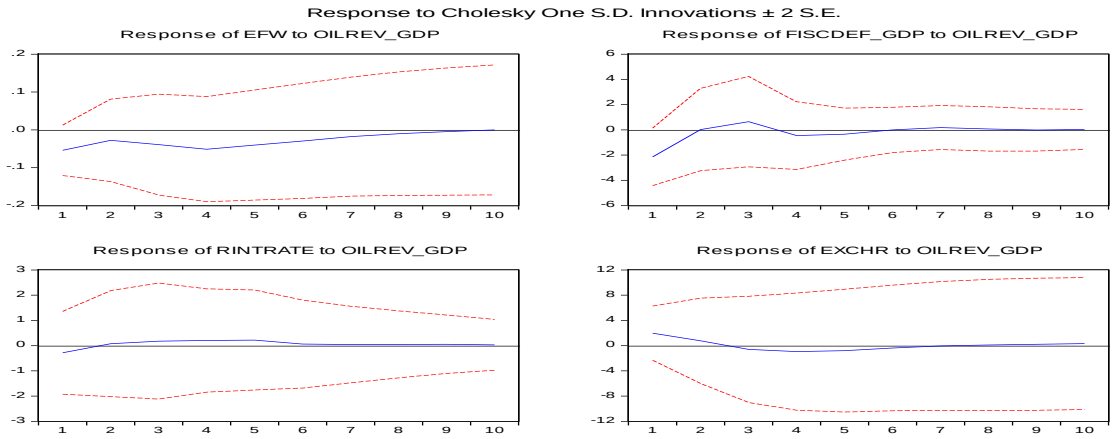
Figure 6: Impulse responses to one standard deviation shock in oil revenues.



Note: The graphs display the impulse responses of the key macroeconomic indicator (exchange rate), fiscal policy, monetary policy (money supply growth) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

The picture that emerges on a closer look at Figure 7 is somewhat similar. Here, an alternative measure of monetary policy stance – the interest rate – is included. From Figure 7, the indicator of the quality of institutions is relatively better. Coinciding with the foregoing is the near nil response of fiscal deficits and the interest rate. These indicators of fiscal and monetary policy respectively did not change following the observed appreciation of the exchange rate on impact. This appreciation is however slight and the effect is quickly dampened. This is plausibly indicative of the fact that it is not just the establishment of institutions, but more importantly the impact and sustainability of these institutional structures that dampens the negative consequences of the Dutch disease during oil windfall episodes in Nigeria.

Figure 7: Impulse responses to one standard deviation shock in oil revenues

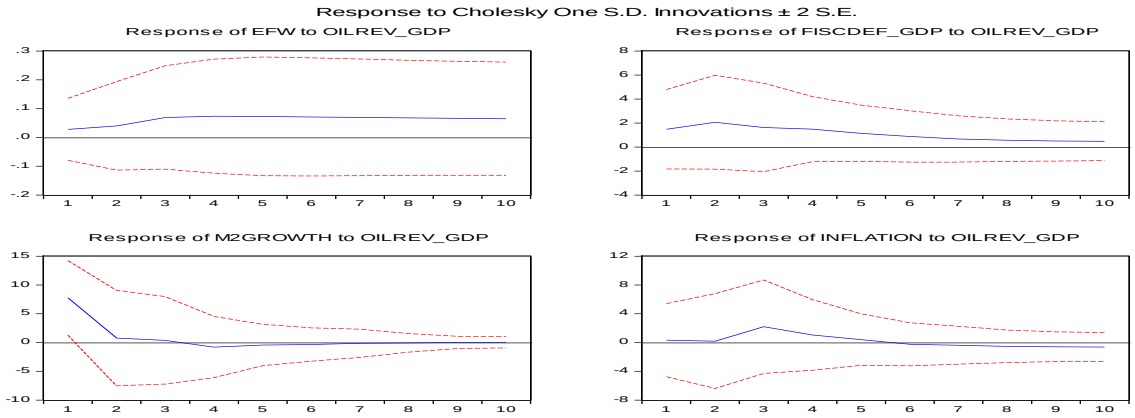


Note: The graphs display the impulse responses of the key macroeconomic indicator (exchange rate), fiscal policy, monetary policy (interest rate) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

4.1.3 Inflation Models

There is an improvement in institutional quality, as Figure 8 makes clear, in the second and third years relative to the initial impact. By this second year, the hike in money supply growth evident at the inception has almost completely petered out. Also, fiscal deficit begins to dip from about the second year. The key indicator of economic performance – inflation – is observed to have spiked in year 3 but this impact dies off over the rest of the horizon. This can be viewed as being in line first with the sustained gains from institutional appropriateness and then prudent monetary and fiscal policies as evident from the subsequently observed behaviour of both the growth of money supply and fiscal deficits to GDP. Hence, well functioning institutions have a way of mitigating the adverse effects of a direct pass-through of oil revenue shocks to domestic prices.

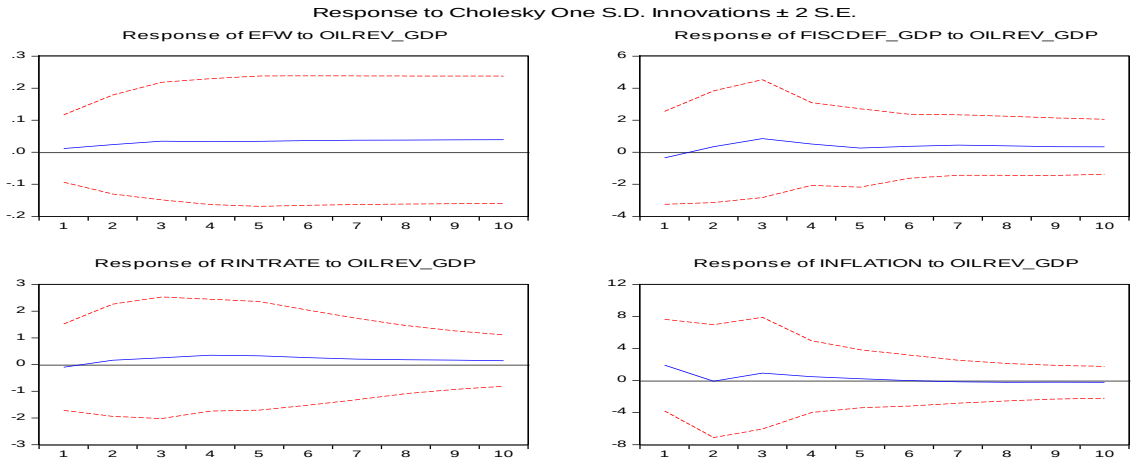
Figure 8: Impulse responses to one standard deviation shock in oil revenues



Note: The graphs display the impulse responses of the key macroeconomic indicator (inflation), fiscal policy, monetary policy (money supply growth) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

In Figure 9, the pattern of monetary policy response is not clear over the entire time horizon. Also, inflation rises initially with the inflationary pressure almost totally wiped out by the second year. However, there is a subtle spike in inflation in the third year consistent with the observed spike in fiscal deficits in the same instance. This shock to oil revenue - via real appreciation - leads to changes in the position of relative prices in the economy. That is, there is an increase in the prices of both tradables and non-tradables (although with different magnitudes) implying a rise in the general price level consequent upon the initial oil shock. It is important to note, however, that both inflation and the deficit to GDP ratio flatten out in the succeeding periods. In a similar vein, it appears difficult to delineate a specific role for institutional quality, in response to oil revenue shocks, here as the contours of the measure are scarcely discernible. This finding, nonetheless, does not trim down the importance of institutional quality in inflation-prone oil producing countries.

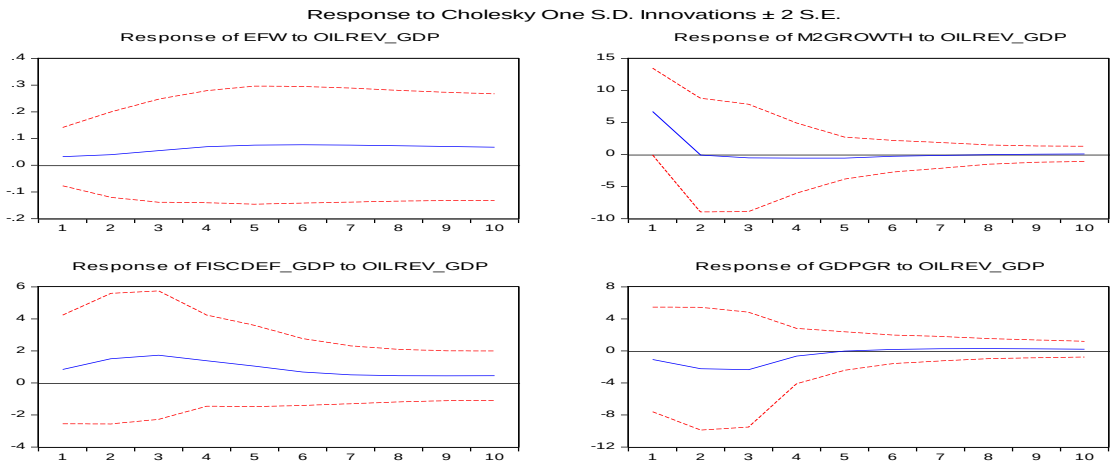
Figure 9: Impulse responses to one standard deviation shock in oil revenues



Note: The graphs display the impulse responses of the key macroeconomic indicator (inflation), fiscal policy, monetary policy (interest rate) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

A major critique of the analysis conducted so far is that the impulse response functions, emanating from the standard Cholesky-type ordering scheme adopted, are sensitive to the ordering of the variables in the VAR models. The typical antidote in the vast VAR literature is to conduct robustness tests using several alternative orderings of variables. The conclusion from performing such exercise, for this study, is that the response of the key variables of interest was not only qualitatively but also to a large degree quantitatively similar to the ones already reported. However, for the sake of completeness this claim is substantiated using the output and inflation models. For instance, Figure 10 which derives from a different ordering of the variables in the output model appears indistinguishable from Figure 4. A similar scenario comes out of a comparison of the impulse responses of two alternative orderings of the models of inflation as obvious when Figure 11 is squared with the corresponding Figure 9. Hence, the essential findings in the analysis remain robust in the face of sensitivity checks.

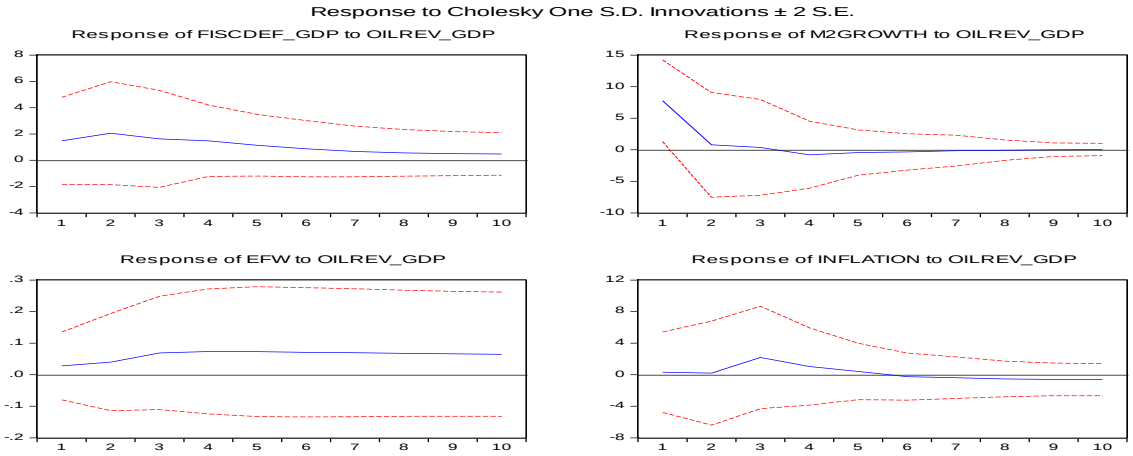
Figure 10: Impulse responses to one standard deviation shock in oil revenues



Note: The graphs display the impulse responses of the key macroeconomic indicator (output), fiscal policy, monetary policy (money supply growth) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the

magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

Figure 11: Impulse responses to one standard deviation shock in oil revenues



Note: The graphs display the impulse responses of the key macroeconomic indicator (inflation), fiscal policy, monetary policy (money supply growth) and institutional quality to one standard deviation shocks to oil revenue. The vertical axis indicates the magnitude of response, while the number of successive post-shock periods is on the horizontal axis. The dotted lines are + and – 1 standard deviation boundaries.

4.2 Variance Decomposition Results

The variance decomposition (VDC) attempts to answer the question; what is the relative importance of oil revenue shocks in the changes to the other variables in the VAR? The approach accomplishes this by providing a quantitative measure of the proportion of the shocks to each variable that is accounted for by its own shocks and shocks to other variables. The VDCs, in what follows are obtained using similar Cholesky orderings as the ones for the impulse response functions (IRF's). For the output model, Table 4 contains the variance decomposition results. Specifically, it appears there is a marginal role for oil revenue in accounting for the variance of output. For example, oil revenues contributed only about 2.62% to the variability of the forecast error in output even after a decade. This outcome plausibly reflects the equally low influence of oil revenues on institutions, fiscal deficits and money growth which averaged 2.90%, 5.56% and 7.34% respectively by the fifth year.

Conversely, money supply growth influences output as it accounts for 3.63% of variance of output innovations in the first year, 14.54% and a slight decrease to 14.43% in the second and third years in that order. Also, by the tenth year, the relative contribution of institutions and oil revenues to the error variance of output is barely distinguishable. To further buttress the argument along the lines of the nexus between fiscal profligacy and accommodating monetary policy responses, fiscal deficits contributed 5.83% and 12.74% to the observed variance of money growth. Interestingly also, institution initially did not account for any proportion of the forecast error variance of both fiscal deficits and the growth of money supply. However, by year 10, institutions appear to matter more for fiscal than monetary policy. This is evident from the 13.72% and 3.93% recorded for fiscal deficit and money supply growth which arguably captures behaviour particularly in contexts like Nigeria where the proceeds from oil sales accrue directly to the government. Moreover, aside own shocks, money supply growth accounted for the bulk of the variation in output error variance in the face of rising oil revenues.

Table 4: Variance Decomposition Results for the Output Model

Years Ahead	Oil Revenue	Fiscal Deficit	M2 Growth	Institutions	Output
Variance Decomposition for Oil Revenue					
1	100.00	0.00	0.00	0.00	0.00
5	74.89	8.78	11.31	1.79	3.23
10	71.63	9.61	10.83	4.50	3.42
Variance Decomposition for Fiscal Deficit					
1	0.68	99.32	0.00	0.00	0.00
5	5.56	75.65	3.02	8.37	7.41
10	5.54	70.30	2.98	13.72	7.45
Variance Decomposition for Money Growth					
1	10.38	5.83	83.78	0.00	0.00
5	7.34	12.68	75.36	3.86	0.76
10	7.34	12.74	75.21	3.93	0.78
Variance Decomposition for Institutional Quality					
1	0.97	19.86	0.98	78.19	0.00
5	2.90	26.68	0.98	62.60	6.82
10	4.15	29.56	0.55	57.85	7.89
Variance Decomposition for Output					
1	0.30	0.001	3.63	0.32	95.75
5	2.58	0.21	14.54	1.71	80.95
10	2.62	0.61	14.43	2.10	80.24

The forecast error variance decomposition of innovations in the exchange rate model is displayed in Table 5. It can be observed that both fiscal and monetary policy contributed more to the variance of exchange rate forecast error than oil revenues. These proportions, in the fifth year for instance, stood at 3.05% and 2.65% vis-à-vis the 0.52% obtained for oil revenues. This is indicative of a likely indirect pass through of oil revenue shocks to the exchange rate. In other words, oil revenue volatility may not be immediately transmitted into exchange rate fluctuations. Here, institutions which influence both the design and conduct of monetary and fiscal policies appear to be effectual, as the institutional variable accounted for almost 20% of the variance of exchange rate by year 10. Unlike the case with the output

model, fiscal deficits explained 10.94% of the variance in money growth in the fifth period but the reverse influence (1.10% by the tenth year) was at best marginal. Eventually, the importance of oil revenue for fiscal deficit, money supply growth and institutions is observed to have diminished through time. This response pattern is also mimicked by the exchange rate.

Table 5: Variance Decomposition Results for Exchange Rate Model

Years Ahead	Oil Revenue	Fiscal Deficit	M2 Growth	Institutions	Exchange Rate
Variance Decomposition for Oil Revenue					
1	100.00	0.00	0.00	0.00	0.00
5	71.02	1.94	15.66	0.70	10.69
10	69.64	1.95	15.36	1.09	11.96
Variance Decomposition for Fiscal Deficit					
1	5.68	90.79	0.00	3.53	0.00
5	3.65	50.71	1.22	7.31	37.11
10	3.41	40.47	1.10	13.35	41.67
Variance Decomposition for Money Growth					
1	8.49	4.88	85.61	1.01	0.00
5	5.59	10.94	72.96	4.38	6.11
10	5.60	10.94	72.71	4.49	6.27
Variance Decomposition for Institutional Quality					
1	6.63	0.00	0.00	93.37	0.00
5	4.12	7.61	2.18	27.54	58.54
10	2.07	4.53	1.07	22.55	69.77
Variance Decomposition for Exchange Rate					
1	2.29	0.63	3.40	0.62	93.08
5	0.52	3.05	2.65	8.61	85.16
10	0.89	2.10	1.26	19.65	76.09

Finally, and in relatively terse terms, the forecast error variance decompositions for the inflation model are shown in Table 6. First, institutions explained 15.09% of variations in the inflation errors in the fifth year, while there was a further increase by more than six percentage points to 21.21% by year 10.

Second, monetary and fiscal policies were important contributors to inflation innovation variances responsible for 11.44% and 9.07% respectively in year 5. However, these magnitudes had declined to 10.83% and 8.36% by the close of the decade. Finally, although oil revenue accounted for 1.22% of the variance of inflation at inception, this influence is minimal when juxtaposed with the proportions recorded for the innovations of other variables aside from own shocks.

Table 6: Variance Decomposition Results for Inflation Model

Years Ahead	Oil Revenue	Fiscal Deficit	Interest Rate	Institutions	Inflation
Variance Decomposition for Oil Revenue					
1	100.00	0.00	0.00	0.00	0.00
5	88.27	3.86	3.94	1.81	2.12
10	83.93	4.17	5.95	3.65	2.31
Variance Decomposition for Fiscal Deficit					
1	0.16	82.80	0.00	17.04	0.00
5	0.99	54.58	26.42	14.47	3.53
10	1.25	46.17	31.79	16.94	3.84
Variance Decomposition for Interest Rate					
1	0.04	5.01	94.14	0.81	0.00
5	0.57	14.31	81.50	1.98	1.64
10	0.77	14.72	81.19	1.79	1.52
Variance Decomposition for Institutional Quality					
1	0.13	0.00	0.00	99.87	0.00
5	0.92	0.86	6.27	86.54	5.41
10	1.34	2.12	14.95	75.79	5.80
Variance Decomposition for Inflation					
1	1.22	7.28	4.59	3.64	83.28
5	1.08	9.07	11.44	15.09	63.31
10	1.02	8.36	10.83	21.21	58.57

Based on the foregoing sensitivity analysis using Impulse Response Functions and Variance decompositions, the major implications of the obtained results are provided below. Primarily, this is done in order to synchronise the findings from the empirical assessment with the objectives of the study. First, output slumped in response to oil revenue on impact (in the first year of the oil revenue shock), which coincided with expanding deficit-to-GDP ratio sustained over a period of about 3 years. This expansionary fiscal stance together with the accompanying accommodating monetary policy – clear from the higher money supply growth in the first two years – suggest the need for a better articulated and appropriate mix of both policies in order to stem the tide of the potentially adverse effects of oil windfalls. The institutional quality measure, where an alternative monetary indicator is used, seems to work through fiscal and monetary policies to elicit an improved output response. This is further indicative of the key role of institutional soundness in dampening the adverse effects of oil revenue volatility on the Nigerian economy. As an illustration of the importance of institutional soundness for oil revenue management in Nigeria, we can point to the relative improvement in macroeconomic and fiscal policy management between 2004 and 2006, in the midst of the most recent oil windfall (2000 to 2005). The introduction of robust stabilisation measures, such as the oil price-based fiscal rule, and budgeting reform, helped Nigeria cope relatively better with oil revenue volatility. This indicates that strong domestic institutions and coherent economic policies are crucial for determining how Nigeria manages its oil revenues.

Second, the exchange rate appreciates immediately in response to the shock to oil revenues. However, improvement in the institutional context, particularly between the fourth and fifth years, appears to have sufficiently offset the tendency towards continued appreciation. Nevertheless, a semblance of the initial Dutch disease pattern shows up in the later time horizons. All of these findings point to both the inevitable exchange rate appreciation following oil revenue surges, as well as the moderating influence of better institutions working through the creation and implementation of better domestic demand management (fiscal and monetary) policies.

Third, in response to oil revenue shocks, inflation is observed to rise between the second and third years. However, the sustained improvement in institutional quality from the fourth year onwards appeared to have considerably doused inflationary pressures. This notion of better institutions sits quite well with the lower money supply growth and shrinking fiscal deficits during this time. Therefore, we can say that *institutions matter* with respect to the inflationary consequences of oil revenue shocks to the Nigerian economy. In the subsequent and final section of this study, the policy lessons arising from the foregoing analysis and discussion are presented.

5. Concluding Remarks and Policy Recommendations

The preceding sections have dealt with issues around the theory and empirics of the Dutch disease phenomenon, as well as the macroeconomic consequences of oil windfalls in Nigeria. Several policy prescriptions are offered in this section with a view to fostering an upturn in the management of Nigeria's abundant oil resources. Given the complexities of managing natural resource wealth in developing countries, these suggestions straddle economic, social, institutional and political dimensions.

On the economic front, there is a need for a more pragmatic approach to macroeconomic policy formulation and implementation. For instance, although oil revenue volatility harms economic growth, this negative effect is often exacerbated by accommodating monetary policy in form of rising real interest rates. This substantially lowers productive investment and thereby deepens the output slump. Therefore, macroeconomic policy – fiscal and monetary – should be better coordinated and together aligned towards delinking the economy from the volatility of oil revenues. Along this line, the adoption

of the Medium Term Expenditure Framework (MTEF) in the budgeting process, together with the benchmarking of annual budgets using an oil price-based fiscal rule are steps in the right direction. These core aspects of ongoing fiscal reforms should be sustained. Also, the enforcement of legislation particularly the Fiscal Responsibility Act should underpin this reform agenda for success to be palpable.

Managing volatility in resource revenues could be potentially challenging within a weak institutional context. There is thus the need for concerted efforts at restructuring existing institutions and crafting new ones to serve as clog in the wheel of the rent-seeking emblematic of petro-states. A key institution could be a Resource Wealth Fund which can satisfy the legitimate needs to manage the immediate impact of revenue volatility and save revenues for investment and use by future generations. Nigeria recently established a Sovereign Wealth Fund account with US$1 billion and the competitive process of staff recruitment for the regulator – the Sovereign Wealth Investment Authority - is under way. What should be guaranteed going forward is the independence of this body and the related revenue management mechanisms to shield it from undue political interference. Norway and Kuwait are sterling examples in this regard.

The emergence of credible political leadership has also engendered good economic outcomes in a few *blessed* oil economies. A more competitive electoral process and better citizen participation in setting national priorities could help build the social capital necessary for sustained economic prosperity. The government should also demonstrate the political will to stamp out the deeply rooted waste and corruption pervasive in the system. This can be accomplished via the strengthening of existing agencies such as the Economic and Financial Crimes Commission (EFCC) and the Independent Corrupt Practices Commission (ICPC) among other anti-corruption initiatives.

In conclusion, managing oil windfalls in Nigeria requires a combination of economic and political strategies which on the one hand, reduce volatility and wasteful consumption, while channelling oil revenues into productive activities and investment. On the other hand, a political culture that encourages transparency, accountability and a common national *ethos*, at the expense of distributive patronage and fiscal profligacy, is instrumental to overcoming the challenges associated with oil abundance. Furthermore, without a competent bureaucracy and strong democratic institutions that safeguard the interests of the citizenry, implementing policies that will not fritter away oil revenues is challenging. Perhaps the most important policy message to be gleaned from this study is that the mismanagement of oil windfalls in Nigeria is not inevitable, and by adopting the right policies, and building strong institutions, Nigeria's resource wealth can be used to lift its people out of poverty.

References

Acemoglu, D., S. Johnson, and J.A. Robinson (2001), The colonial origins of comparative development: an empirical investigation, *American Economic Review*, 91(5) pp. 1369–1401.

Auty, R. M. (1993), *Sustaining development in mineral economies: the resource curse thesis,* London: Routledge.

Auty, R.M. (1994), Industrial policy reform in six large newly industrialised countries: the resource curse thesis, *World Development,* 22(1) pp. 1-26.

Auty, R.M. (1997), Natural resource endowment, the state and development strategy, *Journal of International Development*, 9(4), pp. 651-663.

Auty, R.M. and J.L. Evia (2001), A growth collapse with point resources: Bolivia, in Auty, R.M. (ed.), *Resource abundance and economic development*, Oxford: Oxford University Press.

Bienen, H. (1983), Oil revenues and policy choices in Nigeria, World Bank Staff Working Paper No. 592, Washington, DC: The World Bank.

Bruno, M. and J. Sachs, (1982), Energy and resource allocation: A dynamic model of the Dutch disease, *The Review of Economic Studies*, (49)5, pp. 845-859.

CBN (2010) Central Bank of Nigeria Annual Report, 2010.

Corden, W. M. and J. P. Neary, (1982), Booming sector and de-industrialization in a small open economy, *Economic Journal* (92) pp. 825-848.

Devlin, J. and M. Lewin (2004), Managing oil booms and busts in developing countries, Draft Chapter for *Managing Volatility and Crises: A Practitioner's Guide*, Washington, DC: The World Bank.

Easterly, W., and R. Levine, (2002), Tropics, germs, and crops: how endowments influence economic development, NBER Working Paper, No. 9106.

Engerman, S.L., and K.L. Sokoloff (2002), Factor endowments, inequality, and the path of development among the new world economies, NBER Working Paper No. 9259.

Fardmanesh, M. (1991), Dutch disease economics and the oil syndrome: an empirical study, *World Development,* 19(6) pp. 711-717.

Frynas, G. J., G. Wood and R. M. S. Soares de Oliveira (2003), Business and politics in Sao Tome é Principe: from cocoa monoculture to petro state, *African Affairs* (102), pp. 51-80.

Gelb A.H. and Associates (1988), *Oil windfalls: blessing or curse*? Oxford: Oxford University Press.

Gylfason, T., T. Herbertson and G. Zoega (1997), *A mixed blessing: natural resources and economic growth,* Centre for Economic Policy Research (CEPR) Discussion Papers 1668.

Hausmann, R. and R. Rigobon (2003), An alternative interpretation of the 'resource curse': theory and policy implications," NBER Working Papers 9424, National Bureau of Economic Research

Isham, J., M. Woolcock, L. Pritchett and G. Busby, (2003), The varieties of rentier experience: how natural resource export structures affect the political economy of economic growth, Discussion Paper No. 03-08, Department Of Economics, Middlebury College, Vermont.

Krugman, P.R. (1987), The narrow band, the Dutch disease and the competitive consequences of Mrs Thatcher, *Journal of Development Economics*, 27: 41-55.

Mikesell, R. (1997), Explaining the resource curse, with special reference to mineral-exporting countries, *Resources Policy* 23(4).

Nigerian Bureau of Statistics (2012), Excerpts from the Nigeria Household Living Standards Survey.

Rodriguez, F. and J.D. Sachs (2000), Why do resource-abundant economies grow more slowly? A new explanation and an application to Venezuela, *Journal of Economic Growth* (4) pp. 277-303.

Rodrik, D. (1999a), Institutions for high-quality growth: what they are and how to acquire them, Paper prepared for the International Monetary Fund Conference on Second-Generation Reforms, Washington, DC, November 8-9, 1999.

Rodrik, D. (1999b), Where did all the growth go? external shocks, social conflict, and growth collapses, *Journal of Economic Growth* (4), pp.385-412.

Rodrik, D. (2002), Institutions, integration, and geography: in search of the deep determinants of economic growth, Weatherhead Centre for International Affairs, **Harvard University Working Paper.**

Sachs, J.D. and A.M. Warner (1995), Natural resource abundance and economic growth, NBER Working Paper 5398.

Sachs, J.D. and A.M. Warner (1999), The 'big push': natural resource booms and growth, *Journal of Development Economics*, 59 pp. 43-76.

Sala-i-Martin, X. and A. Subramanian (2003), Addressing the natural resource curse: an illustration from Nigeria, IMF Working Paper WP/03/139.

Stijns, J-P. (2000), Natural resource abundance and economic growth revisited, Working Paper, Department of Economics, University of California at Berkeley, November 2000.

Stijns, J-P. (2002), An empirical model of the Dutch disease hypothesis using a gravity model of trade, Mimeo, University of California at Berkeley.

Timmer, C. P. (1994), Dutch disease and agriculture in Indonesia: the policy approach, Harvard Institute for International Development Discussion Paper No. 490, June 1994.

Van Wijnbergen, S. (1984), The 'Dutch disease': A disease after all? *Economic Journal,* (94) pp. 41-55.