Oil Price Shock and Fiscal-Monetary Policy Variables in Nigeria: A Structural VAR Approach

Okunoye, Ismaila and Hammed, Sabuur

University of Ibadan, Ibadan, Nigeria, Obafemi Awolowo University, Ile-Ife, Nigeria

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Abstract

The study employed structural vector auto regressive model in a disaggregated analysis to measure the relative response of monetary and fiscal policy variables to the structural Oil price shocks in a small open and oil-dependent economy and identify sequence of appropriate policy response. Data utilized cover annual time series from 1981 to 2019. The study considers SVAR model with better and efficient tool to combine both short run and long run restrictions. Some empirical striking findings are discernible from our analyses. First, we establish that significant variation in monetary policy rate, exchange rate and money supply are explained by oil price shock. Second, we found that oil price shock have a significant impact on inflation rate, oil revenue and government expenditure. Lastly, we found that government expenditure has less innovations (less error term), compared to oil revenue and interest rate, and this indicates the direct policy of the government and not under the influence of monetary policy in Nigeria. Moreso, the result found more importantly, large reaction of inflation rate comes from oil price shock than the independent monetary policy rate and oil price shock caused large variation and reaction in monetary policy variable than fiscal policy variables. It is recommended there should be complementarity of fiscal policy and monetary policy carefully and appropriately, in order to avoid distortion in monetary policies implementation of the CBN in stabilizing the economy; government expenditure should be tailored to internal generated revenue, not oil-generating revenue; and government deposit in the financial sector is reduced as well as strengthen of treasury single account (TSA)policy to track government generated revenue may be a right policy for Nigeria financial sector.

1.1 Introduction

The issue of transmission mechanism of various economic variables in relation to shock and speed of adjustment is gaining momentum in the world over. This is a reflection of the concern that differences in transmission mechanisms across countries could widen the existing cyclical variation which could potentially impede the inflation-targeting role of the Central bank and further curtail the problem of the global financial crisis. The emanated shocks could be managed through the fiscal policy of the government, monetary policy of the monetary authority or by using both. Meanwhile, these two policies are implemented by conjoined institutions with quite dependent policies. The challenges of these policies are evident during the global financial crisis of 2008 – 2009 to all economies, particularly Nigerian economy, due to its overdependence on crude oil which represents 60 per cent of fiscal revenue and 90 per cent of foreign exchange inflows. Aliyu (2009) identified transmission mechanism of crude oil price shock to include both supply and demand channels. The supply side relates to the fact that crude oil is a basic input to production and commerce. In that wise, an increase in oil price leads to a rise in production, distribution cost and eventually to lower output. The demand side effect relates to consumption and investment. The effect on consumption is positive given the relation of oil price shock to disposables income while investment is adversely affected (though indirect) as oil price affects firm's input price and then increase their cost of production. The effect of such shock on foreign exchange market has always been associated with very high interest rate and high inflationary pressure which often lead to monetary and financial market instability.

Following the vulnerabilities of country's overdependence on crude oil, government expenditure, build-up in the demand for foreign exchange and high exposure of the banking sector to the oil and gas sector could trigger shocks and be transmitted entirely to the economy. Meanwhile, the impact of rising oil prices on activity depends on policy responses and oil price shocks have received considerable attention due to their intended macroeconomic consequences. Without exception, the fact that the monetary and fiscal policy variable response of oil price shocks may be more pronounced for most oil exporting countries, particularly oil dependent and open economies such as Nigeria cannot be overemphasized. The Nigeria's economic base structure with significant dependence on oil as a major source of revenue is prone to series of vulnerabilities build-up from external shocks and international financial environment. Hence, the need to understand the fiscal and monetary implications of the oil price shock in the domestic economy of the country has become even more imperative.

For instance, the effects of oil price shock on fiscal policy tools like government expenditure, government revenue, are probably to be more severe, affect the economic cycle through fiscal policy (Hussain et al. 2008) and worsen output cycles in oil endowed countries (Balassone and Kumar, 2007; Kumah and Matovu, 2005; Baldini, 2005), as well disrupt government policies, plans and may risk repeated patterns of weak economic governance. Also, the effect of oil price shock on monetary policy tools like interest rate, exchange rate, money supply is likely to be more severe in an oil-dependent country than a well-diversified oil-exporting economy. And, oil price shock is capable of distorting the expected government and monetary policies when they occur. Exactly, the conjoined features of Nigeria's oil- and import-dependent economy are likely to result in monetary and fiscal policies shock, since external shocks such as oil price shock, frequently put pressure on the government and monetary policy authorities in pursuing their core mandate of macroeconomic stability and economic stabilisation.

Extant literatures on the association of oil price shocks on macroeconomic activities have showed that oil price shocks insignificantly retard economic growth but depicted positive relationship between oil price and macroeconomic activities, except for oil exporting countries (Akpan 2010; Umar and Kilishi, 2010; Alley, et al, 2014; Aastyeit, 2013; Chen, et al, 2019) and oil price shocks have fluctuating result on real macroeconomic activities such as real GDP (Aliyu 2009). Aliyu (2009) specifically found that asymmetric oil price decreases adversely on real GDP and non-linear estimation have significant improvement compare to linear estimation of oil price shock on real macroeconomic activities. Also, Akpan (2010) and Bekhet and Yusoff (2013) emphasized that symmetric oil price shock has a positive impact on fiscal policy even though fiscal policy proved as the main channel to mitigate the adverse effect of oil price shocks. Oyelami (2017) also found that oil price movement has significant effect on macroeconomic activities, with the evidence of asymmetric effect for output and exchange rate, in emerging economy especially in oil exporting countries and transmission of oil price pass through monetary medium. Also, Studies by and Sajjadur, et al (2010) claimed that monetary response are required, as it ensues through it, by the government and policymakers to cushion the effect of the oil price shocks in the emerging economy as well as reinforce its effect on output.

Meanwhile, studies have revealed that interest rate response to oil price shock are time variant as well as data variant (Kim, et al, 2017 and Chuku, et al (2011). Filis and Chatziantoniou (2013) and Antonakakis, et al (2014) however showed that oil price shocks are oil- dependent variant as interest rates responses depends heavily on the monetary policy regime of each country. Thus, stock markets responses in net oil-importing countries exhibit a negative response to oil price shock and positive to net oil-exporting countries. Empirical results indicate that international oil price shocks have positive effect on inflation in the short run and negative in the long run. Khan and Ahmed (2011) and Natal (2012) emphasized that short term interest rate declines, as implied consistent with monetary contraction after an inflationary oil price shock and found that oil price shocks pass through interest rate and exchange rate channels.

Studies have also explained the relationship between variables of monetary or fiscal policy to oil price shocks (Bernanke et al., 1997; Hassan 2010; Kim et al., 2016; Ahmed and Wadud 2011; Rotimi and Ngalawa 2017) but not limited to local oil price volatility (Ayadi 2005; Akpan 2010; Sun et al., 2010; Bekhet and Yusoff 2010; Natal 2012; Saddiqui et al., 2017). Notable recent developments in this regard that focus on effect of monetary and fiscal policy changes due to oil price shock to the economy (Hasan 2010; Bekhet and Yusoff 2010; Natal 2012; Antonakakis et al., 2014; Saddiqui et al., 2017**;** Rotimi and Ngalawa 2017, Adedokun 2018) have been able to trace the monetary channel or fiscal policy responses to oil price volatility, using different methodology techniques and have found that optimal monetary policy response to a persistent increase in the oil price could be mitigated by interest rate channel (Natal 2012) or both interest rate and exchange rate channel (Khan and Ahmed 2011) and that variation in government spending is strongly explained by oil revenue shock (Adedokun, 2018).

However, many of these literatures have either used monetary policy variables or fiscal variables in examining the volatility of oil price. Some other studies which focused on oil price shock vis-a-vis macroeconomic variables sometime mixed the variables of both policies, though not in their full inclusion, most especially with the exclusion of oil revenue and monetary policy rate, MPR. To our believe and given the nature of Nigerian economy (which is oil dependent), these variables would be very much significant in explaining strong variation in government expenditure, while their exclusion might produce a biased result. In this wise, we see the need for a study that would consider necessary variables of both fiscal and monetary variables which would provide the government and the monetary authority with right direction of policy stance given shock to crude oil price. In Nigeria, oil is accounted more than 75 percent of its exports, 25 percent of its Gross Domestic Product (GDP) and 80 percent of government total revenues. With this, a small oil price fluctuation can have a large impact on the monetary and fiscal policy of the economy, particularly oil dependent country. Asides, oil prices have been more volatile than other commodities in Nigeria and the government and policymaker would have to respond depending on the structure of the oil price volatility to curtail further endemic problem. In fact, in about 20 months up to the earlier months of 2016, the oil price dropped rapidly from a high of 130 dollars to a low of 28 dollars and which made the country to experience a sharp fall in its revenue (Adedokun, 2018). Thus, this study would be very much significant as it would trace the responsiveness of policies variables to structural oil price shocks using a better technique, structural VAR that would examine both the relationship among the variables and also determine the short- and long-run reactions among the variables of interest. Our methodology would thus provide an avenue to examine the variation in each of our choice of variables in relation to all of them over times. In this regard, our contribution to the literature would not only be much obtainable on the inclusion of relevant variables, but also on examining sets of policy variables through a single window with distinct econometric technique.

Following the introduction, section two provides the stylized facts about monetary policy and fiscal policy in relation to oil price in Nigerian economy and section three centres on theoretical and Literature review. The data and preliminary analyses are discussed in section four with econometric methodology for the study. Section five presents the discussion of the findings and section six concludes the study.

2.0 Stylized fact on Crude Oil Price, Monetary and Fiscal Policy Variables in Nigeria

Nigeria's experiences with different policies after the oil prices changes, which are rapid and unprecedented, have triggered several simultaneous and significant monetary and fiscal policies in shaping the trajectory of the Nigerian economy. After the collapse of oil prices in the world market, the trend of demand and supply of oil in the global economy, coupled with OPEC activities and the global economic meltdown suddenly counteracted and affects the oil price. Apparently, the volatility of the oil price since 1999, due to OPEC restricted crude oil production and high oil demand from Asian countries, have continued to posed several challenges to fiscal and monetary authorities. With the global financial crisis, many central banks have begun to promote structural transformation and economic growth, beyond the singular mandate of price stability and different fiscal plans have been crumbled due to Nigeria's oil dependent nature.

The fluctuation of crude oil prices is obvious in its trends (see figure 1). The home oil production indicates the OPEC restrictions due to oil price volatility since 1999 and Asian growing oil demand signifying recovery from the 1997 crisis. Meanwhile, the skyrocketed oil price in 2007 to 2008 in figure 1 could be an influence and consequences of global financial crisis of 2007 which was triggered by the housing price bubble in the United States which created considerable uncertainty in the global financial market. As a result of this, the total oil revenue from oil importation in the country was put at ₦4.46 billion in 2007 and ₦6.53 billion in 2008. The increase in the revenue for the year could only be attributed to oil price increase as there was an evidence of slight cut in oil production from 26.4 million barrels in 2007 to 25.2 million barrels in 2008 (CBN, 2020).

With crude oil demand cut from United States, as the top five oil importer in the world, this posed and exposed the inadequacies of monetary and fiscal policies in tackling the challenges that came as a result of the crisis. Pressures from the crisis put the oil prices at higher rates above $40 per barrel in the earlier part of 2009 to $80 per barrel in 2010 before it skyrocketed to above $100 per barrel even though it moves slowly in the 2010 period (see figure 1). Thus, the higher oil price above $100 stayed for more than two years till 2014M8 before it falls and continued gradually. Accordingly, the revenue from oil production stood at ₦8.88billion, ₦8.03billion, ₦6.81billion and ₦6.73billion respectively for the year 2011 running through 2014. In 2015, however, the revenue falls drastically to ₦3.83billion and to as low as ₦2.69billion in 2016, the lowest ever for the period under consideration. It picked up in 2018 to ₦5.55billion while the figure for the 2019 stood at $5.54billion (see figure 1) and there are high chances that it would fall further due to the global pandemic of corona virus which has resulted to locking down of the economic activities in the world over.

During these periods under consideration, there is continual growth in the supply of broad money in the economy and the inflation rate response starts at a high rate and falls within the period of 2006 which is contradictory to the influence of oil prices increase to higher revenue to the government. The inflation rate response is severe compared to the exchange rate response which is stable within the period of 2006 to 2014 (see figure 1). The exchange rate is stable overtime before a surge at the end of 2015 to a higher rate due to high import dependent consumption of commodities even in the middle of oil price volatility. Government expenditure was stable at initial stage but begins to rise from 2005 and this has been minimal all through. In recent time, monetary policy rate and interest rate has been stable while interest rate has been falling, though at a slow rate. These experiences with the policies expanded during the recent economic crisis that begun in 2014 due to number of global shocks, ranges from monetary policies to fiscal policies to soften crude oil prices within the structural vulnerabilities of an oil dependent economies like Nigeria. The oil price volatility has series of effects on the economy such as slowdown in government spending, build-up in the demand for foreign exchange and high exposure of the banking sector to the oil and gas sector. This study intends to fill the gap in explaining the monetary and fiscal policies response to oil price shocks using a structural VAR model technique.

[figure 1 here]

Note: *The variables and its measurement are as follows: Crude oil prices, measured in US dollars; Broad money, measured in billion naira; exchange rate, measured in Naira per US dollar currency; Oil revenue in* *billion Naira; Government Expenditure in Billion Naira; inflation rates, monetary policy rate and interest rates in percentage.*

3.0 Literature Review

Aliyu (2009) assess the effect of the oil price shock on the real macroeconomic activity in Nigeria using monthly data from 1980 to 2007. The result from the VAR approach shows the evidence of both linear and non-linear impact on real GDP. The asymmetric oil price increase in the non-linear models is found to have positive impact on real GDP growth than asymmetric decrease in price. Also, the non-linear estimation records significant improvement over the linear estimation. Hassan (2010), however estimates the impact of oil price shock on the economy through restrictive and non-restrictive VAR using time series data between 1970 and 2008. The results show that the second-round effect of oil price shocks may be transmitted to the other sectors of the economy through the government expenditure-inflation rate channel with significant direct impact on the real sector.

The study by Ayadi (2005) examines whether oil prices have a permanent effect on inflation and product growth rate for the period of 1980 to 2004. The result from his linear dynamic VAR shows that oil price variability is a significant contributor to forecast error in monetary supply. In the same year, Umar and Kilishi (2010) examine the impact of price shock fluctuation in Nigeria macroeconomic. The variables used were real GDP, money supply, unemployment, CPI and crude price. The result shows that three of the variables, namely: real GDP, money supply and unemployment are explained by highly volatile variable and are vulnerable to external shock. The result equally shows that money supply is inversely related to crude oil prices. Meanwhile, investigation by Sajjadur and Apostolos (2010) is on finding the asymmetric effect of oil price shock and monetary policy on macroeconomic activity using monthly data for the period of 1983 and 2008. The result from the logistic smooth transition vector auto-regression shows that in addition to the price of oil, price volatility has an impact on macroeconomic activity and that monetary policy is not only reinforcing the effect of oil price shocks on output, but also contributing to asymmetric response of output to oil price shock.

In Pakistan, Khan and Ahmad (2011) use monthly data spanning from 1990 to 2011 to examine the effect of food and oil prices shock on domestic output, inflation, interest rate and exchange rate.

The result from SVAR and GIR shows that oil price shocks transmit through interest rate and exchange rate channels while other variables as used in the study are not responsive. With respect to Nigeria, Chuku et al. (2011) use quarterly data from 1970 to 2008 to examine the effect of oil price shock on current account balances, output gap and exchange rate misalignment. The SVAR result shows that exchange rate misalignment provides the offsetting effect and lax monetary policy to reinforce the positive effect of oil price shocks in the economy. Earlier before this time, Akpan (2010) had used quarterly data from 1970 to 2007 with VAR approach to examine the relationship between oil price and macroeconomic variables which include government expenditure and others. The result shows that there is positive relationship between oil price and real government expenditure. A study by Ahmed and Wadud (2011) in Malaysia examines the impact of oil price uncertainty on Malaysia macroeconomic activities and monetary responses. The methodology for the study was SVAR and the scope was between January 1986 and May 2009. The result shows an important asymmetric effect of oil price shocks on the conditional oil price volatility. The dynamic impulse response functions obtained from the SVAR model shows a prolonged dampening effect of oil price volatility shock on Malaysia industrial production. It was also found that CPI decline with positive shock to oil price uncertainty.

Bodenstein at el. (2012) use GMM to provide quantitative analysis of how US monetary policy response to oil price fluctuation. The result revealed that structural shocks simultaneously caused fluctuation in macroeconomic aggregate and in the real price of oil. In the period, Natal (2012) used DSGE approach to examine the implication of different monetary policy reaction to oil price shocks. The variables for the study include oil price, inflation, output, nominal and real interest rate. The result shows that that monetary policy (measured through interest rate) response resembles the typical response of inflation targeting. However, the short-term real rates drop right after the shock which helps to dampen real output fluctuation. The work of Bekhet and Yusoff (2013) explore the impact of symmetric oil price shock on the Malaysian economy for the period of 1980 and 2010. The study made use of relevant variables such as oil price (dependent variable), real GDP, oil revenue, government total expenditure and total subsidy. The result of the study shows that high oil prices in the short run would benefit the Malaysian economic which invariably imply that the symmetric oil price shocks has a direct and positive impact on fiscal policy (oil revenue).

In a cross-country study, Fillis and Chatziantoniou (2013) investigate the financial and monetary policy response to oil price shocks using a structural VAR framework with monthly data spanning from January, 1991 to April, 2010. The result from the estimation indicates that the level of inflation in both net oil-exporting and net oil-importing is significantly affected by oil price innovations. It was also found that the response of interest rate to oil price depends heavily on the monetary policy regime of each country. The stock markets operating in net oil-importing countries exhibits a negative response to increase in oil price while the reverse was the case of stock market of the net oil-importing countries. In the same year, Hussain and NoraYusma (2013) explore the symmetric impact of oil price shock on economy to understand its mechanism channel and how fiscal policy response towards it with annual data from 1980 to 2010. The GIR-VAR result found that symmetric oil price shock has a positive and direct impact on oil revenue and government expenditure.

The study by Knut (2013) uses FAVAR approach to examine the impact of different type of oil price shock on the US economy with monthly data from January, 1974 to June, 2008. The result indicates the importance of interacting on oil market and macroeconomic variables when examining the effect of oil price shocks. It was also found that oil demand shocks are more important than oil supply shocks in driving several macroeconomic variables. In their contribution, Alley et al. (2014) use annual data from 1981 to 2012 to examine the impact of oil price shock on the Nigeria economy. The result from GMM finds that oil price shock insignificantly retards economic growth while oil price itself significantly improves it. The significant positive effect of oil price on economic growth confirms the conventional wisdom that oil price increase is beneficial to oil-exporting country like Nigeria.

In another cross-country study, Koh (2015) examine the macroeconomic effect of an adverse oil price shock under different exchange rate and fiscal policy arrangements in 40 oil-exporting countries with annual data from 1973 to 2010. The panel VAR results shows that output and government consumption fall in response to oil price decline. However, the output response is significantly smaller and smoother in countries with flexible exchange rate regimes while countries with fixed exchange rate regimes experience a small and delayed real depreciation, leaving fiscal policy to bear the bulk of the macroeconomic adjustment costs. Meanwhile, a country specific study by Oyelami (2017) is on the investigation of both linear and non-linear effects of oil price movement on critical macroeconomic variables (output, price and exchange rate) in Nigeria. The study adopted linear and non-linear ARDL with quarterly data from 1980 to 2016. The results from the estimations indicate that oil price movement has statistically significant effects on output, rice and exchange rate in the short run and long run while the asymmetric effect was only for output and exchange rate.

Rotimi and Ngalawa (2017) use panel VAR to address the transmission processes of oil price shocks and how it impacts economic performance with in the monetary framework of the Africa's net oil exporting economies (Nigeria, Algeria, Eqypt, Lybia and Gabon). The data analysis reveals that there were significant responses to oil price shocks during this period. The results further show that oil price shocks have large impact on the economic performance of Africa's oil-exporting countries and the transmission of oil price ensue monetary medium. In China, Kim et al. (2016) analyse the effect of positive oil price shock on China's economy with special interest on the response of Chinese interest rate to those shocks. The methodology was TVP-SVAR with generalised impulse response and the scope was between January 1992 and May 2014. The result shows that the response of interest rate to oil price shock is not only time-varying but also show different signs of responses. At early stage, the response was negative and positive at latter period. In a latter year, Wen et. al., (2018) develops a time-varying parameter VAR model to examine the dynamic effect of crude oil price and monetary policy on China's economy between January 1996 and June 2017. The empirical result indicates that crude oil price shocks have positive effects on China's economic growth in the short run but with diverse effect in the long run. Also, monetary policy shocks have positive effects on economic growth.

Saddiqui et al. (2017) examine the effect of exchange rate volatility and fiscal policy changes on oil price volatility using annual data from 1973 to 2014. Granger causality test and generalized autoregressive conditional heteroscedasticity results revealed that exchange rate has an insignificant relationship with local oil price while fiscal policy has a significant relationship with local oil price. In Nigeria**,** Abdulaziz et al. (2019) examine the asymmetric effects of oil shocks on food prices using non-linear ARDL for the period of January 2010 to December, 2017. The result indicate that positive oil price shocks have a positive and significant effects on food price while negative changes have no significant effect on food prices. Earlier before this, Adedokun (2018) had examined the effect of oil shocks on government expenditure and government revenue with exogeneity restriction. His study uses variety of econometric techniques which include VAR, VEC and SVAR with annual data from 1981 to 2014. The results show that oil price shock could not predict the variation in government expenditure in the short-run, while the predictive power of oil revenue shock is very strong both in run and in the long-run. His study also confirms the spend-tax weak fiscal synchronization hypotheses for the Nigerian economy. A similar study by Chen et al., (2019) investigates the relationship among oil price shock, global economic policy uncertainty (GEPU) and

China's industrial growth. The methodology was VAR with granger causality test using monthly data from 2000 to 2017. The result shows that GEPU and world oil prices jointly granger cause China's industrial economic growth. Also, world oil price has a positive effect on China's industrial economic growth while GEPU has a negative effect. Further analysis investigates that asymmetric effect of oil prices and find that the negative components shows a more significant impact on China's industrial economic growth

3.1 Concept of Oil Price Shock

Oil price shocks are unanticipated components of a substantial change in the price of oil. And, it can be defined as the difference between the expected and realized oil price (Baumeister & Kilian, 2016). The world over has experienced series of oil price shock, prominent among which include: the oil price shock of 1970s which is due to the decision by Arab oil producers to cut supply in the wake of the Yom Kippur war with Israel in 1973 which saw the oil prices to soar from US$3 a barrel to close to US$20 virtually overnight and that of 2008 shock which is an offshoot of 2007 global financial crises. As a matter of impact, increase in oil price is generally believed to increase inflation and reduce economic growth, variation in which could be driven by either supply side or demand side and with varying impact. As for inflation, changes in oil prices directly affect the prices of goods made with petroleum products, while further effect is passed into the economy through consumption and investment channels. Increases in oil prices could also depress the supply of other goods because they increase the costs of producing them. The continuous fall in oil price has been associated with the economic impacts of the coronavirus pandemic (covid-19) and the subsequent shutdown of economic activity across the world. This has drastically reduced the global demand for oil even as producers keep pumping out near-record volumes.

3.2 Theoretical Framework

Going with the economic theory, changes in crude oil prices could affect economic activity either through supply or demand channels. For instance, the oil shock of 1970s was considered to emanate from supply channel while the recent one of 2008 was demand driven. In any case, each of the two channels can result in volatility of output level of an economy. An increase in oil prices, for instance, reduces the demand for crude oil and the productivity of other input factors which further induce firms to lower output. According to the neoclassical economists, it is more appropriate to take crude oil price as an input to the economy's production function. Thus, when input prices rise, the profit maximizing level of output fall, thereby leading to reduction in the growth of the economy. This study therefore presents a simple Cobb Douglas production model for a representative firm with the production function of the form:

$$Y = F(L, K, E) \tag{1}$$

The notation description is standard. Y is output level, L is labour, K is capital and E in energy with respective prices of w, r and e. The profit function will then become:

$$\pi = R - C \tag{2}$$

Where R is revenue and C is cost of production

R= P*Y and

$$C = wL + rK + eE \tag{3}$$

Therefore, equation (2) becomes

$$\pi = PY - wL - rK - eE \tag{4}$$

Explaining the supply channel and going with this equation, a rise in oil prices increases the firm's production cost and thus, induces contraction in output and subsequently, lower growth. For the demand channel, the increase in oil price, would translate to higher commodity prices, lower demand for goods and services and lower aggregate output and employment level. It will be expected that a fall in oil price should lead to offsetting the negative impact of increase in oil price. Aliyu (2009) argue that the effect of oil price decline may not be substantially stronger that a rise. In that wise, oil price decline should cause economic expansion, though with slightly lower magnitude compare with a rise in price. The situation under this framework implies that shock to oil price would always take the economy away from equilibrium. But this movement would be preceded by changes in various macroeconomic variables of fiscal and monetary policies. However, the Nigerian situation would be much more complex, being both supplier and purchaser of crude oil substances. A positive shock to oil price will translate to higher oil revenue, and given the spend-tax hypothesis, will generate more spending by the government and this would imply more money in circulation. As explained by Adedokun (2018), inflation in Nigeria is more exogenously determined variable through excessive demand for foreign made products. Thus, the local impact of the shock through either demand or supply channel from being purchaser of refined oil substances from foreign countries will be further heightened by the import-generated inflation. In spite of this, the monetary authority must respond to the rising price through monetary policy, especially by adjusting monetary policy rate which will eventually leads to changes in interest rate. In this wise, our VAR framework will follow this order: crude oil price, oil revenue, government expenditure, money supply, inflation rate, exchange rate, MPR and interest rate.

4.0 Data and stylized facts

Data used in this study are annual series and sourced from Central Bank of Nigeria (CBN) statistical bulletin 2020 edition, National Bureau of Statistics and World Development Indicator, WDI 2020 edition. The annual time-series data include crude oil price (Oilp), fiscal policy variables - oil revenue (orv), government expenditure (tex); and monetary policy variables - broad money (m2), monetary policy rate (mpr), exchange rate (exc), interest rate (int) and inflation rate (inf), covering the period from 1981 to 2019. The large samples were required due to VAR. The sample period is determined by the availability of the data for some variables and the choice of variables is due to the exposure of the economy to structural vulnerabilities of an oil-dependent economy like Nigeria.

Table 1 summarizes the data.

The following variables are used:

Definition	Proxies	Measurement	Source
Crude oil price	Crude oil price	US $ per barrel	CBN/OPEC
Oil Revenue	Crude oil revenue	Billion Naira	CBN
Government Expenditure	Total government expenditure	Billion Naira	CBN
Money supply	Broad money	Billion Naira	CBN
Inflation rate	CPI inflation rate	%	WDI
Monetary Policy Rate	Monetary policy rate(MPR)	%	CBN
Exchange rate	Parallel exchange rate	Naira	CBN
Interest rate	Prime lending rate	%	WDI

Note: The Variables are converted into natural logarithms form before analyzing, except interest rate and inflation rate that are in percentage in their natural form.

In this section from figure 1, we observe the trend between each of the selected monetary policy variables and oil price shock on one hand and fiscal policy variables and oil price on the other hand. Stating from figure 1 which traced the trend between oil revenue, government expenditure and oil price. It could be observed that oil revenue is more volatile than the government expenditure as oil price volatility is obvious from figure 1. And also, there is less volatility in oil revenue and government expenditure for period 1981 to around 2000 despite the oil price volatility that occurred during the period and this indicates that low oil price that oscillate around the average of 23.55USD/barrel before 2002 (Salisu and Oloko, 2015) resulted to low oil revenue and government expenditure but not fluctuating as shown in figure 1. Meanwhile, oil price increase could have led to oil revenue fluctuations after period 2000. On the other hand, it could be observed that low oil price volatility before period 2000 was only felt in money supply and exchange rate but inflation rate, interest rate and monetary policy rate maintained a higher growth rate than oil price. It also observed that inflation rate have a higher value than monetary policy rate and interest rate before period 1998 and a lower value compared to monetary policy rate and interest rate. From figure 1, it could be observed that inflation rate, monetary policy rate and interest rate maintained similar trend before period 2000 while exchange rate and money supply maintained a similar trend for period 1981 to around 1998.

Whereas, it is observed that movement between oil price and oil revenue gives a similar trend after period 2000 and approximately similar before 2000; and movement among inflation rate, interest rate, exchange rate and oil price appears negative before period 2000 and mixed after period 2000. Meanwhile, on the side of the monetary policy variables – inflation rate, exchange rate, monetary policy rate - relation with fiscal policy variables – oil revenue - appears negative before 2000 and mixed after period 2000. Similarly, the relationship between oil price and exchange rate is mixed before 2000 and after 2000. Therefore, the relationship between oil price-oil revenue and oil price-government expenditure is expected as when oil price is low and volatile, oil revenue and government expenditure is low due to Nigeria's nature of oil dependence as a major source of revenue. Also, the relationship between oil price-exchange rate, oil price-inflation rate and oil price-interest rate is mixed and expected, and oil price-interest rate could be approximately negative and may be justified as rising oil price increases liquidity in the Nigerian economy and in turn, reduces cost of borrowing (interest rate).

Thus, there is more correlation between oil revenue, exchange rate, money supply, government revenue and oil price has depicted in the trend analysis. This indicates that increase in oil price will predict rise in oil revenue, increase in government expenditure, raise money supply in the economy and will increase the exchange rate due to heavily-dependent of good importation for production and final consumption.

4.0 Methodological Framework

A large body of empirical literature investigating the effects of oil price shock on fiscal policy or monetary policy or both employ multivariate time series methodology such as the vector autoregressive (VAR) model, structural VAR (SVAR), vector error correction model (VECM), structural vector error correction model (SVECM) among others. Impulse responses generated from these models are used to analyse the effect of shocks in an exogenous variable, usually oil price, on the other variables in the model. Forecast Error Variance Decomposition is also employed to determine the proportion of total variation in a particular variable explained by other variables in the model (Mordi and Adebiyi, 2010).

Thus, to explain the response of monetary and fiscal policy variable to oil price shock, an exogenous variable such as crude oil price, empirically, this study deemed it appropriate to employ structural vector autoregressive (SVAR) model which allows imposition of necessary theoretical restrictions on the model as against the vector autoregressive (VAR) model under which such restrictions are not possible. Adhering to a VAR model in modeling the monetary and fiscal policy response to oil price shock may lead to specification bias since oil price is strictly exogenous to the Nigerian economy, as the proportion of country's supply in global oil supply is not significant enough to influence the global oil price. By implication, shock to oil price is capable of influencing other fundamental domestic variables, such as monetary and fiscal policy variables, including monetary policy rate set as the official interest rate instrument to changes in various private interest rates in the economy.

The procedure of setting monetary policy rate (MPR) by the Central Bank of Nigeria (CBN) in reaction to oil price fluctuations affirms the possibility of oil price shock influence on other monetary tools. However, MPR has been a very relevant monetary policy instrument used by the CBN to channel the movement of interest rate, exchange rate and inflation rate towards achieving one of their mandates of price stability in the country. Thus, it will be appropriate to assume that MPR shocks affect monetary variables and perhaps, oil price shocks affect MPR and the fiscal policy variables included in the model (oil revenue and government expenditure).

We begin the estimation procedure with preliminary test. The most conventional preliminary test on time series variables is the unit root test that is used to ascertain the stationarity properties of variables in the model. The concept of stationarity is important in model building. This step is so relevant and critical to confirm the assertion by Granger and Newbold (1974) that most economic series are non-stationary in nature. However, the fact that estimations and analyses done on non-stationary data lead to spurious regressions makes this test important for our analyses. In that wise, we applied both Augmented Dickey-Fuller (ADF) and the Philip-Perron statistics unit root test. The results are reported in Table 1 showed that all the variables of the study exhibit unit root process at various critical levels but mostly at 1% level of significance, that is, all variables are found to be non-stationary at their level, except inflation rate and money supply. This indicates that each of the variables do not exhibit a clearly defined long term behavior pattern. Thus, this may suggest the use of cointegration test to examine whether all the variables could exhibit a linear stationary combination. The result of cointegration is also presented below in table 3.

Table 2 – Results of Stationary Test Results, 1981 – 2019

Series	ADF	Philips-Perron	Decision
lOP	-2.19	-2.19	I(1)
DOP	-5.44***	-5.40***	
lORV	-4.07	-2.69	I(1)
DORV	-6.29***	-6.36***	
lTex	-2.17	1.55	I(1)
DTex	-5.02***	-3.93**	
lM2	3.66***	3.85	I(1)
DM2	-5.12*	-5.07***	
Inf	-4.02**	-2.87	I(1)
DInf	-5.61***	-10.61***	
lEXR	-2.08	-1.52	I(1)
DEXR	-4.51***	-4.26***	
lMPR	-3.24*	-3.17	I(1)

DMPR	-8.52***	-8.64***	
Iint	-4.02	-2.87	I(1)
Dint	-5.61***	-10.61***	

Note: D represents the first difference operator and l the logarithm. Critical values: 1% = -3.47, 5% = -2.88 and 10% = -2.57. *,** and *** means significant at 10%, 5% and 1%.

Table 3: Cointegration test result

Null	**Alternative**	**Max Eigenvalues stat**		**Alternative**	**Trace Statistics**	
		Statistics	**P-value**		**Statistics**	**P-value**
r=0*	r=1	59.28	0.0085	r≥1	210.68	0.000
r ≤ 1*	r=2	48.88	0.0255	r≥2	151.41	0.0005
r ≤ 2*	r=3	34.89	0.1709	r≥3	102.54	0.0157
r ≤ 3	r=4	28.54	0.1894	r≥4	67.64	0.0737
r ≤ 4	r=5	14.94	0.7531	r≥5	39.09	0.2567
r ≤ 5	r=6	12.33	0.5151	r≥6	24.15	0.1940
r ≤ 6	r=7	9.69	0.2327	r≥7	11.82	0.1658
r ≤ 7	r=8	2.12	0.1449	r≥8	2.12	0.1449

Notes: P-values are based on Mackinnon-haug-Michelis (1999). * denotes rejection of the hypothesis at 0.05 level.

The data in table 3 seem to show conflicting results between trace and maximum Eigen values tests. In particular, the trace test shows that three cointegrating equation whereas the maximum Eigen value test shows two cointegrating equation. Considering the existence of long-term equilibrium relationships among non-stationary variables in the system the analysis employs a SVAR system in levels.

Diagnostic Test

Having presented the result of the data to identify their stationary level, it is also necessary to examine the statistical properties of the empirical model and established the optimal lag. The model was tested for normality, serial correlation, autoregressive conditional heteroscedasticity, heteroscedasticity and specification error. The results reported in table 3 suggest that the model is well specified. The diagnostics indicate the residuals are normally distributed. We established the optimal lag length order of the VAR model through the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQIC), all which suggested a VAR model of different order in table 4. We however used lag two as indicated by AIC. It also shows all the variables are less deviated from their average value, except inflation rate that has a large deviation from its average values.

From the statistic relationship and regression result, it shows that there is positive relationship between oil revenue, money supply, monetary policy rate, interest rate and oil price while there is an inverse relationship between government expenditure, inflation rate, exchange rate and oil price. The result shows that all the variables are significant, except monetary policy rate and inflation rate and it signifies also an overall significance of the model as well as a strong goodness of fit.

4.1 Model Specification

The present study makes use of Structural Vector Autoregressive Model to explain the behavior of crude oil price in the Nigeria economy vis-à-vis the monetary and fiscal policy variables, due to its better tool that allows us to impose both short- and long-run restriction that is consistent with theory, unlike Vector autoregression (VAR) and Vector Error Correction model (VECM). A structural model is a model that is used to estimate the effects of deliberate policy actions or major shocks to the economy, either positive or negative (Sen and Kaya, 2015). The advantage of SVAR over the other classes of vector autoregressive models is that it has better empirical fit and allows identifying structural shocks with respect to economic theory. It makes use of two important tools: Impulse response function and variance decompositions, that gives information with regards to the impacts of shocks and policy innovations (Aarle, Garretsen and Gobbin, 2003).

According to Christiano, Eichenbaum and Evans (1999) in Hammed (2020), the fundamental tools for measuring shock in literature is VAR as it is a convenient device for summarizing the first and second moment properties of the data which make analysis very easy to execute. It is believed that shock to crude oil price would go a long way in influencing the stance of various policies of government. Our VAR model is structured by following basic economic principle. The tenet is that, given that the country is oil-producing country, a sudden change in the price of oil would have an undelay effect on fiscal policy variables such as government oil revenue and expenditure before trickle down to other variables as money supply, inflation rate, exchange rate, monetary policy rate and interest rate. The direct effects of oil price shocks on oil revenue and total government expenditure are expected to be significant due to country's oil-dependent earning nature and this in turn, might put the monetary authority on their strict adherence to balance and stabilize the macroeconomic variables.

In that regard our VAR model is presented as follows:

$$AZ_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i Z_{t-i} + \mu_t \tag{5}$$

From equation (4) Z_t is a **kx1**-dimensional vector of the endogenous variable for model one, A is **kxk** matrix of parameters of endogenous variables, γ_0 is a **kx1**-dimensional vector of constant and γ_i are **kxk**-dimensional autoregressive co-efficient matrices of parameters of lagged value of variables of Z_t and μ_t is the **kx1**-dimensional vector of the stochastic error term normally distributed with white noise properties $N(0,\sigma^2)$. The structural VAR model of oil price shocks in a six-variable setting of monetary policy and fiscal policy measures is based on Kilian (2009).

The structural form of the above equation will be as follows:

$$A\mu_t = B\epsilon_t \tag{6}$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \emptyset_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \emptyset_{31} & \emptyset_{32} & 1 & 0 & 0 & 0 & 0 & 0 \\ \emptyset_{41} & \emptyset_{42} & \emptyset_{43} & 1 & 0 & 0 & 0 & 0 \\ \emptyset_{51} & \emptyset_{52} & \emptyset_{53} & \emptyset_{54} & 1 & 0 & 0 & 0 \\ \emptyset_{61} & \emptyset_{62} & \emptyset_{63} & \emptyset_{64} & \emptyset_{65} & 1 & 0 & 0 \\ \emptyset_{71} & \emptyset_{72} & \emptyset_{73} & \emptyset_{74} & \emptyset_{75} & \emptyset_{76} & 1 & 0 \\ \emptyset_{81} & \emptyset_{82} & \emptyset_{83} & \emptyset_{84} & \emptyset_{85} & \emptyset_{86} & \emptyset_{87} & 1 \end{pmatrix} \begin{pmatrix} \mu_{cop} \\ \mu_{orv} \\ \mu_{gexp} \\ \mu_{m2} \\ \mu_{inf} \\ \mu_{exr} \\ \mu_{mpr} \\ \mu_{int} \end{pmatrix} = \begin{pmatrix} \beta_{11} & 0 & 0 & 0 & 0 & 0 & \beta_{11} & \beta_{11} \\ 0 & \beta_{21} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \beta_{31} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \beta_{41} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \beta_{51} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \beta_{61} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \beta_{71} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \beta_{81} \end{pmatrix} \begin{pmatrix} \epsilon_{cop} \\ \epsilon_{orv} \\ \epsilon_{gex} \\ \epsilon_{m2} \\ \epsilon_{inf} \\ \epsilon_{exr} \\ \epsilon_{mpr} \\ \epsilon_{int} \end{pmatrix}$$

(7)

In equations 6 and 7, μ_t is the matrix of structural shock and each element in the matrix denotes **oil price shock, oil revenue shock, expenditure shock, money supply shock, price level shock, and interest rate shock respectively** and each connotes the presence of contemporaneous relationship between the oil price shock and other variable shocks in the model presentation. But the study stresses the response of other variables to oil price shock. Correspondingly, the elements in matrix ϵ_t denote the residuals of the reduced form equations which represent the absence of contemporaneous relationship between oil price shock and variable shock in the model.

SVAR models are more suited to track and identify structural shocks with respect to underlying economic theory (Chuku, et al. 2011) and hence, it is necessary to impose relevant restrictions on the system of equations to retrieve structural shocks of the model. The following restrictions are therefore employed in the model.

1. Fiscal and monetary policy target variables are endogenous to the Nigerian economy are restricted from affecting crude oil price (being exogenous global variable) while crude oil price affected all the variables contemporaneously and at lags. By fiscal policy target variables, meaning oil revenue and government expenditure, oil revenue is influenced by the oil price and government expenditure is not under the influence of monetary policy and sometimes, oil price while monetary policy target variables are directly affected by the monetary policy of CBN such as interest rate, inflation rate, exchange rate, money supply.

2. All monetary policy target variables are restricted from affecting monetary policy rate (MPR), being exogenous monetary policy instrument while they are all affected by MPR contemporaneously and at lags.

3. MPR does not influence oil revenue, being a function of oil price but government expenditure could influence MPR.

4. Cross correlation among monetary policy target variables and fiscal policy variables are restricted to isolate the effect of oil price shock.

Hence, block exogeneity in SVAR is specified in this model based on the restriction outlined above. To define this, the global exogenous variable – mostly external variable, oil price, would be the ordered first into the system before other endogenous variable to the Nigerian economy; thus we express equation 5 above in a compact form as written below:

$$A(L)z(t) = \varepsilon(t) \qquad (8)$$

Where: A(L) is a 8 x 8 matrix of polynomial in the lag operator L and $\varepsilon(t)$ is the 8 x 1 vector structural disturbances. Optimal lag length is selected using AIC, SC or Hannan-Quinn (HQ) criteria, presented in table 6 in the appendix, necessarily to avoid imposing doubtful restrictions and to satisfy the preference for richer structure at the expense of losing some power.

$$
z(t) = \begin{pmatrix} oilp_t \\ mpr_t \\ int_t \\ inf_t \\ exc_t \\ m2_t \\ oilr_t \\ gexp_t \end{pmatrix} \quad A(L) = \begin{pmatrix} \beta_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{21} & \beta_{22} & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{31} & \beta_{32} & \beta_{33} & 0 & 0 & 0 & 0 & 0 \\ \beta_{41} & \beta_{42} & 0 & \beta_{44} & 0 & 0 & 0 & 0 \\ \beta_{51} & \beta_{52} & 0 & 0 & \beta_{55} & 0 & 0 & 0 \\ \beta_{61} & \beta_{62} & 0 & 0 & 0 & \beta_{66} & 0 & 0 \\ \beta_{71} & 0 & 0 & 0 & 0 & 0 & \beta_{77} & 0 \\ \beta_{81} & 0 & 0 & 0 & 0 & 0 & 0 & \beta_{88} \end{pmatrix} \quad \epsilon(t) = \begin{pmatrix} \epsilon_{1(t)} \\ \epsilon_{2(t)} \\ \epsilon_{3(t)} \\ \epsilon_{4(t)} \\ \epsilon_{5(t)} \\ \epsilon_{6(t)} \\ \epsilon_{7(t)} \\ \epsilon_{8(t)} \end{pmatrix} \tag{9}
$$

In equation 9, the block exogeneity is represented by zero entries in defined in accordance with restrictions stated above.

5.0 Empirical Analysis and Discussion of Results

In this section, we carry out structural factorization of equation 8 to determine the coefficients of A(L) in equation 9; which defines how each variable is affected contemporaneously and by lags of other variables in the model. As described by the diagonal vector of the estimated structural coefficients in table 7, all the variables in the model are significantly influenced by their respective contemporaneous shocks (u_i's), indicating that innovations in both the monetary and fiscal processes have significant influence on the monetary and fiscal variables respectively. Evidence from the statistically insignificant value of likelihood ratio (LR) (see appendix A1) suggests that the null hypothesis of over identification cannot be rejected, implying that our restrictions may be correct.

Table 7: Estimated structural coefficients

$$
A(L) = \begin{pmatrix} 0.2305^{***} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.3888 & 2.70134^{***} & 0 & 0 & 0 & 0 & 0 & 0 \\ -0.2536 & 1.5502^{***} & 1.6204^{***} & 0 & 0 & 0 & 0 & 0 \\ -5.0249^{***} & -0.4173 & 0 & 11.2463^{***} & 0 & 0 & 0 & 0 \\ 0.0561 & 0.0675^{*} & 0 & 0 & 0.2201^{***} & 0 & 0 & 0 \\ 0.0106 & 0.02709 & 0 & 0 & 0 & 0.1027^{***} & 0 & 0 \\ 0.2613^{***} & 0 & 0 & 0 & 0 & 0 & 0.1710^{***} & 0 \\ 0.04515^{*} & 0 & 0 & 0 & 0 & 0 & 0 & 0.1638^{***} \end{pmatrix} \begin{pmatrix} \epsilon_{1(t)} \\ \epsilon_{2(t)} \\ \epsilon_{3(t)} \\ \epsilon_{4(t)} \\ \epsilon_{5(t)} \\ \epsilon_{6(t)} \\ \epsilon_{7(t)} \\ \epsilon_{8(t)} \end{pmatrix}
$$

Note: ***, ** and * represent 1%, 5% and 10% level of significance respectively.

Table 7 presents the summary result of the estimated structural coefficients while the full result is displayed in appendix. The result revealed that oil price shock only has significant impact on inflation rate, oil revenue and government expenditure whereas other monetary and fiscal policy variables such as monetary policy rate (MPR), interest rate, exchange rate and money supply does not react significantly to oil price shock. This is explained by the statistical significance of only β_{41} in the reaction to monetary policy and β_{71} and β_{81} in reaction of fiscal policy to oil price shock (i.e ε_1^{oilp}). This result partially support the findings of Iwayemi and Fowowe (2011) which stated that oil price shock does not have significant impact on interest rate but against their conclusion on oil price shock does not have significant on inflation in Nigeria. Also, this is against the study of Mordi et al (2010) which stated that oil price shock does not reduce price level significantly. Thus, both studies do not examine the impact of oil price shock on fiscal variable to probe into the effect of oil price shock on fiscal and/or monetary policy variable, which is found in this study to respond significantly to oil price shock. Also, this result also contradicts the findings of Farzanegan and Markwardt (2008) where positive oil shocks accounted for an insignificant variation in government expenditure and revenue.

Meanwhile, examining what triggers monetary policy and fiscal policy response significantly, before the exogenous shock - oil price shock- constitutes that interest rate and exchange rate react to MPR shock (as an independent monetary variable). This supports the mandate of the CBN to fix the MPR at a rate that will affect the interest rate and exchange rate in the short run in order to stabilized the economy and put the economic activities of Nigeria and other countries in check for exogenous shock (i.e. the 2008 global financial crisis).

However, it is evident that government expenditure has less error term, followed by oil revenue and interest rate. This indicates that there is more likelihood for fiscal policy variables to react actually and significantly with less hindrance compared to monetary policy variable that could be hindered by some innovations. This supports the claims that fiscal policy is a direct policy of the government and not under the influence of monetary policy.

Furthermore, the Impulse response function (IRF) and forecast variance decomposition (FVD) were generated from the model and used to analyse the dynamics of oil price shocks on selected monetary and fiscal policy variables in Nigeria. IRF was presented graphically in figure 2 and in tabular form in table 7 and 10A (appendix), while FVD is presented in table 8, 10B (appendix) and figure 3.

Figure 2 summarizes the responses of monetary and fiscal policy variables to oil price shock, this is actually a contemporaneous shock, explaining how the current event in oil market affect monetary and fiscal policy variables and its responses. Thus, the kind of oil price shock that is prevalent in the period under consideration appears to be a temporary positive shock. From the IRF graph, the monetary policy variables responses to oil price shock shows that there is a positive and low response of monetary policy variables at the period 1 and have a mixed responses in the further period. For the response of MPR to oil price shock, it started at a positive value in period 1, falls in period 2 and further maintained a negative value in the period 3 to period 10. The response of exchange rate to oil price shock is similar to the MPR reaction and the interest rate response maintained a negative reaction from period 1 to the period 10. However, the response of inflation rate maintained a positive value within period 3 to period 6 while money supply response to oil price shock maintained a positive value in a low level at period 1, rise in period 2 to period 5 before it falls within the positive trend. Whereas, the response of the fiscal policy variables to oil price shock start at a positive note and falls thereafter and beyond its regular level as even during the positive oil price shock within the period 3 and 6. For oil revenue response to oil price shock, it shows that it maintained a positive value for five periods and fall to negative value from period 6.

Meanwhile, examining what triggers monetary policy and fiscal policy shock in the economy, we find that the monetary policy rate shock has impacted on interest rate and money supply; interest rate shock has impacted on exchange rate and government expenditure; inflation rate shock has impacted on money supply; exchange rate shock has impacted on oil revenue and government expenditure; money supply shock has impacted only on government expenditure; and oil revenue shock has impacted only on government expenditure. This result indicates that monetary policy rate shock can be transmitted to government expenditure through the interest rate and money supply, which have significant reaction to monetary policy rate (MPR). It is also found that MPR shock can be transmitted to oil revenue through the exchange rate and exchange rate shock has impacted on fiscal policy variables – oil revenue and government expenditure. Even in the short run, we found that MPR shock has significant influence on interest rate and exchange rate and variation in interest rate and exchange rate is largely due to MPR about 38% and 35% respectively. While variations in monetary policy rate (MPR) is largely due to itself and oil price, about 57.9% and 13% respectively.

However, explaining the response of each variable to monetary and fiscal policy variables in the economy, we find that monetary policy rate (MPR) response to oil revenue shock is positive and rising and to government expenditure is negative and stable. Thus the accumulated response of MPR to fiscal policy is temporary positive and fluctuating. While the MPR response to monetary policy variables are mixed and temporary negative.

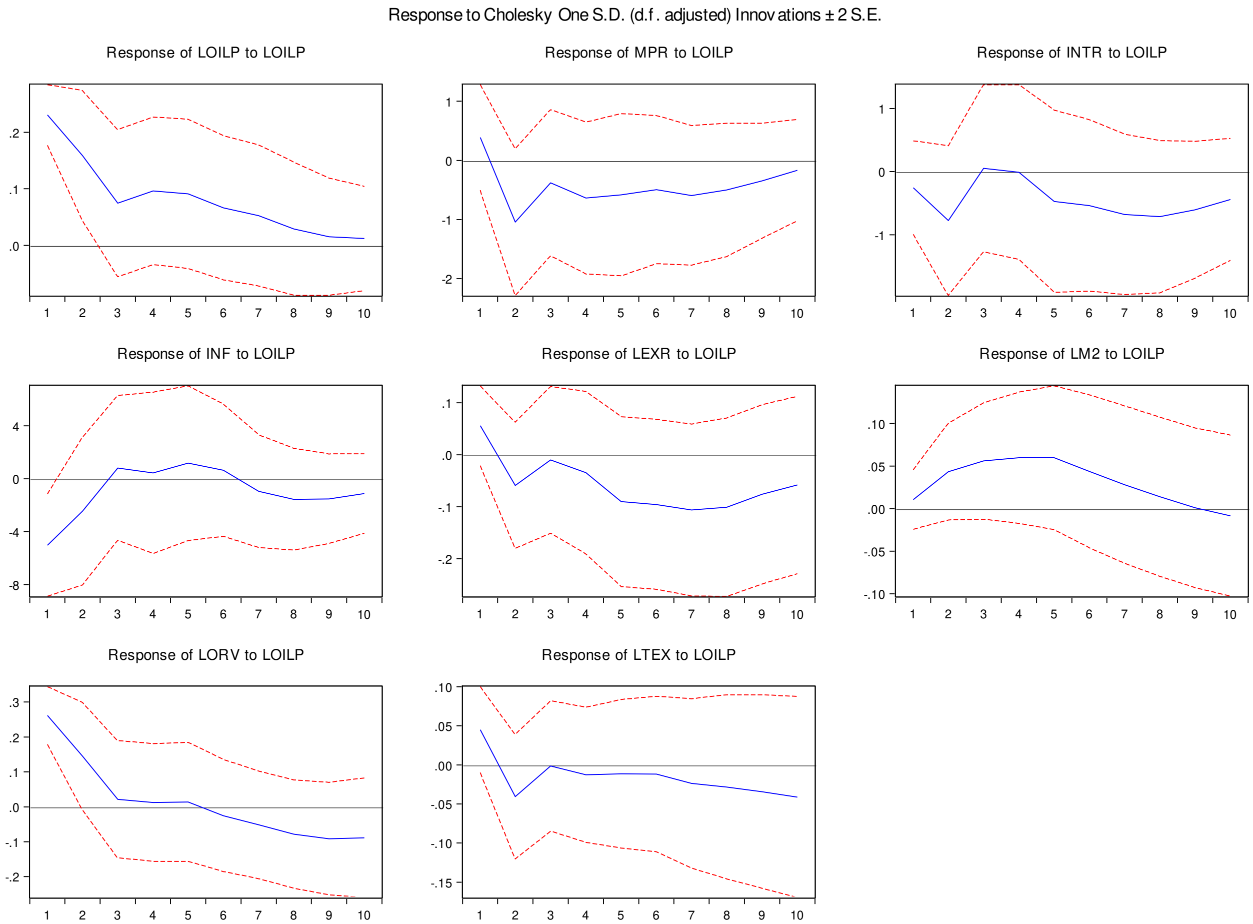
In this wise, this indicates that fiscal policy variables response to oil price shock maintained a temporary positive reaction for some period and fizzles out before the end of the oil price shock and the response of the monetary policy variables to oil price shock maintained a permanent negative reaction for most period, except the money supply that reacted permanent positive reaction in an inverse trend and inflation rate that maintained a temporary positive reaction within period 3 and period 6. Perhaps, the inflation rate reacted to a positive oil price shock within that period. Thus, it shows that monetary policy adopts tightening monetary policy and only relaxed the inflation rate within the period as well as maintained an expansionary money supply throughout the period considered while government adopts expansionary policy and changes to contractionary policy during the negative oil price shock and oil revenue, as a function of oil price, shows a low reaction and falls thereafter to negative region even when oil price maintained a positive region.

Table 7: Impulse responses of monetary and fiscal policy responses to oil price shock

Period	Oil price	MPR	Interest rate	Inflation rate	Exchange rate	Money supply	Oil revenue	Govt expend.
1	0.2305	0.3882	-0.2536	-5.0249	0.0561	0.0106	0.2613	0.0451
2	0.1587	-1.0435	-0.7770	-2.4519	-0.0587	0.0434	0.1450	-0.0406
3	0.0744	-0.3779	0.0523	0.8137	-0.0098	0.0558	0.0216	-0.0014
4	0.0962	-0.6375	-0.0080	0.4454	-0.0346	0.0596	0.0122	-0.0128
5	0.0908	-0.5817	-0.4717	1.1825	-0.0901	0.0597	0.0137	-0.0114
6	0.0663	-0.4954	-0.5372	0.6426	-0.0955	0.0435	-0.0254	-0.0116
7	0.0524	-0.5938	-0.6793	-0.9463	-0.1063	0.0281	-0.0518	-0.0237
8	0.02909	-0.5011	-0.7157	-1.5570	-0.1008	0.0138	-0.0781	-0.0282
9	0.0151	-0.3442	-0.6060	-1.5182	-0.0761	0.0009	-0.0913	-0.0341
10	0.0120	-0.1658	-0.4398	-1.1203	-0.0580	-0.0084	-0.0887	-0.0412

Structural Factorisation

Figure 2: Forecast Variance Decomposition



Structural Factorisation

According to Ravnik and Zilic (2011) in Tule, et al (2020), variance decomposition is a standard approach that shows the share or the proportion of variance of a particular shock in a given period. Put different, it breaks down the ratio of variability of each response in relation to the variability resulting from shocks in other variable. The FVD apportions the total fluctuations in a particular variable to the constituent innovations in the system (Okunoye 2014). It gives information about the relative importance of shocks to variables which will further shows how shock in one of those variables affect other variables of the SVAR model. Table 8 shows the percentage of the forecast error variance decomposition that is assigned to oil price shock which gives variation in any of the monetary and fiscal policy variables as explained by each individual variable. In presenting our result, we intentionally exclude information about oil price, knowing well that it is an exogenous variable and any variation in it will either be due to itself and/or other exogenous variables.

In table 8, the third column shows that the proportion of variation in MPR explained by oil price shock, it is shown that oil price shock has highest contribution of about 7.61 to 25.8% in the variation in monetary policy rate (MPR). As changes in MPR triggers monetary policy actions and other monetary policy tools such as interest rate, inflation rate, exchange rate and money supply, it is also evident in column six of the table that exchange rate followed the MPR in term of oil price shock contribution of about 7.62 to 9.18% in the variation in exchange rate and followed by money supply, where oil price shock contributed about 4.91 to 5.23% in variation in money supply. It indicates that the independent monetary policy rate (MPR) has a contemporaneous effect on the monetary policy tools and have a significant influence and triggers monetary policy actions using this tools – interest rate, exchange rate and money supply – to stabilize the financial and economic activities for macroeconomic stability. Meanwhile, for the remaining fiscal policy variables and basically the oil revenue, we display the proportion of total variations explained by oil price shock. It is shown that the oil price shock has a contribution that started at 5.79 and dropped to about 4.16% on the variation in oil revenue but the oil price shock contribution of about 2.63 to 3.11% in the variation in government expenditure.

Table 8: Share of Oil price shock in the forecast variance decomposition of monetary and fiscal policy variables

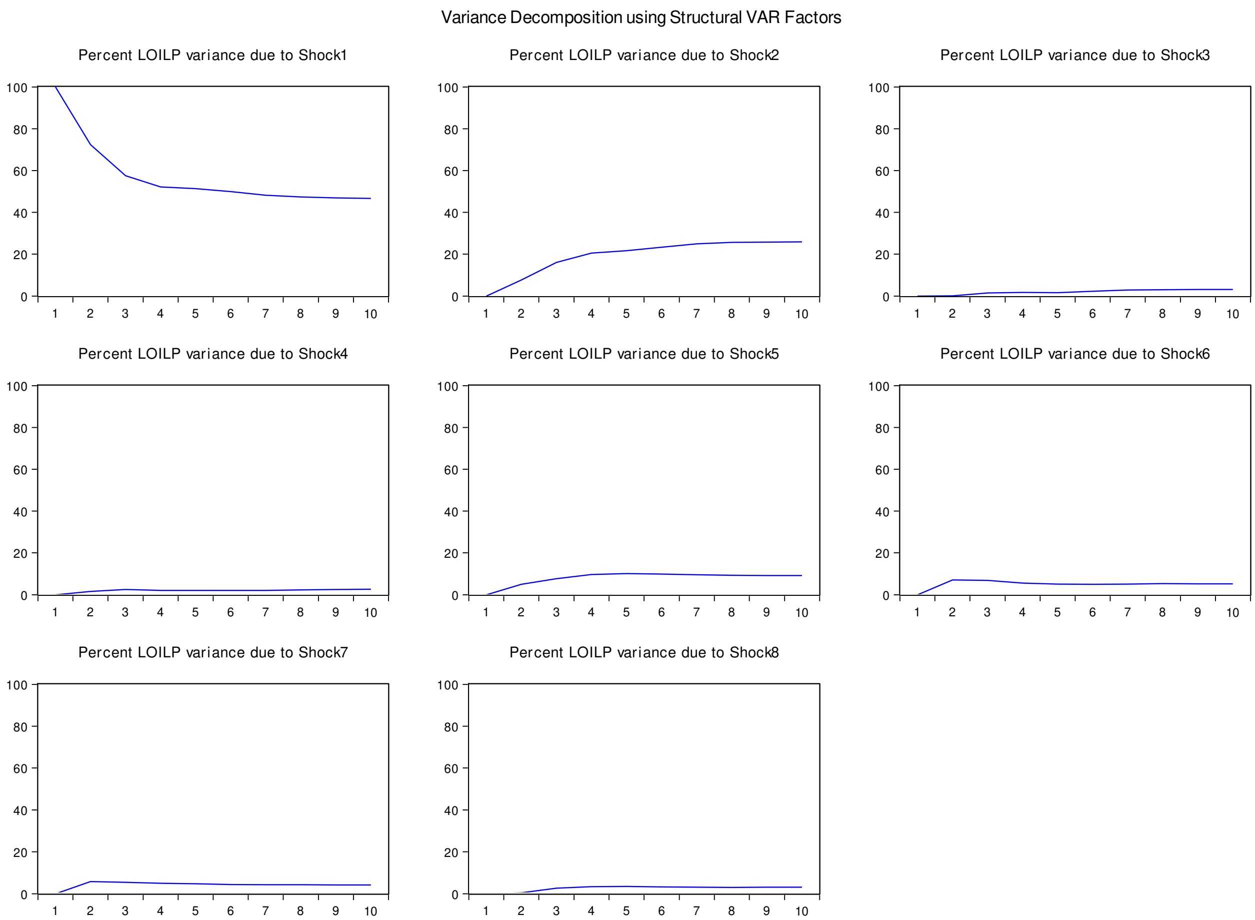
Period	Oil price	MPR	Interest rate	Inflation rate	Exchange rate	Money supply	Oil revenue	Govt expend.
1	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	72.41	7.61	0.10	1.63	4.97	7.07	5.79	0.37
3	57.58	16.02	1.44	2.46	7.62	6.82	5.38	2.63
4	52.17	20.51	1.73	2.05	9.66	5.57	4.92	3.34
5	51.33	21.65	1.57	2.00	10.14	5.06	4.71	3.49
6	49.90	23.35	2.23	2.02	9.87	4.91	4.42	3.25
7	48.16	24.98	2.87	2.04	9.47	5.09	4.27	3.08
8	47.33	25.64	3.03	2.24	9.24	5.25	4.22	3.02
9	46.85	25.81	3.11	2.55	9.14	5.24	4.17	3.09
10	46.66	25.84	3.13	2.66	9.18	5.23	4.16	3.11

Structural factorisation

From table 10B, it shows that proportions of variations in interest rate is largely due to MPR about 38%; variation in inflation rate is due to itself, MPR and interest rate about 45%, 20.5% and 11.5% respectively; proportion of variation in exchange rate is due to MPR with 35%, itself about 15.7% and oil revenue and oil price about 11.9% and 11.7%; and variation in money supply is largely due to itself with 35.7%, followed by exchange rate, monetary policy rate, oil price and oil revenue. While from the fiscal policy variables, it is found that proportion of variation in oil revenue is largely due to oil price about 22%, followed by monetary policy rate, exchange rate and oil revenue; and variation in government expenditure is largely due to monetary policy rate about 32%, followed by money supply and oil revenue about 20.7% and 18.7% respectively.

Thus, it shows that the oil price shock caused large variation and reaction in monetary policy variable than the fiscal policy variables and importantly, the oil price shock caused a large reaction in fiscal policy in period 1 to period 5 before it falls thereafter while oil price shock caused a low reaction in monetary policy in period 1 to period 5 before it rises thereafter. Meanwhile, the proportion of variations in fiscal policy variables is approximately due to monetary policy variables like monetary policy rate, exchange rate and money supply; and proportion of variations in monetary policy variables is approximately due to monetary policy rate (MPR) except inflation rate and money supply which is largely due to itself.

Figure 3: Forecast Variance Decomposition of Oil price shock



Conclusion and recommendation

Concluding from the ongoing debate in the literature, this study examined how monetary and fiscal policy variables respond to oil price shock. This contribution of this study has been to validate or refute this assertion in the context of the Nigerian economy. The study utilized a structural VAR (SVAR) econometric approach to model dynamics of oil price shocks on monetary and fiscal policy variables in the Nigerian economy. Findings from the empirical analyses revealed that oil price shocks have significant impact on inflation, oil revenue and government expenditure and does not have significant impact on monetary policy rate which may affect interest rate, exchange rate and money supply. This indicates that large reaction of inflation rate comes from oil price shock than the independent monetary policy rate. And, it is evident that response of monetary policy rate, interest, exchange rate and government expenditure are not consistent and mostly, shown a negative large impact from one-time oil price shock whereas inflation rate and oil revenue response to one-time oil price shock is alternating during the period, permanent for some period before it fizzles out with mixed impact. Furthermore, it is shown that money supply is consistent overtime, approximately permanent and with positive impact from oil price shock and this indicates that money supply also react positively to oil price shock while interest rate, exchange rate reacted to endogenous shocks other than oil price shocks.

Hence, the implications is that variations in monetary policy rate, exchange rate, money supply and oil revenue are experienced on occasion of oil price shock and with the highest contribution in variation in monetary policy rate (MPR). The policy implication however suggests that the use of fiscal policy tools to reduce the extent of oil price shocks coupled with the monetary policy tools should be complement carefully and appropriated, due to direct use of fiscal policy and carefully thought of monetary policy in order to avoid distortion in monetary policies implementation of the CBN in stabilizing the economy. Moreso, since overdependence of government expenditure and government deposits may be responsible for the transmission of oil price shock to financial sector, it may be recommended that government expenditure should rest on internal generated revenue, not oil revenue, and government deposit in the financial sector is reduced, thus strengthen of treasury single account (TSA) adoption to track government generated revenue may be a right policy for Nigeria financial sector.

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Figure 1: Trend Analysis of the Policy Variables from 1981 to 2019

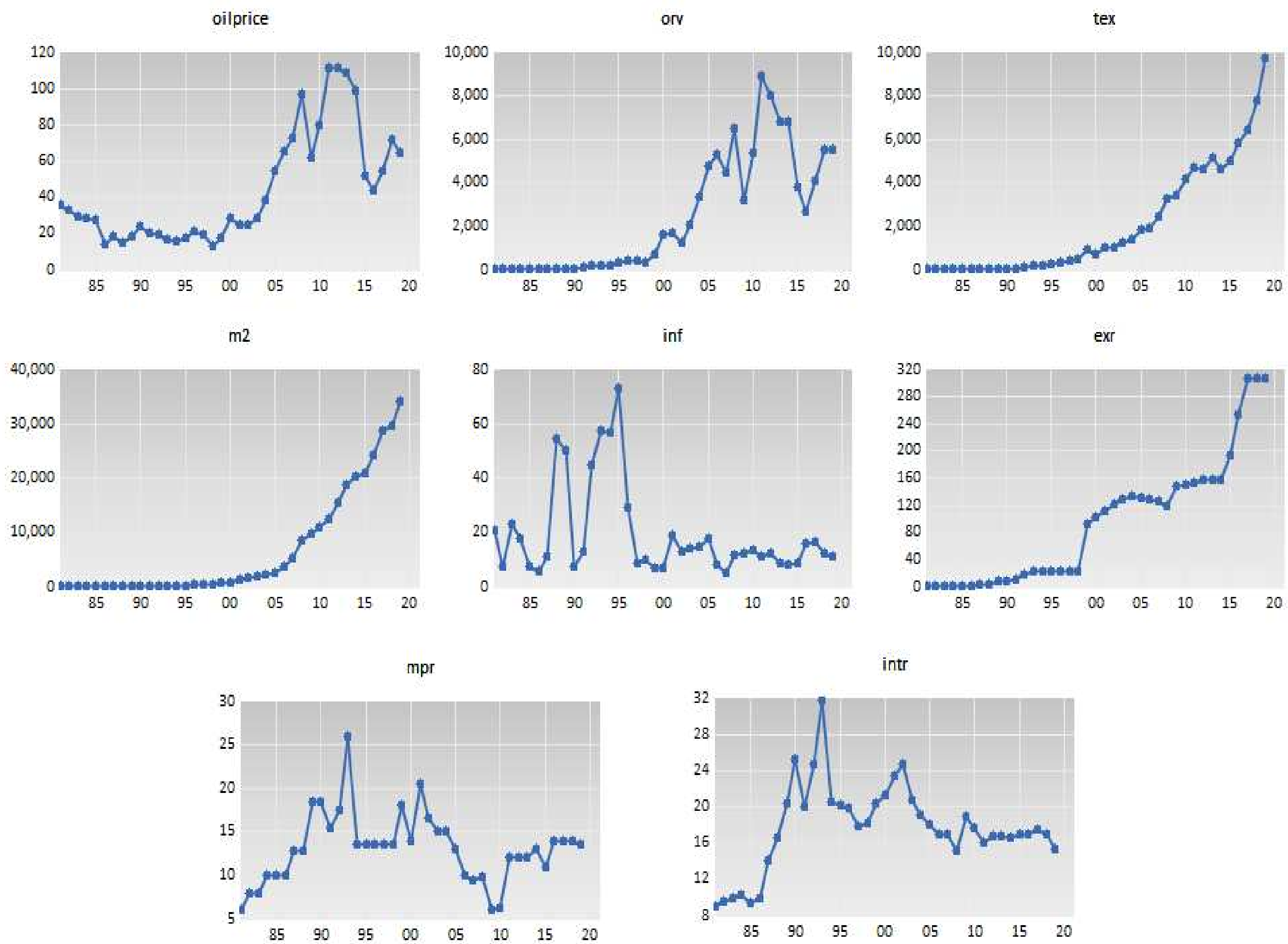

Table 4: Diagnostic tests

Test	F-stat	Probability
Normality Jarque- Bera Statistic	1.392	0.498
Serial Correlation Breusch-Godfrey Serial correlation LM test	2.748	0.0807
Autoregressive conditional heteroscedasticity ARCH LM test	7.214	0.0109
Heteroscedasticity White heteroscedasticity test	3.974	0.143
Specification error Ramsey reset test	5.618	0.0244

Table 5: Descriptive statistics

	Loilp	Lorv	ltex	lm2	inf	Lexc	mpr	Int
Mean	3.55	6.21	6.12	6.68	19.15	3.48	13.07	17.69
Median	3.36	7.11	6.85	6.77	12.55	4.62	13.50	17.55
Max	4.72	9.09	9.18	10.44	72.83	5.72	26	31.65
Min	2.54	1.98	2.26	2.67	5.38	-0.49	6	8.92
S.D	0.66	2.47	2.28	2.64	17.06	1.98	4.04	4.79
Skewness	0.34	-0.52	-0.41	-0.093	1.78	-0.78	0.67	0.25
Kurtosis	1.81	1.80	1.75	1.59	4.99	2.31	4.33	3.75
J. Bera	3.08	4.11	3.62	3.25	27.16	4.73	5.79	1.31
Prob.	0.21	0.13	0.16	0.19	745.71	0.093	0.05	0.51
Sum	138.47	242.54	238.77	260.58	11063.33	135.74	510.00	690.15
SS Dev	16.81	232.22	198.35	265.07		149.12	622.26	873.29
Obs	39	39	39	39	39	39	39	39

Table 6: Series: Optimal Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-441.9537	NA	5.047599	24.32182	24.67013	24.44462
1	-179.6492	397.0014*	0.000121	13.60266	16.73742*	14.70781*
2	-102.8186	83.06020	0.000101*	12.90911*	18.83032	14.99662

Source: Authors' Computation

Table 9: Estimation of Structural parameters

Structural VAR Estimates
Date: 09/19/20 Time: 08:53
Sample (adjusted): 1983 2019
Included observations: 37 after adjustments
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives)
Convergence achieved after 29 iterations
Structural VAR is over-identified

Model: e = Su where E[uu']=I
S =

C(1)	0	0	0	0	0
C(2)	C(9)	0	0	0	0
C(3)	C(10)	C(14)	0	0	0
C(4)	C(11)	0	C(15)	0	0
C(5)	C(12)	0	0	C(16)	0
C(6)	C(13)	0	0	0	C(17)
C(7)	0	0	0	0	0
C(8)	0	0	0	0	0

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.230523	0.026798	8.602323	0.0000
C(2)	0.388244	0.446435	0.869654	0.3845
C(3)	-0.253623	0.369841	-0.685761	0.4929
C(4)	-5.024906	1.940174	-2.589925	0.0096
C(5)	0.056108	0.038412	1.460691	0.1441
C(6)	0.010628	0.017519	0.606667	0.5441
C(7)	0.261367	0.041396	6.313870	0.0000
C(8)	0.045153	0.027440	1.645514	0.0999
C(9)	2.701644	0.314060	8.602323	0.0000
C(10)	1.550157	0.321622	4.819816	0.0000
C(11)	-0.417279	1.849517	-0.225615	0.8215
C(12)	0.067533	0.037031	1.823670	0.0682
C(13)	0.027092	0.017189	1.576100	0.1150
C(14)	1.620433	0.188372	8.602324	0.0000
C(15)	11.24630	1.307356	8.602324	0.0000
C(16)	0.220132	0.025590	8.602324	0.0000
C(17)	0.102787	0.011949	8.602324	0.0000
C(18)	0.171018	0.019880	8.602324	0.0000
C(19)	0.163828	0.019045	8.602324	0.0000

Log likelihood	-237.4342		
LR test for over-identification:			
Chi-square(17)	87.13626	Probability	0.0000

TABLE 10A: Impulse response functions

Accumulated Response of LOILP: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.230523	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.02680)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.389298	-0.090793	0.010859	0.042060	0.073400	-0.087499	-0.079169	0.020246
	(0.07076)	(0.05094)	(0.04779)	(0.05138)	(0.04844)	(0.04787)	(0.03558)	(0.04247)
3	0.463711	-0.213692	0.055474	0.084727	0.148983	-0.135319	-0.118871	0.078847
	(0.11762)	(0.10806)	(0.09276)	(0.10646)	(0.09217)	(0.09678)	(0.06485)	(0.08588)
4	0.559982	-0.328921	0.086983	0.076149	0.227501	-0.139745	-0.149828	0.125047
	(0.16385)	(0.16394)	(0.13887)	(0.15805)	(0.13284)	(0.14245)	(0.08625)	(0.12372)
5	0.650804	-0.407411	0.083808	0.058877	0.280266	-0.146195	-0.172554	0.155549
	(0.21367)	(0.22367)	(0.18696)	(0.20910)	(0.17552)	(0.18676)	(0.11148)	(0.16119)
6	0.717185	-0.489484	0.043508	0.040520	0.310095	-0.166477	-0.180125	0.154432
	(0.26314)	(0.28649)	(0.23241)	(0.25704)	(0.21591)	(0.22183)	(0.13392)	(0.19321)
7	0.769636	-0.571971	0.001759	0.022776	0.330280	-0.199311	-0.196497	0.148691
	(0.31172)	(0.34917)	(0.27653)	(0.30023)	(0.25341)	(0.25173)	(0.15313)	(0.21638)
8	0.798733	-0.626286	-0.021191	-0.001283	0.334430	-0.225071	-0.207173	0.142513
	(0.35746)	(0.40856)	(0.31761)	(0.33797)	(0.28643)	(0.28042)	(0.17447)	(0.23425)
9	0.813929	-0.659909	-0.037924	-0.029274	0.341203	-0.236367	-0.205560	0.126211
	(0.39524)	(0.46085)	(0.35149)	(0.36784)	(0.31151)	(0.30380)	(0.19339)	(0.24751)
10	0.825935	-0.679917	-0.047372	-0.046526	0.355218	-0.241278	-0.200112	0.116680
	(0.42558)	(0.50476)	(0.37804)	(0.38910)	(0.32942)	(0.32302)	(0.21009)	(0.25671)

Accumulated Response of MPR: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.388244	2.701644	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.44643)	(0.31406)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	-0.655259	3.773902	0.212475	-0.422832	0.056192	-0.134860	0.720346	-0.779167
	(0.85410)	(0.70414)	(0.52440)	(0.57052)	(0.54356)	(0.55868)	(0.43297)	(0.51012)
3	-1.033162	4.721246	0.698650	-0.884364	0.838652	0.030891	0.742849	-0.645680
	(1.19878)	(1.13898)	(0.85166)	(1.00089)	(0.84612)	(0.91614)	(0.60955)	(0.83996)
4	-1.670694	6.299696	1.526107	-1.452939	0.557394	0.525422	1.177655	-0.204508
	(1.63102)	(1.61741)	(1.24304)	(1.39328)	(1.16183)	(1.28298)	(0.73938)	(1.11501)
5	-2.252405	7.345471	1.352132	-2.015428	0.373638	1.091098	1.729789	-0.585492
	(2.14616)	(2.20426)	(1.71750)	(1.89470)	(1.59953)	(1.72443)	(1.04364)	(1.49496)
6	-2.747862	7.809553	1.039362	-1.790310	0.137829	1.233048	1.864466	-0.583511
	(2.57741)	(2.79996)	(2.15485)	(2.38643)	(2.00728)	(2.08016)	(1.27270)	(1.83021)
7	-3.341684	8.243468	0.933742	-1.512718	-0.479876	1.398691	1.942678	-0.523510
	(2.95507)	(3.32161)	(2.53379)	(2.75342)	(2.31331)	(2.32519)	(1.39842)	(1.99479)
8	-3.842833	8.633630	0.860229	-1.366343	-0.952875	1.654965	1.980205	-0.714302
	(3.33245)	(3.78720)	(2.87085)	(3.03213)	(2.57066)	(2.54020)	(1.57192)	(2.09626)
9	-4.187112	8.992003	0.865771	-1.051630	-1.172843	1.883695	1.970718	-0.788720
	(3.66236)	(4.23101)	(3.14946)	(3.27306)	(2.79201)	(2.73013)	(1.75227)	(2.21548)
10	-4.352973	9.295692	0.989089	-0.733077	-1.292204	2.091200	1.971028	-0.738578
	(3.93556)	(4.63944)	(3.38886)	(3.48123)	(2.96601)	(2.91923)	(1.91223)	(2.32209)

Accumulated Response of INTR: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	-0.253623	1.550157	1.620433	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.36984)	(0.32162)	(0.18837)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	-1.030638	2.982948	2.217781	0.036218	1.232754	0.599598	0.790155	-0.442707
	(0.81672)	(0.71290)	(0.55005)	(0.52216)	(0.48296)	(0.46845)	(0.35480)	(0.41827)
3	-0.978271	3.898291	3.282252	0.017589	2.366879	0.954889	1.255580	0.156586
	(1.29936)	(1.26382)	(1.00800)	(1.06998)	(0.91447)	(0.93946)	(0.62919)	(0.83996)
4	-0.986316	5.438722	4.198021	-0.708504	2.705947	1.365378	1.694745	0.668138
	(1.82292)	(1.86798)	(1.49768)	(1.60680)	(1.35003)	(1.44340)	(0.86542)	(1.24852)
5	-1.458108	6.529420	4.340355	-1.512688	2.764519	1.687613	2.363212	0.451102
	(2.36043)	(2.50701)	(2.01372)	(2.17600)	(1.82868)	(1.95001)	(1.16351)	(1.67754)
6	-1.995388	7.020281	4.085409	-1.721085	2.785277	1.772494	2.723443	0.358971
	(2.81618)	(3.12109)	(2.47239)	(2.68597)	(2.24947)	(2.31928)	(1.39549)	(2.01279)
7	-2.674709	7.505114	4.013739	-1.719091	2.297537	1.864351	2.953225	0.428931
	(3.21246)	(3.65823)	(2.85118)	(3.04807)	(2.56617)	(2.55724)	(1.53650)	(2.17697)
8	-3.390496	8.052409	3.910802	-1.780913	1.751641	2.104758	3.177798	0.195322
	(3.59608)	(4.13802)	(3.17788)	(3.31371)	(2.82496)	(2.75101)	(1.69844)	(2.25652)
9	-3.996592	8.553788	3.844441	-1.606131	1.419746	2.338326	3.332843	-0.006448
	(3.94146)	(4.59057)	(3.45571)	(3.54538)	(3.04893)	(2.94292)	(1.88643)	(2.35585)
10	-4.436419	9.047018	3.949819	-1.318042	1.188907	2.566043	3.452303	-0.035027
	(4.24173)	(5.01507)	(3.69830)	(3.75698)	(3.22948)	(3.15118)	(2.06804)	(2.47276)

Accumulated Response of INF: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	-5.024906	-0.417279	-2.190358	11.03094	0.000000	0.000000	0.000000	0.000000
	(1.94017)	(1.84952)	(1.83126)	(1.28232)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	-7.476870	-1.481966	-1.332264	18.20403	1.425643	1.323073	-0.770219	0.693899
	(4.01277)	(3.82035)	(3.73843)	(3.25037)	(2.34457)	(2.40657)	(1.83464)	(2.26836)
3	-6.663134	3.628823	3.743473	18.29959	2.823532	3.476173	-2.030743	2.251124
	(5.34865)	(5.65530)	(5.03874)	(5.26938)	(4.10316)	(4.48270)	(2.93359)	(4.09201)
4	-6.217649	10.58089	7.023921	15.01698	4.927168	5.844585	-0.451913	1.475510
	(6.24211)	(6.91944)	(5.95332)	(6.41522)	(5.09817)	(5.48013)	(3.07722)	(4.85043)
5	-5.035090	13.72155	7.686452	12.90143	8.247818	6.421961	0.891259	1.334054
	(7.23045)	(8.00543)	(6.76282)	(7.27086)	(5.92086)	(6.03878)	(3.47697)	(5.29838)
6	-4.392392	15.20611	8.243982	11.69331	9.079030	5.880448	1.129550	3.065752
	(8.06933)	(9.11220)	(7.52491)	(7.93878)	(6.67119)	(6.50496)	(3.82178)	(5.64913)
7	-5.338761	16.07149	7.750207	9.900336	7.657136	5.792583	1.522662	3.211774
	(8.66582)	(10.0896)	(8.09062)	(8.41301)	(7.26449)	(6.84222)	(4.04895)	(5.84748)
8	-6.895859	15.85515	5.925212	9.320050	6.174644	5.786491	1.584936	2.300473
	(9.04348)	(10.7573)	(8.40583)	(8.60312)	(7.54594)	(6.85480)	(4.21002)	(5.76414)
9	-8.414121	15.34231	4.320242	10.26485	4.391055	5.701280	1.262351	1.894650
	(9.31354)	(11.1701)	(8.54200)	(8.52642)	(7.58587)	(6.73133)	(4.34212)	(5.45120)
10	-9.534498	15.18776	3.429124	11.26257	2.563855	5.836942	0.824296	1.441789
	(9.49796)	(11.5136)	(8.59626)	(8.40446)	(7.49301)	(6.75117)	(4.56036)	(5.19852)

Accumulated Response of LEXR: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.056108	0.067533	0.070259	-0.016114	0.207995	0.000000	0.000000	0.000000

	(0.03841)	(0.03703)	(0.03526)	(0.03425)	(0.02418)	(0.00000)	(0.00000)	(0.00000)
2	-0.002681	0.168331	0.148969	-0.042345	0.355139	0.051627	0.080420	0.051986
	(0.08612)	(0.08226)	(0.07665)	(0.07717)	(0.06339)	(0.04905)	(0.03738)	(0.04401)
3	-0.012539	0.302697	0.209703	-0.178356	0.432817	0.140938	0.173345	0.066148
	(0.13855)	(0.13942)	(0.12264)	(0.13061)	(0.10723)	(0.10108)	(0.06744)	(0.08786)
4	-0.047164	0.481065	0.220071	-0.310334	0.456026	0.209425	0.259654	0.049211
	(0.19564)	(0.20345)	(0.17559)	(0.18845)	(0.15522)	(0.15819)	(0.09557)	(0.13369)
5	-0.137330	0.618321	0.190384	-0.386431	0.440577	0.262428	0.361707	0.008449
	(0.25442)	(0.27215)	(0.22960)	(0.24874)	(0.20637)	(0.21404)	(0.12816)	(0.18020)
6	-0.232884	0.724294	0.172473	-0.416352	0.414808	0.312234	0.434860	-0.015157
	(0.31089)	(0.34205)	(0.28225)	(0.30538)	(0.25543)	(0.26089)	(0.15578)	(0.21957)
7	-0.339251	0.855553	0.192209	-0.425581	0.369626	0.380055	0.501735	-0.025155
	(0.36991)	(0.41336)	(0.33336)	(0.35642)	(0.30173)	(0.30111)	(0.18061)	(0.24998)
8	-0.440112	0.995852	0.220794	-0.424272	0.342843	0.467228	0.576582	-0.047382
	(0.43486)	(0.49004)	(0.38778)	(0.40906)	(0.35058)	(0.34375)	(0.21075)	(0.27953)
9	-0.516247	1.131607	0.262453	-0.400811	0.345236	0.553010	0.643766	-0.051716
	(0.50298)	(0.57295)	(0.44492)	(0.46606)	(0.40093)	(0.39175)	(0.24589)	(0.31329)
10	-0.574333	1.269546	0.322650	-0.376821	0.356475	0.636082	0.708012	-0.038181
	(0.57173)	(0.65928)	(0.50380)	(0.52489)	(0.44927)	(0.44341)	(0.28216)	(0.34878)

Accumulated Response of LM2:

Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.010628	0.027092	-0.025330	0.053179	0.011822	0.083401	0.000000	0.000000
	(0.01752)	(0.01719)	(0.01664)	(0.01517)	(0.01378)	(0.00970)	(0.00000)	(0.00000)
2	0.054070	0.055449	-0.005408	0.103735	0.038369	0.165980	-0.002895	0.019757
	(0.04088)	(0.03919)	(0.03810)	(0.03726)	(0.03436)	(0.02853)	(0.01618)	(0.01978)
3	0.109958	0.106126	0.019452	0.129066	0.090607	0.249955	0.006721	0.040308
	(0.06938)	(0.06943)	(0.06385)	(0.06751)	(0.06022)	(0.05512)	(0.03177)	(0.04287)
4	0.169595	0.145637	0.048673	0.134948	0.154149	0.322848	0.032330	0.061641
	(0.10122)	(0.10567)	(0.09527)	(0.10272)	(0.08999)	(0.08698)	(0.04830)	(0.06936)
5	0.229353	0.179667	0.073877	0.126659	0.223581	0.385924	0.060604	0.086728
	(0.13646)	(0.14697)	(0.12913)	(0.14028)	(0.12127)	(0.11856)	(0.06662)	(0.09653)
6	0.272935	0.213578	0.097202	0.108513	0.280729	0.443875	0.098220	0.109305
	(0.17385)	(0.19229)	(0.16496)	(0.17869)	(0.15392)	(0.14924)	(0.08512)	(0.12265)
7	0.301044	0.247249	0.111428	0.085060	0.331715	0.501118	0.142807	0.121124
	(0.21245)	(0.24020)	(0.20140)	(0.21650)	(0.18628)	(0.17806)	(0.10305)	(0.14558)
8	0.314891	0.286190	0.124789	0.065035	0.375509	0.557191	0.191394	0.130203
	(0.25158)	(0.28912)	(0.23780)	(0.25268)	(0.21746)	(0.20573)	(0.12142)	(0.16524)
9	0.315852	0.336680	0.141889	0.045711	0.412674	0.615874	0.245692	0.135589
	(0.29092)	(0.33843)	(0.27341)	(0.28718)	(0.24729)	(0.23318)	(0.14063)	(0.18339)
10	0.307396	0.399971	0.164836	0.026528	0.448745	0.677855	0.305003	0.137880
	(0.33061)	(0.38850)	(0.30878)	(0.32116)	(0.27622)	(0.26183)	(0.16131)	(0.20171)

Accumulated Response of LORV:

Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.261367	0.052983	0.028333	-0.029783	0.087173	0.002733	0.130933	0.000000
	(0.04140)	(0.02743)	(0.02653)	(0.02609)	(0.02380)	(0.02153)	(0.01522)	(0.00000)
2	0.406417	-0.059225	0.102105	-0.029470	0.267720	-0.099400	0.144398	0.031865
	(0.09684)	(0.08146)	(0.07800)	(0.08144)	(0.07273)	(0.06641)	(0.04957)	(0.05757)
3	0.428024	-0.100330	0.248898	-0.047367	0.411133	-0.112758	0.197409	0.129687
	(0.15281)	(0.15205)	(0.13467)	(0.14809)	(0.12477)	(0.12383)	(0.08410)	(0.10912)
4	0.440310	-0.084847	0.354514	-0.135695	0.532812	-0.043241	0.301510	0.161267

	(0.20634)	(0.22084)	(0.19447)	(0.21131)	(0.17475)	(0.17911)	(0.10950)	(0.15240)
5	0.454105	-0.029667	0.395473	-0.199722	0.643812	0.015963	0.398602	0.175092
	(0.26306)	(0.29045)	(0.25204)	(0.27130)	(0.22440)	(0.22751)	(0.13807)	(0.19174)
6	0.428617	0.044847	0.419741	-0.247127	0.698798	0.055881	0.503373	0.180967
	(0.31737)	(0.36095)	(0.30552)	(0.32627)	(0.27228)	(0.26860)	(0.16503)	(0.22535)
7	0.376721	0.136912	0.446319	-0.309408	0.732099	0.096747	0.601233	0.164762
	(0.36832)	(0.42853)	(0.35451)	(0.37321)	(0.31382)	(0.30242)	(0.18703)	(0.24769)
8	0.298527	0.262912	0.490693	-0.366276	0.756079	0.149473	0.699213	0.149188
	(0.41890)	(0.49194)	(0.40007)	(0.41341)	(0.35084)	(0.33455)	(0.21119)	(0.26431)
9	0.207172	0.411205	0.543373	-0.411809	0.777890	0.219953	0.806414	0.134473
	(0.46975)	(0.55445)	(0.44326)	(0.45236)	(0.38743)	(0.36919)	(0.23812)	(0.28480)
10	0.118402	0.569995	0.601962	-0.442840	0.801658	0.298370	0.910946	0.128016
	(0.52279)	(0.61995)	(0.48766)	(0.49523)	(0.42546)	(0.41047)	(0.26890)	(0.31101)

Accumulated Response of LTEX: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.045153	0.090744	0.061973	0.035159	0.059791	0.038422	0.028166	0.087656
	(0.02744)	(0.02478)	(0.02124)	(0.01955)	(0.01781)	(0.01578)	(0.01478)	(0.01019)
2	0.004516	0.101177	0.111363	0.054103	0.091985	0.105462	0.102951	0.114039
	(0.05503)	(0.05246)	(0.04836)	(0.04836)	(0.04559)	(0.04335)	(0.03362)	(0.03395)
3	0.003023	0.120856	0.134001	0.075135	0.160876	0.186701	0.142964	0.141240
	(0.08294)	(0.08590)	(0.07655)	(0.08221)	(0.07242)	(0.07064)	(0.04808)	(0.05665)
4	-0.009821	0.192750	0.175885	0.089932	0.182309	0.264168	0.201075	0.172368
	(0.11631)	(0.12417)	(0.11001)	(0.11753)	(0.10316)	(0.10399)	(0.06396)	(0.08121)
5	-0.021277	0.271537	0.195265	0.073446	0.217718	0.339198	0.270132	0.158437
	(0.15513)	(0.16863)	(0.14526)	(0.15608)	(0.13640)	(0.13699)	(0.08302)	(0.10822)
6	-0.032939	0.354679	0.229813	0.063954	0.266102	0.397083	0.329839	0.162033
	(0.19719)	(0.21892)	(0.18352)	(0.19700)	(0.17118)	(0.16845)	(0.10231)	(0.13486)
7	-0.056730	0.455819	0.281116	0.042878	0.305153	0.460593	0.399550	0.172967
	(0.24526)	(0.27530)	(0.22604)	(0.24032)	(0.20876)	(0.20360)	(0.12393)	(0.16077)
8	-0.084973	0.562122	0.330718	0.011558	0.347128	0.530148	0.474345	0.176313
	(0.29885)	(0.33810)	(0.27311)	(0.28796)	(0.24933)	(0.24368)	(0.15062)	(0.18934)
9	-0.119152	0.671023	0.376706	-0.011243	0.387645	0.598984	0.549309	0.184401
	(0.35579)	(0.40669)	(0.32331)	(0.33935)	(0.29214)	(0.28754)	(0.18000)	(0.22230)
10	-0.160358	0.780494	0.420341	-0.029709	0.418551	0.668272	0.625812	0.192890
	(0.41514)	(0.47972)	(0.37617)	(0.39322)	(0.33623)	(0.33451)	(0.21114)	(0.25716)

Factorization: Structural
Standard Errors: Analytic

Figure 4: Impulse response function of Oil price and monetary – fiscal policy variables

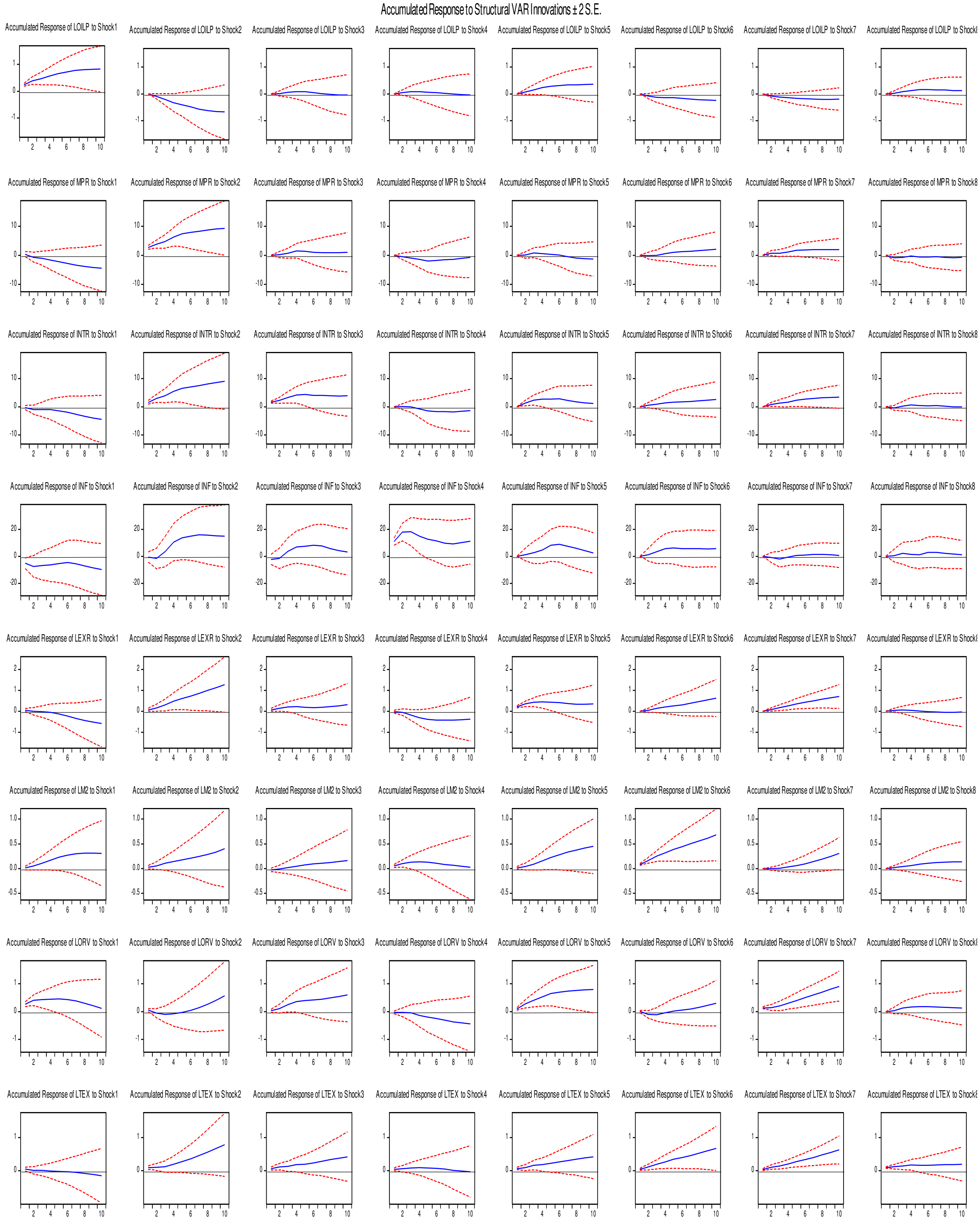

TABLE 10B: Forecast Variance Decompositions

Variance Decomposition of LOILP: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	72.41111	7.618564	0.108970	1.634960	4.979152	7.075724	5.792679	0.378845
3	57.58976	16.02827	1.447457	2.464223	7.620556	6.825843	5.385004	2.638895
4	52.17229	20.51217	1.736868	2.051519	9.669610	5.579490	4.929814	3.348245
5	51.33250	21.65893	1.575000	2.005308	10.14943	5.064178	4.717336	3.497316
6	49.90900	23.35859	2.233640	2.027461	9.876700	4.912741	4.422555	3.259317
7	48.16264	24.98858	2.874101	2.046620	9.470346	5.098962	4.278571	3.080188
8	47.33388	25.64487	3.030658	2.246250	9.242813	5.259530	4.221722	3.020270
9	46.85268	25.81381	3.113185	2.553559	9.149182	5.249629	4.171114	3.096837
10	46.66057	25.84435	3.134284	2.666242	9.183193	5.231490	4.161169	3.118699

Variance Decomposition of MPR: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	2.023369	97.97663	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	11.20872	76.39221	0.408204	1.616589	0.028550	0.164448	4.691873	5.489399
3	10.46732	70.76493	2.131498	2.966547	4.659583	0.345724	3.932738	4.731657
4	10.03838	66.42681	5.421835	4.012661	3.897241	1.628584	3.975543	4.598939
5	10.42632	63.37924	4.883928	5.055497	3.569454	2.990801	4.966506	4.728249
6	11.24199	62.28789	5.184685	5.127161	3.713980	2.986618	4.886960	4.570724
7	12.30196	60.19170	4.989817	5.232483	5.260619	2.969206	4.683430	4.370790
8	12.99145	58.86625	4.848448	5.153019	6.063202	3.157702	4.534749	4.385176
9	13.24723	58.27620	4.754704	5.477169	6.152904	3.320488	4.447334	4.323975
10	13.19763	57.93634	4.759446	5.837484	6.136081	3.460901	4.391650	4.280462

Variance Decomposition of INTR: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	1.262967	47.18109	51.55594	0.000000	0.000000	0.000000	0.000000	0.000000
2	6.181652	41.22975	27.59795	0.012137	14.06146	3.326582	5.776998	1.813467
3	4.541862	35.84179	27.86599	0.011231	18.99781	3.288824	5.693849	3.758646
4	3.485737	39.83389	25.74152	2.747864	15.17616	3.399312	5.371510	4.244013
5	4.074766	40.38989	22.68721	5.361355	13.33663	3.457324	6.752778	3.940042
6	5.205178	40.05664	22.19029	5.367519	12.87818	3.369708	7.091070	3.841415
7	6.930248	39.34917	21.27097	5.139926	13.33514	3.262393	7.013001	3.699157
8	8.622605	38.52156	20.21839	4.890626	13.84052	3.325603	6.853698	3.726998
9	9.747508	38.17845	19.54564	4.841788	13.79387	3.422890	6.712742	3.757115
10	10.23732	38.15853	19.10798	5.035746	13.65626	3.534315	6.601833	3.668020

Variance Decomposition of INF: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8

1	16.62223	0.114627	3.158376	80.10477	0.000000	0.000000	0.000000	0.000000
2	14.46662	0.605139	2.560896	80.11940	0.940535	0.810066	0.274525	0.222816
3	11.43186	9.821811	11.20738	62.00224	1.427570	2.286933	0.781423	1.040787
4	8.862582	20.90194	11.60393	50.74344	2.320826	3.309625	1.289796	0.967863
5	8.555372	21.85310	10.84640	48.08318	4.961209	3.146697	1.653598	0.900442
6	8.478441	21.94363	10.69569	47.43545	5.029375	3.153708	1.632969	1.630732
7	8.546156	21.73387	10.56372	47.37361	5.435271	3.099048	1.641604	1.606720
8	8.939900	21.26680	11.13048	46.41185	5.843059	3.030855	1.606407	1.770649
9	9.281602	20.85478	11.48693	45.58746	6.459292	2.965046	1.595039	1.769849
10	9.425238	20.53172	11.48933	45.09908	7.128515	2.922580	1.614222	1.789323

Variance Decomposition of LEXR:

Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	5.604929	8.119843	8.788633	0.462296	77.02430	0.000000	0.000000	0.000000
2	5.995472	13.36407	10.10559	0.860385	58.93008	2.419697	5.871303	2.453397
3	3.866091	18.90826	8.549880	11.21899	40.92998	6.139294	8.712693	1.674807
4	3.335666	27.27135	6.302788	15.56509	30.18285	6.473593	9.521793	1.346866
5	5.612643	29.21118	5.535212	14.93498	25.11291	6.351911	11.54251	1.698652
6	7.956259	29.93302	5.100523	13.77151	22.89053	6.521100	12.11673	1.710325
7	10.23219	31.38807	4.634144	12.24117	20.87978	7.075450	12.00385	1.545342
8	11.61669	32.76553	4.317299	10.86712	18.71397	8.173420	12.05112	1.494858
9	11.92003	34.09398	4.334848	10.04353	17.08156	9.132437	12.02498	1.368627
10	11.67976	35.36883	4.748971	9.366662	15.75198	9.851438	11.93404	1.298313

Variance Decomposition of LM2:

Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.989793	6.431412	5.622423	24.78128	1.224635	60.95046	0.000000	0.000000
2	8.007255	6.157594	4.157586	21.55380	3.380778	55.14674	0.033557	1.562685
3	12.13401	9.724468	3.923144	14.26996	8.462340	49.32262	0.238834	1.924631
4	14.78896	9.655793	4.277206	10.32511	12.96716	44.53661	1.289180	2.159975
5	16.47667	9.179508	4.230618	8.242749	16.71946	40.50672	2.092816	2.551463
6	16.29759	9.185362	4.249553	7.438030	18.07929	38.55629	3.421856	2.772038
7	15.32277	9.342009	3.991621	7.187393	18.76509	37.69362	5.085841	2.611660
8	14.10301	9.902595	3.793707	6.905159	18.83987	37.18377	6.821762	2.450118
9	12.79046	11.13505	3.687556	6.577708	18.25282	36.63159	8.678348	2.246472
10	11.52276	13.01989	3.705485	6.176789	17.35244	35.75704	10.44732	2.018280

Variance Decomposition of LOILR:

Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	70.02148	2.877374	0.822812	0.909199	7.789271	0.007657	17.57221	0.000000
2	49.40491	8.513705	3.453047	0.490504	22.22540	5.771763	9.579246	0.561426
3	37.73796	7.179314	11.67753	0.507300	25.53014	4.460826	8.459781	4.447154
4	31.15011	5.999088	13.48488	3.119263	26.16422	5.349144	10.72334	4.009952
5	27.88893	6.301536	12.56657	4.054887	27.18676	5.863245	12.49640	3.641679
6	26.09858	7.450571	11.84497	4.413271	26.12841	5.905539	14.76523	3.393439
7	24.84656	9.141125	11.13964	5.111265	24.45316	5.904065	16.19681	3.207376
8	23.90551	12.06490	10.53243	5.391934	22.22096	5.998935	16.93064	2.954694
9	23.01738	15.40709	9.948868	5.232303	19.84296	6.388614	17.49161	2.671174
10	22.09809	18.59535	9.556590	4.865307	17.86233	6.889262	17.73508	2.397995

Variance Decomposition of LGEXP: Period	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	7.059827	28.51435	13.29963	4.280658	12.37934	5.111945	2.747219	26.60703
2	8.153754	18.43568	13.87661	3.524433	10.18951	13.19300	14.11095	18.51607
3	6.124537	14.48156	11.26695	3.379474	15.52128	20.85085	13.24851	15.12685
4	4.919958	17.72862	10.90143	2.877950	12.52123	23.68807	14.49480	12.86795
5	4.102041	20.67898	9.176278	2.600060	11.38557	24.88982	16.59198	10.57528
6	3.591717	23.52883	8.809111	2.279976	11.67902	23.99256	17.15322	8.965569
7	3.368567	26.75063	9.155144	2.199328	10.72688	22.68341	17.63625	7.479789
8	3.286574	29.07327	9.107386	2.421341	9.999770	21.81173	18.05619	6.243744
9	3.418531	31.02383	8.896667	2.343529	9.418865	21.13931	18.37103	5.388239
10	3.757735	32.56166	8.648305	2.205905	8.678910	20.67365	18.72228	4.751550

Factorization: Structural

FORECAST VARIANCE DECOMPOSITION GRAPH