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MONETARY POLICY TRANSMISSION MECHANISM AND GROWTH OF THE MANUFACTURING SECTORS IN LIBYA AND NIGERIA: DOES EXCHANGE RATE REGIME MATTER?

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Abstracts
The study examines the role of exchange rate regimes in determining the nature of relationship between monetary policy transmission mechanisms and manufacturing output growth in oil producing economies in Africa. Libya and Nigeria were used in the study because of the different exchange rate regimes practice in both oil exporting countries. Nigeria as a net oil exporter practices flexible exchange rate while Libya as a net oil exporter practices fixed exchange rate system. The study employs structural variance decomposition approach (SVAR). It was found out from the study that exchange rate regime has some influences on the monetary policy transmission mechanism and its effectiveness on the manufacturing output growth in the two oil exporting countries. Oil price shocks affect the monetary policy instrument of both countries greatly. While monetary policy instrument appears to be ineffective in promoting output growth of the manufacturing sector in Libya that practices fixed exchange rate, the reverse is the case in Nigeria. Flexible exchange rate appears to create enabling environment for monetary policy instrument to influence manufacturing output growth positively in the face of oil price shock.

Research paper

Keywords: Exchange rate regime, Monetary policy transmission mechanism, Oil price shock

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Introduction

There has been a near consensus on the fact that monetary policy only has transitory effects on the economic activity, but what has been a subject of debate in recent times is the path through which monetary policy influences economic activities. This debate has given birth to some researches on the assessment of the transmission mechanism of monetary policy and its influence on the real activities. While there is handful of literature on this assessment on developed economies, there are still limited numbers of researches on developing economies (see Ngalawa and Viegi, 2012)

The situation is even worse for oil rich countries in Africa. Empirical literature on the influence of monetary policy transmission mechanism on the economic activities remains extremely limited on Africa oil exporting countries (AOECs) in particular. Nigeria, which is the largest oil producer, enjoys the largest share of the limited empirical literature. Mordi and Adebiyi (2010), Mahmud (2009), and Riman et al(2013) among others, have studied issues relating to monetary policy mechanism and growth of Nigeria within the context of oil price shock.

However, a unique thing about the AOECs is the fact that oil is the mainstay of the economies and oil contributes the largest percentage to their Gross Domestic Products (GDPs) and also provides the highest foreign exchange earnings. For instance, in Nigeria, the oil sector contributed about 44.9 percent to the GDP in 2012 and accounted for 87 percent of the total export earnings, in Algeria oil generates 97 percent of the total export earnings and in Libya it is 90 percent of the total export. Another common thing about the AOECs is that the enormous resources generated from oil have not been translated to the overall economic development of these economies

(World Bank, 2012; IMF, 2010). The prevalence of unemployment, poverty, and excessive importation of manufactured goods, decay infrastructures, inadequate power and energy supplies and low human development index are testimonies to the position of the World Bank and the IMF.

The dwindling nature of oil reserves in most of the AOECs and myriads of problems facing them resulted in the stern warning given by the IMF in 2010 that if by the end of the next two decades there is no positive efforts directed towards diversification of these economies most of them are likely going to run into deep economic recession. This is where the manufacturing sectors of these countries have key roles to perform. Many of the AOECs are heavily dependent on imported manufactured goods. The focus on the oil sector only has led to the neglect of the manufacturing sector and this has led to fall in domestic output of the manufacturing industries leading to rise in prices of local manufactured consumer goods. For instance, Algerian government has been subsidizing the price of manufactured consumer good for the past three years. The manufactured goods subsidy bill rose from 185 million USD in 2011 to about 3 billion USD in 2012. This huge amount of money could have been invested in promoting the growth of the manufacturing sector.

However, the decadence in the growth of the manufacturing sector of the AOECs has aggravated the existence of structural imbalances in terms of high inflation rate and increase in unemployment rate. In Nigeria, in the past two decades more than 160 textile

manufacturing firms have closed down leading to loss of about 100.000 jobs (Caroroll, 2012).

The structural imbalance and the economic instability in the AOECs have made inflation rate and exchange rate policies helpless in resuscitating their ailing manufacturing sectors. In addition, building a virile non-oil sector that will be able to contribute about 50 percent to the GDP has been identified as a way of reducing the dependence on oil sector and promotes the development of the AOECs. (African Development Bank ADB, 2010). According to the ADB (2010), this requires a thorough assessment of the monetary policy administration in a way that it will involve strategic synergy with both the exchange rate and inflation rate polices to create an enabling environment for the non-oil sector to thrive. Consequently, the manufacturing sector as a key important sector in the non-oil sector requires a favorable climate in terms of inflation rate, exchange rate polices and general administration of monetary policy to be able to remain competitive domestically in the AOECs.

Monetary policy as one of the economic polices usually used in achieving various macroeconomic objectives like increase in output needs some favourable environment for it to be effective in promoting output (see Frankel, 2003). Exchange rate has been identified as one of the factors that can influence the effectiveness of the monetary policy instruments. According to Aliyev (2012), policy makers are often faced with challenges of choosing between fixed exchange rate regime which is a good recipe for maintaining economic stability and flexible exchange rate which gives independence to monetary policy. This challenge is even tougher in the oil rich countries that are faced with volatile foreign exchange windfalls

However, the influence of the regime of exchange rate and the role of monetary policy in promoting macroeconomic performance has been a subject of debate for some years now. While some believe that apart from the fact that fixed exchange rate policy guides against economic instability, it can also be used to promote output through an appropriate monetary policy. These researchers criticize the assumptions of exogenous money supply, perfect international capital market and inelastic exchange rate expectations by the Mundell-Fleming model. They argued that in reality, the Central Bank has the power to operate within specific asymmetric bounds which enable it to control the domestic interest rate exogenously.

They further argued that this can happen even in an open economy with free capital mobility without bringing in any market mechanism that can automatically adjust the levels of interest rate and exchange rate to a sustainable level (see Serrano and Saumna, 2010; Habib and Sttrashy, 2008; Habib and Kalamova, 2007). On the contrary, some researchers are of the opinion that follows the Mundells-Fleming model that fixed exchange rate regime do not allow the monetary authority to utilize monetary policy to positively influence the level of output (see Blanchard, 2008; Degrauwe, 2000 and Gregory, 2007).

Therefore, this study hope to use Libya which practice fixed exchange rate regime and Nigeria that practice floating exchange rate regimes as oil exporting countries in examining the linkages between the monetary policy transmission mechanism and the manufacturing output growth. This will expose the problems of the manu-

facturing sector and how to tackle them through a robust monetary policy arrangement under different exchange rate regimes.

Methodology

The thrust of this research effort is to examine the relationship between oil price shock, monetary policy transmission mechanism and the growth of the manufacturing sector and the role of exchange rate regime in Nigeria and Libya using Structural VAR model. Generally, VAR models are seen as independent large scale macro econometric model that do not rely on unrealistic assumptions (Elbourne, 2007). The foremost theoretical framework of VAR analysis as proposed by Sims (1980) used Choleski decomposition to get impulse responses. However, the Choleski decomposition used in VAR approach has been described as highly prone to incredible causal ordering if the researcher is interested in looking at more than just monetary shocks (see Bernanke, 1986, Elbourne, 2007). The structural VAR (SVAR) provides economic information for the rationale behind the restrictions that helps in identifying both monetary policy shocks and other shocks. Again, the study is interested in studying the short-term and the medium term behaviours of the variables since there is a near consensus that monetary policy can only influence output significantly in the short run (see Gul, et al. 2012; Sidrauski 2008).

Since Algeria is a net oil exporter in Africa therefore we cannot ignore the influence of both oil resources and oil price shocks apart from the monetary policy shocks hence the suitability of SVAR approach for this study. Another justification for choosing SVAR is the argument that not all variables respond instantaneously to shocks as provided by VAR. Evidenc-

es from past researches have shown that many variables exhibit delay in their response to shocks due to financial deepening and level of integration with the global economy. The structure of the matrix in SVAR has made provision for this (see Ngalawa and Viegi, 2008). In addition, the Choleski decomposition in VAR used partial identification which can only indentify only one of the underlying structural shocks. All other shocks are treated as responding contemporaneously to the identified shocks (Elbourne, 2007).

According to Kim and Roubini (2000) SVAR has been designed to deal with all the puzzles that have affected the recent literatures on the effects of monetary policy on economic activities. The SVAR model adopted for this study is designed to allow for the assessment of both monetary policy shock and oil shocks on the manufacturing sector growth of the three countries in a single model.

A: The Model

The construction of our VAR model follows the conventional method where the initial model is specified thus:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + , \ldots \ldots \ldots . + A_p y_{t-p} + \mu_t$$

(1)

Where:

y_t represents an (nx1) vector containing n endogenous variables,

A_i(*i=1, 2,….p)* are (n x n) matrices coefficients,

And μ_t is an (n x 1) vector containing error terms.

Though the error is $\mu_t \sim iid\ N(0, \Omega)$ but errors do possess tendency of correlating contemporaneously in all the equations.

There exist pn^2 Parameters in the A matrices**.** Equation 1 can be written in other form with the usage of the lag operator L which is selected through $L^k x_t = x_{t-k}$. the equation becomes:

$$A(L)y_t = \mu_t$$

(2)

Where:

$$A(L) = A_0 L^0 - A_1 L^1 - A_2 L^2 - \cdots \ldots \ldots - A_p L^p.$$

A_0= I (identity matrix) it is required that *A(L)* lies outside the unit circle for stationarity to be ensured.

Variance Decomposition and Impulse Response Functions

Both variance decomposition and impulse response functions are computed by re-specifying our autoregressive (AR) function. Two of them evolve through the process described as follows:

$$A(L)\mu_t = y_t$$

(3)

y_t represents a stationary stochastic process in the system and lag operator is L, μ_t is the white noise error term. The theory also requires root *det(1-A(z))=0* should have a module greater than 1, in such a way that *det(1-A(z))* is invertible. The interpretation of our VAR is based on the vector moving average (MA) presented in the following form:

$$y_t = \emptyset_t + \sigma(L)\mu_t E(\mu_t) = 0$$

(4)

$$E(\mu_t \mu_{t-k}) = Q, |k| = 0$$

(5)

$$E(\mu_t \mu_{t-k}) = Q, |k| \neq 0$$

(6)

Where Q represents the covariance matrix sample, $\emptyset_t$is predictable perfectly while the matrix of coefficients of $\sigma(L)$ using lag 0 is the identity matrix.
Equation 4 can be normalized to generate the impulse response functions and at the same time forecast the error decomposition. Nonetheless the variance decomposition adopted is equal to the MA.

B: Model Identification

The nature of SVAR requires imposition of enough restrictions so as to identify the orthogonal structural components of the error terms that is present in the shocks. Note that this is at variance to the standard recursive Cholesky orthogonalisation. The non-recursive orthogonalisation of the error term produced through this process is used for the impulse response function and variance decomposition.

Let us assume that y_t comprises of vector of endogenous variables. For example say k element of endogenous variables in our model where $\sum E[v_t \acute{v}_t]$ is the residual of the covariance matrix, therefore our identification procedure follows:

$$Av_t = B\mu_t$$

(7)

Where v_t and μ_t are vectors with lag length k, $v_t$is the observed residual and μ_t represents the unobservable structural innovations. A and B are k x k matrices which are to be estimated. However, innovation μ_t is assumed to be orthogonal in nature. Hence the covariance is an identity matrix $E[\mu_t \mu_t^t]$=I. Imposition of restriction on A and B is made possible due to the orthogonal assumption of μ_t. hence we have:

$$A\sum \acute{A}=B\acute{B}$$

(8)

The link between the reduced form and the structural form of the VAR model is presented as follows:

$$B(L) = B_0 + B^+(L)$$

(9)

$$A(L) = -B_0^{-1}B^+(L)$$

(10)

$$\sum \doteq B_0^{-1}AB_0^{-1}$$

(11)

Equation 9 divided the structural form in to contemporaneous correlations i.e B_0 and $B^+(L)$.

The former represent correlation at lag zero while the later represent correlation at all strictly positive lags. Equation 10 separated each reduced form coefficients into its structural counterpart B_0 is identified through the reduce form, $\sum \doteq E[\mu_t\mu_t^t]$, and the diagonal covariance matrix of the structural form , $A = E[v_t\acute{v}_t]$ as shown in 11.

Furthermore, due to the vulnerability of long run restrictions to serious mis-specification problems, we use contemporaneous restriction on B_0 matrix to identify the shocks as shown in equation 12 since this study is interested in short run and medium term responses (see Leeper, et al., 1996; Elbourne, 2008).

$$\begin{bmatrix} v_t^{poil} \\ v_t^{oilgr} \\ v_t^{intr} \\ v_t^{msgr} \\ v_t^{infr} \\ v_t^{exr} \\ v_t^{mgr} \\ v_t^{gdpgr} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ B_{21}^0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ B_{31}^0 & 0 & 1 & 0 & 0 & 0 & 0 & B_{38}^0 \\ B_{41}^0 & 0 & B_{43}^0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & B_{53}^0 & B_{54}^0 & 1 & B_{56}^0 & 0 & 0 \\ B_{61}^0 & B_{62}^0 & 0 & 0 & B_{65}^0 & 1 & B_{67}^0 & 0 \\ B_{71}^0 & B_{72}^0 & B_{73}^0 & B_{74}^0 & B_{75}^0 & B_{76}^0 & 1 & 0 \\ 0 & 0 & 0 & 0 & B_{85}^0 & B_{86}^0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{poil} \\ \mu_t^{oilgr} \\ \mu_t^{intr} \\ \mu_t^{msgr} \\ \mu_t^{infr} \\ \mu_t^{exr} \\ \mu_t^{mgr} \\ \mu_t^{gdpgr} \end{bmatrix} \quad (12)$$

There are eight variables in the SVAR model namely oil price (poil) which is the exogenous variable, it occupies row 1 and it constitutes an external pressure on the economy. Other endogenous variables are arranged as follows, oil resources growth rate (oilgr), interest rate (intr), money supply growth rate (msgr), inflation rate (infr), exchange rate (exr), manufacturing output growth (mgr) and GDP growth rate (gdpgr).

Oil price is viewed as the external shock to the entire system, meaning that it affects the oil output growth rate, monetary policy transmission mechanism (MTM) and the outputs. The oil output growth rate is included based on the controversy that often in oil exporting countries economic policies receive shock from the global oil price through the individual countries oil output levels. Berument, et al. (2009) in his study of Oman and UAE found out that oil price shock affect economic policies of these countries through their output levels. He argued that since these countries are heavily dependent on oil, influence of oil price on the output is translated to

economic wealth which dictates the behavior of economic policies in these countries.

However, on the contrary, Jemenez and Rodriguez (2009) opined that most of the oil exporting countries runs very open and liberal economies which make their economic policies to be highly susceptible to external shocks. They argued that since they are heavily dependent on oil, fluctuations in global price of oil affects economic policies in these countries without necessarily passing through their output levels.

The linear specification of the model to be estimated is expressed as:

$$mgr_{t(i)} = \left[intr_{t(i)}, msgr_{t(i)}, inf_{t(i)}, exr_{t(i)}, gdpgr_{t(i)}, oilgr_{t(i)}, poil_t\right] \quad (13)$$

The variables are as defined above. i represents Nigeria and Libya economies

The variables are as defined above.

C: The Data

The data collected are on quarterly basis from 1980Q1 to 2010Q4. As shown in the model, eight variables are used in explaining the monetary policy transmission mechanism as it affects the manufacturing output in Algeria. Data on all the variables are sourced from the World Bank data base except the data on oil price and growth rate of oil output are sourced from the data base of Organization of Petroleum Exporting Countries (OPEC). It should be noted that the growth rate of the variables like money supply, GDP, manufacturing output and oil output are used as this presents a clearer and more realistic perspective of examining the variables in their real values (see Olomola, 2006).

Results and discussions

Impulse Response Result Analysis

The impulse response analysis of the monetary policy transmission mechanism is discussed under three different headings. First, we consider the responses of the variables to shock from oil price, then oil output growth rate shock, and lastly the monetary policy transmission mechanism (MTM) shocks. Note that the MTM shocks comprise of interest rate shock, money supply growth rate shock, inflation rate shock and the exchange rate shock.

Impulse Response on Nigeria

Figure 1. Responses to oil price shock (Nigeria)

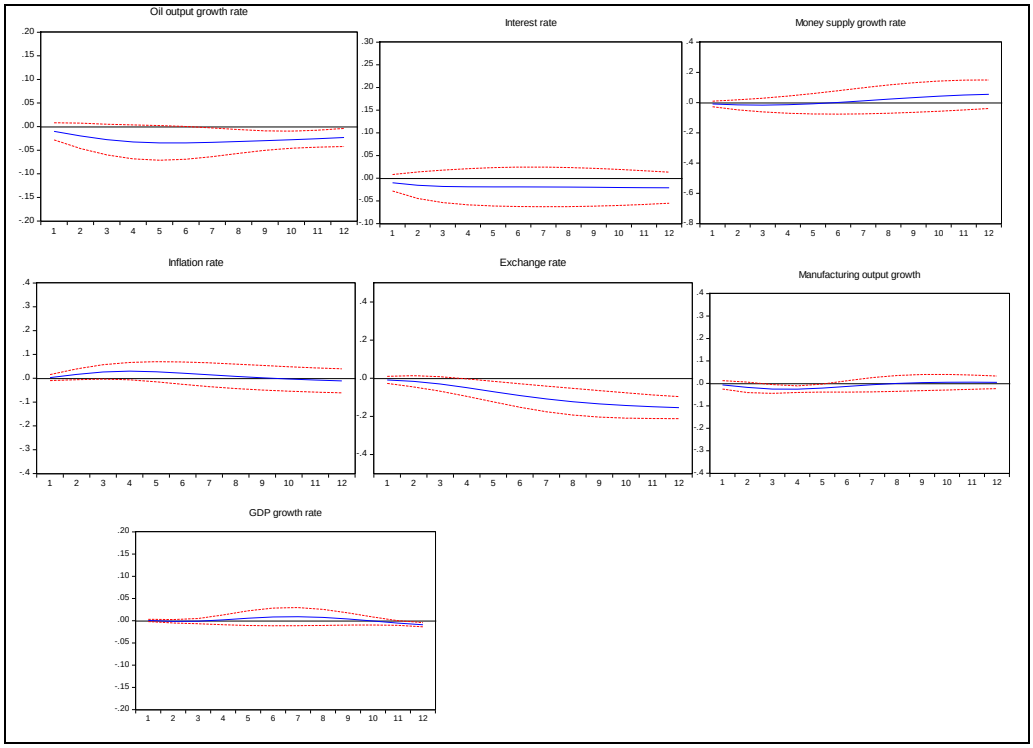


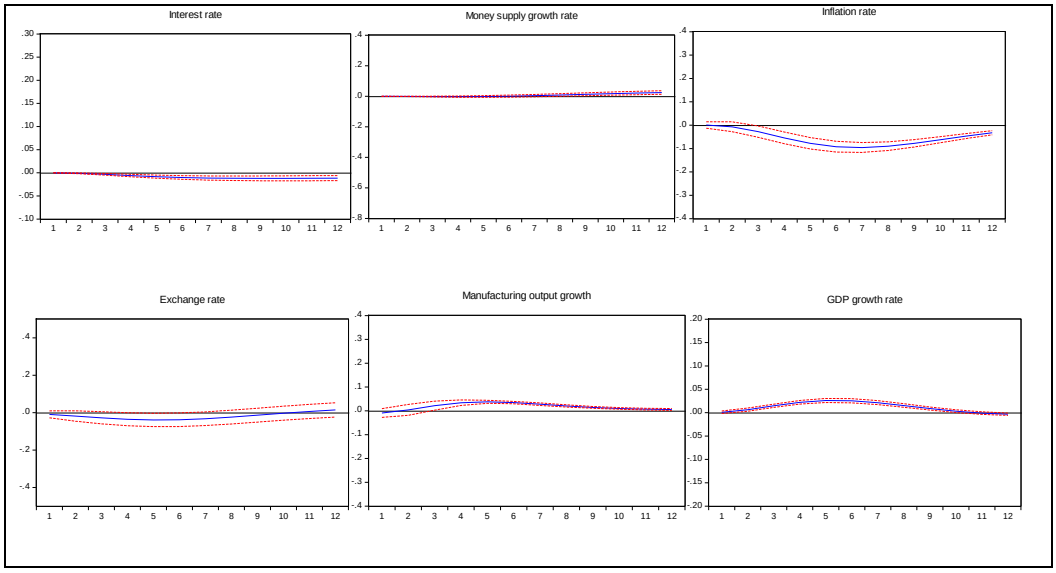
Figure 1 shows the responses from monetary policy instruments, the intermediate monetary variables as well as manufacturing output growth and

GDP growth rate to 1 percent standard deviation oil price shock. The shock caused a steady fall in oil output in the first two periods before picking up gradually. This is realistic since the growth rate of oil output is used. Mahmud (2009) attributed this to a slow movement in oil production growth rate in catching up with increase in global oil demand which probably have caused the initial rise in price of oil. Interest rate falls in response to this and consequently the money supply growth rate increases leading to a steady rise in the inflation rate. The exchange rate response to oil price shock is negative, that is the exchange rate falls steadily though it appears to be picking up gradually as the period progresses. The resultant appreciation in the value of the local currency is similar to the result of studies by Olomola (2006), Riman, et al. (2013) and Mamhud (2009) where they found that in Nigeria, oil price shock usually causes appreciation in the value of naira initially but it depreciates later. Similarly, Burment (2009) found that currency appreciate in the study of countries like Oman and UAE which are net oil exporting countries. Though, Jimenez et al, (2005), and Chen and Chen (2007) have also found that oil price shock leads to depreciation in the value of currency of the G7 countries.

The currency appreciation leads to an initial steady fall in the manufacturing output before picking up later as the currency begins to depreciate. The mechanism through which this work is that currency depreciation is capable of causing a setback for the import sector. In other words, it discourages import and promotes export. Export promotion has the tendency of influencing domestic output growth positively hence the steady growth of the manufacturing output noticed. However, the GDP growth rate react similarly since manufacturing sector output is a component of the GDP.

The responses of other variables to shock from the oil output growth rate is illustrated in figure 2. From the impulse response graph interest rate falls. This is the same response it shows to oil price shock. Also the money supply growth rate rises steadily but contrary to expectation the inflation rate falls for at least first three quarters before it picks up. The implication of this is that the kind of inflation rate generated by the oil output shock might not be a monetary phenomenon. The position of Friedman (1965) that inflation is always a monetary phenomenon has been criticized by many researchers.

Figure 2. Responses to oil output growth rate shock (Nigeria)

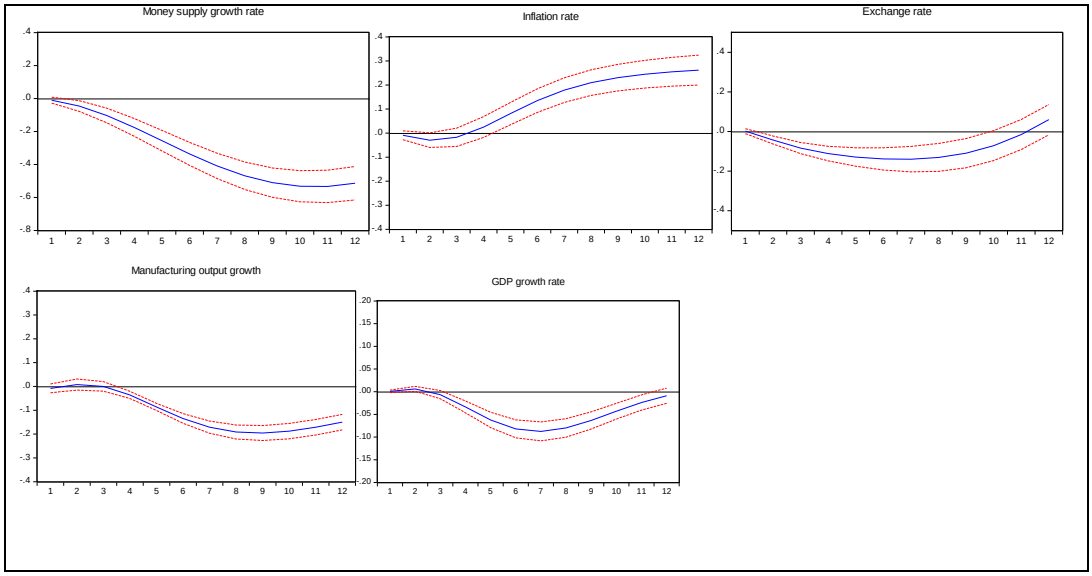


They argue that inflation might not be a monetary phenomenon all the time. For instance, an increase in price that occurs as a result of decrease in output can aggravate inflation rate. They further argued that inflation can be a monetary phenomenon everywhere only if output is stable which is not realistic.(see Nathan, 2012; Aziz, 2013). In other words, in the absence of

price rigidities whenever there is decrease in output, it can lead to increase in price which can trigger inflation apart from money supply. The reaction of exchange rate to the shock shows that the currency appreciates briefly and later begins to depreciate. Manufacturing output picks up slowly and peaks at the 6th period before it falls gradually. The GDP growth rate, just like figure 4, also follows the same pattern of response of the manufacturing growth rate.

From the above, it appears that the kind of inflation associated with oil output growth shock is more of structural than monetary phenomenon which was the case in the oil price shock. Nonetheless, the resultant effect on the manufacturing output has not been all that positive, manufacturing output rises sluggishly whenever the inflation rate is falling while it falls gradually when the inflation rate starts rising. The same trend of response has been demonstrated by the GDP growth rate (see Riman, et al. 2013; Adebiyi, 2010; Bouchaour and Al-Zeaud, 2012).

Figure 3. Responses to interest rate shock (Nigeria)



Unlike what we saw in the first two previous figures, figure 3 which explains the responses of the variables to interest rate shock depict a very sharp contemporaneous responses from all the variables including the manufacturing output growth rate. It appears as if interest rate has sharp spiral effects on the transmission mechanism of monetary policy. A percentage standard deviation shock to interest rate witnessed a very sharp negative response from money supply that is the money supply falls sharply. Similar to the oil output growth shock effect on inflation rate, the inflation rate here also rises but very sharply this time.

The exchange rate responds negatively initially but pick up sharply later. The implication of the interest rate shock on manufacturing output growth is very negative. This is confirming again that currency appreciation is a disincentive to manufacturing output growth in Nigeria. The sharp fall in the exchange rate which means that the value of naira appreciates sharply might have resulted in the sharp fall noticed in the reaction of the manufacturing output to the shock from the interest rate. The GDP, just like we have noticed in the previous figures, also follows the same pattern of response of manufacturing output growth.

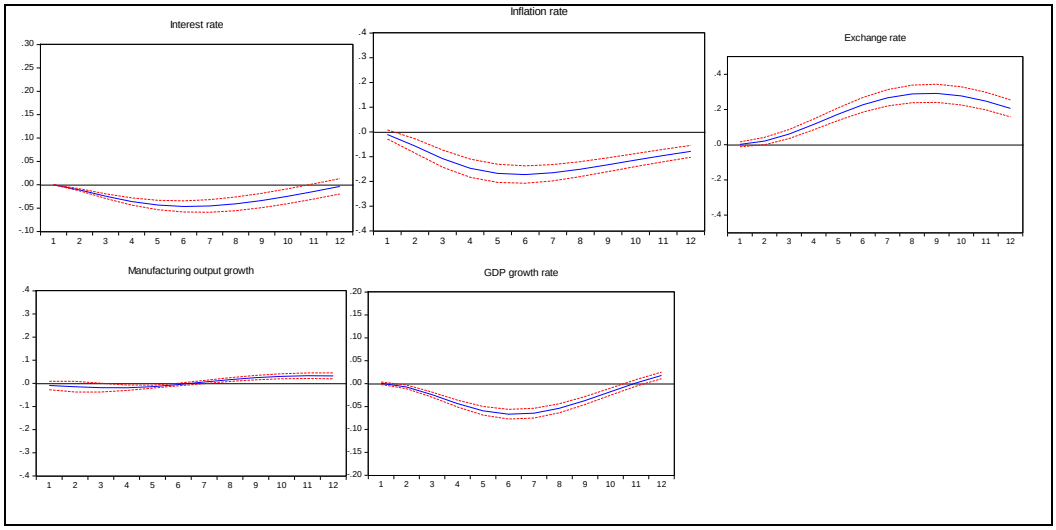
The implication of what we noticed in figure 3 is that interest rate appears to be a very important factor in the monetary policy transmission mechanism. This is shown from the contemporaneous sharp responses from all the variables. But the negative response of the manufacturing output growth to interest rate shock is more pronounced than what we noticed in the oil output growth and the oil price shocks.

The behavior of monetary policy transmission mechanism and manufacturing output growth to shocks form money supply is illustrated in fig-

ure 4. At a first glance at the figure, it is clear that reactions of other variables to money supply shock are also sharp but not as sharp as that of interest rate. Almost the reverse of what we got in interest rate shock is what we found here. The money supply growth rate shock caused the interest rate to fall and the inflation rate falls as well. But the exchange rate rises sharply (meaning that the currency depreciates). The implication of the money supply shock on the manufacturing growth rate here is positive. In other words, the depreciation in currency due to the shock in money supply leads to the gradual growth of the manufacturing output and it continue to rise steadily towards the 11th period.

It is important to note that inflation rate falls in response to the money supply growth rate shock. This might have contributed to the steady rise noticed in the manufacturing sector growth. Because if we compare this to the situation under interest rate shock where inflation rises, the resultant effect on the manufacturing sector was a fall in output. Therefore, it appears that increase in inflation rate is a disincentive to manufacturing output growth. The same situation was also noticed in the following studies (Ushie, et al. 2012; Olomola, 2006; Akpan, 2009 and Mamhud 2009)

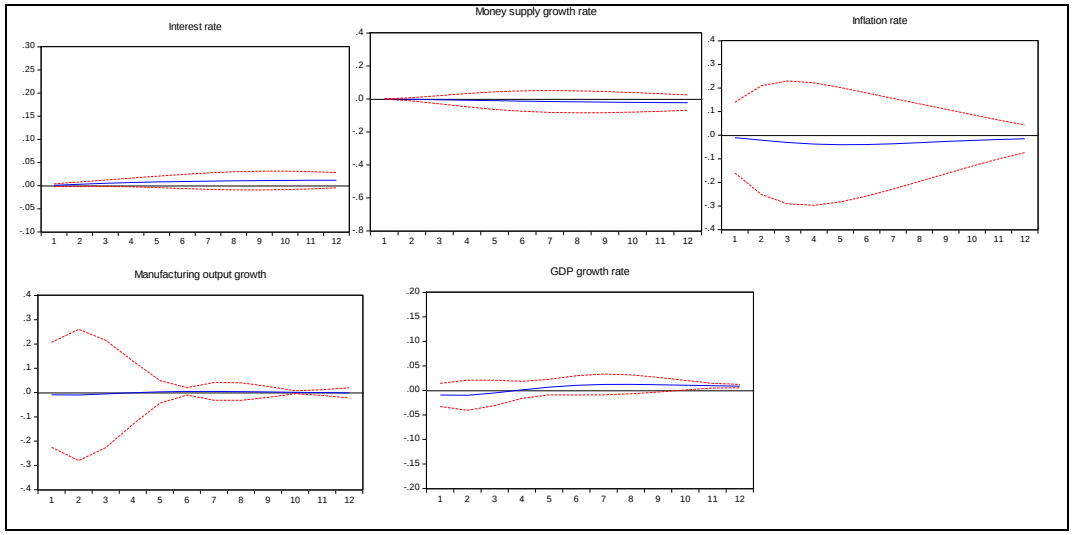
Figure 4. Responses to money supply growth rate shock (Nigeria)



However, it can be inferred from this simple interactions taking place in the monetary transmission mechanism that shock from interest rate are most likely to affect the manufacturing output in Nigeria adversely while the shock emanating from the money supply growth rate shock appears to have a positive influence on the manufacturing sector.

The responses to the exchange rate shock are presented in figure 5. Note that one percent standard deviation shock in exchange rate is synonymous to currency depreciation.

Figure 5. Responses to exchange rate shock (Nigeria)



Interest rate reacts sluggishly to the shock but still positive. But the influence on the money supply is negative. The shock caused the money supply to fall steadily; this might be as a result of the steady rise in the interest rate seen earlier. The inflation rate appears to be falling in the beginning and later rises steadily but the influence on the manufacturing output is not all that pronounced though it showed a seemingly rise response. But the fact is that exchange rate shock does have a positive effect on manufacturing output growth.

This is in line with what has been observed so far, that whenever currency depreciates the effect is positive on the manufacturing output growth. Appreciation in the exchange rate has been viewed by some researchers as having an adverse effect on the industrial sector. According to Olomola (2006) currency appreciation has the tendency of squeezing out the tradable sector and aggravates the problem of Dutch Disease in oil exporting countries.

Having discussed the impulse response analysis of the monetary policy mechanism and its implication on the manufacturing sector output of Nigeria, we also proceed to analyse the variance decomposition of the shocks. This explains the percentage or unit response of each variable in our model to the different structural shocks. In other words we try to explain the contribution of various structural shocks on oil output growth rate, interest rate, money supply growth rate, inflation rate, exchange rate, manufacturing output growth as well as the GDP growth rate. Table 4.6 contains the result of the structural VAR variance decomposition for Nigeria.

Table 1. Variance Decomposition of interest rate (Nigeria)

Period	S.E.	Poil	Oilgr	Msgr	Inf	Exr	Mgr	Gdpgr
3	0.275138	0.883139	0.016926	0.940918	0.002666	0.048572	0.008403	0.520500
6	0.486031	0.739789	0.094220	2.552845	0.002222	0.096670	0.035502	0.204789
9	0.635585	0.716581	0.157071	2.695411	0.006166	0.136436	0.063236	0.314950
12	0.727559	0.789727	0.198371	2.211753	0.010194	0.179590	0.074539	0.463017

Table 1 shows the contribution of each shock to the interest rate. The table shows that price of oil contribute the highest shock of 88percent to interest rate except money supply growth rate which is another monetary instrument that contribute about 94percent. The oil output growth shock does not contribute any significant shock to the interest rate. This is an indication that oil price shock appears to have direct effect on interest rate without passing through the oil output growth rate. Inflation appears to have contributed the lowest percentage. The implication of this is that interest rate is very responsive to oil price shock in Nigeria.

Table 2. Variance Decomposition of money supply growth rate (Nigeria)

Period	S.E.	Poil	Oilgr	Intr	Inf	Exr	Mgr	Gdpgr
3	0.326395	0.535260	0.004388	12.03762	0.019953	0.025656	0.099906	0.003552
6	0.724923	0.156251	0.002532	42.22200	0.059279	0.068004	0.245606	0.085709
9	1.145779	0.196944	0.020434	66.15114	0.073777	0.095567	0.217681	0.297551
12	1.478813	0.453564	0.073099	77.70602	0.073042	0.121385	0.167609	0.510754

Just like what we noticed in table 1, the contribution of different shocks to money supply growth rate as shown in table 2 indicates that price of oil apart from interest rate that is a monetary policy instrument has the highest percentage contribution of shock to the money supply growth rate. This is maintained for all the four periods shown on the table. This is a pointer to the fact that monetary policy instrument appears to be highly susceptible to oil price changes in Nigeria. Again, the oil output growth rate shock seems not to have any significant influence on the behavior of money supply like oil price shock.

Table 3. Variance Decomposition of exchange rate (Nigeria)

Period	S.E.	Poil	Oilgr	Intr	Msgr	Inf	Mgr	Gdpgr
3	0.287065	1.514537	1.419183	10.72038	4.980498	0.773494	1.143999	1.164867
6	0.606537	4.579294	1.466473	15.50820	26.98432	1.030755	0.706468	2.384897
9	0.911644	7.449211	0.865589	12.71493	40.76961	1.800569	0.353753	1.326738
12	1.109657	10.44611	0.605665	9.304812	42.23153	3.180375	0.239103	1.337897

The oil price has again come to play an important role in the shocks received by the exchange rate. Because oil is priced in foreign currency, it contributes high percentage to the shock received by the exchange rate. In the same vein interest rate, money supply growth rate also contribute in large magnitude to the shock received by exchange rate. Expectedly, GDP growth rate is also an important shock that affects exchange rate in Nigeria.

Table 4. Variance Decomposition of manufacturing output growth (Nigeria)

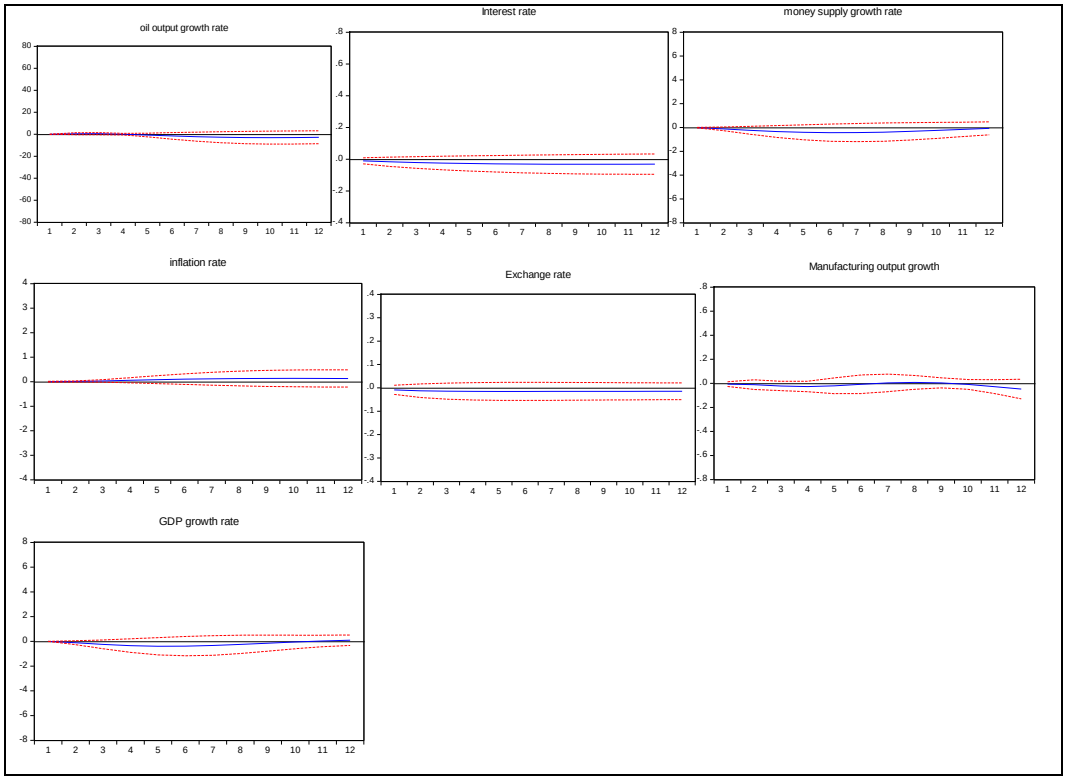
Period	S.E.	Poil	Oilgr	Intr	Msgr	Inf	Exr	Gdpgr
3	0.198445	2.526945	1.446064	0.326550	1.633574	0.995286	0.547589	0.114939
6	0.286878	2.763763	5.279617	32.85794	1.498172	0.603085	0.301960	7.726886
9	0.440767	1.195773	2.960102	67.55929	1.105370	0.268691	0.152748	5.709552
12	0.534697	0.839729	2.074700	76.34862	1.824919	0.185623	0.105112	4.280030

Table 4 shows the response of manufacturing output to the various structural shocks. Four major variables appear to have a very high influence on the manufacturing output growth, these are: price of oil, oil output growth rate, interest rate, money supply growth rate and GDP growth rate. The trend of effect of the shocks on manufacturing output growth rate shows that price of oil have the highest contribution initially in the first period but the contribution reduces as the period proceeds. While the shock of the monetary policy instrument grows as the period proceeds, the implication is that the shock of price of oil is gradually transmitted through the monetary policy instrument to the manufacturing output growth rate. In other words, the fall in the contribution of oil price shock and increase in contributions of both interest rate and money supply shocks as the period progresses is a clear indication that shock from price of oil goes through the monetary policy transmission mechanism to the manufacturing output growth (see Mordi and Adebiyi, 2010)

Libyan Economy

Like other big net oil exporters, Libya impulse response analysis shows a very much influence of oil price on the system. Our analysis of the impulse response on the Libyan economy also starts from the oil price shocks which is the exogenous variable in the model. Figure 6, shows the response of all the variables to shock from the price of oil.

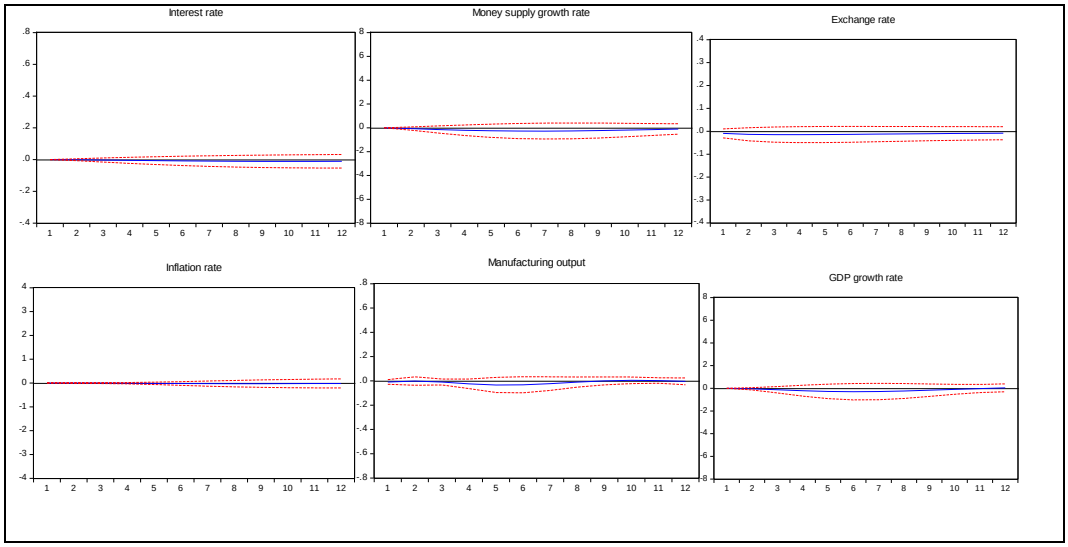
Figure 6. Responses to oil price shock (Libya)



The impulse response analysis on figure 6 shows similar patterns of responses noticed in most of the previous countries analyzed. The oil price shock as usual has a negative effect on the oil output growth rate. The interest rate falls after a brief initial rise; the money supply growth rate also follow in a converse direction that is it rises initially and later falls. However, the initial fall in the money supply does not seem to affect the inflation rate as it rises steadily showing that inflation here might not be money supply motivated. The exchange rate, which is fixed during the periods under study, did not show any significant dimension of movement but maintained almost a straight line movement with the origin. The manufacturing growth

rate falls steadily. This again confirms another scenario of inverse relationship between inflation rate and the manufacturing output growth rate. The GDP growth rate also falls steadily and pick up gradually. Generally the oil price shock effect through the monetary policy mechanism on the manufacturing output growth seems not to be positive in the Libya economy as well.

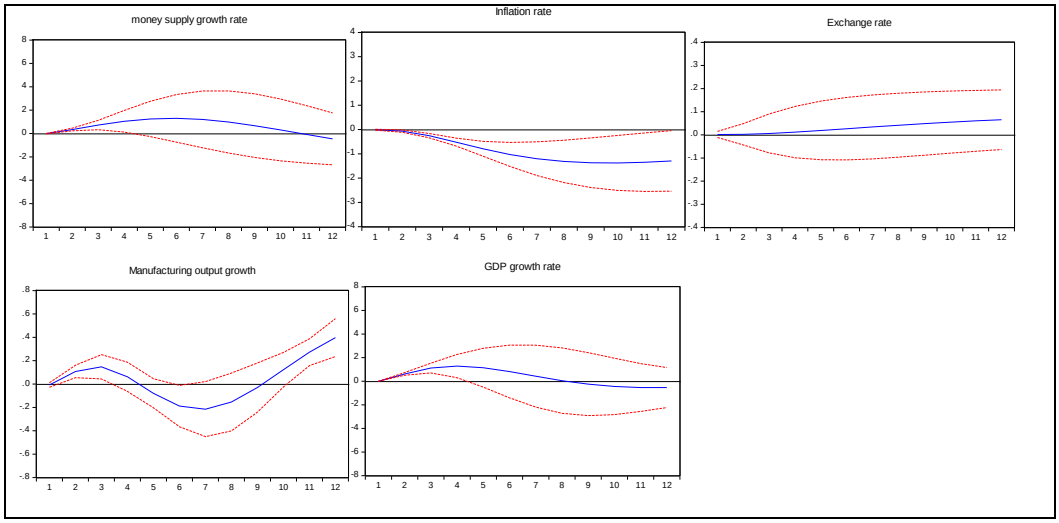
Figure 7. Responses to oil output growth rate (Libya)



The responses to the oil output growth shock is shown in figure 7. The interest rate shows a less conspicuous falling trend while the money supply also moves in the opposite direction. However, the inflation rate seems to be neutral but still on the origin. The exchange rate too, did not demonstrate a conspicuous movement but closer to the origin from below. The manufacturing growth rate shows a more conspicuous downward movement and pick up gradually at period 6. The pattern of movement of the manufacturing output growth is also replicated by the GDP growth rate.

Again the oil output growth shock seems not to have any significant positive impact on the growth of the manufacturing sector.

Figure 8. Responses to interest rate shock (Libya)



As we have been noticing in other countries previously analysed, interest rate has been receiving a kind of sharp contemporaneous responses from all the variables in the model. The same thing is shown here in figure 8. The responses from all the variables are very sharp thus confirming the grip of interest rate on the system. The shock causes an initial rise of money supply and later at period 5 it starts falling. The shock causes inflation rate to fall sharply but the real exchange rate rises sharply in response since Libya practice fixed exchange rate. However, the manufacturing output growth showed a very brief initial rise in response to the depreciation in the real value of the Libya Dinar before nose-diving sharply. This might not be unconnected with the fact that the monetary authority intervenes to maintain the fixed exchange rate causing the currency to appreciate again and conse-

quently leads to fall in manufacturing output. Again, this also confirms that currency appreciation will have a negative effect on the growth of the manufacturing sector in Libya. The GDP growth rate has a more sustained upward movement than manufacturing growth rate before falling steadily.

Figure 9. Responses to money supply growth rate shock (Libya)

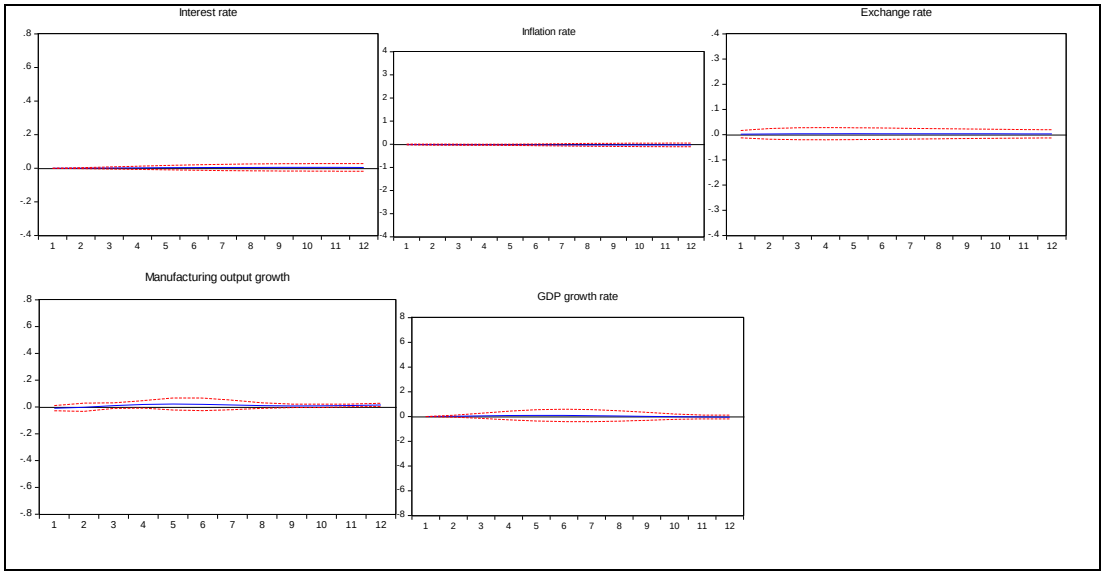
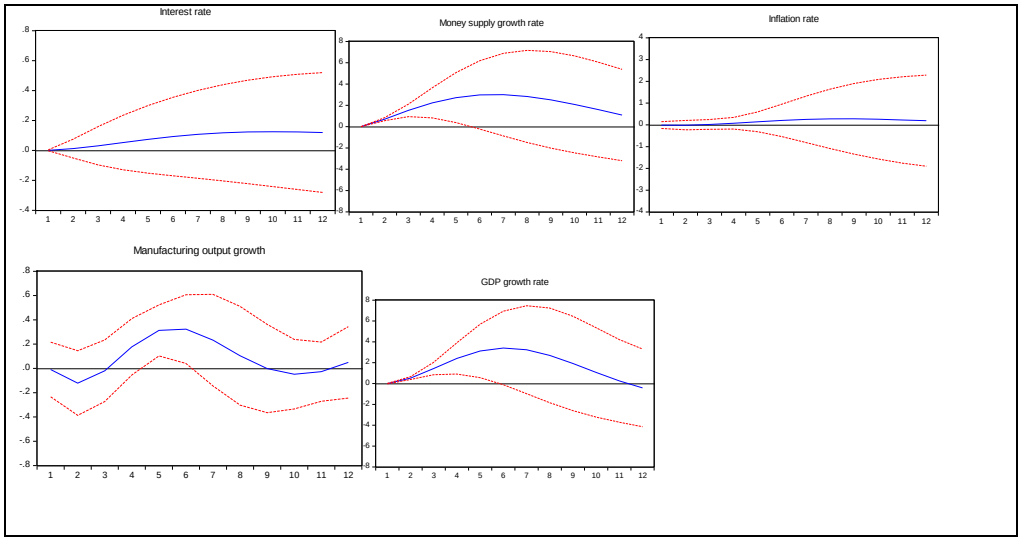


Figure 9 shows the responses of all the variables to money supply growth rate shock. As noticed in the analysis under some countries earlier, it appears that the influence of money supply growth rate on the variables generally in the model is not all that significant. The responses show no conspicuous direction. Virtually all the impulse response graphs are almost tangential to the origin. The implication of this is that they failed to demonstrate any notable pattern of movement towards the shock from the money supply growth rate

Notwithstanding, manufacturing growth rate is seen to give a little gap above the origin which shows a very marginal rise in the manufacturing output growth in response to the shock from the money supply growth rate. However, the response from the GDP growth rate is not also conspicuous. The situation obtained under quite a number of impulse response analyses previously seems to be repeating itself here. This bothers on relative influence of money supply and interest rate on the variables in the system. On comparative ground evidence from the situation seen on figure 9 is another confirmation that interest rate is most likely to influence the variables in the system more that the money supply.

But, it should be noted that most of the sharp responses have been influencing the manufacturing growth rate negatively. But the response of the manufacturing growth rate to money supply has been positive for most of the impulse response analysis graphs on other countries especially for Nigeria and Algeria. Though, often the positive response is very sluggish. But the fact can not be ruled out that the shock form the money supply appears to be having initial positive influence on the manufacturing output growth but it falls steadily later.

Figure 10. Responses to exchange rate shock (Libya)



The sharp responses seen on figure 10 from all the variables to shock form the exchange rate is as a result of the unrealistic pegging of the exchange rate in Libya. According to Ali and Harvie (2013), the unrealistic pegging of the exchange rate in Libya has led to changes in the exchange rate five times within the last three decades. It was changed in 1980, 1985, 1990, 1999 and 2001. The changes became imperative as a result of lack of strength of competitiveness against other currencies on the foreign exchange market. The effect has been adverse on the economic activity creating incessant disturbance and causing economic instability anytime the exchange rate is adjusted (ADB, 2012). This scenario is reflected in the patterns of behavior of all the variables to shock from the exchange rate. It caused upward movement in all the variables aggravating inflation rate as a result. However, the manufacturing output witnessed an initial rise which is as a result of the depreciation in the real value of the Libya dinar. The depreciation will be curtailed by the action of the monetary authority in order to maintain the

fixed exchange rate hence the manufacturing output falls later. That is the manufacturing output falls later as soon as the exchange rate is pegged again after adjustment. The same pattern of relationship is shown by the GDP growth rate.

Next is the variance decomposition of the variables. This enables us to study the contribution of each shock to the each of the endogenous variable behaviours.

Analysis of variance decomposition result (Libya)

Table 5. Variance Decomposition of interest rate (Libya)

Period	S.E.	Poil	Oilgr	Msgr	inf	Exr	mgr	Gdpgr
3	0.257189	1.183792	0.013720	0.004331	0.003808	1.692284	0.016598	0.930062
6	0.449518	1.424414	0.071582	0.019396	0.053204	8.909521	0.091547	0.833732
9	0.607143	1.555554	0.127297	0.030932	0.113047	15.91612	0.167415	0.760660
12	0.731143	1.618177	0.154952	0.036435	0.141775	19.42529	0.206948	0.729027

TABLE 5 shows the contributions of each shock in the model to the level of interest rate in Libya. As noticed in previous discussions oil price again plays an important role as a major shock affecting the interest rate in Libya. The analysis shows that the response of interest rate to oil price shock is very high compared to other shocks in the system apart from exchange rate. However, the contribution of exchange rate to interest rate here is a clear departure from what we have witnessed in most of the analysis done previously. Exchange rate here appears to be a very key factor influencing the rate of interest in Libya. The implication might not be unconnected with what we have discussed earlier that Libya is noted for practicing in unrealistic pegging of their exchange rate. The effect on other variables is very unstable. That is, it causes interest rate in particular to be relatively un-

stable because the unrealistic pegging will be made up for by adjusting interest rate and some other relevant variables (ADB, 2010). In addition, the oil output growth rate shocks seem not to have any significant influence on the behavior of interest rate. Again, this refutes the claim that oil price shocks pass through oil output to affect economic policy in oil exporting countries.

Just as we have seen in previous countries analyzed, the response of interest rate to the shock from oil output growth rate is very weak. This further strengthens our position that shocks from oil price are not likely to have passed through the oil output growth rate to influence the MTM.

Table 6. Variance Decomposition of money supply (Libya)

Period	S.E.	Poil	Oilgr	Intr	inf	exr	mgr	Gdpgr
3	1.922375	1.845489	0.630708	17.51214	0.550180	76.39681	0.596379	0.167620
6	5.515423	1.764798	0.653582	16.38847	0.353093	79.19227	0.619149	0.161388
9	7.595708	1.699479	0.679802	13.63002	0.290562	82.23978	0.635800	0.142424
12	8.146602	1.615468	0.694206	12.31713	0.270165	83.68099	0.629818	0.128100

Libyan economy is offering another dimension to the role of exchange rate in the model. Exchange rate that has a very weak role in most of the previous analysis appears to be the shock that mostly influence the system in Libya. Table 6 indicates that exchange rate contribute the highest shock to money supply growth rate followed by interest rate shock and oil price shock in that order.

The reason again might not be unconnected with whatwe have explained previously. The unrealistic fixed exchange rate practiced in Libya constitutes a crucial disturbance to the overall economy as a whole. The monetary authority in Libya is always falling back on the monetary policy

instruments to support the unrealistic rate of exchange fixed. This has caused a lot of perturbations to the entire monetary policy transmission mechanism. The same situation was noticed in Gabon where fixed exchange rate is in practice too. Just as noticed under the variance decomposition on interest rate the contribution of oil output shock to the behavior of money supply is also very low.

Table 7. Variance Decomposition of inflation rate (Libya)

Period	S.E.	Poil	Oilgr	Intr	msgr	exr	Mgr	Gdpgr
3	0.335082	0.966507	0.005636	61.11702	0.635934	0.600223	0.004208	0.473710
6	1.478982	1.019812	0.031536	92.60114	0.106298	3.110816	0.008727	0.823834
9	2.746869	0.948129	0.037144	93.63641	0.059180	3.787703	0.014345	0.835335
12	3.631599	0.953705	0.031941	94.35862	0.053028	3.343034	0.016623	0.838230

Table 7 shows the contributions of each shock to the inflation rate. In other words it is explaining which of the shocks mostly affect inflation rate. The result shows that interest rate contributes the highest shock to inflation rate this is similar to what was obtained in the previous analysis. Again this underscores the importance of interest rate in the model. The dominance of exchange rate shock among the shock continues. It is the next shock after interest rate shock that influences inflation rate mostly. It is also a clear departure from what have been seen in previous analysis. Oil price also have high influence on inflation rate after exchange rate. It appears that the effect of oil price on inflation is absorbed by exchange rate and interest rate therefore reducing the effect of oil price shock and increasing the effect of the two shocks.

It also appears that exchange rate becomes a powerful disturbance during fixed exchange rate culminating in the incessant unstable behaviours

of the monetary policy instruments. The same thing happens in the case of Gabon where fixed exchange rate is practiced.

Table 8. Variance Decomposition of exchange rate (Libya)

Period	S.E.	Poil	Oilgr	Intr	msgr	inf	Mgr	Gdpgr
3	0.245738	0.714311	0.783647	0.074215	0.040341	0.770807	0.962738	0.000778
6	0.371948	0.809505	0.776112	0.903281	0.047550	0.755791	0.957266	0.010512
9	0.440838	0.924902	0.755445	3.341308	0.053184	0.724440	0.933972	0.037621
12	0.486719	1.035564	0.722139	7.384436	0.057406	0.680984	0.893002	0.079544

A kind of symbioses relationship is noticed between the monetary policy instrument that is interest rate and exchange rate. When we studied the contributions of shocks to interest rate in table 8 it was exchange rate that has the highest contribution. Now, the highest contribution of shock is made by the interest rate to exchange rate behaviours. This shows that interest rate and exchange rate affects each other greatly in Libya. Oil price also shows a relatively high contribution though not initially but has the period progresses the contribution of oil price shock to the exchange rate increases. Though, the result is also similar to what we have seen in other countries analysed in the previous sections. However, it appears that the relationship between interest rate and exchange rate are stronger under fixed exchange rate regime than in the flexible exchange rate regime.

Table 9. Variance Decomposition of manufacturing output growth (Libya)

Period	S.E.	Poil	Oilgr	Intr	msgr	inf	Exr	Gdpgr
3	0.302072	0.712950	0.190408	36.53174	0.208016	0.978220	16.60568	2.362961
6	0.620594	0.477003	0.772451	20.51692	0.372742	0.874647	64.67463	1.370644
9	0.723561	0.368704	0.688843	28.59296	0.350095	0.930008	59.95133	1.055906
12	0.884695	0.641346	0.466397	50.74537	0.289891	0.628813	40.80708	1.018731

It could be seen from the beginning of the variance decomposition analysis under Libya economy that the dominance of oil price shock is relatively lower than that of exchange rate. Again, the exchange rate appears very strong here as it constitutes the largest disturbance to the manufacturing output growth Therefore; the behavior of manufacturing output growth in Libya is mostly determined by the exchange rate shock and not the MPIs shocks as we noticed under other countries especially Nigeria and Algeria. The shock from oil price appears to be weakened by the fixed exchange rate in operation in Libya. This makes exchange rate the highest contributor to the shocks affecting the manufacturing sector. Hence, it appears that the shocks that are supposed to come to the manufacturing sector directly pass through the exchange rate.

Comparative analysis of findings from both Nigeria and Libya

Findings from both the impulse response analysis and the variance decomposition analysis have shown diverse ways through which monetary policy mechanism influences the performance of the manufacturing sector in the two countries. Firstly, it has shown from the study that the effect of oil price shock makes the currency of both countries to appreciate in value causing a gradual fall in the manufacturing output growth. Though Libya practices a fixed exchange rate system but the real exchange rate falls gradually in response to the oil price shock. The same thing happens in Nigeria that practices floating exchange rate. The oil price causes interest rate to fall in both countries leading to rise in inflation. Money supply rises in Nigeria while it falls in Libya showing that inflation in Libya might not be a monetary phe-

nomenon. On the whole, it appears that currency appreciation weakens the manufacturing growth rate of the two countries (see Olomola, 2006).

In terms of variance decomposition, oil price shock contributes the highest shock to the behavior of the MPIs in both countries. But in Libya exchange rate share this role with oil price. That is the behaviors of the MPIs are strongly affected by exchange rate shock apart from oil price shock. Again, it can be deduced from the findings as well that oil output growth rate shock do not influence monetary policy instruments (MPIs) as oil price in both countries. This refutes the position of Berument etal (2009) that shock from oil price pass through the oil output to affect economic policies. It is quite revealing in the case of Nigeria and Libya that the effect of oil price shock is felt directly on the whole monetary policy transmission mechanism without necessarily passing through their oil output growth rates.

Considering the shocks from the MPIs, all variables in both countries react sharply to the shock from interest rate. Manufacturing output falls in response to interest rate in both countries though it picked up later gradually. This effect is more pronounced in Nigeria than in Libya. Again, similarly the shock from money supply growth rate caused the manufacturing output to rise in Nigeria. The reverse is the case in Libya, the reaction of manufacturing output to money supply shock is not very conspicuous and not sharp. This means that expansionary monetary policy might not be effective in Libya. The variance decomposition result indicates that the behavior of manufacturing output is influenced greatly by the MPIs in Nigeria. But this is not the case in Libya where exchange rate appears to have higher

contribution of shock to the behavior of manufacturing output than the MPIs.

It has also shown that inflation in Libya might be more of structural phenomenon than monetary phenomenon. The effect of rise in money supply growth rate as a result of fall in interest rate fails to reflect on the nature of the inflation. Therefore, general price level and instability in output might have led to the nature of the inflation rate in Libya. But in Nigeria it is both a monetary phenomenon and structural phenomenon. However, it is clear that any shock on inflation rate has been producing a counter behavior from manufacturing output growth in response to the same shock. The variance decomposition analysis shows that inflation might not be a big problem to the manufacturing output in Libya as it contributes very little to the behavior of both the MPIs and outputs. But this is not the case in Nigeria where the response of manufacturing output to the shock from inflation rate is among the highest, it is even higher than interest rate in the first quarter though the contribution falls as the period progresses. IMF (2010) stressed that priority given to control of inflation in Libya by the monetary authority has led to the low inflation rate usually observed despite increase in government expenditure.

The behavior of the variables to the shock from exchange rate is the most distinguish feature that characterized the findings from both countries. In Nigeria response to exchange rate shock appears not to be very sharp and distinctive. But in Libya exchange rate shock receives sharp responses from all the variables. The depreciation in the real value of the currency caused the manufacturing output to rise sharply initially but because of the fixed nominal exchange rate in practice the depreciation is adjusted through ex-

ternal reserve and thereby causing the manufacturing output to fall. Though, the exchange rate shock (currency depreciation) caused the manufacturing output to rise gradually in Nigeria but not as conspicuous as that of Libya. The variance decomposition result also shows that exchange rate shock contributes the highest shock to manufacturing output behavior in Libya but not in Nigeria.

Conclusions

We can conclude that oil price shocks constitute a significant disturbance to both MTM and their manufacturing outputs. It was also noted that the shock caused the exchange rate of the two countries to fall. That is the real value of Libya Dinar appreciates since it is fixed while the value of Nigeria Naira also appreciates in response to the oil price shock. In both countries the effects on the manufacturing output is negative.

Again, it is confirmed that currency depreciation leads to a kind of steady increase in the manufacturing output growth in both countries, while currency appreciation weakens the manufacturing sector. It should be noted that all the shocks that produce fall in exchange rate (currency appreciation) also leads to a steady fall in manufacturing growth rate and vice versa. This is in line with the findings of Mordi and Adebiyi (2009), Mahmud (2010), Ushie, et al. (2012). Currency appreciation has been shown to be having a negative influence on domestic output. According to Olomola (2006), any shock that produces a rise in exchange rate will have the tendency of squeezing out the tradable sector and consequently has an adverse effect on the growth of the manufacturing sector.

It appears that MPIs are more effective in influencing manufacturing output in Nigeria than in Libya. Exchange rate appears to have stronger effect on output in Libya. This shows that MPIs are likely to be more efficient in promoting output in flexible exchange rate country (Nigeria) than a fixed exchange rate country (Libya). This revelation has contributed to the growing literature in support of the Mundel-Flemings model. This findings is also similar to that of Ali and Harvie, (2013) where they concluded from their study that flexible exchange rate will likely benefit the private sector in the Libya economy more than the fixed nominal exchange rate policy. According to them, a flexible nominal exchange will lead to an increase in domestic production in the real sector of the economy through accumulation of human and physical capital stocks via importation.

Finally, inflation appears to have a stronger influence on the output of a flexible exchange rate country (Nigeria) than a fixed exchange rate country (Libya). The nature of inflation in oil producing fixed exchange rate country is more of structural phenomenon than monetary phenomenon. That is, structural imbalances between prices and output are often the causes of inflation as against money supply.

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