UNIVERSITY OF KWAZULU-NATAL

MONETARY POLICY AND MANUFACTURING SECTOR GROWTH IN AFRICA'S OIL EXPORTING COUNTRIES.

By

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DECLARATION

I, **OMOLADE ADELEKE,** declare that

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DEDICATION

This research work is dedicated to the Glory of Almighty God and my lovely wife, Toyin, and children, Bright and Peace.

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ABSTRACT

Various studies in the past have attributed the slow level of economic development in many African countries to the underdeveloped real sector of these economies, especially the manufacturing sector. The situation appears to be worse for resource rich countries, such as the oil producing countries in Africa due to the problem of Dutch Disease. Consequently, the World Bank and the International Monetary Fund (IMF) in separate appraisals of the African economy have called on African oil exporting countries to embrace diversification in their economies by developing their manufacturing sectors. The role of monetary policy in promoting the growth of the manufacturing sectors of Africa's Oil Exporting Countries (AOECs), has therefore been questioned by a number of authors.

The purpose of this study, which is to assess monetary policy and the growth of manufacturing sectors in the AOECs, is organised under three major objectives. Firstly, the study examines the relationship between oil and the manufacturing output growth of the AOECs using a panel data analysis. Secondly, the study also assesses the relationship between the manufacturing output growth and the monetary policy using a panel cointegration analysis. Thirdly, the study conducts an individual analysis of each member of the AOECs, using the net oil exporters only and examines the monetary policy transmission mechanism, oil price shock and output relationship in each country using the a structural vector autoregression (SVAR).

After empirical analysis, the study contributes to the existing literature in the following ways: Firstly, a negative or inverse relationship is obtained between oil and manufacturing output growth of the AOECs which might be an indication of the existence of Dutch Disease in these countries' economies. Secondly, through the panel cointegration analysis the study will discover that there exists a very weak long-run relationship between monetary policy variables and manufacturing output, but the

relationship appears to be stronger in the short-run. Thirdly, building on the panel results where the countries exhibit individual cross-sectional differences, the SVAR shows that the effectiveness of monetary policy in promoting the growth of the manufacturing sector in the AOECs is ultimately affected by oil price shock, with the severity depending on the following: the exchange rate system; monetary policy objectives; broadness of export base and level of investment in the manufacturing sector.

ABBREVIATIONS	MEANINGS
AOECs	Africa Oil Exporting Countries
ADB	Africa Development Bank
BEAC	Bank of Central African States
CEMAC	Communaite Economique et Monetaire de'lAfrique Centrale
CBE	Central Bank of Egypt
CBL	Central Bank of Libya
CBN	Central Bank of Nigeria
GDP	Gross Domestic Product
GMM	Generalised Method of Moment
IMF	International Monetary Fund
LD	Libya Dinar
LSDV	Least Square Dummy Variable
MPIs	Monetary Policy Instruments
MTM	Monetary Policy Transmission Mechanism
OECD	Organisation for Economic Co-operation and Development
OPEC	Organisation of Petroleum Exporting Countries
SVAR	Structural Vector Auto-Regression
SYS-GMM	Systemic Generalised Method of Moment

UAC	United Africa Company
USD	United States of America Dollar
VAR	Vector Auto-Regression

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CHAPTER ONE

INTRODUCTION

1.1 Context of the Study

Various studies have shown that many countries, that are rich in natural resources show poorer economic performance when compared to those economies with fewer natural resources (see Olomola, 2007; Bulmer-Thomas, 1994; Auty, 2001; Sachs and Warner, 1997). For instance, in the past decade, members of the Organisation of Petroleum Exporting Countries (OPEC) have been experiencing a stunted gross domestic product (GDP) (Gylfason, 2001) and in some African oil-exporting countries (AOECs) the story is the same. Nigeria, which is the largest producer of oil in Africa, fell short of the United Nations projected GDP-per-capita by US$495 in 2005 (see Olomola, 2007), while, in 2009, Sudan′s and Egypt′s GDP per capita of US$1,388 and US$2,450, respectively, were far below the GDP per capita of countries like Morocco, US$2,847, and Tunisia, US$3,794, that are not oil-exporting countries(see International Monetary Fund(IMF) (2010).

Both the World Bank and International Monetary Fund, have emphasized the need for the oil exporting countries in Africa to embrace diversification as a panacea for their economic problems, (see World Bank, 2004; IMF, 2008) and the manufacturing sector has been tipped as a major sector that can help in the diversification process (Kayode,2000). This sector has been described as a major catalyst that can boost local output of the real sector of the AOECs. For instance, among 65 countries that can be classified as natural resources rich, between 1970 and 1998, only Botswana had long term investments exceeding 25% of its GDPand also recorded GNP per-capita growth exceeding 4% in a year(see Olomola, 2007; Gylfason, 2001). The major reason for the success of this economy was its ability to effectively diversify through accelerated

growth in domestic output, which was made possible through a vibrant manufacturing sector (Olomola, 2007).

However, the manufacturing sector in the AOECs has generated a lot of concerns. In Nigeria, for instance, the contribution of the manufacturing sector to GDP has been dwindling over the years from 2.6% in 1994 to 1.4% in 1996, 1.02% in 1998 and 0.5 % in 2000.In Algeria the manufacturing sector′s contribution to GDP fell from 6.6% in 2003 to 5.2% in 2005 and 4.9% in 2006In Libya, it fell from 4.2% in 2003 to 3.5% in 2006, while in Angola it fell from 3.4% in 2003 to 2.2% in 2006 (League of Arab States Reports, 2004;Majid, 2006). Based on the foregoing, it appears that the manufacturing sector of the AOECs has not been performing very well over the years.

In the literature, the relevance and role of monetary policy in solving the myriad of problems confronting the AOECs′ manufacturing sectors, has been a subject of debate (see for example Mohamed, 2011; Corden and Neary,1982; Lama and Medina, 2010). Different tools and approaches to monetary policy have been discussed in these studies. One of these approaches is the adoption of the Taylor Principle, as a major tool of monetary policy administration by various central banks around the globe. However, several studies have concluded that administration of monetary policy in many developing countries, which also include the AOECs, contributes to the woes of the manufacturing sector due to non-compliance with the Taylor Principle (see for example Woodford,2001;Jordi and Mark,2007;Clarida and Gali,2000; and Gali and Gertler,1998). Some studies indicate otherwise and stress that central banks of many developing countries, including the AOECs, follow a forward looking Philips curve, which can stimulate the growth of the manufacturing sector, by boosting output once the central banks are not tempted to push output beyond its natural level (see for example Kydland and Prescott,1977; and Barro and Gordon,1981).

According to Taylor (1993, 1999), with inflation and the output gaps at zero, the central bank is expected to keep the current and expected future real interest rates at zero. On the other hand, if the economy shows a positive output gap and inflation, the Taylor

Principle has it that the central bank raises nominal interest rates. The feedback exceeds unity, which means that nominal interest rates rise more than one-for-one with inflation. Consequently, this ensures that the central bank raises real interest rates sufficiently to contract demand (i.e. by stimulating a positive sequence of real interest rate gaps). Conversely, as the economy weakens and inflation falls, the [1]Taylor Principle suggests that the central bank makes arrangements within its policy framework to sufficiently provide demand stimulus (see Jordi and Mark, 2007). Woodford (2001) and Clarida and Gali (1998; 2000), opined that the greatest undoing of the developing economies, which include the AOECs, was in their failure, in the past years, to abide by the Taylor Principle which they described as a way of stimulating real output through the production sector, especially the manufacturing sector.

However, considering the two divergent views on the role of monetary policy in promoting the manufacturing sector of the AOECs, it appears that the interaction between monetary policy and the manufacturing sector of the AOECs, calls for empirical investigation. A number of studies on oil exporting economies like Olomola (2007), Mohamed (2011), Corden and Neary (1982), and Acosta, Lartey and Moudelina (2009), among others, have tried to examine the growth problems of oil exporting countries from different perspectives. While Olomola (2007) focused on the impact of oil rent on AOECs growth, Mohamed (2011) was more concerned with the effect and solution to the Dutch disease in AOECs. Corden and Neary (1982) studied the effect of spending and exchange rates on the manufacturing sector of oil exporting countries. Acosta (2009) appraised the impact of oil remittances on some selected oil exporting economies. None of these studies or any other that we are aware of, have assessed the impact of monetary policy on the growth of AOECs′ manufacturing sector, that have been described as a sector that can stimulate the growth of these economies through diversification.

Furthermore the IMF (Year) and World Bank (Year) have recommended that AOECs should diversify their economies. Whether or not and how, the monetary policy can stimulate manufacturing, to serve as a springboard for sustainable economic growth, requires a thorough investigation of the relationship between the oil (which is the main factor that distinguishes AOECs from other developing economies), manufacturing sectors and monetary policy. This is will help in understanding how the monetary policy framework can be used in the diversification process in AOECs (See IMF, 2004; World Bank 2010).

Mohamed (2011),Corden and Neary (1982) and Lama and Medina (2010) have questioned the role of monetary policy in promoting the growth of the manufacturing sector in AOECs. Bouakez, Rebei and Vencatalechellum (2008), however, have maintained that administration of monetary policy administration varies from country to country, with different effects on their economic growth. This study contributes to the literature by examining monetary policy administration and how it can be used to promote manufacturing growth in AOECs.

[1] *According to Taylor, interest rate is increased at the time of high inflation or employment above the full employment level, but when the reverse occurs, interest rate is decreased. (seeCorden and Neary, 1982).*

1.2Objectives of the study

The main objective of this study is to investigate the relationship between the manufacturing sector's performance and monetary policy in AOECs. Specific objectives of the study are:

(i) To examine oil revenue and growth of the manufacturing sector in AOECs;
(ii) To assess monetary policy and growth of the manufacturing sector in AOECs;
(iii) To investigate the monetary policy transmission mechanism and growth of the manufacturing sector in AOECs;
(iv) To examine the interaction between monetary policy and the manufacturing sector in AOECs.

1.3 Organisation of the study

The study starts with chapter one where the introduction discusses the context of the study and its broad objectives. Chapter two follows with an analysis of the first broad objective of the study, which deals with oil revenue and manufacturing sector growth in AOECs. Chapter three addresses the second broad objective of the study, which is an assessment of monetary policy and growth of the manufacturing sector in AOECs.

Chapter four presents an exposition of the third and fourth objectives of the study, which is investigating the monetary policy transmission mechanism and growth of the manufacturing sector in AOECs and examining the interaction between monetary policy and the manufacturing sector in AOEC. This chapter is very broad because it is an individual country-based analysis. Therefore, it covers three sub-sections. Section one discusses the literature and reviews each of the AOEC's covered in the study.

The second section of the chapter focuses on the methodology adopted to analyse the third and fourth broad objectives. The third section is a discussion of the results obtained and inferences on each AOEC.

Chapter five presents a summary and conclusion of the study. Policy implications and recommendations are also presented in this chapter.

CHAPTER TWO

Oil Revenue and Manufacturing Sector Growth in Africa's Oil Exporting Countries (AOECs)

2.1 Introduction

Over the years controversies have surrounded the relationship between oil rents and other sectors of the economy of an oil producing country. For instance in the study of Arab oil producing countries, Lay and Mahmoud (2004),Beblawi and Luciani (1987) and Karl (1997) opined that the presence of oil in Arab countries like Libya, Algeria, Egypt, Iraq, Syria and Saudi Arabia has created serious impediments to the growth of the manufacturing sector of these countries. They based their arguments on the phenomenon of Dutch Disease and resource curse. On the other hand, Stauffer (1984), Vahid and Jabber (1997), Majid (2006) and Amuzegar (2001) have argued that many oil exporting countries have utilized the forward linkage effect of the oil industry to improve the growth of their manufacturing sector.

According to Majid (2006) the contribution of oil in some Arab oil exporting countries in recent times, is evident in the tremendous growth witnessed in the petrochemical industry, which was initially based on natural gas and it's liquid. He further stated that after the first oil price boom, the development of the industrial sector, especially the petrochemical companies, was accelerated as a result of more liberal government policies, that created an enabling climate for the effective utilization of oil as a catalyst, for aiding diversification in the industries. In the Arab oil exporting countries, the contribution of the oil sector to the manufacturing sector, in terms of value added increased from US$25 billion in 1990 to US$54 billion in 2004(OPEC Fund for Industrial Development (OFID), 2006).

However, different studies have been conducted on the effect of oil on the growth of some oil producing economies. Olomola (2007), focused on the effect of oil wealth on the growth of Africa's oil exporting economies. Majid(2006), examined the contribution

of the oil sector to the economic development of Arab countries. In 2009, [2]League of Arab States and the United Nations Economic and Social Commission for Western Asia, examined how industrial development can be sustained in Arab countries.

From the findings of all these studies, it appears that there are two separate views concerning the relationship between oil and the manufacturing sector of an oil producing country. In addition, it is obvious from these studies that the nature of the relationship might vary from country to country. Unfortunately, the exact relationship that exists between oil rents and the manufacturing sector in the AOECs particularly is yet to be explored, and the controversy that was explained earlier is yet to be empirically examined.

This study, therefore, will contribute to the growing literature on oil/manufacturing nexus in oil-rich countries, by providing policy alternatives that can serve as a catalyst for boosting growth, specifically in the AOEC′s manufacturing sector.

Consequently, apart from the major objective of the study, which is to conduct an empirical assessment of the impact of oil revenue on manufacturing sector growth of major AOECs, using a panel data analysis, the study will also investigate the presence of Dutch Disease in the AOECs. Finally it will also assess the nature of the relationship between manufacturing sector growth and other macro variables such as exchange rate and capital formation, among others.

[2]*The Arab oil exporting countries are part of the Arab league of countries. The UN, World Bank and IMF usually discuss these economies within the context of the Middle East and North Africa (MENA) region. It covers Egypt, Libya and Algeria in Africa.*

2.2 Oil revenue and manufacturing output growth relationship

Over the years the relationship between oil revenue and growth has been the subject of discussion. However, the question of how the proceeds from oil, affect output growth of the industrial sector, especially the manufacturing sector, appears not to have been given sufficient attention. Nonetheless, there is consensus from the studies on the issue of 'resource curse' and the existence of Dutch Disease, a problem which many researchers believe is confronting the development of oil rich countries (see Olomola, 2007; Bulmer-Thomas,1994; Auty, 2001; Sachs and Warner, 1997).

To further justify the relevance of this research, some of the findings of the few related studies are discussed in this section. Gawad and Muramalla (2013) examined the relationship between the oil and gas sectors and foreign direct investment in some sixteen countries. Each country was examined, using the ordinary least squares estimating technique. Their results showed that the relationship between oil production and foreign direct investment was only significant in two countries, while it was not significant in the remaining fourteen oil producing countries. This supports the position of many researchers on the issue of the resource curse, in that the existence of oil, in oil rich countries, has not promoted the necessary investment for economic development.

In the same vein, Eksi, Izgi and Senturk (2011) investigated the nexus between oil price and industrial production in OECD countries. The study made use of co-integration analysis and also examined the causality between oil price and production. Their results show that there is meaningful short run causality between oil price and industrial production for almost all the countries, with the causality running from oil price to industrial production only. Again, the result indicates that a similar situation was observed in oil exporting countries such as the United Arab Emirates (UAE) and Saudi Arabia, where oil prices had a significant short run impact on industrial production. If we compare these findings to that of the previous studies, it implies that while oil production fails to have a significant effect on foreign direct investment, the oil price does have a significant effect on industrial production in the short run.

Similarly Majid (2006) examined the linkage between oil and economic development in Arab oil exporting countries. The study discovered that, the effect of oil on the development in these countries varies from one country to the other. The size of the oil sector, stage of economic development and the size of their non-oil sector are major determinants of the effect of oil on the economic development of these countries. The implication of these results is that the relationship between oil and development, in these Arab oil exporting countries is significantly affected by the size of their non-oil sector.

Teka (2011) studied the backward linkage effect of the oil sector on the manufacturing sector in Angola. The study used both descriptive and inferential analysis; also both secondary and primary data were used to study individual manufacturing firms. One of the major findings of the study is the existence of a weak backward linkage effect of oil production on the manufacturing sector. In the same vein, the study also discovered limited local content in the localized manufacturing function. This is an indication that despite the fact that Angola is one of the largest net oil exporters in Africa, the manufacturing sector in the country appears not to be benefiting much from oil production, thus making the economy much more dependent on imported goods.

As part of the empirical literature on the relationship between oil and economic development, Odularu (2008) found that Nigeria, as the largest oil producer in Africa, appears not to be translating oil wealth into economic development. This was Odularu′s conclusion from his study where he found that there was no significant relationship between crude oil production and economic development in Nigeria. Furthermore, Fiess and Verner (2003) took their own research further to cover the agricultural sector. Here they focused on the relationship between oil, agriculture and the industrial sector, within Ecuador′s economy, by applying a co integration and error correction model. Findings from the research indicated a strong and significant relationship between the agricultural sector and the industrial sector, especially in the short run. However, a weak relationship was obtained, between the oil sector and the industrial sector, as well as the agricultural sector.

A common factor in all these studies is that they generally all tend to assess the relationship between oil and output growth.. However, just a few delve into manufacturing output.

Rosser (2006), is of the opinion that, the problem of naturally endowed countries might not be the resource curse but rather political and administrative issues within the countries. Botswana, Chile, Malaysia and Indonesia, are given by Rosser (2006), as examples of countries that have utilized their various natural resources, for the positive development of their economies. According to Rosser (2006) these countries have better manufacturing sectors, compared to other resource endowed countries and the relationship between the growth of their natural resources and their manufacturing output has been positive. It is therefore imperative to ascertain if the same relationship exists between the oil sector and the manufacturing sector of the AOECs.

2.3Theoretical Framework on oil and Manufacturing output growth

2.3.1 Introduction

Generally, economic theories have viewed the relationship between oil and manufacturing output in two distinct ways. Firstly, some theories have looked at oil as a source of wealth, that is, revenue and its growth implications. Prominent among these theories is the resource curse hypothesis and the Dutch Disease phenomenon. Secondly, other theories consider oil as a form of energy that is necessary for the production process. The idea under this category is centred around theoretical foundations on energy and growth relationship. Important theories in these lines are the mainstream theory of growth, growth models with natural resources and growth models without natural resources.

2.3.2 Oil revenue growth and manufacturing output growth

This aspect of theories on oil and manufacturing sector growth centres on the resource curse and Dutch Disease hypotheses. Dutch Disease is a product of resource curse. A situation where countries with abundant natural resources are more economically

backward than those countries with little or no natural resources is referred to as resource curse. The product of this situation is Dutch Disease and the phenomenon is discussed as follows;

2.3.2.1 An overview of "Dutch Disease" phenomenon

A phenomenon that describes a situation, where a booming sector (natural resources) leads to the rise in the relative prices of non tradable commodities, to that of tradable commodities, and consequently, leading to a total reallocation of factors of production, in favour of the natural resources sector and thereby hampering the growth of non-resource tradable commodities sector is referred to as Dutch Disease (See Corden and Neary, 1982).

One of the prominent models that described Dutch Disease was developed by Corden and Neary (1982). A small economy that produces three commodities was used in the model. Two of the commodities have their prices fixed by the world markets, therefore, these two are subject to international competition and comprise of booming tradable sector (B) and non-booming tradable sector i.e lagging sector (L). The third sector in the model economy is the non-tradable sector (N) where domestic forces of supply and demand determine its prices. Therefore, it is not prone to international competition.

Typically, the booming tradable sector referrers to the oil sector, while the non-booming tradable sector refers to the manufacturing sector and the non-tradable sector is the service sector. However, the assumptions underlying the Dutch Disease hypotheses are as follows; firstly, the definition of the real exchange rate is the ratio of the price of non-booming tradable commodities to that of non-tradable sector. Secondly, the three sectors use common factors of production, which comprise of a non-mobile factor that is capital and a mobile factor that is labour, which can move around among the sectors to optimize its wages. Thirdly, the goods produced have positive income elasticity, in that, they are normal goods. These arrangements lead to a boom which arises in any of the following three ways; (1) A favourable shift in production function occurs, due to a once for all development in the technology in the booming sector (2) a kind of windfall

in the natural resources e.g oil windfall (3), the booming sector produces primarily for export hence its price changes are exogenous.

With this economic set-up Corden and Neary (1982) pointed out that the economy can be affected in two ways, the resources movement effect and the spending effect. Salter diagram in figure 1 describes the effect of the boom on the economy. The vertical axis comprise of the outputs of the tradable sector (TG) which includes both the oil tradable sector and non-oil tradable sector (manufacturing). While the horizontal axis has the output of the (NTG) that is non-tradable sector (services).

The diagram has a production possibility curve (PPC). The PPC is represented by curve SP and it indicates all possible output that can be produced, with the available factors of production and technology, by both the tradable and non tradable sector. Io is the society′s indifference curve and the demand curve. Before the boom, the equilibrium in the economy, initially is E, which marks the intersection of the production possibility curve SP, with the indifference curve Io. The exchange rate initially is the slope of EPo and the tangent of the two curves. At the initial equilibrium E the output of the tradable sector (TG) is OT_1 and that of non-tradable sector NTG is OT_2.Note that, also at point E , income is equal to expenditure or demand. Oyo describes the demand expansion path if exchange rate is held constant at EPo and national income rises.

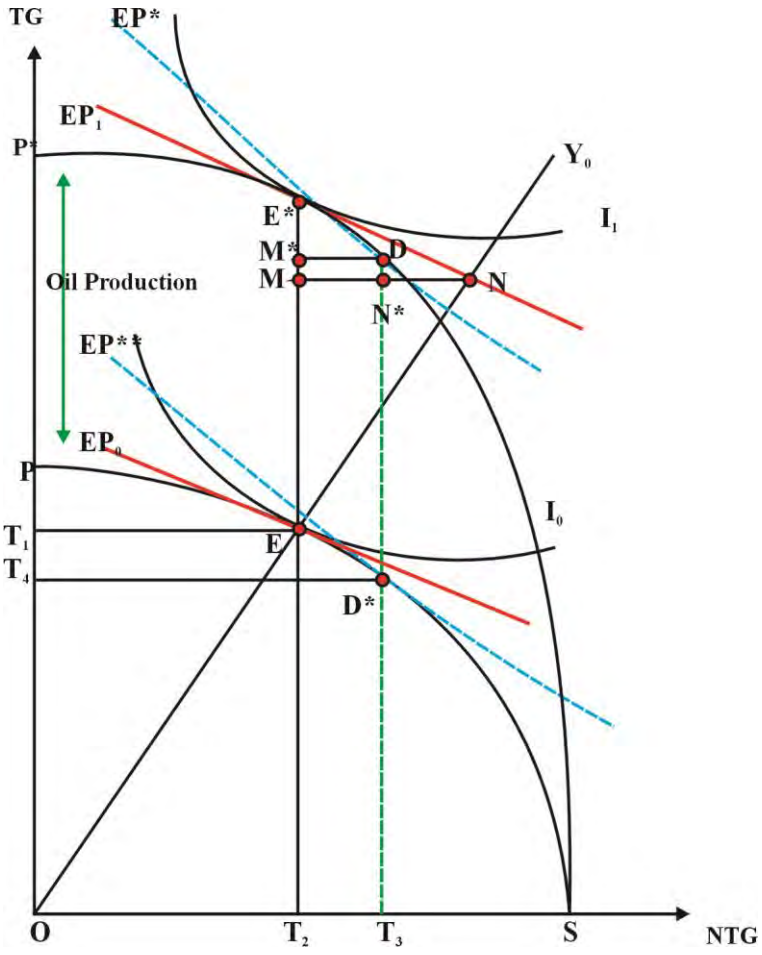
Examining the effect of oil windfall, due to the increase in oil income, assuming oil is not consumed locally, thus indicating that the boom will not affect the maximum output of the non-tradable sector OS, but output of tradable sector rises, especially oil. Therefore the PPC shifts upward from the initial position OP on the vertical axis to OP*. let us assess the spending effect of this situation;

Spending effect

The boom shifts the PPC from SP to SP* and thus bringing a new equilibrium at E* and EE* is the increased oil production, that leads to the boom, but the output of both the no-oil tradable sector and that of non-tradable sector remain at E. The exchange rate

remains the same since E* lies vertically on E, EP_1 is parallel to EPo. As income increases, demand for non-tradable goods rises through the expansion path OYo and stay at N, which is a disequilibrium position, since optimum output is at E*.The implication is that the consumers intend to consume at point N but the producers are willing to produce to point E*.

Figure 2.1: The spending effect



Therefore, the excess demand for tradable goods is represented by NM and Note that the output of the non tradable goods still remains at E at the relative price EPo (exchange rate) also excess demand for non-oil tradable commodities, is shown by EM,

while the rest of the same particular line that is ME* is the balance of payment situation.

The implication of the whole situation is that for market clearance in the economy, the exchange rate must rise and it's shown by EP*, this is necessary to reduce the excess demand for non tradable goods and also to make sure that the balance of payment is restored. Consequently, the new equilibrium will definitely fall between E* and intersection of SP* with the expansion path line OYo. Point D on the diagram is an example the new equilibrium. The summary of the implication is that, oil boom increases demand for non-tradable commodities from M to N, and the real exchange rate appreciates, thus lowering the demand for non tradable goods to N* leading to net rise by MN* which is equal to rise in non tradable output from T_2 to T_3. Again, considering the implication on the non-oil tradable sector (manufacturing sector), the boom increases demand by EM but the rise in real exchange rate increases it further to EM*. This is a decline in the output of the non-oil tradable sector at T_1T_4.

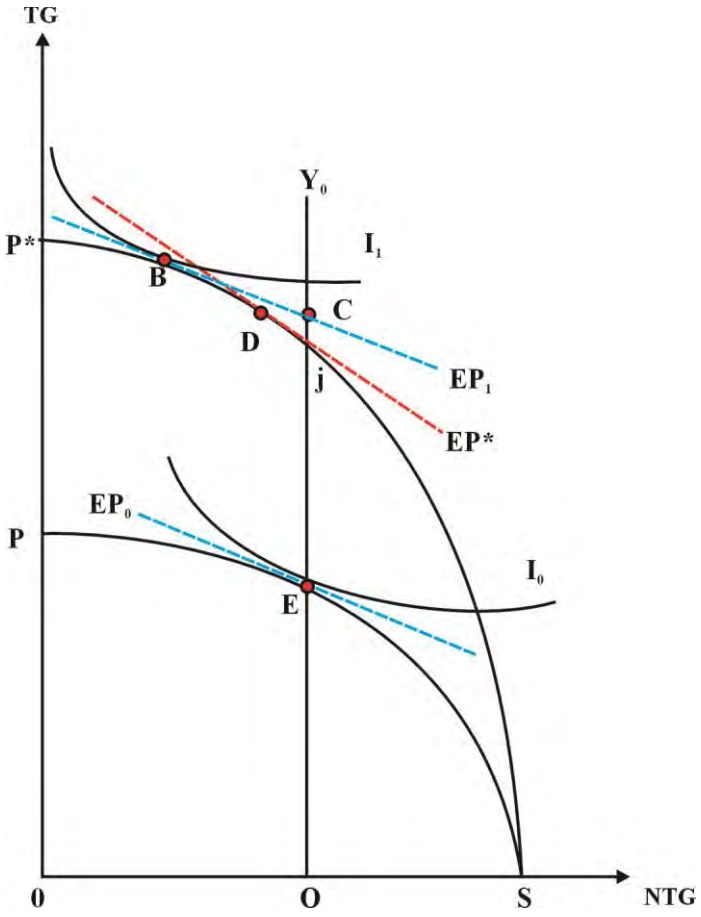
At the new real exchange rate (relative price) EP** the domestic output of both the non tradable and non-oil tradable sectors move along the initial production possibility curve SP to a new point D* on the same SP. This represents the new equilibrium of both non-oil tradable sector (manufacturing) and non-tradable sector (services). At this new equilibrium, the effect of the boom now shows that non-oil tradable sector output falls from T_1 to T_4 while non-tradable sector output rises from T_2 to T_3. But to cover the increased demand for the output of the non-oil tradable sector, importation of non-oil tradable goods must rise by DD*.

Resource movement effect

Figure 2.2 describes the resource movement effect. Just as we held factor mobility constant, to be able to explain the spending effect, we also hold income elasticity for non tradable goods constant. The implication is that the income consumption curve, which indicates the expansion path in the previous diagram that is Oyo, is now vertically passing through E and intersects SP* at j. Labour will be attracted to the oil

sector from both the non tradable sector and the non-oil tradable secto,r due to the increase in marginal product of labour and wages. With same real exchange rate EP1, B is the new point of production following the boom in the oil sector. Note that the relative prices EP_1 is parallel to EPo hence same real exchange rate. The implication of this is there will be a rise in oil sector output and decrease in the non-oil tradable sector output (manufacturing sector) and non tradable output (service sector).

Figure 2.2: The resource movement effect



The resource movement into the oil sector which has depleted the factors of production, available to the two remaining sectors will lead to excess demand for the non -tradable goods. This is shown by point C on the same Figure 2.2 which is the intersection of the

Oyo and EP_1. In clearing the market the real exchange rate needs to rise. This means that prices of non-tradable sector goods rises. This will remove the excess demand and thereby cancelling the decline in the output of the non-tradable sector output which is caused by the resource movement effect.

Point D could be the new equilibrium which shows that the output of the non-tradable sector has fallen, compared to its output in the initial equilibrium thus, indicating the effect of the resource movement. Similarly, the output of the non-oil tradable sector (manufacturing) must have declined due to the real exchange rate appreciation.

In conclusion, Corden and Neary (1982) shows that both resource movement and spending effects shift the mobile factor away from the manufacturing sector and currency also appreciates in value. This occurs since we assume that one specific mobile factor and one non-mobile factor is used in all the sectors. The implication is that the non-oil tradable sector (manufacturing) becomes less competitive and consequently, its output continues to fall whenever there is oil boom.

For the non-tradable sector, the results are ambiguous, while the spending effect leads to expansion, the resource movement effect leads to contraction of the sector. The underlying power of spending effect depends on the propensity to consume the output of the non-tradable sector. The propensity to consume the service sector (non-tradable sector output) is relatively high, mostly in the resources endowed countries (Stijns, 2002). But the strength of the resources movement effect depends on the factor intensity in the sectors. The resource movement is more effective where the production process is more labour intensive and in such economy it will be overshadowed by the spending effect.

According to Corden and Neary (1982), the fall in output of the non-booming sector (lagging sector or the manufacturing sector), as a result of resource movement is referred to as direct de-industrialisation. While the currency appreciation caused by the decline in the output of the non-tradable sector as a result of excess demand for its output is referred to as indirect de-industrialisation.

Finally, the theoretical relationship between oil and manufacturing sector is clearly shown in these analyses of Dutch Disease phenomenon, which is a result of the resource curse hypothesis.

2.3.3 Oil as an input (energy source) and manufacturing output growth

The neoclassical perspective of production function explains the linkages between energy and growth. A general form of production function describes the relationship between oil as a form of energy and economic activity. The function is presented thus;

$$(Q_i \dots\dots, Q_m) = f\left(A, X_i \dots\dots, X_n, E_i \dots\dots, E_p\right) \quad .2.0$$

Where Q_i are various outputs i.e manufactured goods and services

X_i are various inputs such as capital, labour among others.

E_i are energy inputs used in the manufacturing production process i.e oil, gas, coal etc.

According to the neo classical economists, the relationship between energy and growth of the GDP gross domestic products can be affected by the following agents

(i) Substitution between energy and other inputs
(ii) Technological change
(iii) Shifts in the composition of the energy input
(iv) Shifts in the composition of outputs

Other factors can be a shift in the mix of the inputs used in the production for instance either capital intensive or labour intensive. Basically, the linkage between oil as an input and growth is explained by Mainstream economist through their growth theories with natural resources as a form of energy.

2.3.3.1 Growth theories with natural resources (A review)

These growth theories centred on natural resources as a source of energy for production process. Basically, natural resources are categorized to renewable and non renewable energy sources. Oil is referred to as non-renewable natural resources just like other fossil fuels; crude oil is produced from the remains of plants and animals over millions of years. Renewable natural resources must be replaceable within a reasonable amount of time, ranging from days to maximum of years. But in the case of oil it takes millions of years to be replaced, too long for people to wait around for more to be made (see Smulders, 1999).

The major issue growth theory assessed is the issue of sustainability of output level, since most of the renewable resources are exhaustible. Therefore, if growth depends on them, sustainable economic development might not be guaranteed. Conversely, non renewable resources like oil are believed to be inexhaustible depending on the production function. A situation where there are two inputs in a production function that is manufactured capital and natural resources (oil) offer alternative growth paths to economic growth. These growth paths depend majorly on institutional arrangements.

One of the growth paths followed the optimal growth model, which maximizes the discounted social welfare, mostly during an infinite period of time or achieves a sustainable social welfare (that is a non-declining social welfare). Therefore, the growth theories on natural resources and output growth centre on what permits sustainable economic growth, which is synonymous with a non-declining utility or consumption. Consequently, the issue of "Sustainability" is very germane in assessing the role of natural resources like oil, in economic growth. Technical and institutional conditions have been identified as major factors, which can affect oil guaranteeing sustainable economic growth. The technical conditions have to do with the mixture of renewable and non-renewable resources, capital and natural resources endowment, and the possibility, as well as ease of substitution, among various inputs used in production process. While, the institutional set-up covers the market structure which can be

competition or central planning, it also involves issues of property rights which can be common property or private property and lastly the system values itself.

Solow (1974), through his growth model, showed that sustainable growth can be achieved with finite non-renewable resources with no extraction cost and capital that is assumed not to be depreciating. In other words, according to Solow, sustainability is only possible if the non-renewable resources are produced with the usage of natural resources and capital. Oil as a non-renewable resource and input in production, might not completely fit in into the Solow growth model due to the unrealistic assumptions. In addition, oil might not even guarantee sustainable growth, since the same model under a market competition may eventually lead to extinction of the natural resources used in the production of the non-renewable resources (oil) and this will also lead to the decline in social welfare and finally lead to the collapse of the economy (see Stiglitz, 1974; Dagupta and Heal, 1979)

However, standard growth theory advocates for substitutions of the depleting natural resources. According to the theory, the substitutes must be more in abundance and it can also be equivalent to human or man-made capital, which may be machines, capital or factories among others. All these are still within technological arrangements to ensure growth sustainability. Notwithstanding, the neoclassical economists, are more concerned with how institutional arrangements can aid crude oil as a non-renewable resource, to guarantee growth sustainability as opposed to technical arrangements. The neoclassical growth theory believes the priori that technical arrangements can guarantee sustainable growth. But under what institutional arrangement is this feasible? This is the question theory tends to answer (see Stern, 2003).

Oil as a non-renewable resource in production process, is also affected by elasticity of substitution, in the production function for "substitutability" of the resources. This leads to sustainable economic growth. According to Stern(2003), the elasticity of substitution σ, between capital, that is, machines, factories and environmental inputs such as natural resources, ecosystem services and waste assimilation, is a term that measures how much

an input is to be reduced in order to increase another input and still maintain the same level of output. Economic theory shows that a large elasticity of substitution implies that a rising cost of input, say oil, can easily be ameliorated by switching to another production technique which makes use of alternative capital.

However, if elasticity of substitution σ=1, is a case of "perfect substitutability", this means that if the ratio of two inputs is changed with a given percentage while holding output constant, the ratio of the marginal products of the two inputs will change in opposite direction. This implies that as the usage of resources (oil as an input) falls, the usage of capital in the production process can be increased to infinity and still maintains same level of output. This also means that cost of production remains constant along the isoquant. However, when elasticity of substitution σ=0 this is the case of no substitution. Under this condition the two inputs must be used in fixed ratios but where the inputs are infinitely substitutable, the producer cannot differentiate between the inputs and will only go for the cheaper one.

2.3.3.2 Factors affecting substitution of oil as an input in production process

Solow (1997), in his model, identified two different forms of substitution; substitution within category and between category. The within category is the substitution that takes place within category of the same input for example fuels. While substitution between categories refers to that substitution between different forms of inputs, such as the one between energy or say oil and machine. Solow attached more importance to the first category, in the case of oil as an input in production. The substitution of renewable resources for non-renewable resources has affected the usage of natural resources in most of the advanced countries. Example is substitution of wood for oil. Notwithstanding, ecological economist have also identified another form of substitution which is manufactured capital for natural capital. The following factors have therefore been identified as variables that can affect the rate at which oil can be substituted in manufacturing production process (see Stern 2003).

Thermodynamic

This has to do with the level of energy fundamentally required in the transformation process of a certain material into different thermodynamic states (See Ruth 1993; Islam, 1985). The thermodynamic limit is strongly affected by the rate of energy usage during the transformation process. Therefore, where technological development shows a very strong diminishing returns owing to thermodynamic limits do normally have serious implications on possibility of substitution.

"Complimentarity"

Since production process is combination of different forms of capital to generate output consequently, oil as a natural capital substitution is prone to availability of relevant compliments like manufactured capital which is also used in the transformation process (See Cleveland et al; 1984). According to the Georgescu-Roegen's (1976) fund flow model, manufacturing production process describes an activity which involves transformation of a flow of energy, materials and information by two agents namely; labour and manufactured capital. Materials, energy and services from natural resources are been transformed while manufactured capital effect the transformation. For instance, in an energy industry more manufactured capital (machines) may be used to extract more oil from a petroleum reservoir if jointly used with some natural capital. Therefore "complimentarity" limits substitution.

Critical Natural capital

It has been argued that some natural capital at macro level is not replaceable by manufactured capital at least beyond a certain critical stock size. According to Costanzaand Dlay, 1992, there is a limit to the stock of produced capital that can be used since certain level of stock provides life support for the economy as a whole. Therefore excessive substitution of man-made capital for natural capital may approach a threshold beyond which natural system may not be able to cope again and cause a

system collapse. Therefore critical natural capital may definitely limits the ease of substitution of oil in production process.

2.4 Methodology and Data

There are two divergent views regarding the impact of oil revenue on the growth of the manufacturing sector in AOECs. While some believe that the presence of oil in these countries contributes to the growth of their manufacturing sectors (see Majid,2006; OPEC Fund for Industrial Development (OFID), 2006), others are of the opinion that the presence of oil is a setback for their manufacturing sectors (see, Olomola, 2007; Ali, 2013; Ali and Harvie, 2013). To examine the impact of oil on the development of the manufacturing sector in AOECs, a study of six major net oil exporting countries in Africa, namely: Nigeria, Cameroun, Gabon (Sub-Saharan Africa),Egypt, Algeria, and Libya (non-Sub-Saharan Africa) is carried out using pooled data analysis. Initially this study covered all oil-exporting countries in Africa. However, due to the fact that not all of them have dominant oil sectors, the focus was changed to the six net oil exporters only. Our model follows the endogenous growth model of Barro and Lee (1993) with public good, who argue that public expenditure makes private production more profitable. Barro and Lee's (1993) model is expressed thus:

$$y = Ak^{1-\propto}g^{\propto} \tag{2.1}$$

wherey is subject to diminishing returns to capital *(k)* and g is a vector of control variables constituting electricity, exchange rate and per capita income. The individual firm takes *g*as fixed or independent of his decision about *k*.Fedderke (2003) identified the nature of the marginal product of capital (*mpk)* as the reason why some countries with high per capita output experience lower growth rates than the ones with lower per capita output. That is, if

$$y_x = Ak_x^{(1-\propto)_x}g_x^{\propto_x} \tag{2.2}$$

Where y_x is the per capita output growth of country *x* with high per capita output, and

$$y_z = Ak_z^{(1-\propto)_z} g_z^{\propto_z} \quad (2.3)$$

Where $y_z$is the per capita output growth of country *z* with lower per capita output, then

$$\Delta y_z > \Delta y_x \quad (2.4)$$

where both Δy_x and Δy_z, which are the changes in the per capita output growth, represent the growth rate of per capita output in country *x* and *z*, respectively. For the condition in equation (2.4)to have taken place, *mpk* must be a constant and not associated with per capita output. Fedderke (2003) attributes the constant nature of the *mpk* to the spill-over effect of knowledge in the process of capital stock accumulation. This means that knowledge has the characteristics of a public good. That is:

$$k_t = \vartheta \emptyset_t \quad (2.5)$$

Equation (2.5) shows that capital stock *k* at time *t* depends on knowledge ϕ at time *t* such that $\frac{dk_t}{d\emptyset_t} = \vartheta > 0$.This means that knowledge is seen as investing in a process that increases capital stock in all economies. According to Fedderke (2003), investors might not have the power to internalize all the benefits of knowledge. At least some of it still leaks out to the benefit of the whole economy. This simply means that the spill-over effect of knowledge ϕ is non-excludable. Consequently, investors will not want to invest in capital to the point where:

*Smpk = Smpc (*spill-over effect*)* (2.6)

Where,*smpk*is the social marginal product of capital and *smpc* is the social marginal cost of capital. Investors will rather stop investing in capital when:

pmpk = pmc (2.7)

where pmpk is private marginal product of capital and *pmc* is the private marginal cost of capital, thus, avoiding the spill-over effect. The implication of equation (2.7) is that:

smpk>smc (2.8)

This is because once investors set the private marginal product of capital equal to the private marginal cost, the cost of knowledge becomes higher than social marginal cost of capital. Consequently, a more drastic measure will be taken to prevent the spill-over effect by investors.

This situation might be detrimental to growth of the economy as a whole. At this point, government intervention comes in by aiding production through subsidizing major inputs in the production process (Fedderke, 2003). Therefore, equation(2.8) can be rewritten as follows:

$$y = Ak^{1-\propto-\infty}g^{\propto}\lambda^{\infty} \quad (2.9)$$

where, λ^{∞} is the additional input subsidized to aid production. This is to reduce the higher cost of production resulting from setting *pmpk* to *pmc.* This will enable investors to relax their drastic measures to internalise the benefits of knowledge and the spill-over effects can benefit other sectors of the economy.

Our model follows equation (2.9) and λ^{∞} is viewed as oil, which is heavily subsidized in many AOECs. Consequently, our model is stated as:

$$y = Ak^{1-\propto-\infty}oil^{\infty}g^{\alpha} \quad (2.10)$$

Taking logs of the equation it becomes:

$$logy_{i,t} = logA + \beta logk_{i,t} + \infty logOil_{i,t} + \propto logg_{i,t} + \varepsilon_{i,t} \quad (2.11)$$

Where $y_{i,t}$ is the manufacturing sector output growth rate of county *i* at time *t*, A is the intercept, *k* is capital, β is the elasticity of capital and it is equal to $\beta = 1-\propto-\infty$, oil is oil revenue, $g_{i,t}$ is a vector of control variables that comprises electricity, exchange rate and per capita income, and$\varepsilon_{i,t}$is the stochastic variable.

2.4.1 Definition of Variables

All variables measured in monetary terms are in constant US dollars. Manufacturing sector growth*(y)* is the dependent variable. It is measured by annual growth rate for manufacturing value added.

2.4.1.1 *Explanatory Variables*

Capital (k) is an endogenous variable in the model. It is measured by gross capital formation. It consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.

Oil Revenue (*oil*) is our real variable of interest. It is measured by the value of fuel exports (% of merchandise exports).These fuels comprise premium motor spirit (PMS), dual purpose kerosene (DPK) and automotive gas oil (AGO).

2.4.1.2 *Control Variables:* The control variables (g) are strictly exogenous covariates. They are: per-capita income *(pci),* real exchange rate *(exr)*, and electricity generation *(ele).* Per capita income is captured by GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. The exchange rate is the official exchange rate (local currency unit (LCU) per US$, period average). It is the exchange rate determined by national authorities or determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (LCU relative to the U.S. dollar).

The electricity generation is measured by electricity production, which is also measured at the terminals of all alternator sets in a station. In addition to hydropower and nuclear power generation, it covers generation by geothermal, solar, wind, and tide and wave energy, as well as that from combustible renewable and waste sources. Production includes the output of electricity plants that are designed to produce electricity only, as well as that of combined heat and power plants.

2.4.2 Estimation Technique

According to Gujarati (2007), if T, which is the number of time series data, is large and the number of cross sectional units is small, the fixed effects approach is more appropriate. This is referred to as a long panel. According to Toress(2010), the fixed effects panel regression, unlike the ordinary least squares, considers heterogeneity across groups and time, hence the estimates from the fixed effects model are more efficient. Hauser (2010) argues that the assumption that individual intercepts must be uncorrelated with the error term before random effects can be used is usually violated in a long panel, thus making the random effects model inconsistent.

According to him, one of the immediate solutions is to use fixed effects. However, Gujarati (2007) sums up all these views about the choice of fixed or random effects by stressing that, if the panel is long [3](i.e the number of time series T is larger than the number of cross sectional units N) there is likely to be little difference in the values of the parameters generated by both fixed and random effects. Therefore, the choice is based on computational convenience and consequently he advises that fixed effects are preferable in this circumstance. Since our data is from 1970 to 2010 (i.e 40 years) and the number of countries under consideration is only six, the choice of the fixed effects model appears appropriate.

The fixed effects equation in its original form is presented as follows:

$$y_{it} = \beta_1 + \sum_{j=5}^{6} \beta_j x_{jit} + \mu_{it} \qquad (2.12)$$

Where β_1 is the intercept while β_j represent the slopes or the parameter estimates of each of the explanatory variables used in our model. x_{jit} to are explanatory variables for each of the six countries(cross sectional units) at time *t,*

[3] *When T number of series is greater than the number of cross-sectional units N it is called long panel. And when the reverse occurs it is referred to as short panel*

The index *i* stand for the i^{th} cross-sectional unit (country), and *t* is a year counter. That is *i*={1,2,3,4,5,6} and t={1,2…….,40}.The pooled regression analysis can be done by estimating equation (2.12). According Gujarati (2007), it is necessary to explore the specific effects of the cross-sectional units. This takes us to the fixed effects least-squares dummy variable (LSDV) approach. LSDV has been described as a way of accounting for the specific effects of the countries on *y*. This is done by allowing the intercept to vary across the cross-sectional units and leading to equation (2.13).

$$y_{it} = \beta_{1i} + \sum_{j=2}^{6} \beta_j x_{jit} + \mu_{it} \qquad (2.13)$$

The subscript *i*appended to β suggests that the intercepts of the individual countries may be different, which may be attributed to the country's system of administration, leadership style and administrative philosophy. The fixed effects or the LSDV use the different intercept dummies to measure the specific effects of the cross-sectional units. Accordingly, equation (2.13) can be rewritten as:

$$y_{it} = \propto_1 + \propto_i \sum_{i=2}^{7} D_i + \sum_{k=1}^{5} \beta_k x_{kit} + \mu_{it} \qquad (2.14)$$

Equation (2.14) is also known as the least-square dummy variable model.

Gujarati (2007) further states that there is a possibility of a multicolinearity problem in the fixed effects LSDV model due to the addition of many dummy variables especially in small samples. Again, because of the assumption of strict exogeneity of LSDV, the fixed effects model may possibly have an endogeniety problem. This is the situation where the random variable is possibly correlated with the regressors x_{it} thereby leading to inconsistent and biased estimators.

To improve the performance of the estimators, we explore the dynamic panel data approach popularised by Arellano and Bond (1991). According to Franz (2009), when a static specification of the fixed effects model is joined with autoregressive coefficients, which is the lagged value of the dependent variable, it allows feedback flowing from the past or current shocks to the current value of the dependent variable. This method of specification is known as the generalized method of moments (GMM). The dynamic

specification takes away the temporal autocorrelation in the residuals and prevents running a spurious regression, which may lead to inconsistent estimators. The GMM model is specified thus:

$$y_{it} = \beta_1 + \sum_{m=1}^{n} \rho y_{it-m} + \sum_{k=2}^{6} \beta_k x_{kit} + \mu_{it} \quad (2.15)$$

Equation (2.15) is the modified form of the fixed effects model in equation (2.14) with the addition of the lagged value of the dependent variable. Note that m and k are lag length and numbers of parameters respectively.

Taking the first difference of equation (2.15), we obtain equation (2.16) as follows:

$$\Delta y_{it} = \beta_1 + \sum_{m=1}^{n} \rho y_{it-m} + \sum_{k=2}^{6} \beta_k \Delta x_{kit} + \Delta \psi_{it} \quad (2.16)$$

Avoiding possible correlation between y_{it-1} and ψ_{it} necessitates the use of an instrumental variable that will not be correlated with both, and through matrix transposition of the explanatory variable, instrumental variable Z' is obtained. Equation (2.16) is multiplied in vector form by Z'leading to:

$$Z'\Delta y_{it} = Z'(\Delta y_{-1})\rho + Z'(x)\beta_{it} + Z'\Delta \psi_{it} \quad (2.17)$$

Estimating equation (2.17) using the generalized least square (GLS) yields one step consistent GMM estimators. However, additional input to the approach used by Arellano and Bond (1991) evolved over the years and was developed by Blundell and Bond (1998).It is referred to as system-GMM. There is not much difference between this approach and GMM except that system-GMM exercises more precaution in the usage of the instrumental variables. It was developed to tackle the problem of possible weak instrumental variables, which may occur in GMM. Therefore, the SYS-GMM is expected to yield more consistent and efficient parameter estimates. This will be explored in our dynamic panel data analysis.

2.4.3 Data

Data on manufacturing growth rate, capital stock proxied by gross capital formation of each AOEC, per capita income, oil revenue and electricity generation were sourced fromWorld Bank Tables 2012 edition. Data on exchange rates were sourced from Penn World Table (PWT) 6.1.

2.5 Empirical Results

2.5.1 *Descriptive Statistics of the Variables*

Table 2.1 shows the descriptive statistics of the variables for the six countries under study.

Table 2.1: Descriptive Statistics

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
Manufacturing growth rate	246	5.14711	9.601761	-26.58229	47.8
Percapita income	246	7.021713	2.248785	-1.547871	9.610885
Capital	246	20.19376	4.445465	7.40117	24.79918
Oil revenue	246	3.41651	2.031008	-9.124365	4.601729
Exchange rate	246	79.49115	159.761	.0003482	733.0385
Electricity generation rate	246	22.412	1.548126	18.55171	25.59877

Source: Author's Computation

All variables appear in log form to show their elasticities except the manufacturing sector growth rate and real exchange rate.

The mean represents the average value of the data set. Attention is given to manufacturing growth rate and oil revenue because they are our core variables of interest. The mean value of the manufacturing growth rate is 5.14711. The value shows

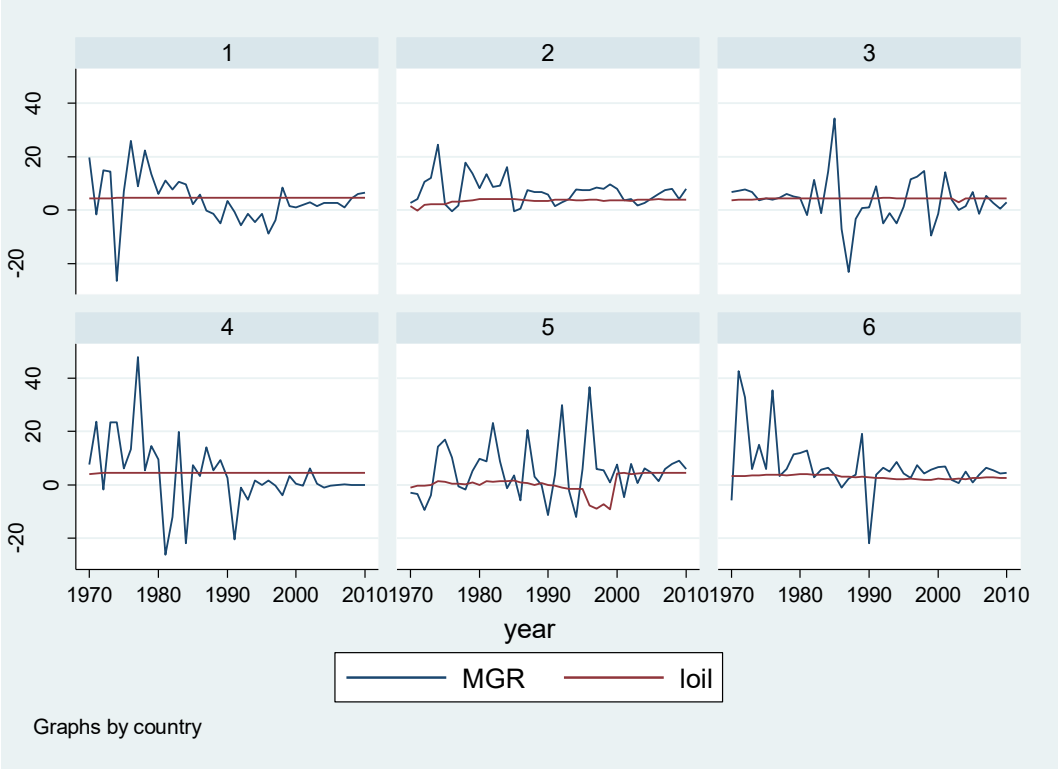
that the mean lies at the lower end of the distribution. The majority of our data values on manufacturing growth rate for all the countries must be concentrated at the lower end. The highest manufacturing growth rate is 34.6 while the lowest is -2.4. This means that the mean drifts toward the lower end as earlier stated. Therefore, on average it appears that the manufacturing growth rates of the AOECs are relatively low. Comparatively, the mean value of 3.41651 of oil revenue falls inthe middle level of the distribution, which is an indication that oil revenue growth rate is relatively moderate at a higher level than manufacturing growth rate for all the AOECs.

The table shows that the standard deviation of manufacturing growth rate is 9.60176 while that of oil revenue is 2.031008. This is an indication that the data on manufacturing growth rate show a more dispersed distribution. That is, they appear to have larger variance across the six countries more than the data on oil. This means that the patterns of growth of the manufacturing sector of these countries have been somewhat unstable.

The description of manufacturing sector growth rate (*mgr*) and oil revenue (*oil*) is again presented in Figure 2.1. The figure describes the characteristics of the two variables across the six countries.

The graphs simply corroborate the result of the descriptive analysis of the data shown in Table 2.1 That is, the pattern of manufacturing sector growth (mgr) shows more variation through the undulating line graph than oil revenue in the six AOECs which almost show a straight line graph across the countries. While the oil revenue line graph follows a non-negative movement fairly above the origin for most of the countries, the manufacturing sector growth has been very unstable and undulating around the origin for all the six countries. The similarities in the patterns of distribution across the six countries is an indication that the findings can be generalized for all other African oil exporting countries not covered in our panel data analysis.

Figure 2.3*: Manufacturing sector growth rate (mgr) and oil revenue (oil)in AOECs*



Key:

Number on graph	***Country***
1	*Algeria*
2	*Egypt*
3	*Gabon*
4	*Nigeria*
5	*Libya*
6	*Cameroun*

Source: Author's Computation

Table 2.2: Panel Correlation Matrix

	Manufacturing growth rate	Per capita income	Capital	Oil revenue	Exchange rate	Electricity generation rate
Manufacturing growth rate	1.0000					
Per capita income	-0.1843	1.0000				
Capital	0.0210	0.1436	1.0000			
Oil revenue	-0.0879	0.1919	-0.1571	1.0000		
Exchange rate	-0.0894	0.4251	0.0348	0.2291	1.0000	
Electricity generation rate	-0.0925	0.1939	0.0750	0.2431	-0.4048	1.0000

Source: Authors Computation

Table 2.2 shows the correlation and covariance nature of the variables used in our panel model. The variables exhibit different forms of relationship with one another. However, very important to our discussion is the correlation between the oil revenue and the manufacturing sector growth rate which is -0.0879. This is an interesting result as it is shown that the two variables have an inverse relationship. Though, the value is very low, thisis an indication of a weak negative relationship. Generally, apart from capital formation, all other independent variables show a negative relationship with the manufacturing sector growth of the AOECs.

2.5.2 Panel estimation results

The idea of using panel data analysis is justified in that it takes care of the unobserved heterogeneity. Therefore, to be able to explain in detail the causal-effect relationship between the dependent and the independent variables and to study the within variations, we use the error-components model. This includes fixed effect and random effects. However, based on the nature of our data, where we have forty time series and six cross-sectional variables, as explained in the methodology, we use only the fixed effects

analysis. This is explored in the form of within variation and least squares dummy variables (LSDV).

Table 2.3: Fixed Effects (within variation regression) Estimation Results for Manufacturing Sector Growth Rate

**Dependent variable: Manufacturing sector growth rate*

Variables	Coefficient	Standard error	t value
Constant	99.38583***	22.19101	4.48
Per capita income	0.4735527	0.4819848	0.98
Capital	0.3638414	0.9524375	0.38
Oil revenue	-0.0285611	0.409897	-0.07
Exchange rate	0.0168206	0.009636	1.74
Electricity generation rate	-4.729151**	1.472804	-3.21

Note: Standard errors in parentheses

*R^2 = 0.0857(within) R^2 =0.0010(overall) F(5,230)=4.31****

** Statistical significance at 10%** statistical significance at 5%.** *statistical significance at 1%*

Source: Author's Computation

Table 2.3 shows the fixed effect results. From the Table, it is clear that there is an inverse relationship between manufacturing sector growth in the AOECs and their oil revenues. The result corroborates our descriptive analysis in the correlation matrix presented in Table 2.1 where we found that the coefficient of correlation between the two is negative. In one sense this is supporting the evidence of Dutch Disease in these countries because the inverse relationship can be termed as a situation where the oil output is growing and the manufacturing sector growth is falling. However, the coefficient is not statistically significant. Again, the overall R-square is very low. The regressors explain about 10% systemic variation in manufacturing sector growth. The F value of 4.31 is significantly different from zero at 1% confidence level.

To be able to demonstrate the specific effects of the cross-sectional units, we also compute the fixed effect LSDV. The purpose of this is to examine if individual country

impact is likely to have any influence on our results. Despite the fact that Figure 1shows almosta similar pattern for both manufacturing sector growth and oil revenue, there may still be a difference in the impact analysis of these variables. This is done by allowing the intercept to vary from country to country. The result of the fixed effects LSDV is presented in Table 2.4.

Table 2.4: Fixed Effects(LSDV) Estimation Results for Manufacturing Sector Growth Rate

**Dependent variable: Manufacturing sector growth rate*

Variables	Coefficient	Standard error	t-value
Constant	101.4067***	22.82078	4.44
Dum 2	8.907043**	2.999682	2.97
Dum 3	-19.43958**	6.15398	-3.16
Dum 4	3.684153	11.99062	0.31
Dum 5	-6.937674**	3.100352	-2.24
Dum 6	1.925871	2.673398	0.72
Per capita income	0.4735527	0.4819848	0.98
Capital	0.3638414	0.9524375	0.38
Oil revenue	-0.0285611	0.409897	-0.07
Exchange rate	0.0168206	0.0096936	1.74
Electricity generation rate	4.729151	1.472804	3.21

Note: Standard error in parenthesis

*R^2 = 0.1149(overall) F(5,230)=2.84***

*** Statistical significance at 5%.** *statistical significance at 1%.*

Source: Authors Computation

The fixed effects LSDV results presented in Table 2.4 show some important revelations when compared to the previous results in Table 2.3. As earlier indicated, the use of the fixed effects LSDV is justified by the need to examine the specific effects of the countries on our results by allowing the intercept to vary across the countries. Again,

the bias of inconsistent estimator varnishes when T is large and N is small in the LSDV model. In our model T=41 and N=6. The dummies represent the individual intercept of the six countries. The F statistics falls to 2.84 but it is statistically different from zero at 5% confidence level. Also, the results show that three of the intercepts (constant inclusive) are individually statistically significant. That is, the intercept values of three out of six countries are statistically different from zero. This shows that there is a relative country-specific effect in our model, which may be attributed to the individual country's system of administration, leadership style and administrative philosophy (see Olomola, 2007; Gujarati, 2007).

The LSDV fixed effects' results also show that the parameter estimate of oil is negative. This is consistent with earlier findings in the fixed effects within group estimation. It further confirms the existence of Dutch Disease problems in the AOECs. The value of the R-square in the LSDV is higher compared to the fixed effects within variation in Table 2.3. The F-statistic rises significantly confirming that the fixed effects LSDV model is also significant. According to the results, none of the explanatory variables is statistically significant at conventional levels. For instance, the elasticity of capital formation in the AOECs is positive, indicating a direct relationship between capital formation and the manufacturing sector growth rate. Although, this is normal and conforms to the a priori expectation, it is not statistically significant. This further justifies the inverse relationship between the oil sector growth as measured by the revenue from oil and the manufacturing sector growth of the AOECs. This is evident in the huge investment in the oil sector of these economies since all other sectors including the manufacturing sector appear to have been neglected.

The per capita income elasticity is also positive but not statistically significant, meaning that the per capita GDP of the AOECs has no significant impact on the manufacturing sector growth. This might be the major reason why the contribution of the manufacturing sector to the GDP of these countries is very low. The coefficient of the exchange rate is also not significant but it is positive, indicating a direct relationship between manufacturing sector growth and the exchange rate. A probable explanation is

that as the exchange rate rises manufacturing sector growth is likely to rise in the AOECs and vice versa.

The elasticity of electricity is also positive but also not statistically significant. The non-significance of the electricity coefficient simply means that in the AOECs, the quantity of electricity generation is still not enough to ensure sustainable growth in the manufacturing sector. For instance, Nigeria, which is part of the AOECs under investigation, has been experiencing an erratic supply of electricity for decades and this has been adversely affecting the manufacturing sector of the country. Many manufacturing firms in the country rely on gas powered generators in their production processes and this has contributed significantly to the increase in the cost of production of these firms. Recently, some giant manufacturing firms closed down their operations in Nigeria and relocated to neighbouring Ghana due to the high cost of production caused by excessive expenditure on gas and diesel. Specifically, in 2009 PZ Pharmaceuticals, Unilever Nigeria PLC, and United Africa Company (UAC) relocated substantial parts of their companies to neighbouring Ghana. They blamed this development on the deplorable state of infrastructural facilities in the country, especially energy (see Nigeria Village Square (NVS) Forum, 2009).

Finally, the fixed effects LSDV results are capable of yielding a consistent estimator when the T is large and N is small. According to Arellano and Bond (1991), to obtain an efficient estimator in panel models, the dynamic panel model is preferred. Consequently, we proceeded to generalised method of moments (GMM) and the system generalized method of moments (SYS-GMM) estimation by Arellano and Bond (1991) and Blundell and Bond (1998), respectively. The use of the two is justified by the need to study the consistency of our results in dynamic panel models, having found out that the results were consistent in the two previous fixed effects models.

2.5.2.1 Dynamic panel estimation for manufacturing sector growth

Arellano and Bond (1991) argued that fixed effects LSDV might be inefficient hence the need to exploit the orthogonality conditions that exist between the lagged values of the dependent variable and the disturbance term through the use of an additional instrument in the model. This approach is called the generalized method of moments(GMM). This was modified by Blundell and Bond (1998) due to the fact that the assumption of strict exogeniety is more relaxed and is capable of yielding a more efficient estimator(see Roodman, 2006).This approach is a form of dynamic panel modelling that limits the tendency of having a spurious regression, which may lead to wrong inferences that is common in static models. The results of the dynamic panel models are presented in Table 2.5.

Table 2.5:The GMM and SYS-GMM Estimation Results for Manufacturing Sector Growth Rate(mgr)

Dynamic Panel Data Analysis	Variables	Coefficient	Standard Error	Z	Prob z
GMM	Manufacturing growth rate(-1)	-0.0202367	0.0645919	-0.31	0.754
	Per capita income	0.4383802	0.5013518	0.87	0.382
	Capital	0.4004976	0.9312599	0.43	0.667
	Oil revenue	-0.2915597	0.3998965	-0.73	0.466
	Exchange rate	0.0197917**	0.0098749	2.00	0.045
	Electricity generation rate	5.089826	1.552222	-3.28	0.091
Wald chi2(6) = 18.78, Prob> chi2 = 0.0045					
SYS-GMM	Manufacturing growth rate(-1)	0.0778381	0.0507784	1.53	0.125
	Per capita income	-0.3366477	0.392417	-0.86	0.391
	Capital	0.3981301	0.2572094	1.55	0.122
	Oil revenue	-0.7079312**	0.3125724	-2.26	0.024
	Exchange rate	0.0001853	0.0062226	0.03	0.976
	Electricity generation rate	0.0465988	0.259019	-0.18	0.857
Wald chi2(6) = 15.29 Prob> chi2 = 0.0181					

*** statistical significance at 5%.** *statistical significance at 1%*

Source: Author's Computation

The results of the GMM and SYS-GMM are shown in Table 2.5. This is another confirmation of our inferences from the previous estimated models. It is clearly shown that there is consistency in our results regarding the different models estimated i.e. from the fixed effects within group estimation to the fixed effects LSDV and dynamic models, which comprise both the GMM and SYS-GMM. All the coefficients' signs are almost the same for the two dynamic models. For instance, they both show that the coefficient of oil is negative, which is the same as what we obtained from our previous fixed effects models. The two dynamic panel models are statistically significant at 5% level with Wald Chi-squared probability value of 0.0045 and 0.0181 for GMM and SYS-GMM, respectively.

The only difference in the results obtained from all the models is in the significance of the parameter estimates. The SYS-GMM results, which according to the literature produce the most reliable parameter estimates, confirm the statistical significance of the oil parameter coefficient. That is, the coefficient of oil is negative and statistically significant, showing that oil revenue growth, which can be seen as a measure of oil sector growth, has a significant negative impact on the manufacturing sector of the AOECs. Specifically, 10% rise in oil revenue (oil sector growth) will lead to about 7.1% fall in the manufacturing sector growth of the AOECs.

We conclude that there is an inverse relationship between oil revenue and manufacturing sector growth of the AOECs. In terms of impact analysis, we conclude that oil revenue, which is a measure of the growth in the oil sector, has a significant negative impact on manufacturing sector growth in the AOECs.

2.5.2.2 Test for over-identification and serial correlation in the dynamic panel data

It has been observed that over-identification is a common problem with dynamic panel data in both systemic genaralised method of moments SYSGMM and genaralised method of moments GMM. This problem is associated with the finite sample behaviour of the GMM estimator and there are two major factors that affect this finite behaviour of samples. These are strength of identification and numbers of moment conditions (See

Hayakawa, 2013). The latest test for the vailidity of the identification problem is the Sagan/Hassen test which is also refered to as the J test. This test has been proven to be valid under weak moments asymptotics even when the number of instruments is large in the cross sectional regression (See Windmeijer,2009; Woutersen, 2013).

Again, the presence of serial correlation or autocorrelation in the estimates of dynamic panel data has also been pointed out as one of the problems of dynamic panel data estimators. The implication is that it limilts the effeciency of both GMM and SYSGMM estimators (see Hayakaya, 2013).

The results of the over-identification test and the test for serial correlation are presented in tables 2.6 and 2.7 respectively.

Table 2.6 Sargan test of over-identifying restrictions

H_0: over-identifying restrictions are valid	
chi2(152)	236.4587
Prob> chi2	0.0000

The results show that the null hypothesis is rejected. Therefore, over-identifying restrictions are invalid. The implication is that the number of instruments used in the GMM estimation does not have any negative effect on the estimators of the GMM.

Table 2.7 Arellano and Bond test for serial correlation

H_0: no autocorrelation		
Order	Z	Prob>z
1	-16.228	0.0000
2	-.66241	0.5077

Table 2.7 shows the acceptance of the null hypothesis at lag length two which is the lag length used for the GMM estimation. The implication is that the null hypothesis that there is no autocorellation is accepted at the lag length two. Therefore the GMM estimates are not affected by the problem of serial correlation hence there esimates remain consistent and efficient.

2.5.3 Discussion and Conclusion

We draw some important inferences from the study. The analysis shows that the six AOECs used in our study did not exhibit much difference in the relationship between their oil sector and the manufacturing sector. This is confirmed from the descriptive statistics, which show that there is no overwhelmingly significant country-specific effect on the nature of both oil revenue and the manufacturing sector in the six countries. The fixed effects LSDV results also do not show absolute support for country-specific effects. The implication of this result is that the findings can be generalized to other oil-exporting countries in Africa not included in the study.

The existence of Dutch Disease is observed in the negative relationship between the oil sector and the manufacturing sector of the AOECs. This is supported by all models. The inference supports the view of several studies that have used different variables and analyses to confirm the existence of Dutch Disease in oil-exporting countries (see Égert and Leonard, 2007; Olomola, 2007; Ismail, 2010; and Majid, 2006).

The study confirms that the negative impact of the oil sector on the manufacturing sector of the AOECs is more significant in the dynamic panel model than in the static models. The finding is at variance with Mehrara, Sadr and Farhani (2007) who concluded that oil revenue does not have a significant negative impact on the non-oil manufacturing sector. Though they confirm a negative relationship, they concluded that it is not significant. It can now be seen that their conclusion might be due to the static model they used. Our dynamic model, specifically the SYS-GMM model, which is capable of showing a more reliable result when compared with the static models,

indicates that oil has a negative significant impact on the manufacturing sector of the AOECs.

Another important inference from the study is the existence of a positive relationship between the exchange rate and manufacturing sector growth. A similar result was obtained by Égert and Leonard (2007) in their study of the oil-rich Republic of Kazakhstan. The coefficient of the exchange rate is not significant on the AOECs manufacturing growth rate but a direct relationship is confirmed.

The stunted growth of capital formation in the manufacturing sector of AOECs is revealed in our study. Both the static and dynamic panel models show that capital does not have a significant impact on the manufacturing sector of the AOECs. This means that the manufacturing sectors are less capital intensive (see Ismail, 2010).

Finally, the non-significance of the estimator of electricity generation in most of our models shows further support for the low investment in energy in the manufacturing sector of the AOECs. This situation is evident in some oil-exporting countries such as Nigeria where manufacturing firms are closing down and relocating to neighbouring countries where there is a more stable supply of electricity. Many of these firms take this step to reduce the high marginal cost of production resulting from the need to find alternative sources of energy.

It can be concluded that there is Dutch Disease in the AOECs as shown by the negative relationship between oil revenue and the manufacturing sector growth. Thus, the study contributes to the growing consensus on the existence of Dutch Disease in many oil-rich nations in the world. It is discovered that the growth of the oil sector has a significant negative impact on the manufacturing sector of the AOECs. The implication of this is that apart from addressing policies to improve the manufacturing sector through diversification and investment policy, among others, efforts must be made to plough back the revenue realised in the oil sector to the real sector of the economy. Utilizing a substantial part of oil revenue for the development of the manufacturing sector may

likely cause the oil sector to start exhibiting positive and meaningful effects on the manufacturing sector of the AOECs

The study confirms that the exchange rate demonstrates a positive relationship with the manufacturing sector growth of AOECs. This corroborates the findings of Égert and Leonard (2007), among others, who also concluded from their studies that the exchange rate has a direct relationship with the manufacturing sector growth of the oil-rich Kazakhstan Republic. This implies that an increase in the exchange rate may likely promote the growth of the AOECs manufacturing sectors. The transmission mechanism through which this occurs might not be unconnected to the fact that a rise in the exchange rate discourages importation of manufacturing competitive goods. This in turn will most likely promote the growth of the manufacturing sector. A currency devaluation policy complemented by the provision of adequate incentives to promote the domestic manufacturing output is recommended.

We can also conclude that the level of investment in the manufacturing sector of the AOECs is grossly inadequate. This implies that the manufacturing sectors of the AOECs are suffering from inadequate capital. As shown in the discussion of the literature, the more the manufacturing sector is capital intensive, the stronger is its resistance to negative influence from the oil sector. This dearth of investment in the manufacturing sector of the AOECs is further revealed through the observation that electricity generation does not have any significant impact on manufacturing sector growth. Consequently, our study supports the call for aggressive investment policy that will accelerate a massive investment in the manufacturing sector of the AOECs.

Finally, it is apparent that there is a problem with the manufacturing sector of the AOECs and there isa need to address this problem if the growth of these countries is to be enhanced. Generally, any of the following courses of action can be employed to address these problems: (i) diversification; (ii) currency devaluation with adequate incentives to promote domestic manufacturing output; (iii) aggressive investment policy to increase capital formation in the AOECs manufacturing sector; (iv) stabilization of

the oil sector and utilization of the oil revenue for more investment in the manufacturing sector; and (v) political will to carry out all these necessary measures. It should be noted that none of these measures is, on its own a perfect panacea for the problem of the AOECs manufacturing sector. All these efforts can be launched together or implemented in successive stages until the growth of the manufacturing sector is promoted.

CHAPTER THREE

Monetary policy and growth of the manufacturing sector in Africa's oil exporting countries (AOECs)

3.1 Introduction

It has been observed that there are two divergent views regarding the effects of monetary policy on manufacturing growth. These include the studies that maintain that monetary policy has been properly administered by many developing economies including AOECs and that this has promoted the growth of their manufacturing sector and the overall growth of the economy and the studies that argue that monetary policy has not been properly practised in the developing economies, leading to the current problem in their manufacturing sector (see Woodford,2001;Jordi and Mark, 2007;Clarida and Gali,2000; and Gali and Gertler,1998).

Other studies have also concluded that it might be necessary to assess the existing relationship between monetary policy and the manufacturing sector in a country before any of the two views can be adjudged to be correct. This might provide insights on how policy administration can be used to improve manufacturing sector growth. The rationale behind this argument is that countries differ from one another in terms of natural resources endowment, level of development, and institutional and structural set-up. The idea, therefore, is that priorities and objectives of monetary authorities in different economies might depend on these factors thereby making monetary policy to have varying degrees of effects on the manufacturing sector (See Blanchard and Gali, 2007; Bouchaour and Al-Zeaud, 2012).

Based on the foregoing, there is a possibility that the unique characteristic of oil abundance in oil-rich countries might influence the relationship between monetary policy and the manufacturing sector in the AOECs. In addition, it appears that there is yet to be a consensus on how monetary policy influences the output of the manufacturing sector especially in the AOECs. Among other studies Olomola (2007)

was more concerned with the relationship between oil rent and economic growth in oil exporting countries in Africa. Other studies such as (Mohamed (2011), Corden and Neary (1982), and Acosta), Lartey and Moudelina(2009) were more focused on the issue of "Dutch Disease" in some oil exporting countries. None of these studies or any one that we are aware of focused on the manufacturing sector of the AOECs that has been described has a major sub sector in the real sector of the AOECs that can play an important role in economic diversification.

While there is a near consensus that monetary policy does not have a long run impact on growth, there are some studies that still contradict this (See Nelson and Plosser, 1982; Tobin, 1965; Samba, 2013). Consequently, to provide a wider policy alternative that can help in promoting the growth of the manufacturing sector, this study explores the relationship between monetary policy and manufacturing growth in the AOECs using a panel cointegration analysis. Apart from allowing us to study the specific relationship between monetary policy and manufacturing output growth, the choice of panel cointegration will also allow us to verify if a long run relationship between the two variables exists in the AOECs or not.

3.2 Monetary policy and growth relationship

The issue of super-neutrality of money has been a subject of debate over the years. Arguments on whether the stock of money has lasting effects on real economic variables or not, have continued to generate contributions from many scholars (see for example, Sidrauski, 1967; Samba, 2013). However, according to Papademous (2003) the link between monetary policies and growth can best be explored, when we consider theoretical arguments, surrounding the relationship between monetary expansion and economic growth.

Theoretical analysis dating as far back as the 1960s, has contributed immensely to answering the questions surrounding the long-run super-neutrality which means that a change in money growth will only affect inflation in the long-run and, therefore, might

not have an effect on the real variables (Nelson and Plosser, 1982). However, this argument has to do with whether a permanent change in money growth would have a long-term or short-term effect on interest rates, capital accumulation and output growth. Briefly we shall assess these contributions as well as the empirical evidence on them sequentially.

In his model, Tobin (1965), examined a situation, which consists of agents saving for future consumption, only from their current income, by holding a cash balance or investing it in real capital assets. According to Tobin (1965), in such a situation, an increase in monetary expansion can lead to higher output growth. This assertion refutes the super-neutrality of money. The transmission mechanism through which this works, is that an increase in money, leads to higher inflation, which in turn reduces the rate of return on money and thus causes a portfolio shift in favour of real capital (Tobin, 1965).,The increase in capital stock, in turn, will lead to a rise in output per person in the long run.

After Tobin's (1965) work, there has been an emergence of advanced theories on the relationship between money, inflation and growth (see for example Stockman, 1981; Sidrausiki, 1967). These theories have challenged Tobin's analysis, that monetary expansion would have a positive and lasting effect on growth. The characteristics of these theories are that they consider an infinitely-lived representative agent with optimistic utility behaviour and where money is supernatural. That is real variables, including the growth rate of output are independent of money supply growth in the long-run.

According to Papademoos (2003), despite the generalization, this has not led to a complete consensus, or robust conclusion, on whether money has a long-run or short-run effect on growth. According to him, in a theory where economic agents are infinitely lived and taking cognizance of some other assumptions, such as money being a compliment to capital, monetary expansion might not influence real interest rates as

well as economic growth.“Super-neutrality of money holds here” but if we consider the alternative approaches where “overlapping generations” are used, support is provided for Tobin’s theory under an explicitly optimizing framework, where an increase in inflation as a result of money supply growth, causes a shift to consumption of portfolio investment. The increase in capital stock can cause outputs to rise in the long-run.

Blanchard and Simon (2001), have also pointed out, that the conclusion of theories on the role of money, in growth, depends on the relationship between real monetary balance and capital, for instance, if they are complimentary, higher monetary balance and inflation may reduce capital accumulation and growth in the long run. This is because there is a “cash-in-advance” constraint on spending, since money balance is employed to finance consumption and investments. But the reverse is the case when monetary growth and capital are treated as substitutes, as in Tobin’s (1965) model. Therefore, different hypotheses on functions of money, lead to different and even conflicting conclusions on the size and signs of permanent effects of monetary expansion on growth.

However, some theories have also supported the view, that there exists a long-run relationship between monetary expansion and growth, but they maintain that such a relationship will be negative (see for example Fischer and Modigliani, 1978; Lucas, 1987, 2003). Their analyses were based on welfare cost of inflation. The cost of inflation, which includes the cost of economic institutional structures, clearly implies a negative effect of increase in monetary growth (inflation) on economic growth. The uncertainty caused by inflation impairs the price mechanism. Which affects its efficiency and this can be expected to have adverse effects on productivity and consequently on economic growth.

On the whole, studies have supported the view that monetary expansion, leading to a permanent rise in inflation, will adversely affect long-term growth (see for example

Lucas, 1987, 2003). Notwithstanding this, a few empirical studies have identified a positive and others a negative long-run relationship between higher monetary expansion and growth. Nonetheless, the rate of inflation must be confined to a relatively low rate. This is in support of the position of Tobin (1965) and Alexey (2011), that a small dose of inflation might be necessary to promote growth and employment.

However, Papademos(2003),is of the opinion, that despite different positions on the negative effects of monetary expansion or inflation on growth, in the long-run it is still subject to consideration of empirical evidence. Consequently, we explore some empirical evidence to further examine the relationship between monetary policy and growth.

Nneka (2012), investigated the performance of monetary policy on the manufacturing sector in Nigeria. The study used interest rate, inflation rate, exchange rate, money supply, company tax rate and company lending rate as independent variables. A vector error correction model was used and Granger causality test was carried out among the variables. The study found a positive relationship between money supply and an index of manufacturing production, while other variables such as interest rate, inflation rate and exchange rate showed a negative relationship.

Alexey (2011), investigated the Dutch Disease and monetary policy in an oil-exporting economy with special focus on Russia. He employed a DSGE framework. The result showed that monetary policy, based on the Taylor principle, performs poorly in promoting economic growth of the oil exporting economy, while consumer price index, inflation targeting and exchange rate pegging, produce a more pronounced effect on the output level.

Onyeiwu (2012), examined the impact of monetary policy on the growth of the Nigerian economy. An ordinary least square estimating technique was used in the study. Results of the analysis showed that money supply has a positive impact on growth and balance of payment of the Nigerian economy, but a negative impact on the rate of inflation. The study recommended that monetary policy should be used to facilitate provision of a

favourable climate for investment through appropriate exchange rate, interest rates and liquidity management.

Ridhwana, De-Groot and Rietvelda (2011), examined the regional impact of monetary policy in Indonesia. The study used vector auto-regression to measure the regional impact of monetary policy shocks on regional output levels in Indonesia. From their results, the impulse responses derived from the estimated model, displayed variations in regional response to monetary policy shocks both in terms of magnitude and timing. The study supported the view that regional responses to monetary policy depends on different sectors′ composition, especially the manufacturing sector. It was also deduced from the study, that a firms′ size was part of the reason for differences in regional responses to monetary policy.

Anthony and Mustafa (2011), studied the impact of the financial sector and monetary policy reforms on non-oil exports of the Nigerian economy. They employed cointegration and error correction mechanisms. The results showed that the monetary and financial sector liberalisation has a significant positive effect on the growth of non-oil exports in Nigeria, hence the need to sustain a deregulated monetary policy in order to promote the non-oil output in Nigeria.

Peersman and Smet (2002), using the European economy, examined the impact of a change in monetary policy on output, in eleven industries between the period1980-1998. The study employed panel cointegration analysis and found that the negative effects of monetary tightening were more significant during recessions than in boom periods. The result also revealed the presence of cross-industry heterogeneity and that an asymmetric monetary policy effect was significant on the financial structure of the industries.

Gul, Mughal and Rahim (2012), examined the linkages between monetary policy instruments and growth in Pakistan. The method of ordinary least square was employed. The results showed that monetary policy tightening, with appropriate balance adjustment, in inflation rates, exchange rates and interest rates will have a positive

impact on growth in Pakistan. However, they pointed out that evidence from previous studies has suggested that in the short-run, an expansionary monetary policy will likely have positive effects on growth.

Nenbe and Madume (2012), empirically assessed the role of monetary policy in maintaining macro-economic stability in Nigeria. The study made use of a cointegration and error correction model, the results revealed that there exists a long run relationship between monetary policy variables and macro-economic stability in Nigeria. Money supply was shown to have a significant positive impact on the growth of the country.

Ditimi, Nwosa and Olaiya (2012), examined the impact of monetary policy on economic stabilization using an ordinary least squares estimating technique. They found that a monetary policy mix involving exchange rates and money supply have a significant impact on the growth of the Nigerian economy. They also established a long-run relationship between monetary policy variables and the growth of the economy as a whole.

Sahinoz and Cosar (2010), assessed sectoral growth cycles and the impact of monetary policy on the growth of the manufacturing sector in Turkey. Using a vector auto-regression model (VAR), it was found that the Turkish manufacturing sector, responded to a contractionary monetary policy shock, through a pronounced reduction in output. The degree of response varied from firm, to firm in the entire manufacturing industry of Turkey, with paper, chemical and paper product manufacturing firms being the most responsive.

Ibrahim and Amin (2005), assessed the relationship between exchange rates, monetary policy and manufacturing output growth in Malaysia. The study employed a VAR and found out that exchange rate shocks have a significant impact on manufacturing output - more than the overall growth of the economy. It was also shown that monetary policy tightening leads to a negative response from real activities. On the whole the study found that manufacturing output responds sharply to both monetary and exchange rate shocks more than the overall output of the Malaysian economy.

3.3 Methodology

Romer (1996) in his modification of Arrow's seminal work on the economies of learning by doing pointed out that investment in knowledge (experience) has a strong linkage with increase in productivity. According to Romer (1996), the indexes of experience by cumulative investment follow the following production function.

$$Y_{it} = F(K_{it}, A(t)L_{it}). \quad (3.1)$$

Where Y_{it} is the output of firm i , *A(t)* is the stock of knowledge of firm i at period t, K_{it} and L_{it} are the capital and labour of the firm at period t. Romer (1996) pointed out that labour is more productive due to accumulation of knowledge which also depends on experience. However, experience is a function of past investment. Consequently the growth rate of output of the firm can be written as a function of indexes of experience by cumulative investment as follows:

$$G(t) = \int_{-\infty}^{t} I(v)dv = k(t). \quad (3.2)$$

Where G(t) is the growth rate of the output of the firm, *I(v)dv* is the index of the cumulative investment which is equal to capital stock *k(t)*. However, the growth rate of output of the firm according to Romer (1996) is equal to the per-capita production function (real output/income) i.e.

$$y = k(t) \quad (3.3)$$

Substituting 3.2 in equation 3.3 shows that:

$$G(t) = y. \quad (3.4)$$

Where y is the real output

Again, in the money demand function, Romer(1996) postulated a relationship between inflation, money growth and interest rates as such that demand for real money balance is a decreasing function of interest rates and an increasing function of real income. That is:

$$\frac{M}{P} = L(r, y) \tag{3.5}$$

This can be written in linear form as:

$$\frac{M}{P} = \alpha y - \beta r \tag{3.6}$$

Therefore:

$$\alpha y = \frac{M}{P} + \beta r \tag{3.7}$$

Dividing both sides by α leads to:

$$y = 1/\alpha \left(\frac{M}{P}\right) + \alpha/\beta(r) \tag{3.8}$$

where $1/\alpha$ and α/β are elasticities of real money balances and interest rates respectively.Substituting equation 3.7 into 3.8 leads to:

$$G(t) = 1/\alpha \left(\frac{M}{P}\right) + \alpha/\beta(r) \tag{3.9}$$

Thus the growth rate of a firm can be presented as a function of the real money balance and interest rate which determines capital stock investment, where labour remains constant.

Our model is a modification of equation 3.9. In our attempt to study the impact of monetary policy on the growth rate of the manufacturing sector of the AOECs, apart from the monetary policy instruments like interest rates and money supply, we also include in the model as explanatory variables, some policy variables like exchange rates and inflation rates. Net domestic credit represents the financial sector indicator while gross capital formation is used as a control variable. The growth rate of the manufacturing sector is the dependent variable. More explicitly our model is expressed as:

$$G_{i,t} = \varpi_0 + \varpi_1 K_{i,t} + \sum_{j=2}^{6} \varpi_j M_{ji,t} + \mu_{i,t} \tag{3.10}$$

where$G_{i,t}$is the growth rate of output of the manufacturing sector of country *i* at time *t*, $M_{ji,t}$ comprises of the monetary policy instruments; real money balance measured by real money supply and real interest rate. It is also comprises of policy variables such as real exchange rates, and inflation rates as well as a financial sector indicator that is net domestic credit in the economy in country *i* at time *t*.$K_{i,t}$is the capital of country *i* at time *t* and $\mu_{i,t}$ represents the country specific stochastic variable. Note that *i*=1,2.....9 and t=1,2…….,40.

3.3.1 Definition of Variables

Based on literatures the following variables are used in the model, their definitions and unit of measurement are presented as follows.

Dependent Variable: Manufacturing sector growth $G_{i,t}$is the dependent variable. It is measured by annual growth rate of manufacturing value added. The aggregates are based on constant US dollars.

Explanatory Variables

Monetary Variables (M_{pt})

(i) Monetary policy instruments: real interest rates (%) and real aggregate money supply i.e quasi money (M2) (constant US dollar).

(ii) Policy variables: It involves real exchange rate (local currency unit per US dollar (period average) and CPI inflation rates.

(iii) Financial sector indicator: Net domestic credit (constant US dollar),

Control variable

This is the physical Capital (K)in the model. It is measured by the gross capital formation. It consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Data are in constant US dollars.

3.3.2 Estimation Technique

The estimation technique adopted for this study is the panel data error correction approach proposed by Westerlund(2007)[4]. Westerlund (2007) developed a new panel cointegration test that makes use of the structure dynamics rather than residual dynamics (see Demetriades and Fielding, (2010). Therefore since the new panel cointegration test makes use of structural dynamics it does not impose the restriction of common factors like the one that makes use of residual dynamics. The procedure is divided into three. The first stage is to test for stationarity,i.e panel unit root test.

The second stage is the error correction based panel cointegrationtest and the third stage is the estimation of both the long run and the short-run equations. Another rationale for this study's choice of this approach lies in the fact that Westerlund's (2007) panel cointegration is based on error correction. Therefore, short run relationships/dynamics are given more attention. This is necessary because of the near consensus that monetary policy often exhibits weak or no long-run relationship with real variables (see Tobins, 1965; Mundel, 1963). Again, the panel cointegration test is an array of tests that are normally distributed and can accommodate generally unit-specific short-run dynamics, unit-specific trends and slope parameters as well as cross-sectional dependence.

As earlier stated, Westerlund developed four panel cointegration tests which are divided into two separate groups. The first two tests developed by Westerlund(2007) test the alternative hypothesis that at least one cross-sectional unit is cointegrated, while the other two test the alternative hypothesis that the whole panel is cointegrated. The process of estimating our model starts with the panel unit root test.

[4] *The Westerlund cointegration implements a relatively new command in stata. The idea is to test for the absence of cointegration, that is to determine if any of the panel test is error correcting or not (Westerlund and Persyn, 2007).*

3.3.2.1 Panel unit root test

The panel unit root test explores the data characteristics of the panel before proceeding to the panel cointegration test. The idea here is to test for stationarity of each variable used in the study. According to Engel and Granger (1987) a variable may not be stationary but a linear combination of the non-stationary variables maybe stationary. So, we test for cointegration just to verify this. The method of panel unit root test adopted for this study is the Im, Pesaran and Shin (IPS) test. The test has been proven to be suitable in verifying stationarity of variables in panel data (see Im, Pesaran and Shin, 2003; Maddala and Wu, 1999).

Again, the choice of IPS has to do with the problem of intercept heterogeneity associated with many estimates. IPS allows for heterogeneity of the intercept. The IPS unit root tests are superior to the homogenous test when N (cross sectional unit) is relatively smaller than T (series). Therefore, in this study where T>N, the IPS is more suitable for the unit root test (See Chris Brooks, 2013). The basic IPS specification is given by:

$$\Delta y_{i,t} = \alpha y_{i,t-1} + \sum_{j=1}^{p_i} \gamma_{ij} \Delta y_{i,t-j} + \beta_0 + \beta_1 t + \beta_1 x_{i,t} + \varepsilon_{i,t} \ldots \quad (3.11)$$

where, β_0 is the constant, $x_{i,t}$ represents the explanatory variables, $\Delta y_{i,t}$ is the explained variable, $\beta_1 t$ is a time trend and p_i is the required lag length. The null hypothesis to be tested for the IPS is $H_0: \alpha_i = 0$, for all 'i's while the alternative hypothesis is $H_1: \alpha_i < 0$, for at least one i. The lag lengths are selected using the Akaike Information Criterion which is used mostly in panel estimation. According to Westerlund (2007) all series must be largely non-stationary series i.e. I(1) before a panel cointegration test can be carried out.

3.3.2.2 Error-correction based panel cointegration test

After the stationarity test, we proceed to the cointegration testor the error-correction based panel cointegration test developed by Westerlund (2007).The panel cointegration test model is given by:

$$\Delta G_{i,t} = \alpha_i + \theta_i ECT_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta G_{i,t-j} + \sum_{j=0}^{p_i} \pi_{ij} \Delta X_{i,t-j} + \varepsilon_{i,t} \quad (3.12)$$

Where X and $G_{i,t}$ are explanatory variables and manufacturing growth rate respectively, α_i, β_i and π_i are parameter estimates.ECT is the error correction term while parameter θ_i determines the speed of adjustment at which the system corrects back to equilibrium when there is a sudden shock. If $\theta_i < 0$, it means that there is error correction, which simply implies that $G_{i,tit}$ and mp_{it} are cointegrated. But if $\theta_i = 0$, then there is no error correction hence there is no cointegration. Therefore the null hypothesis is stated as $H_0: \theta_i = 0$ for all i while the alternative hypothesis depends on the assumption we made about the homogeneity of $\theta_i$and this varies in the four panel cointegration tests (see Demetriades and Fielding, 2010; Westerlund, 2007). The four tests are divided into two, namely: the group-mean test and the panel test.

3.3.2.3 Estimating the group-mean tests

Considering equation 3.12 which is the error correction based panel cointegration equation, we compute the group mean tests as follows (see Persyn and Westerlund, 2008):

$$V_\tau = \frac{1}{N} \sum_{i=1}^{N} \frac{\widehat{\theta}_i}{SE(\widehat{\theta}_i)} \quad (3.13)$$

$$V_\alpha = \frac{1}{N} \sum_{i=1}^{N} \frac{T\widehat{\theta}_i}{SE\widehat{\theta}_i(1)} \quad (3.14)$$

Consequently, the first two tests which verify existence of cross-sectional unit cointegration are estimated using equations 3.13 and 3.14. Both V_τ and V_α test statistics test the null hypothesis that there is no cointegration across all the cross sectional units, against the alternative hypothesis that there is cointegration in at least one cross-sectional unit(i.e $H_0^V: \theta_i = 0$ for all *i)* while $H_1^V: \theta_i < 0$ for at least one *i.* Therefore the rejection of the null hypothesis means that there is cointegration in at least one of the cross-sectional units.

3.3.2.4 Estimating the panel tests

The second sets of tests are the panel tests for cointegration. The test statistics are computed as follows:

$$B_\tau = \frac{\hat{\theta}}{SE(\hat{\theta})} \tag{3.15}$$

$$B_\alpha = T\hat{\theta} \tag{3.16}$$

Equations 3.15 and 3.16 are panel test statistics for cointegration. The null hypothesis is that there is no cointegration for the whole panel (i.e H_0^B:θ_i = 0 for all *i*)against the alternative hypothesis that there is cointegration for all the cross-sectional unitsi.e the whole panel(H_1^B:θ_i< 0 for all *i*). Once the null hypothesis is rejected it means there is cointegration for the whole panel.

The P values are computed based on both asymptotic test distribution and cross sectional dependence which makes use of the bootstrap values of the parameter estimates as the robust P values.

Asymptotic test distribution

According to Westerlund (2007) the asymptotic distribution of error-correction test is purely based on sequential limit theory which simply implies that T is taken to infinity before N. The implication of this is that for the test to be justified, T must be substantially larger than N. This is peculiar in our current study which features T=41 and N=9. Asymptotic P values are obtained for all the four categories of tests highlighted in equations 3.13, 3.14, 3.15 and 3.16 (see Elberhardt, 2011; Frimpong, 2011; Basher and Elsamadisy, 2010; Demetriades and Fielding, 2010).

Cross-sectional dependence

The bootstrap approach of computing the parameter estimates is used to capture the cross-sectional dependence. The idea behind this is that there is a possibility of cross-sectional correlation existing which can affect our results. Consequently, Westerlund (2007) developed bootstrap values which take care of any expected cross-sectional dependence (Ishibashi, 2012; Demetriades and Fielding, 2010). The P values obtained here are referred to as the robust P values even in the presence of common factors in time series. In this study the lags and the leads are set using the Akaike Information Criterion (AIC) as used by previous studies (see Westerlund, 2007; Pedroni 2000;Ishibashi, 2012; Demetriades and Fielding, 2010)and the Bartlett Kernel window width are set according to $4(T/100)^{2/n}$. The time series in this study is 41 years i.e T=41. Putting this into the formula for selecting the Kernel window gives approximately 3 which is the Irwindow. Considering the T which is 41, the number of replications regarding the bootstrap values is 400 (see seeWesterlund, 2007; Pedroni 2000).

Finally, after the estimation of the model, we test for cross sectional dependence. The essence of the test is to find out if the presence of common factors has an effect on the panel cointegration test result. Notwithstanding, bootstrapping has been identified as a remedy for the presence of the common factor (see Persyn, andWesterlund,2008;Ishibashi, 2012; Demetriades and Fielding, 2010).This further provides justification for bootstrapping. However, the test requires that T>N and in our study T=41 and N=9.This condition is not violated. Therefore, we can conveniently test for cross sectional dependence in the residuals.

3.3.3 Data

Data on manufacturing growth rate, capital stock proxied by gross capital formation of each AOEC, CPI inflation rates, interest rates, money supply and exchange rates are all sourced from World Bank Tables,

3.4 Results and discussion

This section presents data analysis and interpretation of the empirical results. We start by exploring the panel dimension of our data so as to understand the individual nature of the variables and to ascertain their suitability for the estimating technique adopted. This is done through the test for stationarity which is also known as the unit-root test. As explained in the methodology, determination of the order of integration is very important before embarking on the panel cointegration test. A non-stationary series contains unit roots and such series have the tendency of sustaining shocks. The reverse is the case for a stationary series,i.e a series that does not contain unit-roots. It is important that all the series are integrated in the same order before the error-correction based panel cointegration can be applied

Consequently, our first task is to perform the unit root test and determine the order of integration of all variables. In recent panel studies there are two well established and appropriate unit-root tests: the Im Pesaran and Shin(IPS) test and the Augmented Dickey Fuller (ADF)-Fisher Chi square unit root test (see Demetriades and Fielding 2010; Ishibashi, 2012; and Frimpong, 2012). Therefore this study also employs these two types of unit-root tests as follows:

3.4.1 Results of the unit root test.

Table 3.1 IPS and ADF- Fisher Chi square unit root tests

Variable	IPS Unit-root test			ADF-Fisher Chi Square Unit roottest		
	t* Statistics	P Value	Order of integration	P* Statistics	P Value	Order of integration
Mgr	-5.1512	0.000***	I(1)	201.5101	0.000***	I(1)
Infr	-4.2698	0.000***	I(0)	165.8511	0.000***	I(1)
Intr	-6.9332	0.000***	I(1)	90.5803	0.000***	I(1)
Ms	-2.8047	0.006***	I(1)	105.4495	0.000***	I(1)
Ndc	-4.9793	0.000***	I(1)	176.3935	0.000***	I(1)
Exr	-4.7159	0.000***	I(1)	199.6552	0.000***	I(1)

Cap	-4.9161	0.000***	I(1)	190.9667	0.000***	I(1)

"***" "**" and "*" represent statistical significance at 1%, 5%, and 10% respectively. Each model includes trend and constant terms

Table 3.1 shows the results of the unit-root test. It is clear that the series are integrated of order one, which is I(1) except the inflation rate which is stationary in levels under IPS unit root test only is assumed to be I(1) since this what we obtained under ADF-Fisher test. We nonetheless treat all variables as I(1), consistent with the ADF-Fisher Chi Square Unit root test results. The ADF-Fisher test has been identified as a better test for unit roots in panel data because it doesn't impose stringent measures like IPS where the panel must be balanced before it can be applied. Again ADF-Fisher also permits usage of different lag lengths in the ADF regressions. This might be difficult in IPS(see Demetriades and Fielding, 2011).We therefore proceed to the error-correction based panel cointegration test.

3.4.2 Error-correction based panel cointegration test results

Four basic types of tests were explained in the methodology for the purpose of testing for cointegration in panel data. The tests are conducted based on both asymptotic distribution and cross-sectional dependence i.e bootstrapping. Results of the asymptotic distributionfor the four tests are shown in Table 3.2

Table 3.2 Westerlund panel cointegration test (Asymptotic distribution values)

Statistics	Value	Z-value	P-value
Vt	-3.771	-1.942	0.026**
Va	-3.534	5.481	1.000
Bt	-4.494	4.389	1.000
Ba	-1.898	4.948	1.000

"***" "**" and "*" represent statistical significance at 1%, 5%, and 10% respectively.

Each test includes trend and constant terms. The lag and lead lengths are selected based on AIC and the Bartlett kernel window width is set according to $4(T/100)^{2/n} \approx 3$. In

asymptotic property estimation, the Bartlet kernel window has been shown to have the tendency of producing improved property relative and improved power size better than other conventional kernel like quadratic kernel. The T in the formula for calculating the Bartlet kernel window represents the number series which is 41 in our study and n is the number of cross-sectional units which is 9 countries. By substituting these values in the formula we get approximately 3 (See Philips and Sun, 2003).

The Table shows that cointegration is confirmed in one out of the four tests. This is at Vt only but Va , Bt and Ba all show acceptance of the null hypothesis of no cointegration. This is an indication that there appears to be a very weak long run relationship between the explanatory variables and the manufacturing growth rate. This might not be unconnected with the presence of the monetary policy instruments that are among the independent variables on which there is a near consensus that they are often not likely to have long run relationships with the real variables. Notwithstanding this, we estimate the error correction model in equation 3.12 using the fixed effect within regression. This is because Toress (2010) explained that fixed effects, unlike the ordinary least squares, considers heterogeneity across groups and time, hence the estimates from fixed effects models are more efficient. The results are presented in Table 3.3.

3.4.3 Fixed effect panel estimation

Table 3.3 shows the error-correction based panel cointegration regression result. The results are basically divided into two: the long and the short run relationships. The first aspect displays the variables in the non-differenced forms and thus explaining their long- run relationship while the second aspect shows the variables in their differenced forms showing their short-run relationships. Considering the long-run relationships, our empirical results indicate that besides monetary policy instruments, the policy variables which include exchange rates and inflation rates have no significant long-run relationship with the manufacturing growth rate in the AOECs. On the other hand the short-run relationship is different. The results show that three of the monetary variables

have a significant impact on manufacturing growth rate of the AOECs. Precisely, net domestic credit, the economy, money supply and exchange rate exhibit a significant impact on manufacturing growth rate of the AOECs.

The net domestic credit shows a negative relationship with the manufacturing growth rate. This is contrary to *apriori* expectations, which postulate a positive relationship. The reason for this might not be unconnected with the views of Nnanna (2002) and Kayode (2000) that most of the domestic credit meant for the development of the manufacturing sector through selective credit control policy in many developing countries is often diverted to other sectors by the banks. Thus, the positive effect of the released credit to the economy is not felt on the domestic manufacturing output growth. However, from the result, the negative effect or the inverse relationship between net domestic credit and manufacturing growth turns positive in the long-run, but no longer significant, meaning that the significant effect dies out in the long-run.

The exchange rate also shows a significant direct relationship in the short-run with manufacturing growth. Likewise, this significant effect is not sustained to the long-run. The direct relationship on one side means that increases in exchange rate (currency devaluation) may stimulate manufacturing growth rates of the AOECs in the short-run but in the long-run the effect appears not to be significant any longer. In addition, money supply also appears to have a significant and positive relationship with the manufacturing growth rate only in the short-run. The effect is also not significant in the long-run.

Considering the overall R square on table 3.3, it indicates that about 24 percent variation in the manufacturing growth rate is explained by all the explanatory variables. The estimated fixed effects model is also statistically significant when we consider the F statistic of 4.89 at 1% level of significance and the F probability value of 0.000. The implication is that the monetary policy instrument, policy variables as well as the financial sector indicator and the gross capital formation may jointly have a significant effect on the growth rate of the manufacturing sector of the AOECs.

Table 3.3 Fixed-effects (within) regression results of manufacturing growth rate and monetary policy.

Long-run model		Short-run model	
Variable	Coefficient (Standard Error)	Variable	Coefficient (Standard Error)
Inflation rates	-.1758862 (.1848733)	DInfr	-.031391 (.1298093)
Interest rates	-.0123941 (.1858485)	DIntr	.4748447 (.3168622)
Log of money supply	.1839855 (.4956953)	DlMs	.7774004* (1.059281)
Log of net domestic credit	.1338133 (.4116798)	DlNdc	-.6077424* (.499157)
Exchange rates	-.1774174 (.2047998)	DExr	.2501215** (.6462862)
Log of capital formation	.1849015 (.2279221)	DlCap	-.2185353** (.3736775)
Constant	42.13699 (46.53014)		
sigma_usigma_e rho	0.4400788 0.11628055 .12528863		

F(16, 121) =4.89; Prob> F = 0.0000;R-sq: within = 0.39 ; between = 0.100; overall = 0.24

Source: Author's Computation

3.4.4 Test for cross-sectional dependence

Furthermore, because of the possibility of cross-sectional dependence among the cross-sectional units we conduct a cross-sectional dependence test[5].In particular, the AOECs share a common feature of having oil as the mainstay of their economies hence there is a tendency of similarities among the cross-sectional units which may lead to cross-members' correlation. We generate the correlation matrix of the residuals and carry out a Breusch-Pagan LM test of independence (see Persyn and Westerlund, 2008;

Westerlund, 2007). The results of the cross-sectional dependence test are presented in Table 3.4.

Table 3.4: Correlation matrix of residuals

	--e1	--e2	--e3	--e4	--e5	--e6	--e7	--e8	--e9
--e1	1.000								
--e2	-0.023	1.000							
--e3	0.178	0.068	1.000						
--e4	-0.083	0.971	0.104	1.000					
--e5	0.252	-0.156	0.176	-0.105	1.000				
--e6	-0.070	-0.288	-0.098	-0.278	-0.113	1.000			
--e7	0.018	0.949	0.118	0.956	0.047	-0.299	1.000		
--e8	-0.096	-0.342	0.322	-0.308	0.305	0.051	-0.329	1.000	
--e9	-0.102	-0.127	0.518	-0.040	0.294	-0.060	-0.080	0.790	1.000

Breusch-Pagan LM test of independence: chi2(36) =181.946, Pr = 0.0000,H_0:There is no cross-sectional dependence

Source: Author's Computation

Table 3.4 shows the results of the cross-sectional dependence test. The results indicate the presence of common factors affecting the cross-sectional units. This confirms the possibility of cross-member correlations in the series.

This result necessitates bootstrapping in order to obtain a reliable result. Persyn and Westerlund, (2008) describe the bootstrapping option as a means of getting a robust P value even in the presence of cross-sectional dependence. Consequently we proceed to the panel cointegration test, taking into account cross-sectional dependencies. The results are presented in Table 3.5

Table 3.5 Panel cointegration test with cross-sectional dependence

Statistics	Value	Z-value	P-value	Robust P-value
Vt	-3.771	-1.942	0.026**	0.030**
Va	-3.534	5.481	1.000	0.995
Bt	-4.494	4.389	1.000	0.760
Ba	-1.898	4.948	1.000	0.885

*"***" "**" and "*" represent statistical significance at 1%, 5%, and 10% respectively. Each test includes trend and constant terms. The lag and lead lengths are selected based on AIC and Bartlett kernel window width is set according to 4(T/100)$^{2/9}$ ≈ 3.We allow for 400 bootstrap replications.*

Source: Author's Computation

The results in Table 3.5 show that in spite of taking into account cross-sectional dependence, the cointegration test still rejects the null hypothesis of no cointegration in only one of the four tests. This confirms a weak long-run relationship between monetary policy variables and manufacturing sector growth of the AOECs. From our previous discussions on the fixed effects estimated model, it is clear that the monetary policy variables are likely to exhibit a stronger influence on the growth of the manufacturing sector in the short-run than in the long-run. This finding shows some consistency in our results.

[5] *The test for cross-sectional dependence is based on the fact that T (number of series) must be greater than N that is number of cross-sectional units. According to Persyn (2008) this test will be impossible if this condition is not fulfilled.*

3.4.5. Dynamic panel estimation (SYS-GMM)

Furthermore, we explore the dynamic nature of the relationship between the monetary policy variables and the manufacturing growth rate through the use of dynamic panel data (see Mitze, 2010; Frimpong, 2012). The idea behind this is the fact that the dynamic panel analysis will be able to yield a more efficient, consistent and on the whole a more reliable estimator than the fixed effect model. In addition, the analysis of the estimation results of the fixed effects model has shown that the monetary variables appear to have a more significant impact in the short run than in the long run. Since dynamics are associated with the short run, we estimate a dynamic panel for our second level analysis. Given the performance found in many Monte Carlo simulation studies (see for example Soto, 2007) preference is given to Blundell-Bond SYS-GMM, thus serving as a robustness check on our estimated model in Table 3.3. The results of the SYS-GMM estimation are shown in Table 3.6.

Table 3.6: Dynamic panel data estimation of the relationship between manufacturing growth rate and monetary policy using SYS-GMM.

Variables	Coefficient	Standard error
Differenced log of lagged value of manufacturing growth rate	3.54e-13	2.70e-13
Differenced log of inflation rates	1.38e-13	2.93e-13
Differenced log of interest rate	-1.63e-12	1.02e-12
Differenced log of money supply	2.59e-12	1.60e-12
Differenced log of net domestic credit	-5.20e-12**	1.55e-12
Differenced log of exchange rate	2.71e-11***	2.40e-12
Differenced log capital formation	6.38e-12***	1.51e-12
Constant	-8.54e-13	4.56e-13

Wald chi2(15) = 315.95 Prob> chi2 = 0.000

Source: Author's Computation

Table 3.6 shows the results of the dynamic panel data analysis. The SYS-GMM results which indicate the short run relationship shows that both net domestic credit and exchange rates have a significant impact on manufacturing growth rate. Capital formation also, as expected, has a significant positive impact on manufacturing growth. These findings show consistency in our results when compared to the fixed effects estimation.

In the dynamic model, money supply shows a positive but not statistically significant relationship with manufacturing growth. However, both net domestic credit and exchange rates maintained their respective significant effects both in the short-run fixed effects model and in the dynamic panel model.Net domestic credit retains its significant inverse relationship with manufacturing growth in the short-run.

The exchange rate shows a positive significant relationship with manufacturing growth in the dynamic model. This means that our results support devaluation to promote the growth of the manufacturing sector in the short-run. In addition, all other monetary policy variables such as inflation rates, interest rates and money supply fail to have any significant impact on the manufacturing growth rate of the AOECs.

Finally, considering the overall test of statistical significance, the dynamic model is statistically significant, like the fixed effects model. This shows that with the focus on short run effects only, all the monetary policy variables used in our model will jointly have a significant influence on the growth of the manufacturing sector in the AOECs.

3.4.6 Inferences and comparison with previous empirical studies

Firstly, the results show that there is a weak long-run relationship between individual monetary policy variables and growth of the manufacturing sector in the AOECs. In both the static and dynamic panel models, all monetary policy variables demonstrate a more significant impact in the short-run than in the long-run. This is in line with findings of some authors who have shown that monetary policy variables demonstrate little or no significant long-run relationships with growth of real output (see Mundel,

1963). However, our findings do not completely refute the existence of a long-run relationship because it appears that Tobin's Principle which supports the existence of long run relationship between money and output is also supported by our result.

According to Tobin(1965), the monetary transmission mechanism through which growth can be boosted in the long-run is via expansionary monetary policy which increases the volume of money in circulation. This will lead to an increase in inflation which in turn leads to higher portfolio investments. The increase in capital stock can thus bring about improvements in growth in the long-run. Many authors have found the existence of a long-run relationship between some of the variables e.g exchange rate, capital formation and growth (see Cipollini, Hall and Nixon, 2012; Nenbe and Madume, 2011; Gul, Mughal and Rahim, 2012).

It can be inferred that the panel estimation results are reflections of the fact that we focused on manufacturing growth rate only rather than the over-all growth of the AOECs' economies. This shows that the manufacturing sector growth can be significantly affected by monetary policy instruments, especially money supply in the short-run(transitory). The interest rate however, has not been shown to be a strong determinant of manufacturing sector growth even in the short run. Moreover, it appears that monetary policy generally appears to have more of a transitory effect on manufacturing growth rate in the AOECs.

Secondly, our result fails to convincingly support the general belief that expansionary monetary policy will have a positive and significant relationship with growth. This is because despite the fact that the coefficient of money supply is statistically significant in the fixed effects model, it fails to show a significant impact on the manufacturing sector growth in the dynamic model which produces a more reliable estimator. These findings are consistent with Anthony and Mustafa, (2011); Gul, Mughal and Rahim, (2012); and Ditimi, Nwosa and Olaiya, (2011) who found that expansionary monetary policy will promote manufacturing growth, although some see it otherwise (see, Nenbe and Madume, 2011).

Our results also show that net domestic credit has a significant negative relationship with growth of the manufacturing sector in the AOECs in the short-run, but the significant effect dies off in the long-run. The implication of this is that an increase in domestic credit might not necessarily promote the growth of the manufacturing sector in the AOECs. This might well be the reason why the money supply does not have a significant impact on manufacturing sector growth of the AOECs. Apparently, selective credit control often used by the central banks to increase credit supplies to a particular sector of the economy, might not be effective in controlling credit channels after all in some AOECs.

Our investigation shows that credit allocation to the manufacturing sector in some AOECs has been dwindling over the years. For instance, in Algeria it fell from 16.5% in 2009 to 14.8% in 2011; in Egypt it fell from 42% in 2009 to 31.3% in 2011;while in Nigeria, it fell from 38.6% in 2008 to 21.15% in 2011 (World Bank, 2012). In another separate finding, the Central Bank of Nigeria(CBN) (2008) discovered that less than 5% of the Nigerian banks comply with the selective credit control policy of the CBN.

It should be noted that selective credit control is one of the policies of the CBN designed to develop some particular sectors of the economy. According to the policy, the CBN usually directs or mandates commercial banks to improve credit allocation to particular sectors of the economy. Nnanna (2000) reveals that the CBN special order or directive is not being followed by many of the commercial banks in Nigeria. This is evident in the Nigerian economy where huge loans are made available to civil servants in the form of soft loans. Many of these loans were supposed to be made available to manufacturers if the directive of the CBN is followed, but because of the problem of loan recovery associated with manufacturing loans among others, many of the Nigerian banks often divert loans meant for the manufacturing sector to other sectors where loan recovery will be easier(see Kayode, 2000; CBN, 2009; and Nnanna, 2003). This is an indication that credit diversion is rampant in the AOECs, and consequently the purpose and intention of monetary authorities of either to follow a market based credit allocation or selective credit control are often sabotaged by financial intermediaries.

Furthermore, findings from our study also show that inflation has a positive but not significant effect on the growth of the manufacturing sector both in the long run and the short-run. This is an indication that the level of inflation currently experienced in the AOECs might not be having a notable influence on manufacturing industries' output. In the same vein, the interest rate has the appropriate inverse relationship, but it still fails to have any significant impact on manufacturing sector growth in the AOECs. This has further supported the inverse relationship between manufacturing growth rate and net domestic credit. It shows that interest rates have not played a significant role in stimulating the growth of the manufacturing sector in the AOECs. The reason might not be unconnected to Aiyegbusi (2010) who observed that the large number of people that do not have access to banking in most developing countries, have limited the effectiveness of monetary policy tools, such as interest rates.

The exchange rate has a significant positive relationship with manufacturing growth rates in the short-run. This finding has supported the growing literature on currency undervaluation and growth in most developing countries. Many empirical studies have strongly supported the view that the positive relationship between growth and exchange rates is more pronounced in developing countries than in the developed countries (see Rodrik, 2008). Our study has not deviated from this position since all the AOECs are developing countries. It further shows that despite our focus on the growth of the manufacturing sector, the currency value that is based on equilibrium level of exchange rate has been shown to have a significant and positive relationship with the manufacturing growth rate in the AOECs. The mechanisms through which this works can be explained within the confines of development economics in that an increase in the exchange rate (i.e fall in value of currency) will discourage imports and encourage exports. This has the tendency of boosting domestic output and consequently promotes the growth of the real sector (see Todaro, 2003).

Finally, our findings have shown that a combination of the monetary variables will have a significant impact on the growth of the manufacturing sector of the AOECs. This is shown in both the dynamic panel and fixed effects models. The overall test of statistical

significance through both the Chisquare test value and Wald test confirmed this. This result is similar to the conclusion of many studies that have posited that an appropriate monetary policy mix that reflects the empirical relationship obtained in this studywould have a significant effect on the manufacturing growth rate and overall growth of most economies (see Olomola, 2007; Oladipo and Fabayo, 2012).

3.5 Summary and Conclusion

3.5.1 Summary

The study explores the impact of monetary policy on the growth of the manufacturing sector of AOECs. Selected monetary policy variables are used and through the endogenous growth approach a model expressing manufacturing growth rate of the AOECs as a function of the selected monetary variables is formulated. Specifically, the selected variables are interest rates, inflationary rates, money supply and exchange rates while capital formation is added as a control variable. Based on the nature of our data, the recently developed panel cointegration analysis with special focus on Westerlund's (2007) error-correction based panel cointegration test is employed. This approach makes use of the structure rather than residual dynamics i.e a structurally based panel cointegration test. Data for the analysis were collected from both the World Bank Tables and Penn World Tables.

The analysis begins with the exploration of the nature and panel dimension of the data used. This is carried out using two methods of the unit-root test namely: Im, Pesaran and Shin(IPS) test and ADF-Fisher Test. The results from the stationarity test indicate that all the variables are integrated of order one I(1). Consequently we proceed to the error-correction panel cointegration test. The four tests i.e the group-mean test which are Vt, Va, and the panel tests; Bt and Ba developed by Westerlund, (2007) are first conducted based on asymptotic distribution. The results show that cointegration is confirmed at Gt only while it is rejected in the remaining three tests. This indicates that there is a weak long-run relationship between manufacturing growth rate and the monetary policy variables.

The model estimation is next and the fixed effect within group approach is used to estimate both the long-run and the short-run relationship between the monetary policy variables and the manufacturing growth rate. The results from the model estimation fall in line with the results obtained from the cointegration test as two of the monetary policy variables are significant in the short-run against none in the long-run. Specifically, both exchange rates and net domestic credit show a significant relationship with the manufacturing growth rate in the short-run while none of the variables is significant in the long-run. Considering the tendency of existence of cross-sectional dependence in our analysis, we carried out a cross-sectional dependence test and the results show the presence of cross-sectional unit correlation. This can have negative implications on our analysis hence bootstrap values are used to conduct the panel cointegration test again. The results are similar to the previous ones on asymptotic distribution even after taking care of the cross-sectional dependence. The existence of a long-run relationship is also confirmed in one of the four tests.

Following previous studies, we use the dynamic panel analysis to estimate only the short-run relationship between monetary policy variables and manufacturing growth. The results show an almost similar result to the fixed effects estimation. Net domestic credit, exchange rate and capital formation all show a significant relationship with the manufacturing growth rate in the dynamic panel analysis.

Explicitly, in the short-run, money supply shows an insignificant positive relationship, net domestic credit shows a significant negative relationship while exchange rates show a significant positive relationship with the manufacturing growth rate. Moreover, the over-all significance of the two model estimations, that is, both the fixed effect and dynamic panel analysis, show that they are both statistically significant. The F test of the fixed effect estimation, the Chi-square value and the Wald test in the dynamic analysis all confirmed this. The implication of this is that the combination of the monetary policy variables has a significant effect on manufacturing growth rate of the AOECs.

3.5.2 Conclusion

Some important conclusions can be made from the findings and inferences drawn from our empirical analysis. Firstly, we can conclude that based on the findings of this research, it appears that monetary policy has more transitory (short-run) than long run effects on the growth of the manufacturing sector of the AOECs. This is evident from the fact that we obtained a weak long-run relationship. A relatively large number of the monetary policy variables are individually statistically significant in the short-run, while in the long run all monetary variables are statistically insignificant.

Net domestic credit has shown a significant and negative relationship with the manufacturing growth rate. Consequently, our findings have shown that an increase in net domestic credit in the economy might not translate to the growth of the manufacturing sector. Further investigations show that in many of the AOECs there are indications that the bulk of net domestic credit does not go to the manufacturing sector. Again, because credit diversion is noticed in many of these countries, selective credit control policies of some central banks appear not to be working for their manufacturing sectors. Accordingly, the aims of the monetary authorities are often not achieved and this has prevented the total credit in the economy from having a significant positive impact on manufacturing growth in the AOECs. The aforementioned findings could have been the reason why the money supply fails to have any significant impact on the manufacturing sector's growth.

Furthermore, it appears that interest rates do not have any significant impact on growth of the manufacturing sector, both in the long and short-runs. This finding can be linked to the behaviour of the net domestic credit in the AOECs. Since interest rates are not showing any significant influence on the manufacturing growth rate, net domestic credit and money supply in the economy are not likely to have a positive effect on the manufacturing sector. Investigation has revealed however, that most of the developing nations still have a large number of people that do not have access to banking, and investment decisions are at times often based on profit and rate of return rather than cost

of capital. This has been limiting the effectiveness of interest rates in controlling the real sector of the economy of the AOECs. Despite this, the study has also shown that the level of inflation in AOECs is not a major factor determining the growth rate of the manufacturing sector.

In addition, exchange rates have demonstrated a significant positive relationship with the growth of the manufacturing sector. This has contributed to the growing body of literature showing that undervaluation of currency promotes growth of output in developing countries; although our results have also shown that this only happens in the short run. That is, the situation might be reversed in the long-run as exchange rates are usually prone to shocks.

Finally, findings in this study show that all the variables used jointly have a significant impact on the growth of the manufacturing sector in the AOECs. Therefore, to promote the growth of the manufacturing sector in the AOECs, an appropriate monetary policy mix that focuses more on boosting investment (capital) in the manufacturing sector through an increase in money supply should be embraced. Since currency valuation based on equilibrium exchange rate appears not to be working, monetary policy approaches might embark on alternative ways of boosting credit allocation to the manufacturing sector. This study has shown that a shortage of net domestic credit to the sector appears to be having an adverse effect on its growth.

In addition the study shows that the exchange rate has a positive and significant impact on manufacturing growth in the short-run. The implication is that the appropriate monetary policy mix to boost the growth of the manufacturing sector should also discourage overvaluation of currency. This approach has the tendency of restricting imports and encouraging exports.

CHAPTER FOUR

Monetary policy transmission mechanism and growth of the manufacturing sector in Africa's oil exporting countries (AOECs).

4.1 Introduction.

There is near consensus that monetary policy has only transitory effects on economic activity. However, the way in which monetary policy influences economic activity remains a subject of debate. This debate has given rise to some research on the assessment of the transmission mechanism of monetary policy and its influence on real activities. While there are some studies on this assessment in developed economies, there is still limited research on the developing economies (see Ngalawa and Viegi, 2011).

The situation is worse for oil rich countries in Africa. Empirical literature on the monetary policy transmission mechanism in Africa's oil exporting countries remains limited. Several studies have been carried out on the subject in Nigeria, which is the largest oil producer in Africa. Mordi and Adebiyi, (2010), Mahmud, (2009) and Riman, Akpan and Offiong, (2013) among others, have studied issues relating to monetary policy mechanisms and growth in Nigeria within the context of oil price shocks.

A unique aspect of the AOECs is the fact that oil is the mainstay of their economies and contributes the largest percentage to their GDPs, while also providing 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; in Angola it generates 85percent of the total export earnings, and in Gabon it generates 80percent of the total export earnings. Another factor common to AOECs, are the enormous resources generated from oil which have not been translated into overall economic development (World Bank, 2012; IMF, 2010). The prevalence of unemployment, poverty, an excessive importation of manufactured goods, infrastructural decay, inadequate power

and energy supplies and low human development index are testimony to the position of the World Bank and the IMF.

The dwindling nature of oil reserves in most AOECs and the myriad of problems facing them resulted in the stern warning by the IMF in 2010 that if by the end of the next two decades there is no positive effort towards diversification of these economies; most will run into deep economic recessions (IMF, 2010). This is where the manufacturing sector of these countries has a key role as many of the AOECs are heavily dependent on imported manufactured goods. The focus on the oil sector has led to the neglect of the manufacturing sector leading to a fall in domestic output and a rise in the prices of local manufactured consumer goods. For instance, the Algerian government has been subsidizing the price of manufactured consumer goods since year 2000. 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.

Lack of growth in the manufacturing sector of the AOECs has aggravated the existence of structural imbalances in terms of high inflation rates and increased unemployment rates. In Nigeria in the past two decades more than 160 textile manufacturing firms have closed down leading to a loss of about 100,000 jobs (Adegbite, 2012).

Structural imbalances and economic instability in the AOECs have made inflation and exchange rate policies less effective in resuscitating 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 dependence on the oil sector and promoting development of the AOECs (African Development Bank (ADB) report, 2010). This, according to the ADB (2010) requires a thorough assessment of the monetary policy administration in a way that 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, manufacturing as a crucial part of the non-oil sector requires a favourable climate in terms of inflation and exchange rate polices and general administration of monetary policy to be able to remain domestically competitive in the AOECs.

For instance, there are two divergent views on the type of exchange rate system suitable for monetary policy instruments′ effectiveness in the monetary policy transmission mechanism (MTM). According to Aliyev (2012), policy makers are often faced with the challenges of choosing between a fixed exchange rate regime which is a good recipe for maintaining economic stability and a 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. Some studies follow the Mundel-Flemming model that identified a flexible exchange rate system as the most suitable for monetary policy (see Blanchard, 2008; Degrauwe, 2000 and Gregory, 2007) while others have criticized some assumptions of the model and have posited that monetary policy can also be effective under a fixed exchange rate system. These researchers criticize the assumptions of exogenous money supply, perfect international capital markets and inelastic exchange rate expectations in the Mundell-Fleming model. They argue~~d~~ 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~~.~~ (see Serrano and Saumna, 2010; Habib and Sttrashy, 2008; Habib and Kalamova, 2007).

This study, therefore, is a country based analysis using five AOECs that have adopted different types of exchange rate systems. This will allow us to ascertain the exchange rate regime that is more suitable for monetary policy instruments to have a significant impact on manufacturing growth in the AOECs within the framework of the MTM. Since Chapter Three has shown that monetary policy is more effective in the short run, a Structural Vector Auto-regression model is adopted since it is based on short run analysis. In addition, the idea of studying individual economies separately follows directly from the findings in Chapter Three where the panel result confirmed that

country specific factors might affect the results. That is, individual countries in the AOECs might likely possess some peculiar characteristics that distinguish them from each other.

Based on the foregoing, examining the linkages between the MTM and manufacturing output growth in the AOECs is imperative. This has the potential to expose the problems of the manufacturing sector and consequently tackle them through a robust monetary policy arrangement. To the best of our knowledge, there is no study that we are aware of that has investigated the monetary transmission process in AOECs, with particular attention to the manufacturing sector. In addition, this study, among others, contributes to the literature by attempting to understand the relationship between oil price shocks and manufacturing sector growth in AOECs within the context of the monetary transmission process.

4.2 Objectives

The major objective of this Chapter is to examine the relationship between oil price shocks and manufacturing sector growth within the framework of the monetary policy transmission process in AOECs. The study will also investigate:

(i) the behaviour of monetary policy instruments (MPIs) to shocks from oil prices;
(ii) vulnerability of manufacturing output growth to both monetary policy shocks and oil price shocks;
(iii) the role of oil output as an intermediary in transmitting shocks from oil prices through the monetary policy transmission mechanism (MTM);
(iv) relative effectiveness of different exchange rate regimes in the monetary policy transmission mechanism; and
(v) comparative patterns of monetary policy administration in individual countries of the AOECs, and their effect on output growth of their manufacturing sectors.

4.3 Scope of the study and justification

Africa has been identified as one of the few continents in the world with many countries that are naturally endowed with mineral resources. Prominent among these resources is oil. With about eleven net oil exporters the unique feature of oil production in Africa is that all the major oil producing countries (i.e AOECs) which are net oil exporters are controlled by a cartel called Organisation of Petroleum Exporting Countries (OPEC). Therefore, both oil production and export are regulated by OPEC. The bulk of oil export in Africa is controlled by the following net oil exporters; Nigeria, Algeria, Libya, Angola, Egypt, Sudan, Equitorial Guinea, Garbon, Cameroon, Congo Democratic Repubic and Chad. 80 percent of the total oil production in Africa is produced by these countries (OPEC, 2008).

However, the focus of the study is on Nigeria, Algeria, Libya, Egypt and Gabon . These countries are used as case study for the AOECs. The rationale behind the selection of these five countries is based on the OPEC data presented in Table 4.1 below.

Table 4.1 Ranking of Africa'snet oil exporting countries

Strata	Countries	Oil export bpd	Rank
First (above 1m bpd)	Nigeria	2.2 million bpd	1st
	Algeria	2.1 million bpd	2nd
	Angola	1.9 million bpd	3rd
	Libya	1.7 million bpd	4th
Second (500,000-1m bpd)	Egypt	680,000 bpd	5th
Third (below 500,000bpd)	Sudan	487,000 bpd	6th
	Equatorial Guinea	346,000 bpd	7th
	Rep. of Congo	274,400 bpd	8th
	Gabon	241,700 bpd	9th

Source: OPEC data 2010

**Bpd: Barrels of oil per day*

From the first stratum, Nigeria, Algeria and Libya are picked for the purpose of our analysis. Angola is excluded due to non-availability of data on some of the variables needed. Egypt is included as the only country that falls in the middle class or the second stratum. In the third stratum, three of the countries in the group belong to the same monetary zone, the Central African Monetary Zone (*CommunauteEconomiqueetMonetaire de l' AfriqueCentrale(CEMAC)*)[5].They are: Equatorial Guinea, Congo and Gabon. Monetary policy in these countries is administered by only one Central Bank called [6]BEAC. Sudan is the only country in the group outside the monetary zone.

Over the years the Sudanese economy has been ravaged by incessant war characterized by civil and political unrest, making it difficult to get data on some of the variables needed. Consequently, Gabon which appears to have the most complete data set on all the variables needed, and is among the members of CEMEC, was picked to represent the group. Since we are considering a monetary policy transmission mechanism, it is obvious that these three countries i.e Equatorial Guinea, Congo and Gabon, are most likely to share common features in monetary policy administration because their monetary policy is handled by a common Central Bank.

[5] *CEMAC (Central African Economic and Monetary Community) is a monetary zone which comprises of six countries namely; Cameroun, Equatorial Guinea, Gabon, Central Africa Republic, Rep of Congo and Chad.*[6]*BEAC is the Central Bank controlling the CEMAC monetary zone and operates a fixed exchange rate system where their currency is pegged to the Franc.*

4.4. A brief review of the five economies

4.4.1 Introduction

Based on the discussion in chapter four the following countries are selected among the AOECs for the purpose of assessing the relationship between oil price shocks, monetary policy transmission mechanism, and output growth of the manufacturing sector: Nigeria, Algeria, Libya, Gabon and Egypt. However, to provide enough empirical evidence for the assessment it is important to examine the individual peculiarities of these countries in terms of their economic structure with regardto monetary policy administration, and the status of their manufacturing sector.

Consequently, this chapter focuses on an assessment of all the five net oil exporting countries in Africa so as to provide an adequate reference for the findings at the end of the empirical assessment. This chapter also examines some literatureon past empirical studies that are related to the subject under consideration. This will form a basis for making a comparison between our findings and those of other studies. It is our belief that this will guide us in making appropriate inferences that will lead to a more realistic conclusion at the end of this study.

4.4.2. Nigerian economy and monetary policy administration

Nigeria is the largest producer of oil in Africa. With oil production of about 2.2 million barrels per day, it is not surprising that the economy is driven solely by the oil sector (OPEC, 2008). Since 2004, the growth of the economy has been on a downward trend. The growth rate of real GDP fell from 7.4 percent in 2011, to 6.6 percent in 2012. Despite enormous deposits of crude oil the economy has been finding it difficult to transform wealth from the oil sector to the overall development of the economy. This major challenge facing the economy is compounded by an upsurge in insecurity arising from religious and ethnic conflict making the investment climate in the economy very precarious for prospective investors. The oil sector grew at an average growth rate of

8.0 percent in 2012, while the non-oil sector growth rate has been -0.35 percent for the same year.

Despite having 34 different recorded minerals including gold, limestone, iron ore, tin and exporting approximately 2.3 million barrels of oil per day, the growth of the economy has not seen any structural changes leading to sustainable economic development. The unemployment rate rose from 21 percent in 2011 to 24percent in 2012. The economy has been tailored towards two main aspects of development, namely oil and agriculture. However, external shocks in the form of flooding and security challenges have continued to affect the development of the agricultural sector.

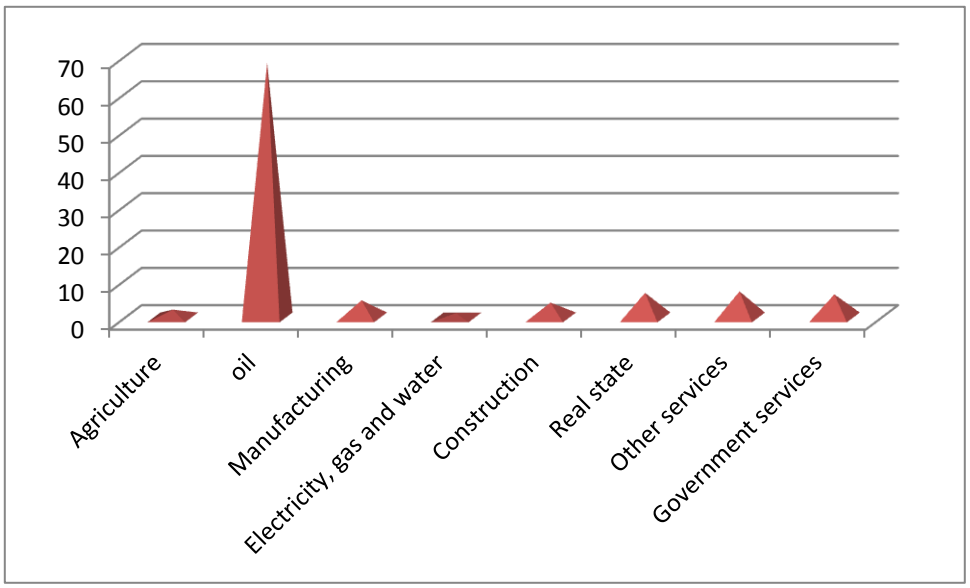
The manufacturing sector has been dormant since the 1990s. In the 1980s the sector was driven by 209 textile mills, which have now been reduced to less than 40 (NVS, 2009).The economy witnessed a massive deindustrialization since the 1990saggravated by the closure of major manufacturing companies, such as the United Africa Company(UAC). Some major challenges in the manufacturing sector are poor infrastructural facilities, erratic supplies of power and energy and an influx of Chinese textile products. Coupled with a high rate of insecurity, this has made the entire investment climate in Nigeria unfriendly.

Monetary policy in Nigeria has focused mainly on reduction of the inflation rate to single digits, leading to monetary tightening since 2011. A steady decline in the inflation rate was recorded in December 2011 when it fell from 11.2 percent in January 2011, to 10.3 percent in December 2011. The inflation rate picked up steadily in 2012 owing to a partial removal of the oil subsidy. Consequently, in mid 2012 the CBN increased tightening measures on monetary policy which led to a very sluggish growth of the money supply. Major drivers of inflation in the economy have been prices of consumer goods, electricity, housing, water and transport. The high inflation rate in 2011 led to an increase in the interest rate as the CBN’s monetary policy tightening measure. The exchange rate regime has been a controlled floating system with the use

of external reserves to augment shortfalls. This has seen the value of the Naira against the US dollar hovering around 157 and 160 naira for both years 2012 and 2013

The oil sector is contributes about 85percent of the total export earnings and about 40percent of the total GDP making the sector the most vibrant of all the sectors in the economy. Figure 4.1shows the summary of the contributions of various sectors to the GDP.

Figure 4.1: Contributions of each sector to the Nigerian GDP in 2010



Source: World Bank 2010

From figure 4.1, the total percentage contribution of each sector to GDP is as follows: Agriculture, 3.9 percent; extraction and construction, 1.2 percent; electricity, gas and water, 0.2 percent; real estate and business services, 6.2 percent; manufacturing, 1.9 percent; oil, 40.9 percent; other services, 18 percent; and Government services, 0.7 percent. It is clear from figure 5.1 that the Nigerian economy is driven by the oil sector.

4.4.3 Algerian economy and monetary policy administration

Algeria is the second largest producer of oil in Africa, after Nigeria. The Algerian economy is largely driven by oil and produces about 2.1 million barrels of oil per day (OPEC, 2008). In recent times however the attention of the government has shifted to diversification of the economy and since the turn of the century, the dominance of the oil sector has drastically declined. The contribution of oil to the country's GDP fell from 40.2 percent in 2005, to 36.7 percent in 2011. Nonetheless, oil still constitutes almost 97 percent of the total exports of the Algerian economy.

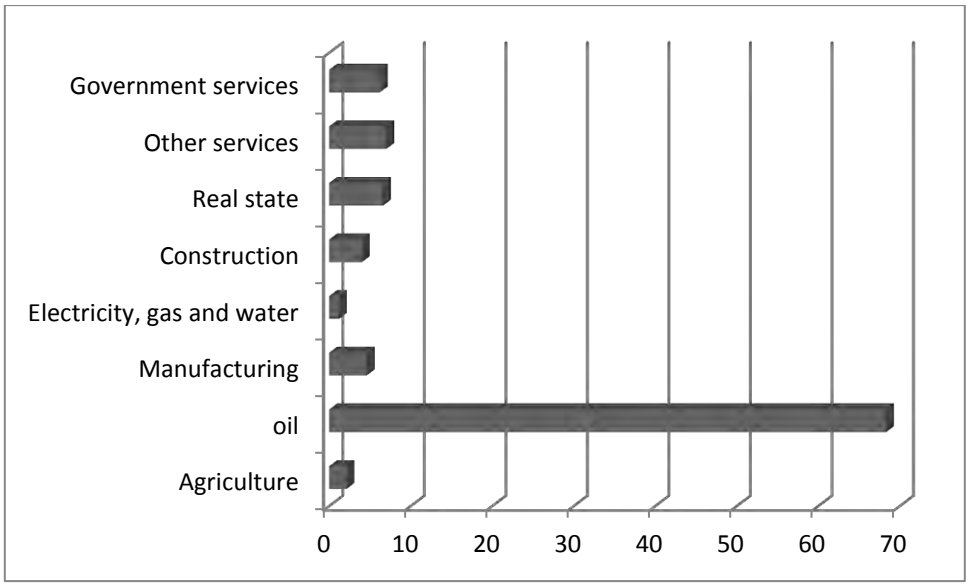
Foreign reserves have increased considerably from 181 billion USD in 2011 to about 190.7 billion USD in 2012. This was achieved following the development of hydrocarbons components for pharmaceuticals. The proceeds have been used to modernize the economy and the development of social and infrastructural facilities. This has significantly increased government expenditure by 2.3 percent, widening the budget deficit to 3.3 percent of GDP in 2012.

The manufacturing sector has not witnessed any significant growth in the past two decades. Recent surveys have shown that its contribution to GDP fell from 4.2percent in 2011 to 3.9percent in 2012 leading to a rise in the prices of manufactured consumer goods. Consequently, the Algerian government has been subsidizing domestic prices of consumer manufactured goods for some years now. The total subsidy expenditure has risen from 175 million USD in 2009 to about 3billion USD in 2012. This has aggravated government expenditure and increased the inflation rate from 4.49percent in 2011 to 8.3percent in 2012.

Monetary policy has been handled by the Bank of Algeria with the primary objective of controlling inflation, money supply and exchange rates. Despite the control measures by the bank, inflation rose to 8.9 percent in the first quarter of 2013. The country practices a controlled floating exchange rate system. The exchange rate is strictly controlled around a minimum rate of Algeria Dinar to US dollar. In January 2014 the exchange rate was 81.5 DZD to 1 USD and this has been monitored strictly with the use of

external reserves. Despite the rise in growth rate of broad money (M2) from 11.97percent in 2011 to 19.9percent in 2012 owing to the increase in domestic credit, the cash in circulation continues to dwindle. The currency in circulation fell by 8percent in 2012 and overnight deposits collected by banks also fell by 3percent in 2012. Currently the monetary authorities are pursuing a reduction in the inflation rate to single digits by 2014. The contribution of each sector to the GDP is shown in figure 4.2.

Figure 4.2: Contributions of various sectors to GDP in Algeria in 2010



Source: World Bank 2010

Allocation of percentage contributions to the GDP as shown in figure 5.2 is as follows: Agriculture8.6 percent; construction9.6 percent; electricity0.8 percent; real estate and business services3.2 percent; manufacturing3.9 percent; petroleum38.5 percent; government services16.2 percent; and other services19.2 percent.

It is apparent that the Nigerian and Algerian economies have a lot in common. Apart from the fact that the oil sector is the predominant sector in these economies, their manufacturing sectors are also among the least contributors to the GDP.

4.4.4 Libyan economy and monetary policy administration

Libya is among the largest net oil exporters in Africa. With an average of 1.7 million barrels of oil production per day, the oil sector in Libya has continued to drive the economy. The activities of insurgents in the Arab countries in recent years have adversely affected the economic performance of Libya. Although our study covers the pre-revolution period in Libya, both the pre- and post-revolution economic performances will be briefly examined.

Like most other AOECs, Libya's economy is largely dependent on oil and economic performance is predicated on the growth of the oil sector. The oil sector contributed about 90 percent of the total government revenue in 2007.It also accounts for almost 95 percent of total exports. However, following the revolution that eventually toppled the administration of Muammar Gaddafi in 2011, by 2012, oil production declined to about 1.2 million barrels per day.

Government expenditure depends largely on oil revenue and virtually all the government's budget is financed through the proceeds from oil. Fiscal deficit widened from 5.6 percent in 2007 to about 6.6 percent of the government budget in the wake of the Libyan revolution in 2010. The major reason for this has been the contraction in oil production, the major source of government revenue.

Before the revolution, government had been making efforts to diversify the economy but the US and UN sanctions in early 2000 were major factors against the effectiveness of the economic diversification policy. Lifting of sanctions in 2004 created renewed interest by the government in diversifying the economy and within two years improvements were seen in the contributions of agriculture, construction and services, but this progress was halted again in the wake of the 2011 revolution.

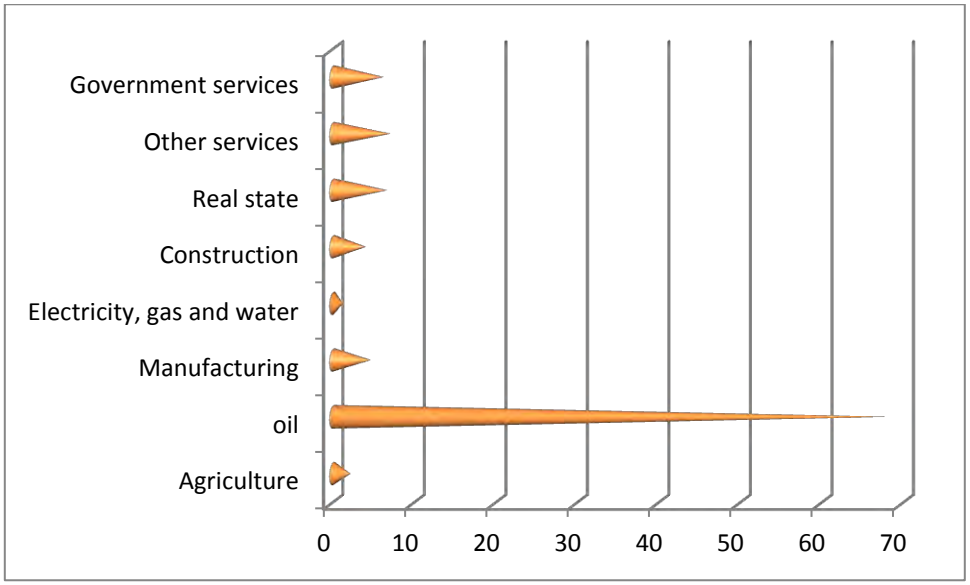
The performance of the manufacturing sector has continued to dwindle since 1970 when the country experienced an oil boom. The sector's contribution to GDP fell from 7.8 percent before the oil boom to 6.2 percent in 1986. Contributions of other non-oil

sectors to GDP have not been encouraging. Agriculture contributes about 5.5 percent to GDP while the manufacturing contribution was 6.7 percent in 2007. Problems in the manufacturing sector have been compounded by disruptions caused by civil and political unrest.

Libya's monetary policy is handled by the Central Bank of Libya (CBL). The primary objective of the bank has been price stabilisation because Libya practices a fixed nominal exchange rate system. The exchange rate of the Libyan Dinar (LD) to the USD is pegged, which seems unrealistic due to the incessant lack of competitiveness in the foreign exchange market on the part of the Libyan Dinar. This situation has made the country experience several phases of fixed exchange rates within the last three decades. There were different peggings in 1980, 1985, 1990, 1999 and 2001. To forestall the frequent change in the pegging of the exchange rate, the Central Bank of Libya adopted what they called dual fixed exchange rate system in 2001. The official fixed nominal exchange rate was 1 LD to 2.5 USD, and another special exchange rate which is close to the prevailing parallel market was fixed at 1 LD to 0.36 USD (IMF, 2003). All these inconsistent exchange rate policies have been taking their toll on the non-oil sector of the economy. The increase in the money stock through the proceeds from oil put more pressure on domestic prices of manufactured and other tradable goods, thereby leading to the appreciation of the real exchange rate which further reduced the growth of the manufacturing sector *(exchange rate effect of Dutch Disease)*.

In the face of the inconsistency in the exchange rate policy, CBL has continued to pursue an aggressive inflation policy, keeping the rate of inflation at single digit of 4.7 percent in 2010 despite the incessant rise in government expenditure. Figure 4.3 shows the contributions of different sectors to the Libyan economy's GDP as at 2010.

Figure 4.3: Contributions of various sectors to GDP in Libya in 2010



Source: World Bank 2010

As with the two big oil exporters, Libya's economy is predominantly a crude oil based one. This is evident in figure 4.3. Oil contributes the most while the manufacturing is among the sectors that contribute the least to the GDP.

4.4.5 Egyptian economy and monetary policy administration

The Egyptian economy has witnessed tremendous changes within the last three decades. The most pronounced one is the recent revolution in 2011 that led to the toppling of President Hosni Mubarak's administration. Before this unrest economic performance in Egypt was generally stable.

The Egyptian economy appears more diversified than other AOECs. Despite being a major net oil exporter, oil is not the mainstay of the economy. However, real GDP growth rate has fallen from 5.5 percent in 2010 to 2.2 percent in 2011. Total investment growth rate, which was 16.7 percent in 2010, fell to 15.5 percent in 2011/2012. Public consumption as a percentage of GDP rose from 73 percent in 2005 to 79 percent in 2011/2012. The economy has continued to operate largely in deficit since the

revolution. A rescue mission of the IMF could not be adopted by the Egyptian government because of the persistent political and civil unrest. Fiscal deficit as a percentage of GDP rose from 9.7 percent in 2010 to 10.8 percent in 2011/2012.However, net foreign reserves reached an all-time low at 13.6 billion USD as at May 2013. This is in sharp contrast to the years before the revolution when the external reserves stood at an average of 35 billion USD.

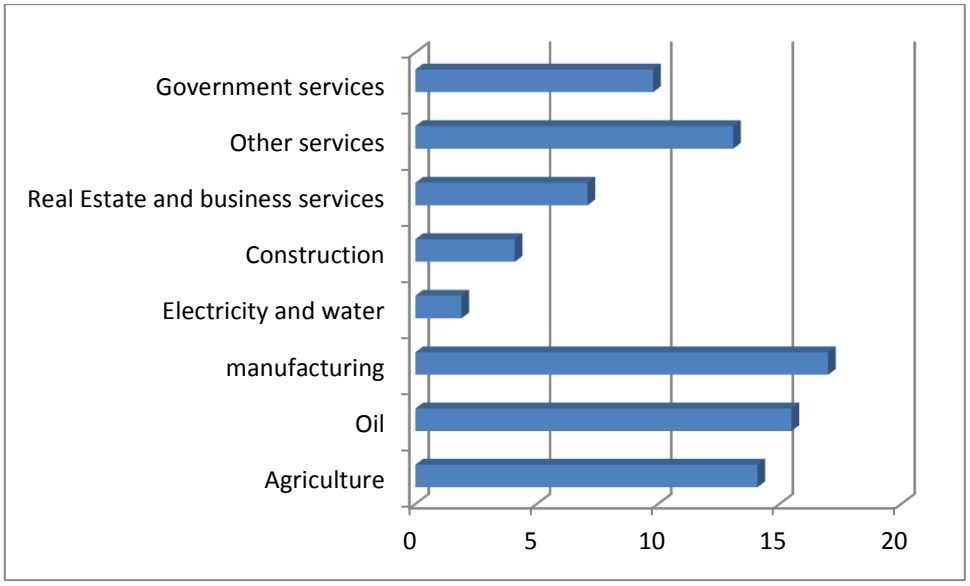
As at 2007, the manufacturing sector contributed 17 percent to GDP while the oil sector contributed 15.5 percent. Besides the two, other dominant sectors in the Egyptian economy are tourism, agriculture, construction and telecommunications. However, tourism and the manufacturing sector have been hit the worst by the revolution. The contribution of the manufacturing sector to GDP has since dropped drastically to about 12 percent of the GDP, while tourism dropped to about 5.1 percent in 2011/2012. Post revolution performance has not significantly affected agriculture, real estate or construction.

Before the revolution, the manufacturing sector attracted almost 14 percent of the total investment, but by 2011/2012 the percentage had dropped to about 8.7 percent. However, investment in the oil and gas sector still attracts the largest investments, estimated at 25 percent of total investments. The administration of monetary policy in Egypt can also be discussed under pre- and post-revolution periods. The Central Bank of Egypt (CBE) is the monetary authority responsible for monetary policy administration in the country and since 2000 Egypt has adopted a floating exchange rate system. However, as a result of the dwindling nature of the Egyptian pound (EGP) in 2003, the CBE started pursuing what is termed a managed floating exchange rate with the objective of achieving EGP 6 to 1USD. However, with the severe economic downturn caused by the political unrest, in 2013 the exchange rate fell to EGP 6.5 to 1 USD. The central bank of Egypt has been using foreign reserves to sustain the exchange rate since 2004, compounding the pressure on the country's external reserves. This has contributed to the sharp fall in the Egyptian foreign reserves which at present can barely cover three months' of imports. Despite the upsurge in money supply as a result of an

increase in government expenditure during both pre and post revolution, the interest rate has continued to be on the upward trend thereby overshadowing the effect of an increase in money supply in the real sector of the economy prior to 2008.

After the revolution, the Central Bank of Egypt discovered that inflation had dropped owing to contraction in government activity caused by the political unrest. The inflation rate fell from 8.9 percent in 2010 to about 4.4 percent in 2011/2012. However, the Central Bank of Egypt noted that imbalances in output supply of consumable goods and prices are likely to be responsible for the existing inflation rate. Consequently, a ministerial committee was constituted in January 2013 to address this structural cause of inflation. Figure 4.4 shows the contribution of different sectors to the Egyptian GDP.

Figure 4.4 Contributions of various sectors to Egyptian GDP in 2010.



Source: World Bank 2010

From Figure 4.4 it is apparent that the Egyptian economy is far more diversified than other AOECs discussed earlier. The manufacturing sector which contributed the least in previous economies discussed is the highest contributor to GDP in Egypt.

4.4.6 Gabonese economy and monetary policy administration

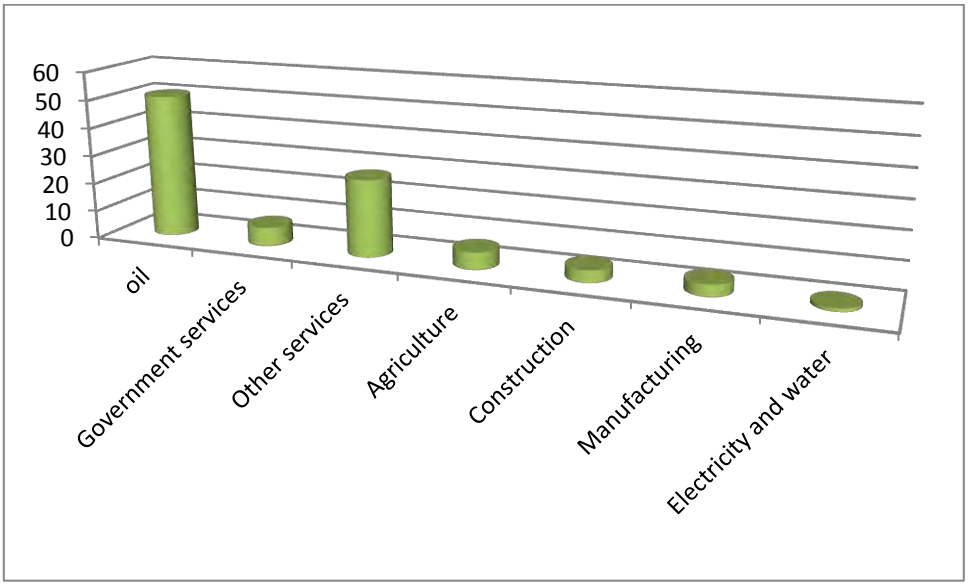
Gabon is a country in sub-Saharan Africa that belongs to the Central African Monetary Zone. The country's economy is mainly driven by the extraction industry, especially oil. The country is heavily dependent on oil revenue which contributes about 50percent to GDP and more than 80percent of the total export. The real GDP growth rate has followed a rising trend over the years up to 2005 when the oil reserve of the country started shrinking. Between 2004 and 2005, oil production had fallen by 1.3 percent and fell a further 3.1percent in 2006 (ADB/OECD, 2007). Gabon produces 241,700 barrels of oil per day making her one of the net oil exporters in Africa. The increase in government spending owing to increased wage bills and dwindling oil resources culminated to an increase in inflation rate by 1.9percent in 2012.

The shrinking oil reserves have brought about a new development plan in the economy which is driven towards diversification in a bid to prepare for the aftermath of the oil era. The economy of Gabon has achieved increasing growth of the mining sector with manganese (not oil), wood, forestry and the service sectors between the years 2011 and 2013. The manufacturing sector was not seen as a viable means of diversification owing to some structural constraints imposed by an unfriendly international climate and decayed infrastructure (IMF,2012). Despite the falling oil reserve, the GDP growth rate rose by 1.3 percent in 2012.This improvement was linked to a massive exportation of wood and forestry products which now account for about 25 percent of the GDP. The country is currently the largest wood exporter in Africa after Cameroun.

The administration of monetary policy in Gabon has been controlled by the CEMAC (*Communaute Economiqueet Monetaire de l' AfriqueCentrale*) or Central African Monetary Union. The union comprises of six member countries, namely: Republic of Central Africa, Congo, Gabon, Equatorial Guinea, Cameroun and Chad. These countries practice a unified monetary system controlled by one central bank called the Bank of Central African States (BEAC). An interesting thing about the union is that they are all net oil exporters except the Central African Republic. In other words, oil is

the mainstay of these economies. The zone practices a fixed type of exchange rate with the aim of maintaining economic stability. Gabon like other countries is required to comply with the rigid exchange rate regime. Despite a rise in the aggregate money supply (M2) by 26.7 percent, inflation was close to zero in the country in 2011. Inflation was also expected to further fall by another 1.9 percent in 2012. Individual economies in the monetary zone adjust their internal monetary policy mechanisms to ensure economic stability in the face of the fixed exchange rate. Trends in loans have been largely driven by cash needs of households and firms against investment needs. This has contributed to the stunted growth of the manufacturing sector (ADB, 2007).

Figure 4.5 Contributions of various sectors to GDP in Gabon in 2010



Source: World Bank 2010

As can be seem from Figure 4.5, oil contributes 50.7 percent, government services contribute 6.6 percent, other services 27.2 percent, agriculture and forestry 6 percent, mining and construction 4.2 percent, manufacturing 4.1 percent and water and electricity 1.2 percent to GDP (2010 estimates).

Of all five countries considered, Egypt appears to be the only country that stands out in terms of economic diversification. Despite being one of the major net oil exporters in

Africa, Egypt's manufacturing sector still contributes more than the oil sector to the GDP. Apart from the manufacturing sector, other sectors' contributions such as agriculture for example are also competitive. The remaining four countries, Nigeria, Algeria, Libya and Gabon share a common feature of a very under-developed manufacturing sector. Although their governments claim to be in the process of economic diversification, the effect of these efforts still remains to be seen.

Another similarity is that the diversification efforts of the four countries is non-manufacturing driven. Gabon anchored her diversification efforts on the extraction of manganese, whereas Algeria, other than oil, focuses on components of hydrocarbons and as a means of diversification, Nigeria is focusing on agriculture. The issue is that all their diversification efforts are natural resource oriented, and are going to bring about the production of primary or intermediate goods rather than finished goods.

4.4.7 Monetary policy transmission mechanism, oil price and economic growth

As earlier stated in the introduction, empirical studies on monetary policy transmission mechanisms are very scanty in developing countries compared to developed countries. Despite this we will examine some past empirical studies on the link between monetary policy transmission mechanisms and economic activities, especially those in the oil rich economies. A common feature in the literature is that they either consider the effect of oil price shocks on monetary policy mechanisms or oil price shock on economic growth. Few examined the impact of monetary policy shocks on economic growth as well.

Olomola (2007) studied the impact of oil price shocks on selected macroeconomic variables in Nigeria. He focused on output, inflation, exchange rates and money supply. Using quarterly data in Nigeria he found out that the oil price significantly influences exchange rates in Nigeria and that the oil price shock may lead to wealth effects that cause the currency to appreciate, squeezing the tradable sector and leading to Dutch Disease. However, in a separate study Akpan (2009) used the Nigerian economy again and discovered that the oil price shock significantly influences inflation, real national

income and government expenditure. He made use of a vector auto regression (VAR) technique.

The results obtained by the previous two authors on the Nigerian economy are almost similar to those of Bouchaour and Al-Zeaud (2012) on the Algerian economy. The study used a vector error-correction model VECM to investigate the impact of oil distortions on some monetary and macroeconomic variables in the Algerian economy. Their findings revealed that the oil price has an inverse relationship with exchange rates and a positive relationship with the inflation rate. Their impulse response analysis showed that currency depreciation is likely to promote the growth of real GDP.

In the same vein, Mordi and Adebiyi (2010) investigated the asymmetric effects of oil prices on output and prices and the expected role of monetary policy in Nigeria. The study adopted a structural VAR (SVAR) and found that oil price shocks significantly affect money supply and the general price level. They also discovered that the Nigerian Naira depreciates in response to the oil price shocks. The same result was obtained by Jimenez-Rodriguez and Sanchez (2005) and Chen and Chen (2007). They noted that monetary policy should respond cautiously to the asymmetric effects of oil price shocks on output and price.

Vector auto-regression was also adopted by Samba (2013) to examine the administration of monetary policy under CEMAC (*Communaute EconomiqueetMonetaire de l' Afrique Centrale*). The study focused mainly on the interest rate as a monetary policy instrument and how it influences GDP and consumer price index. The study concluded that the interest rate has not been impacting positively on the output of the members countries. It also argued that there are differences in the responses of output to interest rate shocks. This depends on the ability of each country to utilize the internal variables like credit channels to influence their real sectors (Samba, 2013).

Mahmud (2009) used a structural VAR to appraise the relationship between the monetary policy aggregates and oil price shocks in Nigeria. The study focused mainly

on the effects of oil price shocks on inflation rates, GDP per capita growth rate, exchange rates, interest rates, government expenditure, money supply and manufacturing output. The research findings revealed that the effect of oil price was transmitted through government expenditure and monetary policy variables to the manufacturing output and the real GDP growth rate. This result is similar to the findings of Zafar (2004), who concluded from a study of Gabon that oil price shocks influence trade through monetary policy variables. He emphasized that oil price effects are reflected in the behaviour of the interest rate and money supply which later affects the volume of trade in the country.

Among the few authors that studied the impact of oil shocks on macroeconomic variables are Ali and Harvie (2013). Perhaps, it is the only empirical study on the Libyan economy available to us. They focused on the macroeconomic adjustments and their relationship with oil related shocks in Libya. They used a dynamic macroeconomic model and discovered that the negative impact of oil related shocks can be reduced by a flexible nominal exchange rate system. They concluded that if Libya can adopt a flexible nominal exchange rate system, growth of the non-oil sector will be influenced positively by boosting the accumulation of imported capital stock, physical capital stock and human capital stock.

Monetary policy and exchange rates were the focus of Saleem's (2013) study. He investigated the relationship between a policy induced nominal interest rate and exchange rate in Egypt. The study was pure desk research which was based on the application of economic theories and comparison with other empirical studies to assess the situation in Egypt. He found out that while the developed economies might benefit from interest rate shocks through demand effects because of the larger steady state value of the demand deposits in these countries, the story might not be the same for the developing economies, especially oil exporting economies like Egypt. According to Saleem (2013), due to large fiscal deficits in the developing countries, the output effect will pose a serious threat to the production sector of these economies since firms rely more on bank credits.

Considering all the literature discussed under this section, it is confirmed that research studies of the monetary policy transmission mechanism and its effects on manufacturing output are very scarce especially in the oil exporting countries. The manufacturing sector which has been described as a major sector that can aid the diversification efforts in the AOECs has not been touched by any of these reviewed empirical studies (see Kayode, 2000).

Again, monetary policy transmission mechanism has been described as framework that can be used to appraise the manufacturing sector and also develop policy framework that can improve the growth of the manufacturing sector in the AOECs (see for example Mohamed, 2011; Corden and Neary,1982; Lama and Medina, 2010). From all the empirical reviews none of the studies on AOECs or any other one of which we are aware include manufacturing sector in their monetary policy transmission mechanism instead, other macroeconomic variables such as inflation rate were given attention (See Mamud, 2009).

Based on the foregoing, and among others that have been stated in the introductory aspect of this study, the need for this research work is further necessitated. Findings from this research work are expected to contribute to the existing literatures by providing insight into the behaviour of manufacturing sector in the monetary policy transmission mechanism and also lead to policy alternatives that positively influence the growth of the manufacturing sectors in the AOECs

4.5 Methodology

4.5.1 Introduction

The main objective of this Chapter is to investigate the relationship between oil price shocks and manufacturing sector growth within the framework of the monetary policy transmission process in AOECs, focusing on the Nigerian, Algerian, Libyan, Egyptian and Gabonese economies using a Structural VAR model. Generally, VAR models are

seen as independent large scale macro econometric models that do not rely on unrealistic assumptions (Elbourne, 2007). VAR analysis was pioneered by Sims (1980), who used Choleski decomposition to get impulse responses. However, the Choleski decomposition has been described as being 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), on the other hand, provides economic information for the rationale behind the restrictions that help in identifying both monetary policy shocks and other shocks. Again, the study is interested in examining the short-term and medium-term behaviour of the variables since there is near consensus that monetary policy can only influence output significantly in the short-run (see Gul, Mughal and Rahim,2012; Sidrauski, 1967).

Since the five countries under study share a common characteristic of being net oil exporters in Africa, we cannot ignore the influence of both oil resources and oil price shocks apart from the monetary policy shocks, hence the suitability of the SVAR approach for this study. Another justification for choosing the SVAR is the argument that not all variables respond instantaneously to shocks as provided by VARs. Evidence from past research has shown that many variables exhibit delays in their response to shocks due to financial deepening and the level of integration with the global economy. The structure of the matrix in SVAR has made provision for this (see Ngalawa and Viegi, 2011). In addition, the Choleski decomposition in a VAR uses partial identification which can only identify one of the underlying structural shocks. However, SVAR has been designed to distinguish between those variables that respond contemporaneously to a particular shock and those that respond with a lag. (Elbourne, 2007).

According to Kim and Roubini (2000), SVARs have been designed to deal with all the puzzles that have affected the recent literature 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 shocks and oil shocks on the manufacturing sector growth of the five countries.

4.5.2 The Model

Construction of our VAR model follows the conventional method where the primitive/structural model is specified thus:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} +, \ldots\ldots\ldots + A_p y_{t-p} + \mu_t \quad (4.1)$$

where:

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

A_i $\forall$(*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 possess a tendency of correlating contemporaneously in all the equations.

There are pn^2parameters in the A matrices**.** Equation 4.1 can be rewritten using the lag operator L which is selected through$L^k x_t = x_{t-k}$. where x is a group of exogenous variables and k is the lag length. The equation becomes:

$$A(L) y_t = \mu_t. \quad (4.2)$$

where:

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

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

<u>Variance Decomposition and Impulse Response Functions</u>

Analysis of the VAR will be carried out using variance decomposition and impulse response functions. Both variance decomposition and impulse response functions are computed by re-specifying our autoregressive (AR) function. The two of them evolve through the process described as follows:

$$A(L)\mu_t = y_t \tag{4.3}$$

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

$$y_t = \emptyset_t + \sigma(L)\mu_t E(\mu_t) = 0 \tag{4.4}$$

$$E(\mu_t \mu_{t-k}) = Q, |k| = 0 \tag{4.5}$$

$$E(\mu_t \mu_{t-k}) = Q, |k| \neq 0 \tag{4.6}$$

Where Q represents the covariance matrix sample, $\emptyset_t$is predictable perfectly while the matrix of coefficients $\sigma(L)$ using lag 0 is the identity matrix.

Equation 4.4 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.

4.5.3 Model Identification

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

For clarity, assume that $y_t$is comprised of vector of endogenous variables. For example, say *kth* 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:

$$Av_t = B\mu_t \tag{4.7}$$

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 restrictions on A and B is made possible due to the orthogonal assumption of μ_t. hence we have:

$$A \sum \acute{A} = B \acute{B} \tag{4.8}$$

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

$$B(L) = B_0 + B^+(L) \tag{4.9}$$

$$A(L) = -B_0^{-1} B^+(L) \tag{4.10}$$

$$\sum \doteq B_0^{-1} A B_0^{-1} \tag{4.11}$$

Equation 6.9 is the structural form divided into contemporaneous correlations i.eB_0 and $B^+(L)$. The former represents correlations at lag zero while the later represents correlations at all strictly positive lags. Equation 4.10 separates each reduced form coefficient into its structural counterpart B_0, identified through the reduced 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 4.11.

Furthermore, due to the vulnerability of long run restrictions to serious misspecification problems, we use a contemporaneous restriction on theB_0 matrix to identify the shocks as shown in equation 4.12 since this study is interested in short-run and medium term responses (see Leeper, Sims and Zha, 1996; Elbourne, 2007).

$$\begin{bmatrix} v_t^{poil} \\ v_t^{oilgr} \\ v_t^{intr} \\ v_t^{msgr} \\ v_t^{infr} \\ v_t^{exr} \\ v_t^{mgr} \\ v_t^{gdpgr} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ B_{21}^0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ B_{31}^0 & 0 & 1 & 0 & 0 & 0 & 0 & B_{38}^0 \\ B_{41}^0 & 0 & B_{43}^0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & B_{53}^0 & B_{54}^0 & 1 & B_{56}^0 & 0 & 0 \\ B_{61}^0 & B_{62}^0 & 0 & 0 & B_{65}^0 & 1 & B_{67}^0 & 0 \\ B_{71}^0 & B_{72}^0 & B_{73}^0 & B_{74}^0 & B_{75}^0 & B_{76}^0 & 1 & 0 \\ 0 & 0 & 0 & 0 & B_{85}^0 & B_{86}^0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{poil} \\ \mu_t^{oilgr} \\ \mu_t^{intr} \\ \mu_t^{msgr} \\ \mu_t^{infr} \\ \mu_t^{exr} \\ \mu_t^{mgr} \\ \mu_t^{gdpgr} \end{bmatrix} \quad (4.12)$$

There are eight variables in the SVAR model namely oil price (*poil*) which is the exogenous variable.It occupies row 1 and it puts external pressure on the economy. Endogenous variables are arranged as follows: oil resources growth rate (*oilgr*); interest rates (*intr*); money supply growth rate (*msgr*); inflation rate (*inf*); exchange rate (*exr*); manufacturing output growth (*mgr*); and GDP growth rate (*gdpgr*). The role assigned to each variable is explained in the flow chart in figure 4.6

The oil price is viewed as the external shock to the entire system, meaning that it affects the monetary policy transmission mechanism MTM. The oil output growth rate is included in the MTM based on the controversy that often in oil exporting countries economic policies receive shock from the global oil price through the individual country's oil output levels. Berument, etal (2004) in his study of Oman and UAE found that oil price shocks affect economic policies of these countries through their output levels. He argued that since these countries are heavily dependent on oil, the influence of oil prices on output is translated to economic wealth which dictates the behaviour of economic policies.

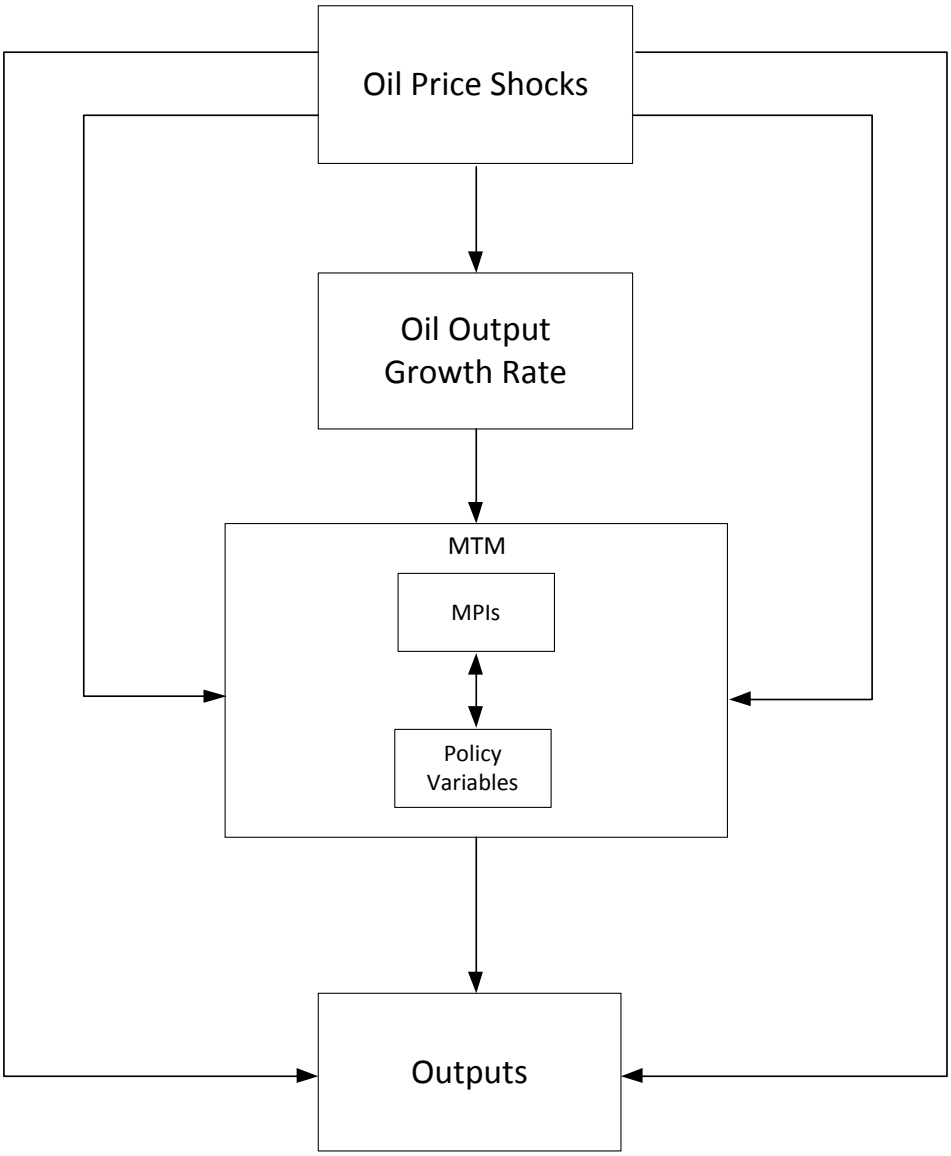
On the other hand, Jemenez and Rodriguez (2005) noted that most oil exporting countries run very open and liberal economies which make their economic policies highly susceptible to external shocks. They argued that as these countries are heavily dependent on oil, fluctuations in the global price of oil affect their economic policies without necessarily passing through their output levels.

The MTM comprises of the monetary policy instruments (MPIs) and the policy variables. The MPIs are interest rates and money supply growth rates. They are the operating targets (see Mahmud, 2009; Elborne, 2007). While the intermediate targets are the policy variables, namely inflation rate and exchange rate. They are viewed as an internal policy shock to the system (see Ushie, Adeniyi and Akongwale, 2012; Mordi and Adebiyi, 2010; Ngalawa and Viegi, 2011). The policy goals used are manufacturing output growth and GDP growth rate. Note that the manufacturing output growth is calculated as a percentage of GDP. The ordering of the variables follows Pesaran and Shin (1998) in order to overcome arbitrary ordering and likelihood of contemporaneous correlation.

The flow chart for the system is explained in figure 6.1. The MTM is the monetary policy transmission mechanism which involves the operating targets; the MPIs which are the interest rates and the money supply growth rates. It also includes the policy variables which are the intermediate targets, that is inflation rates and exchange rates. Policy goals include manufacturing output growth and GDP growth rate.

The flow chart shows a schematic diagram of the monetary policy transmission mechanism (MTM). Firstly, there are the direct effect of the oil price shock on all the components in the model, which are oil growth rate, MTM, and outputs. Secondly, the diagram shows how the oil price shock passes through each of the components as they are arranged. Thirdly, we focus on the direct influence of the shocks in the MTM on the monetary policy goals; and finally we analyse how shocks in the MTM affect the variables in the model.

Figure 4.6 Flow chart for variables' roles in the monetary transmission system



4.5.4 The Data

Data used in this study are in quarterly frequency from 1980Q1 to 2010Q4. As shown from the model, eight variables are used in explaining the monetary policy transmission mechanism with particular attention to manufacturing output in the five economies. 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 that are sourced from the data base of the 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, 2007).

4.6 RESULTS AND DISCUSSION

4.6.1 Non Stationarity.

This study follows the work of Uhlig(2005),Peersman and Smet(2002),Vonnak(2005), Clements and Hendry(1995),Fève and Guay(2006), and Ibrahim and Amin(2005) among others, where levels VAR are used. The studies have argued that this approach will prevent loss of vital information about the data sets which might occur in the course of differencing. It has also been argued that the inclusion of lagged lengths of the variables in the VAR will enable the residual to be stationary even with a non-stationary series that is $I(1)$ (see Berkelmans, 2005). Many studies in recent times have also followed the same procedure (see, among others, Ngalawa and Viegi, 2011; Elboure, 2007; Mordi and Adebiyi, 2010; Mahmud, 2009).

4.6.2 Lag Length Selection and Normality test

The reduced form equation is estimated with 2 lags length for all variables as suggested by the Akaike Information Criteria. This is a more general model which has been used in SVAR estimation by a number of researchers. The choice of 2-lag length by this study offers accurate and a more robust dynamic model without necessarily shortening the estimation sample too much; and allows for no serial correlation in the residuals (see Elboure, 2007). A normality test is conducted in order to determine the suitability of the model to be estimated. In other words, the test clears the model of violations of conditions of achieving consistent and efficient estimates. The results of the normality test are presented for the five countries on Tables 4.2 to 4.6

Table 4.2 Normality test (Nigeria)

com	Skewness				Kurtosis				Jarque-Bera		
	skew	Chi-sq	df	Prob	Kurtosis	Chi-sq	Df	Prob	Jqbera	df	prob
1	-68335.0	9.50E+10	1	0.00	1.34E+08	9.08E+16	1	0.00	9.08E+16	2	0.00
2	3603.5	2.64E+08	1	0.00	4372244.	9.72E+13	1	0.00	9.72E+13	2	0.00
3	-549.85	6147634.	1	0.00	53388.31	1.45E+10	1	0.00	1.45E+10	2	0.00
4	2188.1	97353430	1	0.00	223244.1	2.53E+11	1	0.00	2.53E+11	2	0.00
5	7847.8	1.25E+09	1	0.00	29746314	4.50E+15	1	0.00	4.50E+15	2	0.00
6	22349.8	1.02E+12	1	0.00	79643963	3.22E+16	1	0.00	3.22E+16	2	0.00
7	-46513.4	4.40E+10	1	0.00	44163175	9.91E+15	1	0.00	9.91E+15	2	0.00
8	5566.7	6.30E+08	1	0.00	617200.4	1.94E+12	1	0.00	1.94E+12	2	0.00
Joint		1.16E+12	8	0.00		1.38E+17	8	0.00	1.38E+17	16	0.00

Table 4.3 Normality test (Algeria)

com	Skewness				Kurtosis				Jarque-Bera		
	Skew	Chi-sq	df	Prob	Kurtosis	Chi-sq	Df	Prob	Jqbera	df	prob
1	10290.39	2.15E+09	1	0.00	1.07E+08	5.79E+16	1	0.00	5.79E+16	2	0.00
2	1125.011	25734867	1	0.00	232784.9	2.75E+11	1	0.00	2.75E+11	2	0.00
3	38.56227	30236.66	1	0.00	15238.59	1.18E+09	1	0.00	1.18E+09	2	0.00
4	6562.192	8.76E+08	1	0.00	790238.8	3.17E+12	1	0.00	3.18E+12	2	0.00
5	-899.7360	16460339	1	0.00	249782.5	3.17E+11	1	0.00	3.17E+11	2	0.00
6	683.9072	9510492.	1	0.00	176285.8	1.58E+11	1	0.00	1.58E+11	2	0.00
7	801.4894	13061833	1	0.00	215793.2	2.37E+11	1	0.00	2.37E+11	2	0.00
8	36.36973	26896.07	1	0.00	25601.11	3.33E+09	1	0.00	3.33E+09	2	0.00
Joint		3.09E+09	8	0.00		5.79E+16	8	0.00	5.79E+16	16	0.00

Table 4.4 Normality test (Gabon)

Com	Skewness				Kurtosis				Jarque-Bera		
	skew	Chi-sq	df	Prob	Kurtosis	Chi-sq	Df	prob	jqbera	df	prob
1	-79392.85	1.28E+11	1	0.00	1.72E+08	1.50E+17	1	0.00	1.50E+17	2	0.00
2	3680.995	2.76E+08	1	0.00	6670904.	2.26E+14	1	0.00	2.26E+14	2	0.00
3	247.6872	1247429.	1	0.00	20079.77	2.05E+09	1	0.00	2.05E+09	2	0.00
4	1274.166	33011159	1	0.00	163601.3	1.36E+11	1	0.00	1.36E+11	2	0.00
5	182470.1	6.77E+11	1	0.00	87943774	3.93E+16	1	0.00	3.93E+16	2	0.00
6	11557245	2.72E+15	1	0.00	2.25E+10	2.57E+21	1	0.00	2.57E+21	2	0.00
7	1800.646	65927265	1	0.00	19592251	1.95E+15	1	0.00	1.95E+15	2	0.00
8	15379.49	4.81E+09	1	0.00	7485136.	2.85E+14	1	0.00	2.85E+14	2	0.00
Joint		2.72E+15	8	0.00		2.57E+21	8	0.00	2.57E+21	16	0.00

Table 4.5 Normality test (Libya)

Com	Skewness				Kurtosis				Jarque-Bera		
	skew	Chi-sq	df	Prob	Kurtosis	Chi-sq	Df	prob	jqbera	df	prob
1	-143611.6	3.85E+11	1	0.00	1.54E+08	1.10E+17	1	0.00	1.10E+17	2	0.00
2	-69690950	9.07E+16	1	0.00	3.52E+11	5.77E+23	1	0.00	5.77E+23	2	0.00
3	-151.9811	431167.4	1	0.00	15600.28	1.14E+09	1	0.00	1.14E+09	2	0.00
4	7516.226	1.05E+09	1	0.00	1740352.	1.41E+13	1	0.00	1.41E+13	2	0.00
5	121.6304	276153.8	1	0.00	65911.19	2.03E+10	1	0.00	2.03E+10	2	0.00
6	-79928.28	1.19E+11	1	0.00	42230125	8.32E+15	1	0.00	8.32E+15	2	0.00
7	-146259.3	3.99E+11	1	0.00	1.93E+08	1.74E+17	1	0.00	1.74E+17	2	0.00
8	11766.44	2.58E+09	1	0.00	4373136.	8.92E+13	1	0.00	8.92E+13	2	0.00
Joint		9.07E+16	8	0.00		5.77E+23	8	0.00	5.77E+23	16	0.00

Table 4.6 Normality test (Egypt)

Com	Skewness				Kurtosis				Jarque-Bera		
	skew	Chi-sq	df	Prob	Kurtosis	Chi-sq	Df	prob	Jqbera	df	Prob
1	-153324.9	4.78E+11	1	0.00	1.43E+08	1.04E+17	1	0.00	1.04E+17	2	0.00
2	-1284.028	33524147	1	0.00	3750054.	7.15E+13	1	0.00	7.15E+13	2	0.00
3	-10575.37	2.27E+09	1	0.00	2609265.	3.46E+13	1	0.00	3.46E+13	2	0.00
4	1185.155	28560054	1	0.00	205251.0	2.14E+11	1	0.00	2.14E+11	2	0.00
5	2462.394	1.23E+08	1	0.00	321017.0	5.24E+11	1	0.00	5.24E+11	2	0.00
6	-12.82418	3344.013	1	0.00	10459.33	5.56E+08	1	0.00	5.56E+08	2	0.00
7	-558.2397	6336509.	1	0.00	533670.6	1.45E+12	1	0.00	1.45E+12	2	0.00
8	379.7349	2932037.	1	0.00	19937.34	2.02E+09	1	0.00	2.02E+09	2	0.00
Joint		4.80E+11	8	0.00		1.04E+17	8	0.00	1.04E+17	16	0.00

Tables 4.2 to 4.6 show that the normality test is conducted on the basis of the three known tests, that is skewness, kurtosis and Jarque-Bera. For the five countries the results show that all the variables in the model passed the normality test, both individually and jointly. This is shown by the probability values which indicate that they all passed the test at 1 percent level of significance. The implication of this is that the residuals of the model for the five countries are normally distributed.

4.6.3 Structural VAR estimation results for Nigeria

Impulse response analysis of the monetary policy transmission mechanism is discussed in three cases. First we consider the responses of all the endogenous variables to a shock from oil prices; second, we examine the impact of oil output growth rate shocks on all variables of interest; and third we analyse other shocks in the monetary policy

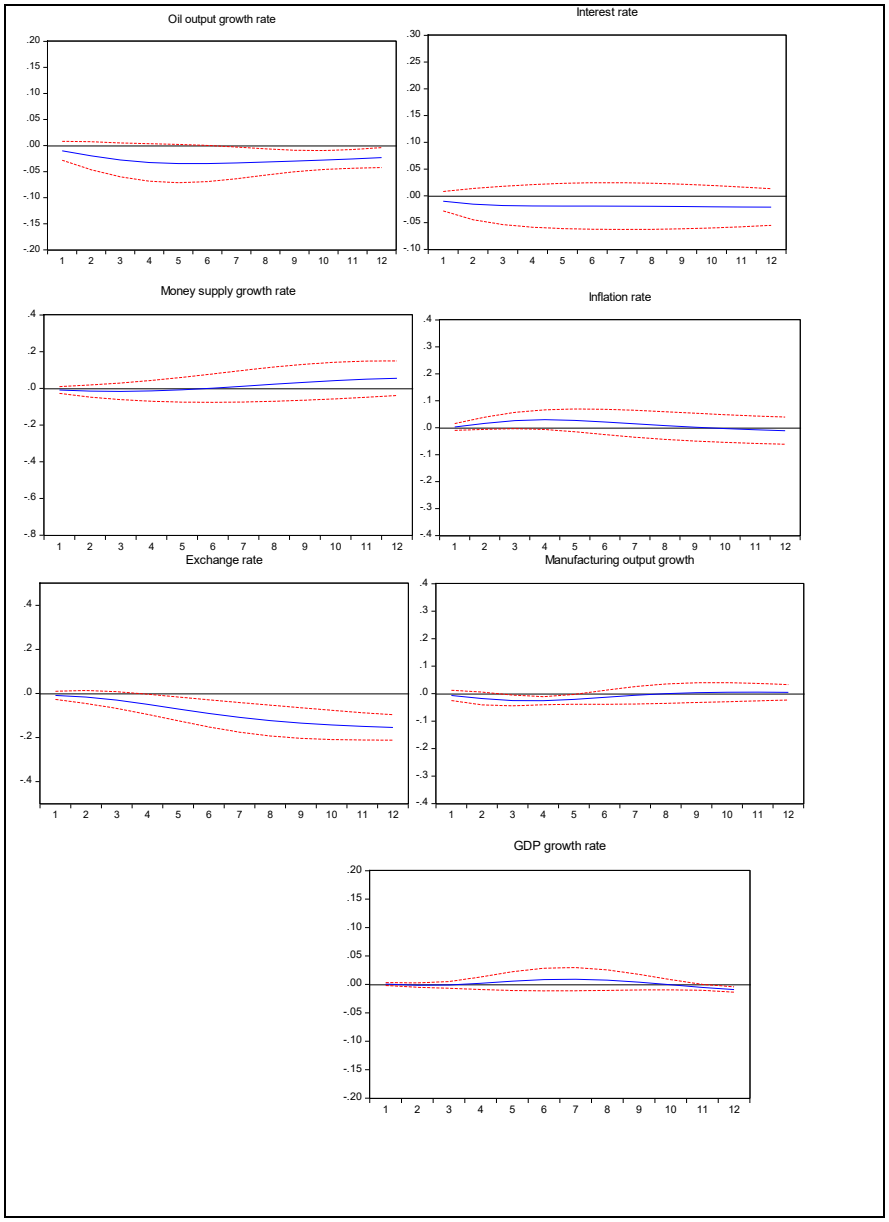
transmission mechanism (MTM). Note, that in the third case, we concentrate on interest rate shocks, money supply growth rate shocks, inflation rate shocks and the exchange rate shocks. We focus on the Nigerian economy first.

4.6.3.1 Impulse response function analysis on Nigeria

Figure 4.7 shows impulse responses of monetary policy instruments, the intermediate monetary variables as well as manufacturing output growth and GDP growth rate to a one standard deviation oil price shock. The shock causes 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 the increase in global oil demand which probably caused the initial rise in the price of oil. Interest rate fall 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 an oil price shock is negative and significant especially from the second period. That is the exchange rate falls steadily although 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, Akpan and Offiong (2013) and Mamhud (2009) where they found that in Nigeria, an oil price shock usually causes appreciation in the value of Naira initially, but it depreciates later. Similarly, Burment (2004) found that in the study of countries like Oman and UAE which are net oil exporting countries, currency appreciates. Jimenez-Rodriguez and Sanchez (2005), and Chen and Chen (2007) have also found that an oil price shock leads to a depreciation in the value of currency of the G7 countries.

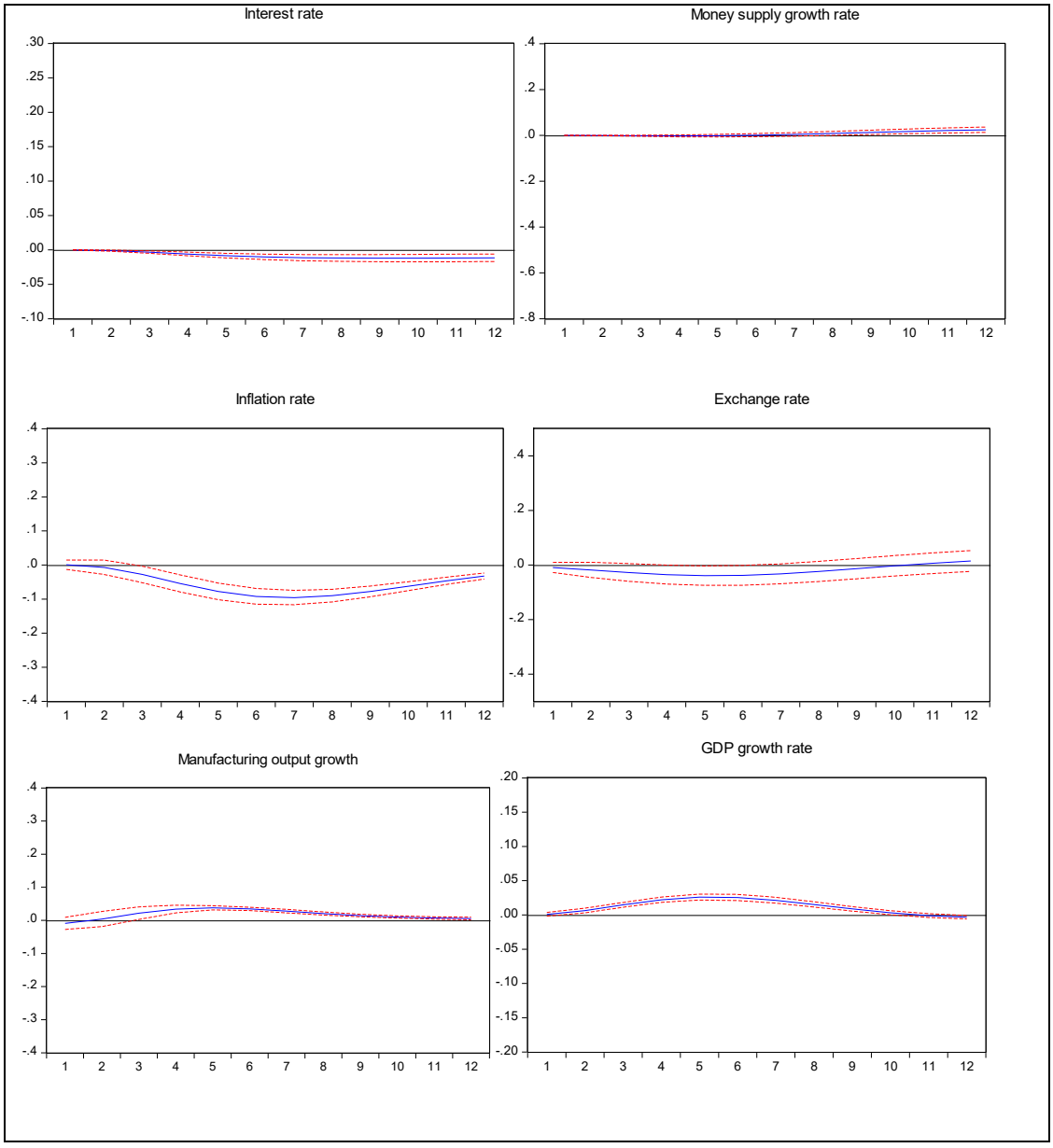
Figure 4.7: Impulse responses to an oil price shock (Nigeria)



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 works is that currency depreciation discourages imports and promotes exports. Export promotion has the tendency of influencing domestic output growth positively;

hence a steady growth of the manufacturing output is noted. However, GDP growth rate reacts similarly since manufacturing sector output is a component of the GDP.

Figure 4.8: Impulse responses to an oil output growth rate shock (Nigeria)



Impulse responses of selected variables to a shock from the oil output growth rate are illustrated in Figure 4.8. From the impulse response functions, interest rates fall

following the shock. This is the same response it shows to an oil price shock. The money supply growth rate also rises steadily but contrary to expectation, the inflation rate falls for at least the 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.

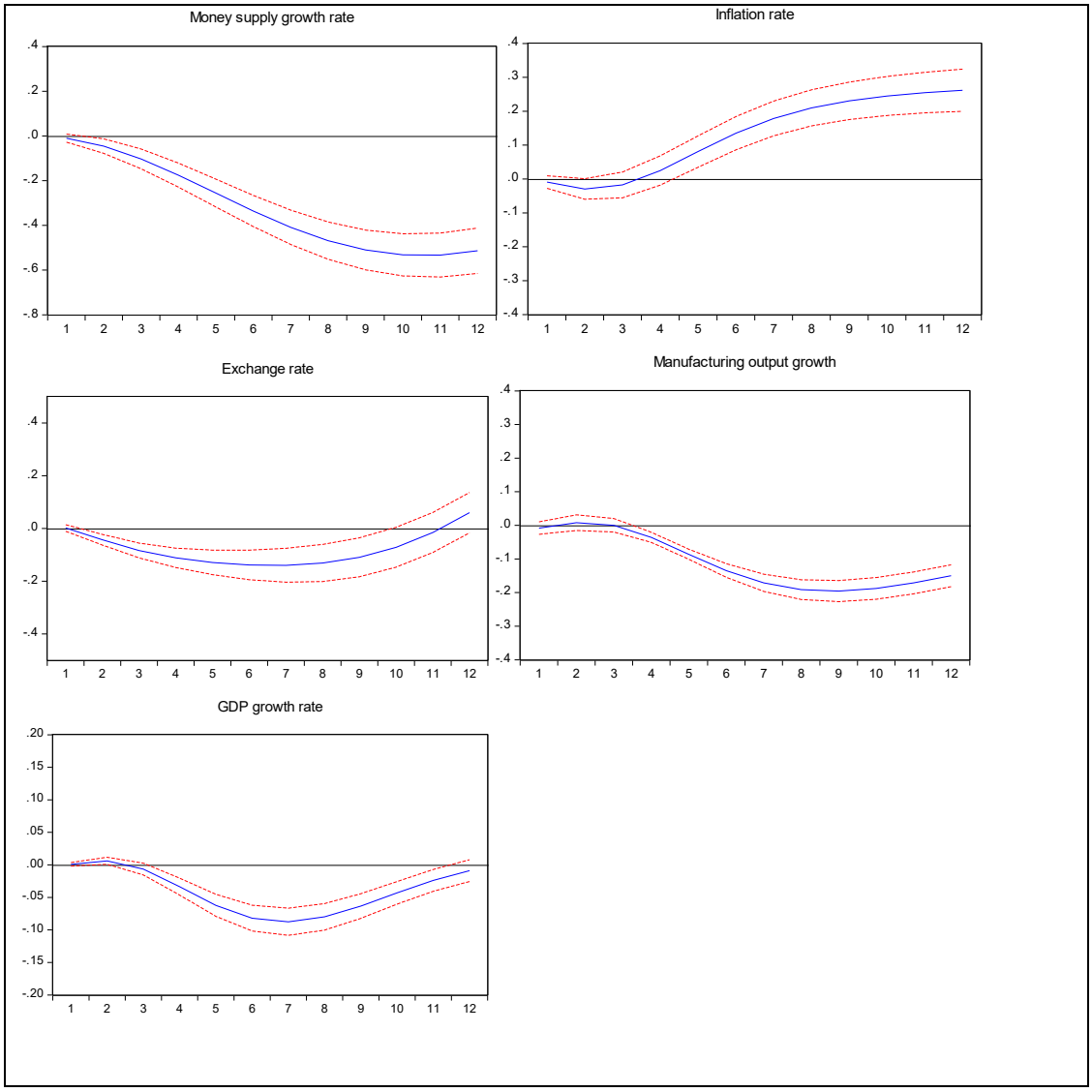
The position of Friedman (1965) who maintains that "inflation is always and everywhere a monetary phenomenon" is therefore rejected just as it has been criticized by many researchers. They argue that inflation might not be a monetary phenomenon all the time. For instance increases in prices that occur as a result of a decrease in output can aggravate the inflation rate. They further argue that inflation can be a monetary phenomenon 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 a decrease in output, it can lead to an increase in prices which can trigger inflation. The reaction of exchange rates to the shock shows that the currency appreciates briefly and later begins to depreciate. Manufacturing output picks up slowly and peaks in the sixth period before it falls gradually. The GDP growth rate, just like Figure 4.7, 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 a structural than monetary phenomenon, which was the case in the oil price shock. In spite of this, the resultant effect on the manufacturing output has not been positive with output rising sluggishly whenever the inflation rate is falling and falling gradually when the inflation rate starts rising. The same trend of response has been demonstrated by the GDP growth rate (see Riman, Akpan and Offiong, 2013;Mordi and Adebiyi, 2010; Bouchaour and Al-Zeaud, 2012).

Unlike what is observed in the two previous figures, Figure 4.9 explains the impulse responses of selected variables to an interest rate shock depicting a very sharp contemporaneous response from all the variables including the manufacturing output growth rate. It appears that the interest rate has sharp spiral effects on the transmission

mechanism of monetary policy. A one standard deviation shock to the interest rate causes a very sharp negative response of money supply, which falls sharply. Similar to the oil output growth shock effect on inflation rate, the inflation rate also rises, but very sharply this time.

Figure 4.9: Impulse responses to an interest rate shock (Nigeria)



Initially the exchange rate responds negatively, but picks up sharply later. The interest rate shock affects manufacturing output growth negatively and the response is

significant. This confirms 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 the 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, as observed in the previous figures also follows the same pattern of response as manufacturing output growth.

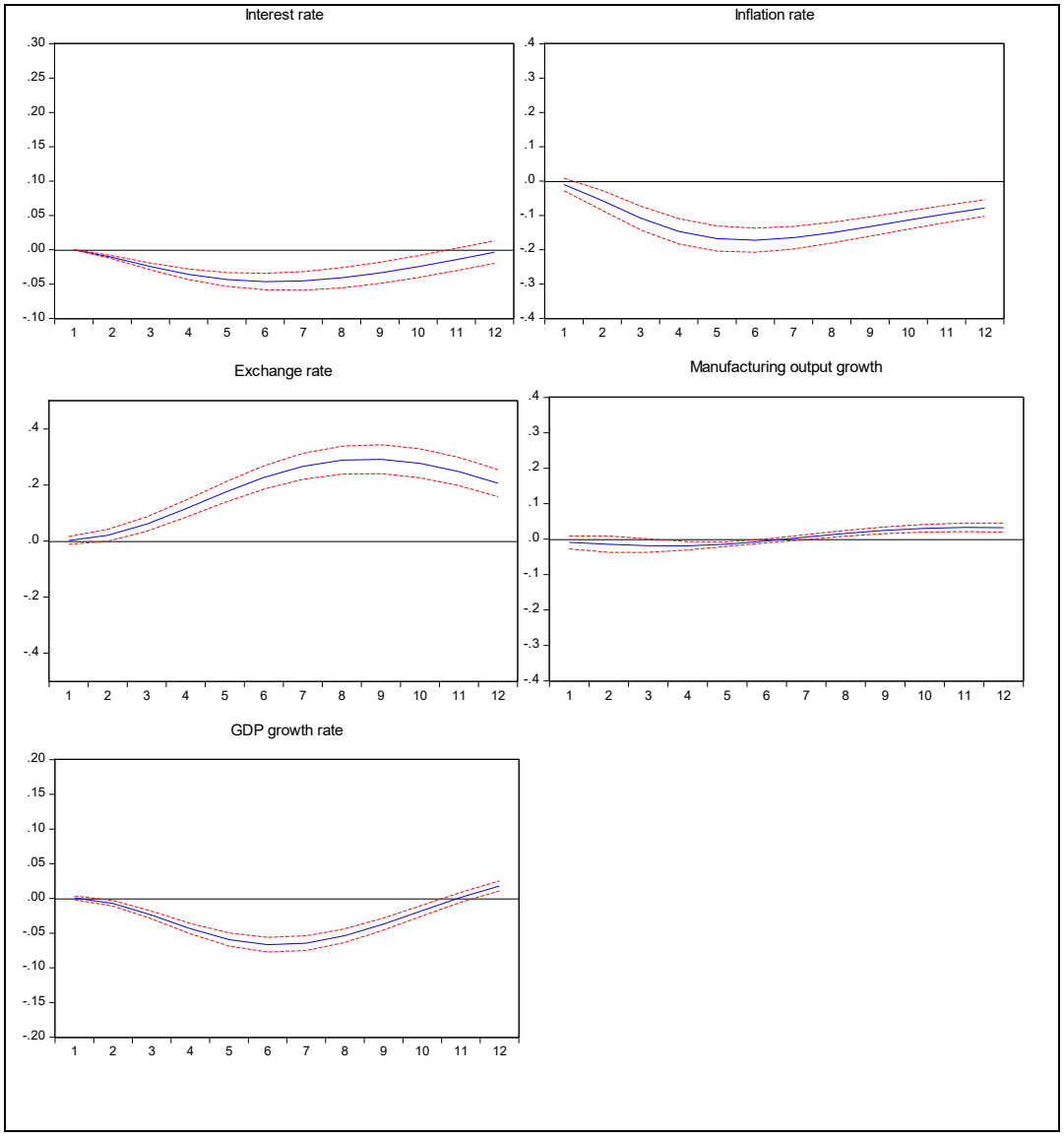
The implication of the results in Figure 4.9 is that interest rates appear to be a very important factor in the monetary policy transmission mechanism. This is shown from the contemporaneous sharp responses from all the variables. The negative response of the manufacturing output growth to an interest rate shock is more pronounced than what is observed in the oil output growth and the oil price shocks.

The behaviour of the selected variables including manufacturing output growth following shocks from money supply is illustrated in Figure 4.10. It is clear that a money supply shock leads to a sharp response of the variables, although not as sharp as in the case of an interest rate shock. We find here almost the reverse of what we found in the interest rate shock. The money supply growth rate shock causes interest rates to fall. Inflation rates fall as well. However, the exchange rate rises sharply (meaning that the currency depreciates). The money supply shock causes a positive response of the manufacturing growth rate. In other words, the depreciation in currency due to the shock in money supply leads to a gradual growth of the manufacturing output and it continues to rise steadily towards the eleventh period.

It is worth noting here that the inflation rate falls in response to a money supply growth rate shock. The fall in inflation rate appears to show that inflation at this instance might be as a result of increase in output. This is a pointer to the fact that inflation might not be all the time a monetary phenomenon as posited by Friedman. To corroborate this, a steady rise is noticed in the manufacturing sector growth. If we compare this to the situation under interest rate shock where inflation rises, the resultant effect on the manufacturing sector is a fall in output. Therefore, it appears that an increase in the

inflation rate is a disincentive to manufacturing output growth. The same situation is also noticed in Ushie, Adrniyi and Akongwale (2012),Olomola(2006),Akpan(2009) and Mamhud(2009).

Figure 4.10: Impulse responses to a money supply growth rate shock (Nigeria)

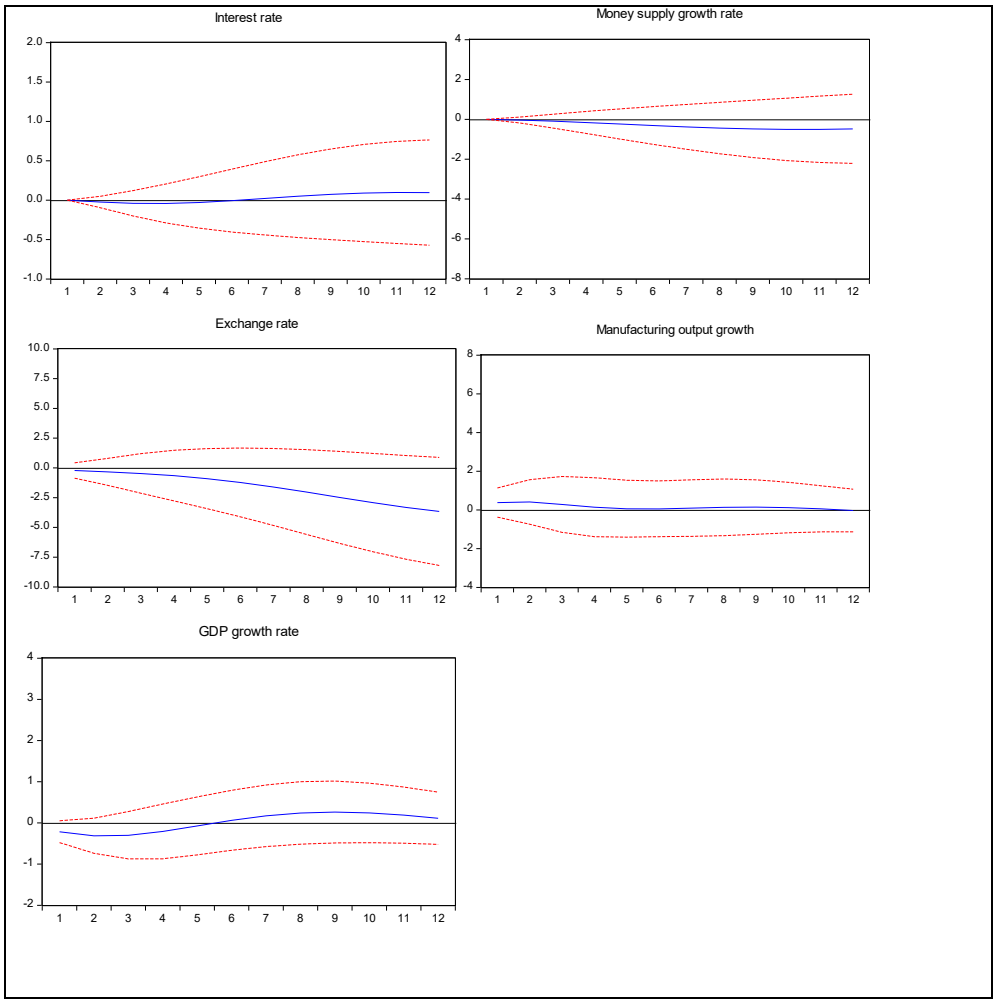


However, it can be inferred from the interaction in the monetary transmission mechanism that a shock from interest rates is most likely to affect the manufacturing

output in Nigeria adversely, while a shock emanating from the money supply growth rate has a significant positive effect on the manufacturing sector until the eighth period.

Impulse responses of the variables to an inflation shock are presented in Figure 4.11. There appears to be sharp responses from all the variables as well. The interest rate rises and money supply falls; the exchange rate falls and manufacturing output growth falls steadily. The GDP growth rate also falls steadily but later rises gradually. The manufacturing output fall might not be unconnected to the appreciation in the value of the currency.

Figure 4.11: Impulse responses to an inflation shock (Nigeria)

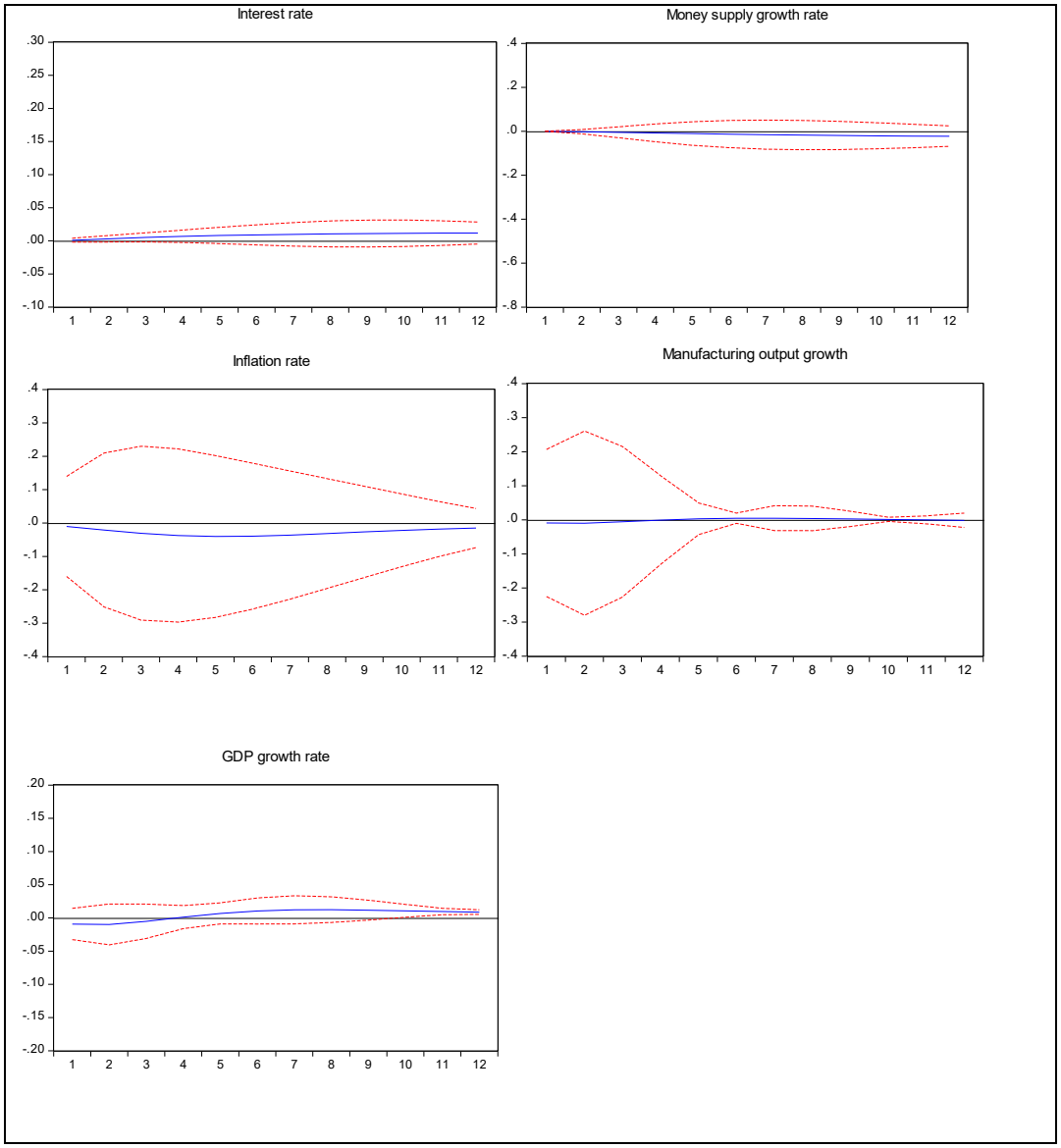


This, again, confirms that a currency appreciation will lead to a fall in output growth of the manufacturing sector. The result also indicates that the rate of inflation is not favourable to growth in manufacturing output in Nigeria. On the whole, an inflation shock appears to be a very important shock in the monetary policy transmission mechanism in Nigeria, and the influence on the manufacturing sector is not positive. It appears that the low inflation policy of the CBN has been very weak in tackling incidents of frequently high inflation rates usually noticed in Nigeria.

Impulse responses to an exchange rate shock are presented in Figure 4.12. Note that a one standard deviation shock in the exchange rate is synonymous to currency depreciation. Interest rates react sluggishly to the shock but they nonetheless increase, although the response is insignificant. The impact of the shock on money supply is negative. The shock causes money supply to fall steadily, which might be 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 pronounced though it shows a seemingly upward (rising) response. None of these responses is significant with the exception of GDP growth rate, which becomes significant in the 10^{th} period. Thus, the exchange rate shock shows no significant effect on manufacturing output growth.

This is in line with what has been observed so far, that whenever a currency depreciates, the effect manufacturing output growth responds positively. An appreciation of the exchange rate has been viewed by some researchers as having an adverse effect on the industrial sector. According to Olomola (2007), a currency appreciation has the tendency to squeeze out the tradable sector, aggravating the problem of Dutch Disease in oil exporting countries.

Figure 4.12: Impulse responses to an exchange rate shock (Nigeria)



Next, we analyse the variance decomposition of the shocks. Variance decomposition 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.

4.6.3.2 Variance decomposition analysis on Nigeria

The structural VAR variance decomposition for Nigeria is presented in Table 4.7.

Table 4.7: Variance decomposition of interest rate (Nigeria)

Period	Oil price	Oil output growth	Interest rate	Money supply	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.883139	0.016926	97.57888	0.940918	0.002666	0.048572	0.008403	0.520500
6	0.739789	0.094220	96.27396	2.552845	0.002222	0.096670	0.035502	0.204789
9	0.716581	0.157071	95.91015	2.695411	0.006166	0.136436	0.063236	0.314950
12	0.757282	0.185565	96.02373	2.367827	0.009211	0.164676	0.072702	0.419003

Table 4.7 shows the contribution of each shock to interest rate changes. The Table shows that except for money supply growth rate, which is another monetary policy instrument that contributes about 0.94 units, the price of oil contributes shock of 0.88 unit to interest rate changes. The oil output growth shock does not contribute any significant shock to fluctuations in interest rate. This is an indication that oil price shock has a direct effect on interest rates without passing through the oil output growth rate. Inflation appears to have contributed the lowest percentage to interest rate changes. We conclude, therefore, that interest rates are very responsive to oil price shocks in Nigeria.

Table 4.8: Variance decomposition of money supply growth rate (Nigeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.535260	0.004388	12.03762	87.27367	0.019953	0.025656	0.099906	0.003552
6	0.156251	0.002532	42.22200	57.16062	0.059279	0.068004	0.245606	0.085709
9	0.196944	0.020434	66.15114	32.94691	0.073777	0.095567	0.217681	0.297551
12	0.453564	0.073099	77.70602	20.89453	0.073042	0.121385	0.167609	0.510754

As noted in Table 4.8, the contribution of different shocks to money supply growth rate (see Table 4.8) reveals that the oil price shock, apart from an interest rate shock, which is a monetary policy instrument, has the highest percentage contribution to the money supply growth rate. This is maintained for all the four periods shown on the Table. This is a pointer to the finding that money supply growth responds to oil price changes in

Nigeria. Again, the oil output growth rate shock seems not to have any significant influence on the behaviour of money supply.

Table 4.9: Variance decomposition of inflation rates (Nigeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	1.109146	0.922942	1.429209	16.85416	72.09112	1.675197	0.001891	5.916341
6	0.889970	5.304519	7.753942	27.31903	38.89006	1.767592	0.049555	18.02534
9	0.512949	6.372189	23.90038	24.78931	24.24223	1.397244	0.195932	18.58977
12	0.391131	5.392751	38.72105	21.04617	17.95055	1.125237	0.252344	15.12076

Inflation is both an asset price and a monetary policy intermediate target. It, therefore, responds substantially to virtually all the shocks. Shocks to the monetary policy intermediate targets, that is interest rates and the money supply growth rate, appear to explain most of the variations in inflation rates.

Table 4.10: Variance decomposition of exchange rate (Nigeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	1.514537	1.419183	10.72038	4.980498	0.773494	78.28305	1.143999	1.164867
6	4.579294	1.466473	15.50820	26.98432	1.030755	47.33960	0.706468	2.384897
9	7.449211	0.865589	12.71493	40.76961	1.800569	34.71960	0.353753	1.326738
12	10.44611	0.605665	9.304812	42.23153	3.180375	32.65451	0.239103	1.337897

The oil price shock again plays an important role in explaining exchange rate variations. Since oil is priced in foreign currency, its shock contributes a large proportion to exchange rate fluctuations. In the same vein, interest rate and money supply growth rate shocks also contribute significantly to exchange rate variations. As expected, a GDP growth rate shock is also important in explaining changes in exchange rates in Nigeria.

Table 4.11: Variance decomposition of manufacturing output growth (Nigeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	2.526945	1.446064	0.326550	1.633574	0.995286	0.547589	92.40905	0.114939
6	2.763763	5.279617	32.85794	1.498172	0.603085	0.301960	48.96858	7.726886
9	1.195773	2.960102	67.55929	1.105370	0.268691	0.152748	21.04847	5.709552
12	0.839729	2.074700	76.34862	1.824919	0.185623	0.105112	14.34127	4.280030

Table 4.11 shows the response of manufacturing output to the various structural shocks. Four major shocks appear to have a very large impact on manufacturing output growth, viz: price of oil, oil output growth rate, interest rate, money supply growth rate and GDP growth rate shocks. The trend of effect of the shocks on manufacturing output growth rate shows that the price of oil has the highest contribution initially in the first period, but the contribution reduces in subsequent periods. While the impact of the shock of the monetary policy instruments increases in the ensuing period proceeds, the oil price shock is gradually transmitted through the monetary policy instrument to the manufacturing output growth rate. In other words, a fall in the contribution of the oil price shock and an increase in the contributions of both interest rate and money supply shocks in the later periods is a clear indication that an oil price shock is transmitted through the monetary variables to manufacturing output growth (see Mordi and Adebiyi, 2010).

4.6.3.3. Inferences and Comparisons with other empirical studies (Nigeria)

Findings from both the impulse response functions and variance decomposition analysis have shown diverse ways through which monetary policy influences the performance of the manufacturing sector in Nigeria. Firstly, the study has shown that an oil price shock generates an increase in money supply that leads to an increase in inflation. However, the effect brings about an inverse relationship between exchange rates and manufacturing output growth. When the currency appreciates, it leads to a fall in the manufacturing sector growth rate. It should be noted that the nature of inflation that occur as a result of the oil price shock appears to be a monetary phenomenon since it

reflects the spiral effects of the oil price shock through a gradual fall in interest rates which leads to an increase in money supply that later culminates in a rise in the inflation rate.

It can be deduced from these findings that an oil output growth rate shock does not influence monetary policy instruments (MPIs) as does an oil price shock. This refutes the position of Berument and Dincer (2004) who maintain that an oil price shock passes through the oil output to affect economic policies. It is quite revealing in the case of Nigeria that the effect of oil price shock is felt directly on the whole monetary policy transmission mechanism without necessarily passing through the oil output growth rate of Nigeria.

The results across various impulse response analyses have indicated that currency depreciation as a result of a fall in exchange rates, has been leading to a steady increase in manufacturing output growth in Nigeria, while currency appreciation weakens the manufacturing sector. This is in line with the findings of Mordi and Adebiyi (2009), Mahmud (2010), Ushie, Adeniyi and Akongwale (2012). Currency appreciation has been shown tohavea negative effect on domestic output. According to Olomola (2007) any shock that produces a rise in exchange rates will have the tendency to squeeze out the tradable goods sector and consequently have an adverse effect on the growth of the manufacturing sector in Nigeria. It should be noted that all the shocks that produce a fall in exchange rate (currency appreciation), also lead to a steady fall in the manufacturing growth rate and vice versa. For instance, as the exchange rate falls sharply (i.e the currency appreciates) following an interest rate shock, manufacturing output growth also falls considerably.

It is also apparent from the analysis that the pressure on the price level that occurs as a result of other shocks, except the oil price shock, produces a kind of inflation that is more of structural than monetary in nature. The effect of a rise in money supply growth rate as a result of a fall in interest rates fails to reflect on inflation. The implication here is that inflation might not be a monetary phenomenon. Therefore, structural reasons like

the general price level and instability in output might have led to the nature of the inflation rate common to all other shocks, except the oil price shock. However, it is clear that any shock on inflation rate has been adversely affecting manufacturing output growth. For instance a shock from money supply produces a falling inflation rate, but manufacturing output growth rises in response to the same shock; a shock from interest rates produces a rise in inflation but a fall in manufacturing output growth. The variance decomposition analysis also appears to show support for this behaviour. The response of manufacturing output to an inflation shock is among the highest. It is even higher than interest rates in the first quarter, although the contribution falls in subsequent periods.

Both money supply and interest rate shocks have been shown to have the highest contribution to manufacturing growth rate as the period progresses. An oil price shock has only a very high initial contribution to the manufacturing output growth, that is in the first period. The contribution of the shock, however, falls in the ensuing periods, while that of monetary instruments picks up gradually. Hence, it appears that as the periods that follow, the oil price shock to manufacturing output is transmitted through the monetary variables and this has led to a rise in the contribution of both interest rate and money supply shocks while the contribution of oil price shocks has fallen. This is in line with the findings of Mahmud (2009), who concluded that the second effect of the price of oil on different sectors in the Nigerian economy is transmitted through the monetary policy system.

The study has found that the effect of oil price shocks in the monetary policy transmission mechanism is profound, besides the monetary policy instruments themselves. For instance 53 percent of the variations in money supply growth rate are accounted for by oil price while 88 percent of the fluctuations in interest rates are attributed to the same oil price shocks. The implication is that oil price shocks appears to be a very important factor that affects the monetary policy transmission mechanism in Nigeria. This supports our earlier position which is also in line with previous

empirical studies; that oil price shocks affect the manufacturing sector through the monetary policy transmission process.

On comparative grounds, it can be inferred from the impulse response analysis that interest rate shocks are most likely to have a negative effect on manufacturing output while money supply shocks appear to have a positive effect on the growth of manufacturing output in Nigeria. However, variance decomposition results have shown that manufacturing output growth responds considerably to the two monetary policy operating target shocks, that is money supply shock and interest rate shock.

4.6.4 Analysis of structural VAR estimation results for Algeria

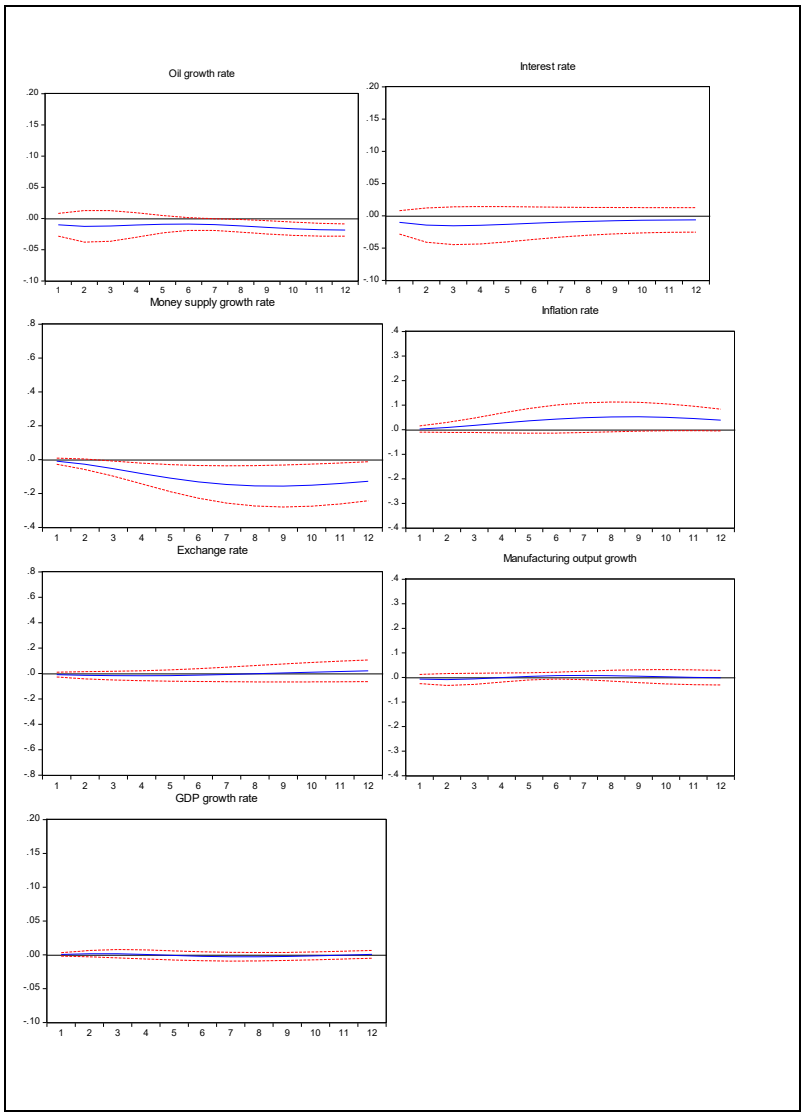
4.6.4.1 Impulse response function analysis for Algeria

Figure 4.13 shows responses of all the variables in the model to a one standard deviation oil price shock. The shock leads to a fall in oil output growth rate which might not be unconnected to the increase in demand for oil in the international market, which may have led to the initial oil price increase. The implication of this is that the rate of growth in production is slow to catch up with the increase in demand. Furthermore, the shock causes interest rates to fall initially, at least for the first four periods, and later to start rising. The shock, however, has contrary effects on money supply. When interest rates are low money supply is rising and as interest rates begins to rise, money supply starts falling.

The implication of the foregoing discussion is that the effect of oil prices on the two monetary policy instruments follows the standard economic theory which postulates an inverse relationship between money supply and interest rates. Expectedly, the oil price shocks push the inflation rate up. But the decline in the money supply may be a response by the monetary authorities to decrease the effect of the inflation. Bouchaour and Al-Zeaud (2012) also obtained a similar result and concluded that the inflation that arises as a result of an oil price shock can be categorized as imported inflation. The

exchange rate shows a very sluggish positive response to the oil price shock while the manufacturing sector growth also exhibits the same response and in the same direction.

Figure 4.13: Impulse responses to an oil price shock (Algeria)



The slow response of the exchange rate might not be unconnected to the type of exchange rate policy practiced in Algeria, which is termed controlled flexible exchange rate, where the monetary authorities intervene constantly with the exchange rate system to prevent excessive undervaluation of the currency (see Bouchaour and Al-Zeaud, 2012; De Bock and Gijon, 2011). This incessant interference normally limits the

response of the exchange rate to external shocks. However, it appears that this has not been having a positive influence on the manufacturing sector of the economy, going by the sluggish downward trend noticed. This also slightly affects the GDP growth rate.

Figure 4.14: Impulse responses to an oil output growth rate shock (Algeria)

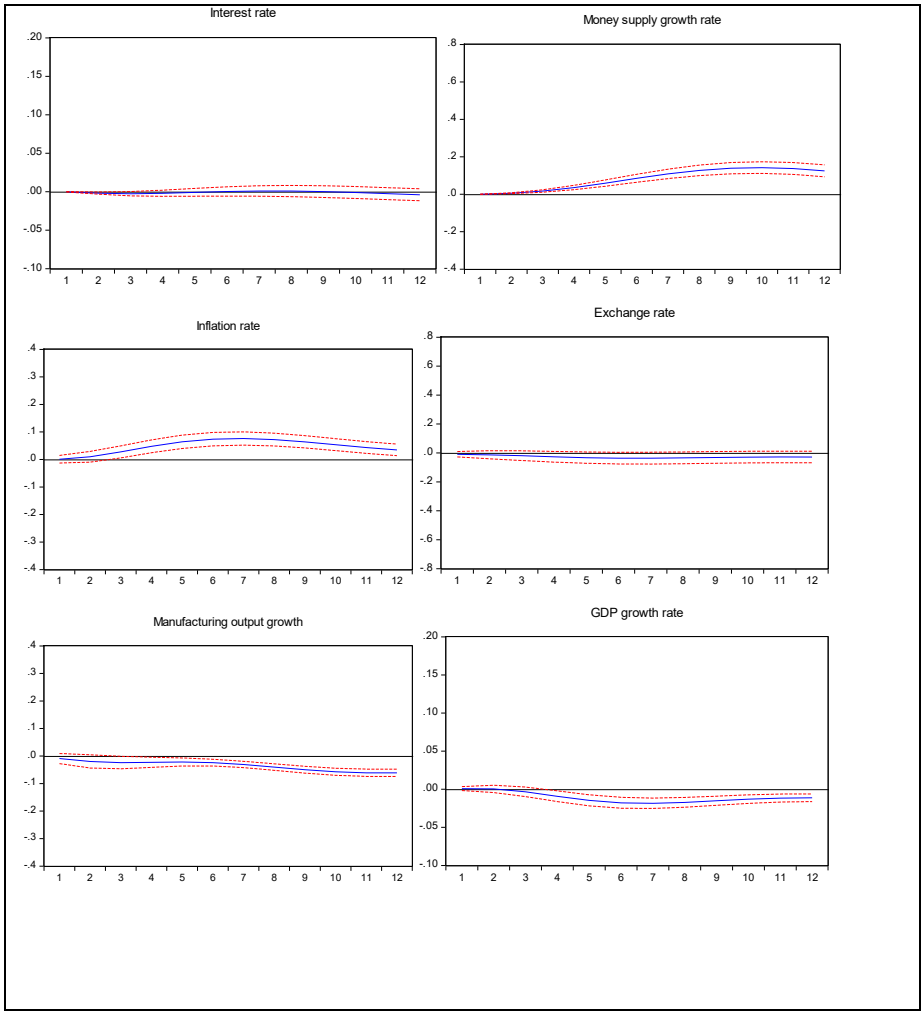
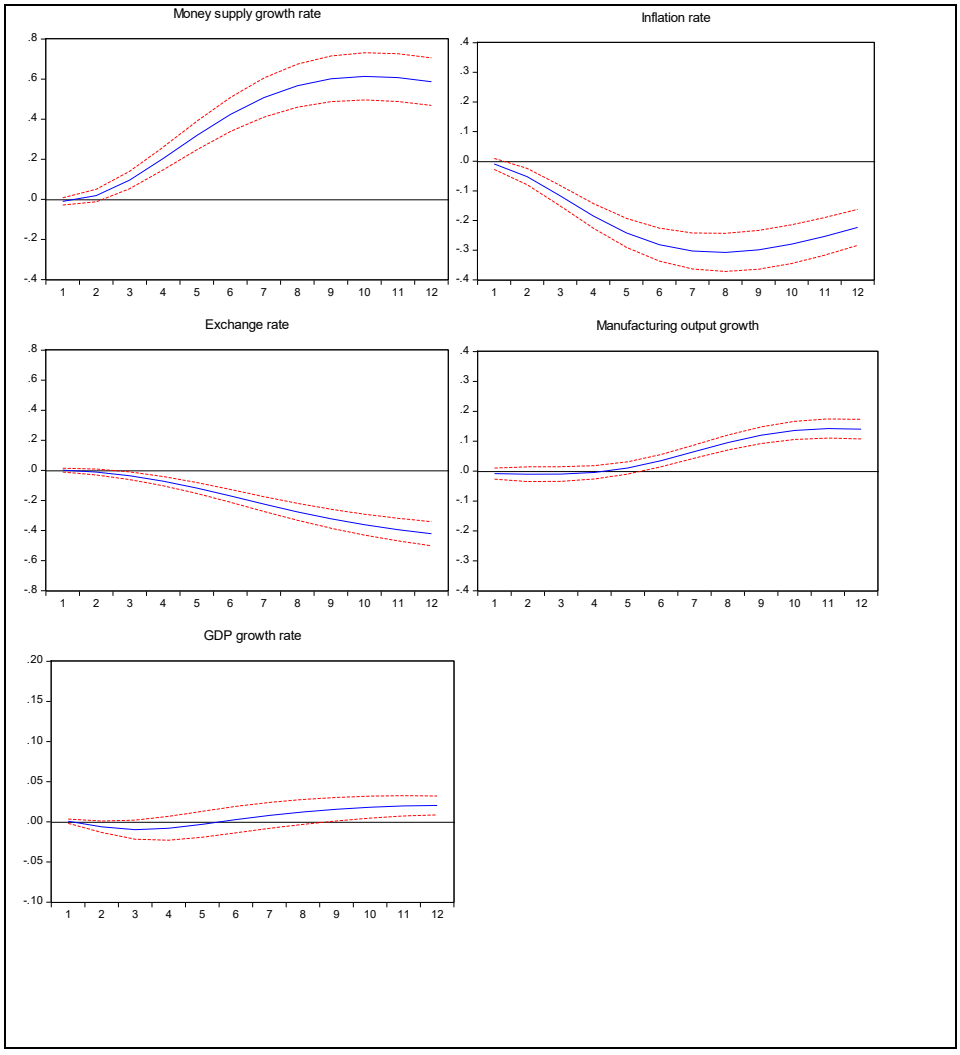


Figure 4.14 shows the responses to an oil output growth rate shock. The effect of the oil growth rate shock on interest rates is similar to that of the oil price shock. Again, as the interest rate begins to fall money supply rises. Inflation rate and money supply also respond to the oil output growth shock with an increase. Currency appears to appreciate and the manufacturing output growth falls. The GDP growth rate follows the same

pattern too. The implication again here is that currency appreciation is a disincentive for manufacturing growth rate.

Figure 4.15: Impulse responses to an interest rate shock (Algeria)



Unlike the two previous analyses, it seems as if all variables display significant responses to an interest rate shock as shown in Figure 4.15. Money supply increases sharply as a result of the interest rate shock. The inflation rate however falls in response to the shock, again confirming that inflation in Algeria might not be as a result of changes in money supply. The interest rate shock also causes the exchange rate to fall

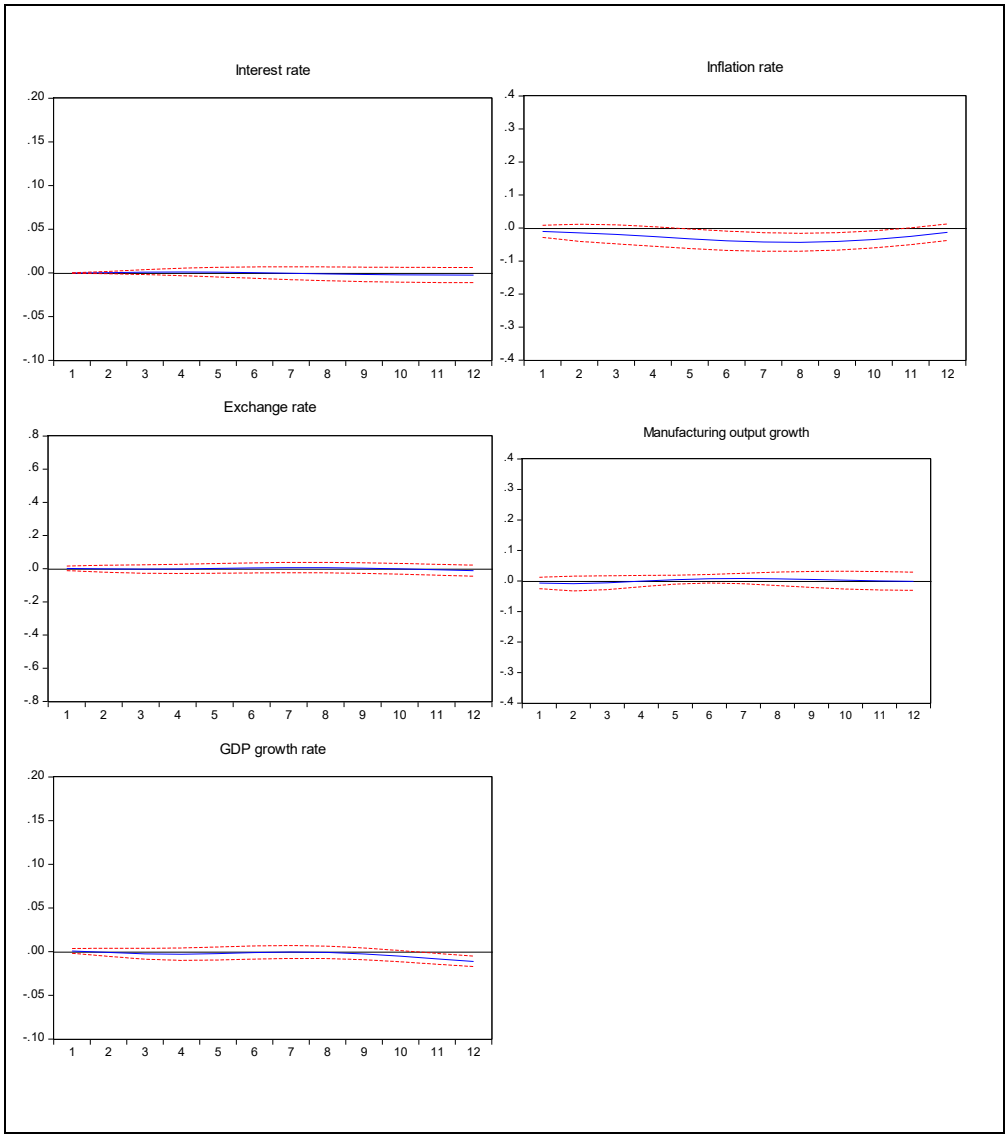
and manufacturing output to decline initially up to the fourth period before picking up gradually. The currency appreciation might have been the cause of the initial fall in manufacturing output. However, it rises later as a result of the control of inflation which falls sharply. Expectedly, the GDP growth rate also follows the same pattern of growth.

This revelation is a pointer towards the fact that interest rate policy is likely to have a significant influence on output growth of the manufacturing sector in Algeria. According to Berument (2007), when studying the monetary transmission mechanism in an oil rich country, if interest rate policy is used to curtail a rise in inflation rate (Taylor Principle), it will have a significant positive effect on real output. The implication of this finding and the foregoing discussion is that interest rates can influence output of the manufacturing sector in Algeria through the exchange rate and inflation rate as the medium of transmission (intermediate targets).

The first thing noticed in Figure 4.16 is that the absence of the sharp and significant responses from all the variables as observed under the interest rate shock. There appears not to be very clear responses from the variables to a money supply shock in Algeria. The inflation rate responds slowly in a decreasing form and later picks up gradually. The exchange rate appears neutral as the zero line margin overshadows the impulse response graph from exchange rate. However, it appears that both manufacturing sector growth and exchange rate fail to respond to money supply shock.

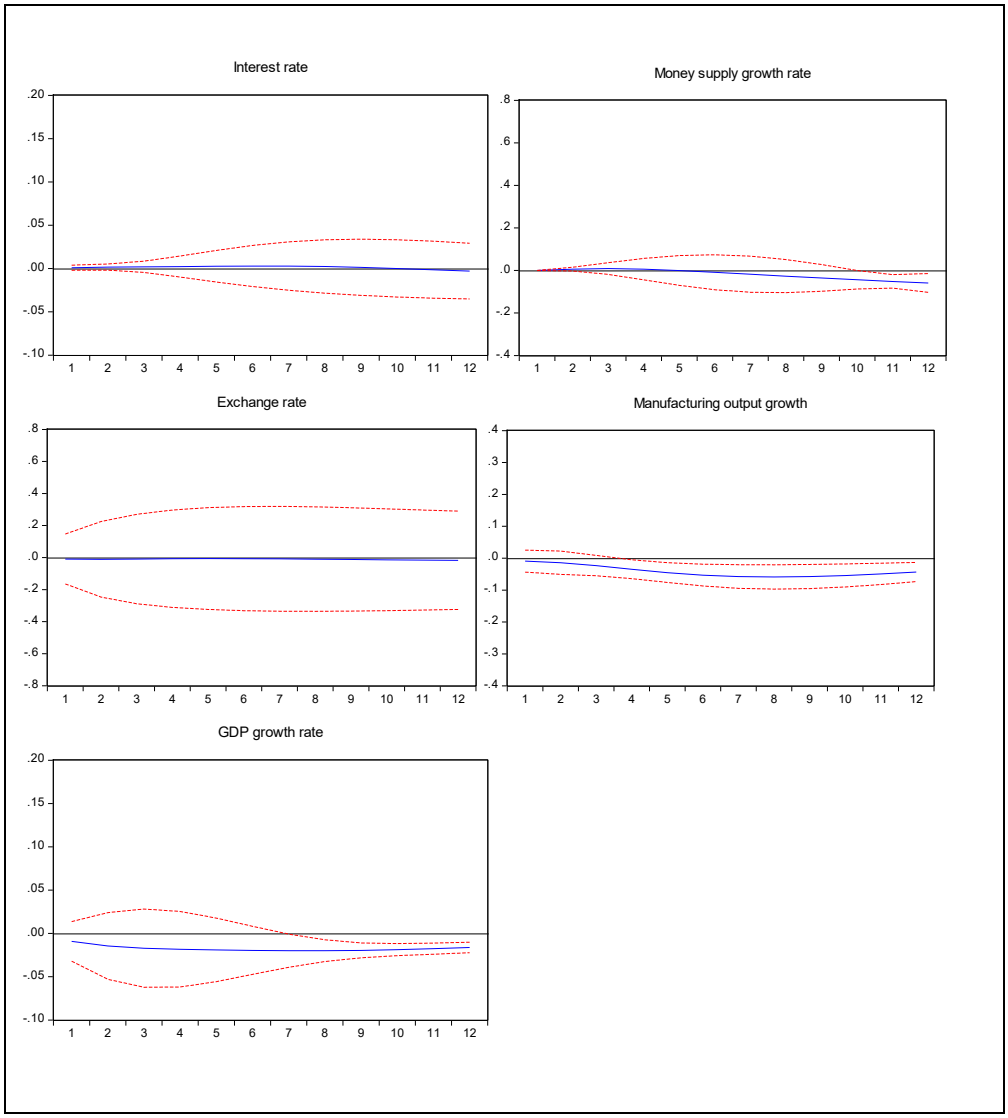
The inflation shock as shown in Figure 4.17 appears to have no effects on the variables except manufacturing output growth and the GDP growth rate. Interest rates do not respond at all. Money supply responds with a decline that becomes significant in the tenth period. This might not be unconnected to the incessant interference by the monetary authorities in Algeria to stabilize price and exchange rate. Often the central bank of Algeria, in her pursuit of inflation rate and exchange rate targeting, makes use

Figure 4.16: Impulse responses to a money supply shock (Algeria)



of external reserves of the country to augment any imbalance noticed (Bouchaour and Al-Zeaud 2012). This interference has been preventing monetary policy instruments from demonstrating appropriate and natural responses to shocks from inflation rate and the exchange rate (see Francois and Mignon, 2008).

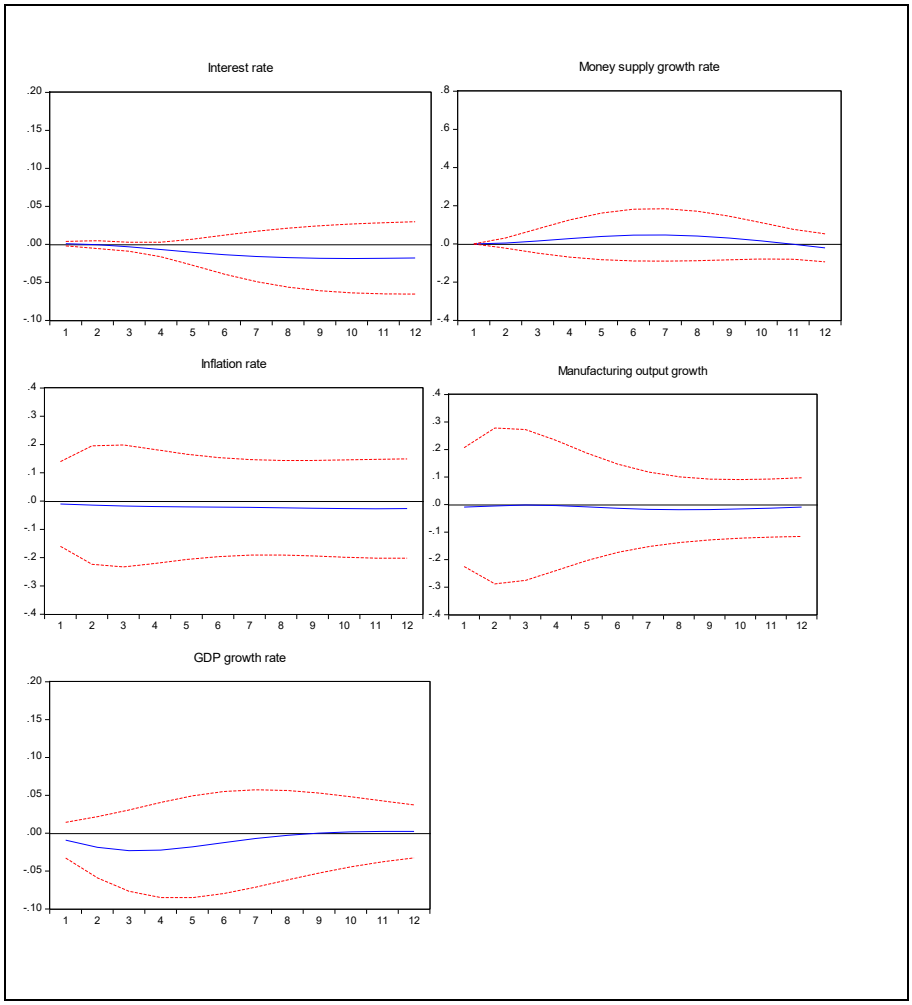
Figure 4.17: impulse responses to an inflation shock (Algeria)



However, it should be noted from the impulse response graph that unlike other variables in the graph, manufacturing output growth appears to demonstrate a very conspicuous response to the inflation shock. There is an indication that the shock makes the output of the manufacturing sector in Algeria fall gradually. Apart from manufacturing output, it can also be seen that GDP growth rate is another variable that demonstrates a clear response to the shock from the inflation rate. The reaction is also negative. This is also

showing that inflation rate in Algeria is an impediment to the growth of GDP, especially resulting from a decline in the manufacturing output growth.

Figure 4.18: Impulse responses to an exchange rate shock (Algeria)



As expected, the responses of the variables are not in a distinctive rise or fall pattern to an exchange rate shock as shown in Figure 4.18. Despite this, manufacturing output displays a sluggish albeit insignificant downward trend following the exchange rate shock, while the monetary policy instruments and inflation rate hardly show a noticeable pattern of movement in response to the shock. However, the fact that the manufacturing growth rate appears to rise initially and slowly up to period 4 is in

response to the currency depreciation caused by the exchange rate shock. Although it falls gradually later, this might not be unconnected to the intervention of the monetary authority to control the shock. It again confirms that currency depreciation might promote output of the manufacturing sector (see Mordi and Adebiyi,2009; Mahmud, 2010; Ushie, Adeniyi and Akongwale,2012; Olomola, 2006).

4.6.4.2 Variance decomposition analysis on Algeria

We now focus on components of the monetary policy transmission mechanism. With variance decomposition, we explain the responses of these variables to each shock identified in the Algerian economy. In other words we set out here to investigate the contribution of each shock to the components of monetary policy transmission mechanism.

Table 4.12: Variance Decomposition of interest rates (Algeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.936829	0.017356	98.69360	0.001520	0.012655	0.019942	0.001708	0.316393
6	0.835934	0.011856	97.58076	0.002400	0.021771	0.277225	0.210049	1.060003
9	0.739469	0.009643	94.30725	0.004277	0.024733	0.718717	0.788827	3.407084
12	0.661947	0.018976	90.95664	0.011230	0.025352	1.055934	1.280472	5.989451

Table 4.12 confirms the dominant role of the oil price in determining the level of interest rates in Algeria. Out of all the shocks, the oil price shock has the greatest influence on changes in interest rates. The oil price contributes about 93 percent of the changes in interest rates in the first period only. The contribution decreases in subsequent periods, while that of GDP increases. Money supply, inflation rate and exchange rate, which are all components of the monetary policy transmission mechanism, do not contribute significantly to the changes in interest rates.. Again, we noticed that the oil output growth shock does not contribute much to the interest rate fluctuations in Algeria. This is confirmation that the shock from the oil price appears to influence the interest rate without passing through the oil output growth rate.

Table 4.13: Variance Decomposition of money supply (Algeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	3.575931	0.317982	9.624737	85.17430	0.111178	0.247669	0.744989	0.203216
6	5.564502	1.746828	46.86021	43.49735	0.032267	0.666155	1.581269	0.051423
9	5.442392	2.980515	63.45253	26.12216	0.126233	0.478793	1.364032	0.033344
12	5.000503	3.410883	70.33137	18.94270	0.316203	0.306221	1.039257	0.652857

Oil price continues to affirm its influence in the monetary policy transmission mechanism in Algeria as shown in Table 4.13. Again, apart from interest rate which is a monetary policy instrument, oil price shock contributes the highest percentage to the variations in money supply

Table 4.14: Variance Decomposition of Inflation rate (Algeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.516769	1.069329	20.58701	0.865833	69.24148	0.757319	0.248144	6.714122
6	0.970810	2.838451	41.98115	0.871760	27.53939	0.416223	0.710831	24.67139
9	1.261831	2.868420	47.83664	0.950501	17.16261	0.365950	0.418090	29.13596
12	1.420550	2.601777	50.56804	0.863324	14.48438	0.438649	0.479145	29.14413

The impulse response analyses have shown that inflation has some linkages with other variables in the monetary policy mechanism especially interest rates. The same observation is made in Table 4.14. Apart from interest and GDP growth rates, oil price and oil output growth rates are another important factor that influences inflation rates in Algeria. Money supply as a component of monetary policy does not affect the inflation rate in Algeria as much as the oil price does. This is consistent with our earlier finding that inflation in Algeria might not be as a result of an increase in money supply.

Table 4.15: Variance Decomposition of exchange rate (Algeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.742382	0.844015	1.889646	0.011991	0.397429	92.43763	0.239517	3.437389
6	0.460013	1.340992	17.58272	0.012474	0.156851	71.62539	0.253684	8.567877
9	0.193791	1.020606	39.53477	0.017257	0.106281	48.18137	0.195773	10.75015
12	0.158075	0.694539	53.57782	0.022548	0.107686	33.63627	0.114981	11.68808

Table 4.15 shows that an oil price shock has a high influence on exchange rate fluctuations in the first period, but the influence weakens as the ensuing period. This is as a result of adjustments in the exchange rate to cope with any oil price regime the economy is facing. Once, the exchange rate is adjusted to cope with the new oil price regime, that influence is absorbed. The interest rate continues to be the most dominant monetary policy operating instrument in Algeria and interest rate shock has the highest contribution to changes in the exchange rate in Algerian. The GDP growth rate and the oil output growth rate are also very strong shocks that contribute to exchange rate variations.

Table 4.16: Variance decomposition of manufacturing output growth (Algeria)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.309415	2.190588	0.574823	0.273215	1.731715	0.239293	87.96335	6.717605
6	0.234693	2.739144	1.727245	0.687814	7.235354	0.397010	60.73537	26.24337
9	0.200103	4.183053	16.10652	2.426450	9.273727	0.736962	32.22488	34.84830
12	0.119686	5.857290	28.02267	2.741843	7.731906	0.590879	19.13293	35.80279

Manufacturing output growth is our variable of primary interest. Table 4.16 quantifies the contribution of different shocks in the system to variations in manufacturing output growth. The table indicates that the contribution of oil price shocks to changes in manufacturing output growth diminishes in ensuing periods, while that of the monetary policy instruments shocks increase. Interest rate shocks again play a pronounced role in explaining variations in the level of output in Algeria's manufacturing sector. In the same vein inflation rate is another important shock that affects the manufacturing sector. This was also shown in the impulse response analysis. GDP growth rate and oil

output growth rate are also found to have a great influence on the variations in manufacturing output. The implication of this result is that the monetary policy transmission mechanism (MTM) in Algeria conveys the shock from the oil price to manufacturing output. This is because the contribution of an oil price shock to fluctuations in manufacturing output reduces as the period progresses, while the contribution of the MPIs shocks rises (see for example Bouchaour and Al-Zeaud, 2012).

4.6.4.3 Inferences and comparisons with previous empirical studies (Algeria)

As earlier stated, related literatures on monetary policy and economic activities in the Algerian economy is very scanty. Little research has been done on oil shocks, monetary policy and output in Algeria. Therefore, from the available literature we shall make comparisons in terms of similarities and differences with the findings of this study.

This study has confirmed the effect of oil prices on manufacturing output growth. It has been shown that this effect can be traced through the monetary policy transmission mechanism (MTM). The variance decomposition analysis shows that as the contribution of an oil price shock to the manufacturing output growth falls that of monetary policy instruments' shocks continue to rise. The same results were obtained by Bouchaour and Al-Zeaud(2012).

It also appears that the oil price shock affects back into the MTM directly without passing through the oil output growth. This confirms that the impact of oil output growth does not have as much influence on the variables in the MTM as does the oil price shock. The MPIs' shocks also have a greater contribution to the behaviour of manufacturing output than oil output growth shock in the MTM.

The effect of inflation rates on the manufacturing sector in Algeria appears to be significant. However, the nature of inflation in Algeria appears not to be predominantly a monetary phenomenon. Our study results corroborate the findings of previous empirical studies that inflation in Algeria is mostly imported inflation as a result of oil price shocks. Output also appears to be another important factor that explains the rate of

inflation in Algeria. The variance decomposition analysis shows that the contribution of GDP growth rate (output) to variations in inflation rate is very high. This is in agreement to the finding of Aziz (2010), who observed that output, instead of money supply, account for a large part of fluctuations in inflation rates due to the effect it has on price. This further supports the view that inflation, especially in the oil exporting countries, might not necessarily be a monetary phenomenon but an effect of structural rigidities in the economy.

However, Algerian monetary authorities frequently manipulate monetary policy to cope with inflation pressure, but the result has not always been favourable to the manufacturing sector of the economy. The impulse response analysis also confirms that as inflation rises manufacturing output growth falls.

Nevertheless, the relationship between exchange rate and manufacturing sector growth has been very sluggish. It is, however, apparent that currency depreciation promotes the growth of the manufacturing sector, although the impact is small. In other words over-valuation of a currency is inimical to the growth of the manufacturing sector. The variance decomposition shows that the exchange rate might not be a very important shock in explaining fluctuations in the performance of the manufacturing sector in Algeria. This is due to the incessant control and monitoring of the exchange rate by the Algerian monetary authorities through a dedicated exchange rate targeting policy.

Between the two monetary policy instruments, interest rates appear to be the stronger tool of monetary policy in Algeria. By comparison, the impact of money supply on other variables in the monetary transmission mechanism is larger than that of interest rates. The impulse response analysis and variance decomposition are in agreement on this finding.

Finally, the large impact of interest rates on the performance of the manufacturing sector makes it the best tool to be used to stimulate the growth of the manufacturing sector in Algeria.

4.6.5 Structural VAR estimation results for Gabon

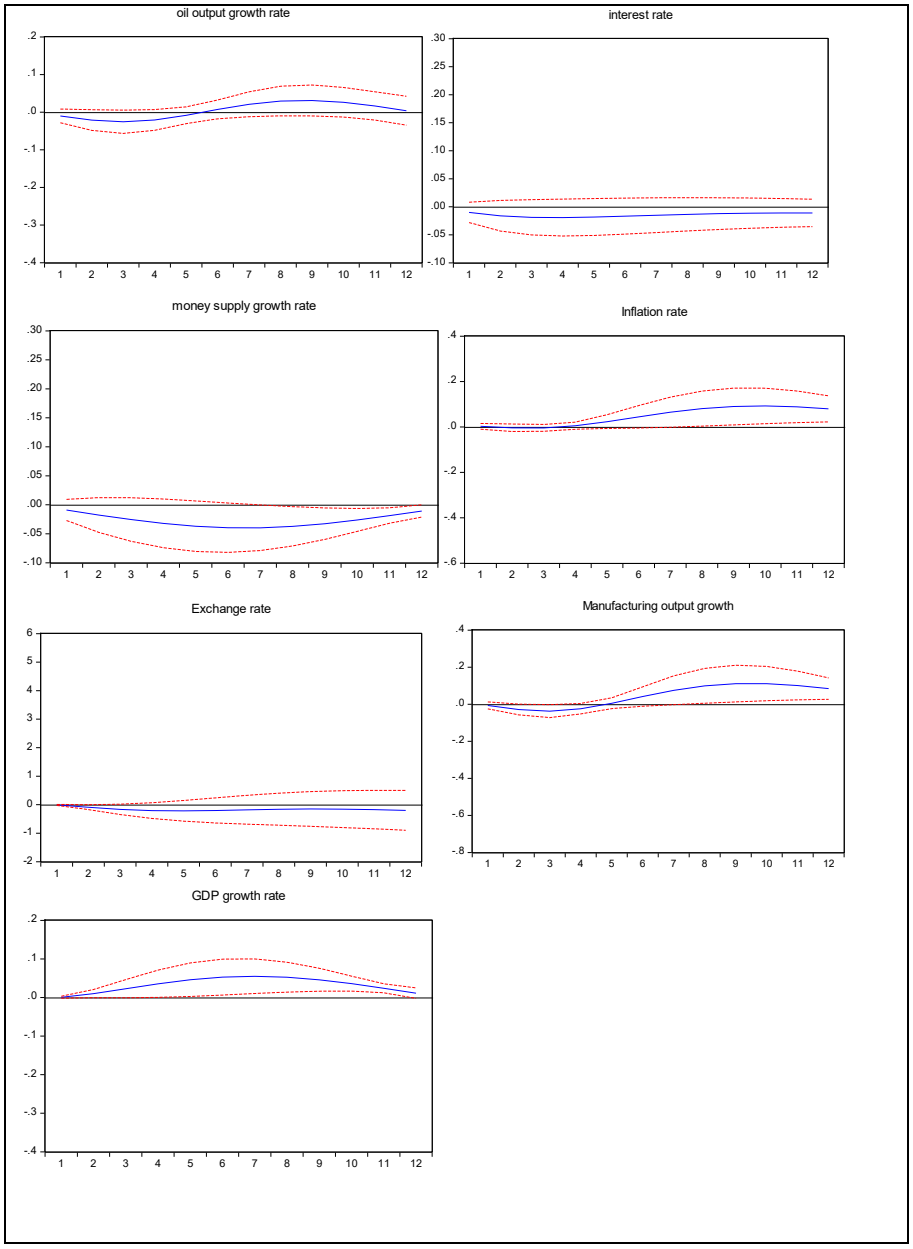
As earlier stated, Gabon is one of the small net oil exporting countries in Africa, yet oil remains the mainstay of the economy constituting about 50percent to GDP and almost 85percent of total exports. Gabon is among the small oil producing countries in Africa such as Equatorial Guinea, Sudan, and Cameroun. The country is included in our analysis of monetary policy and manufacturing to investigate if there is any deviation from the results obtained in the analysis of large oil exporters like Nigeria and Algeria.

4.6.5.1 Impulse response function analysis on Gabon

The sequence of analysis follows the same pattern as in the case of Nigerian and Algerian economies. We begin with the effect of oil price shocks on the system. Figure 4.19 shows the responses of selected variables in the monetary policy transmission mechanism to a one standard deviation oil price shock. As observed in the analysis of Nigeria and Algeria, a similar response of oil output growth rate to an oil price shock is also noticed.

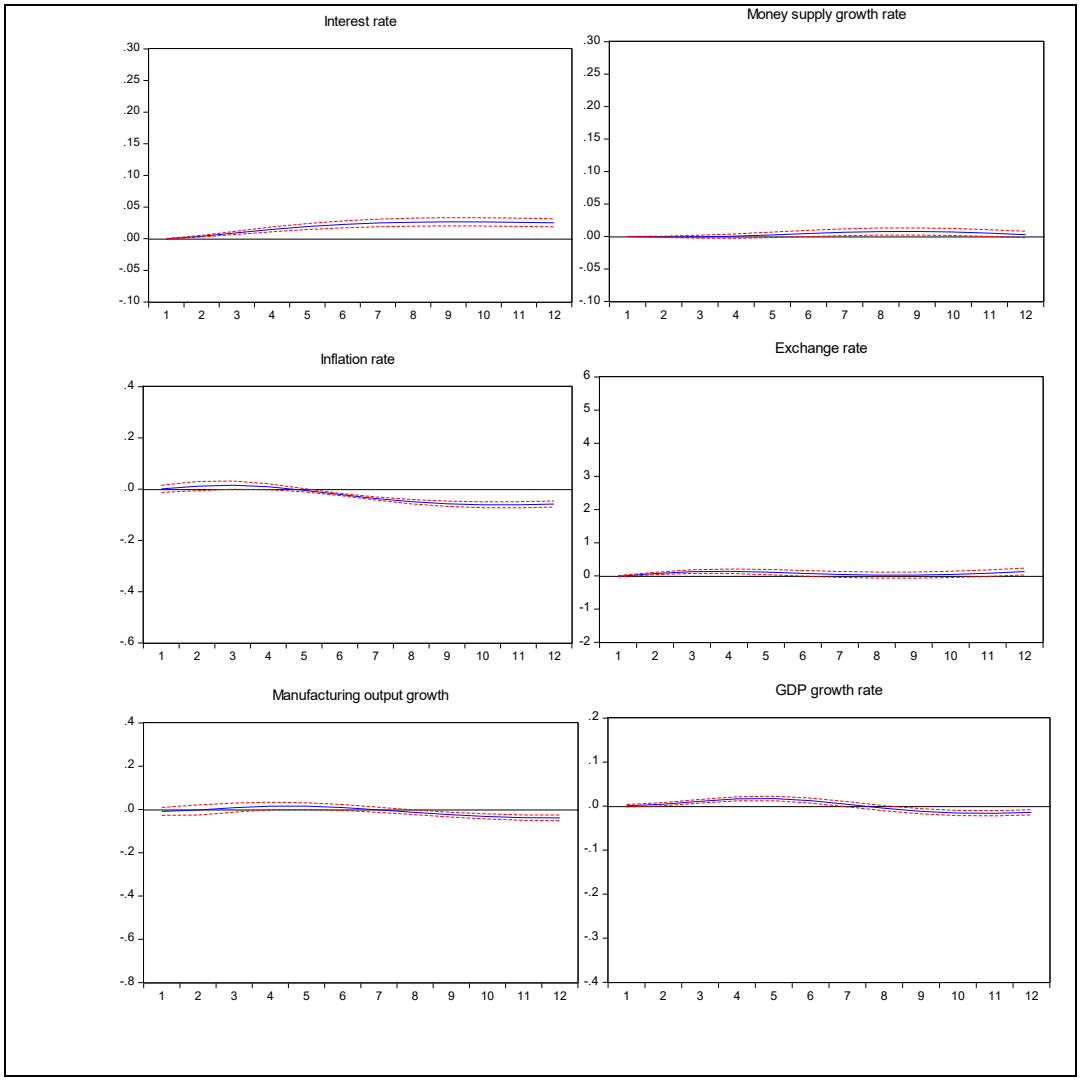
The oil output first falls before it picks up sharply. Interest rates do not show a clear response to the oil price shock but the response is insignificant. The effect of the shock shows that the growth rate of money supply falls initially, becoming significant after six periods. Later, the money supply growth rate picks up gradually. The oil price shock triggers a sharp rise in the rate of inflation, which becomes significant in the seventh period. This shows that inflation might not be a result of changes in money supply. In response to the shock, manufacturing output falls initially but after the fourth period it starts rising.

Figure 4.19: Impulse responses to an oil price shock (Gabon)



This might be a result of the actions of the monetary authorities in stabilizing the exchange rate, since they practice a fixed exchange rate regime.

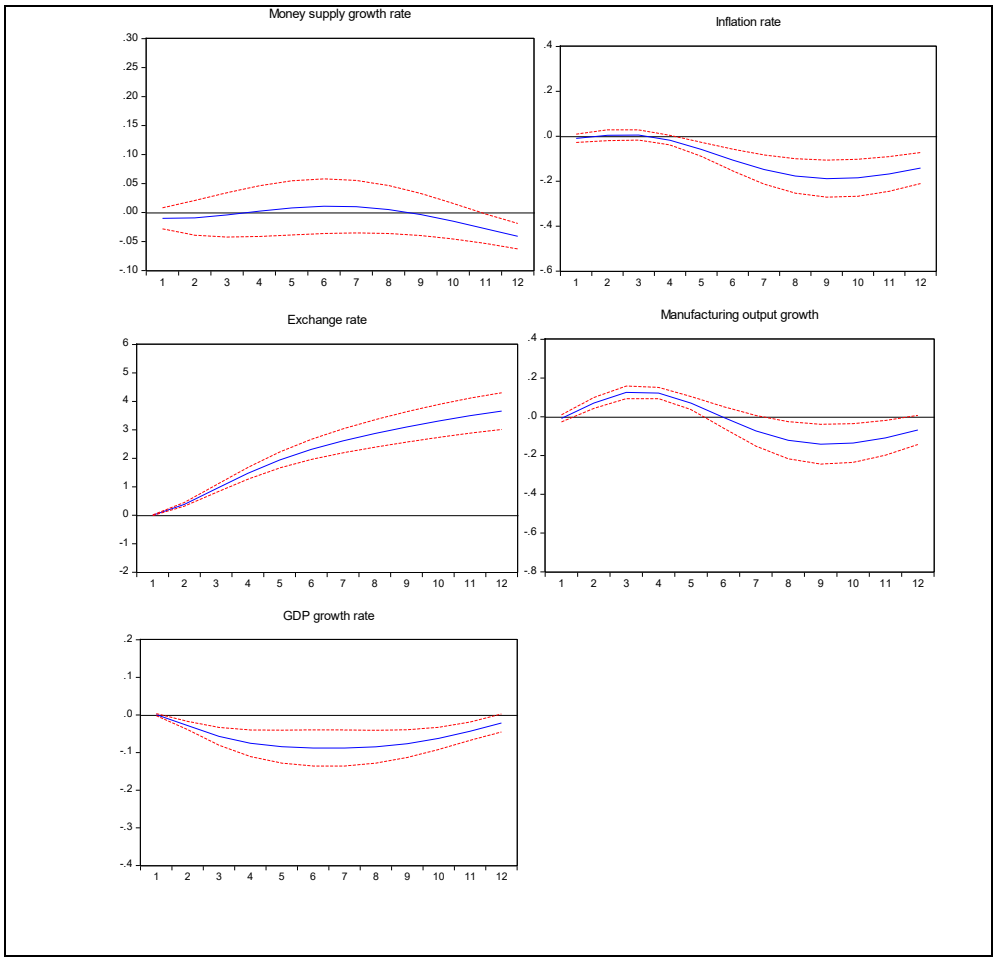
Figure 4.20: Impulse responses to oil output growth rate shock (Gabon)



The shock from the oil output growth rate in Gabon and the responses from selected variables in the monetary policy transmission mechanism are shown in Figure 4.20. The shock causes interest rates to rise and money supply growth rate to rise initially and latter fall. The inflation rate rises while manufacturing output growth decreases in response to the oil output growth shock. It should be noted that the real exchange rate also falls, although the response is insignificant. The currency appreciation might have induced the fall in the manufacturing output. GDP growth rate rises initially and later

falls gradually, beginning about the fifth period. The implication of this is that the Gabonese economy is highly susceptible to the negative effect of oil output growth. World Bank (2012) emphasized that oil production shock in Gabon has been having a detrimental effect on growth in recent times which is attributed to dwindling oil reserves in the country. This has been making it difficult for the country to cope immediately with any increase in the global demand for oil.

Figure 4.21: Impulse responses to an interest rate shock (Gabon)



The interest rate shock has a major impact on the economy of Gabon as shown in Figure 4.21. Gabon is a member of a unified monetary zone called CEMAC (communaute economique et monetaire de l' afrique centrale). Members of this monetary zone are

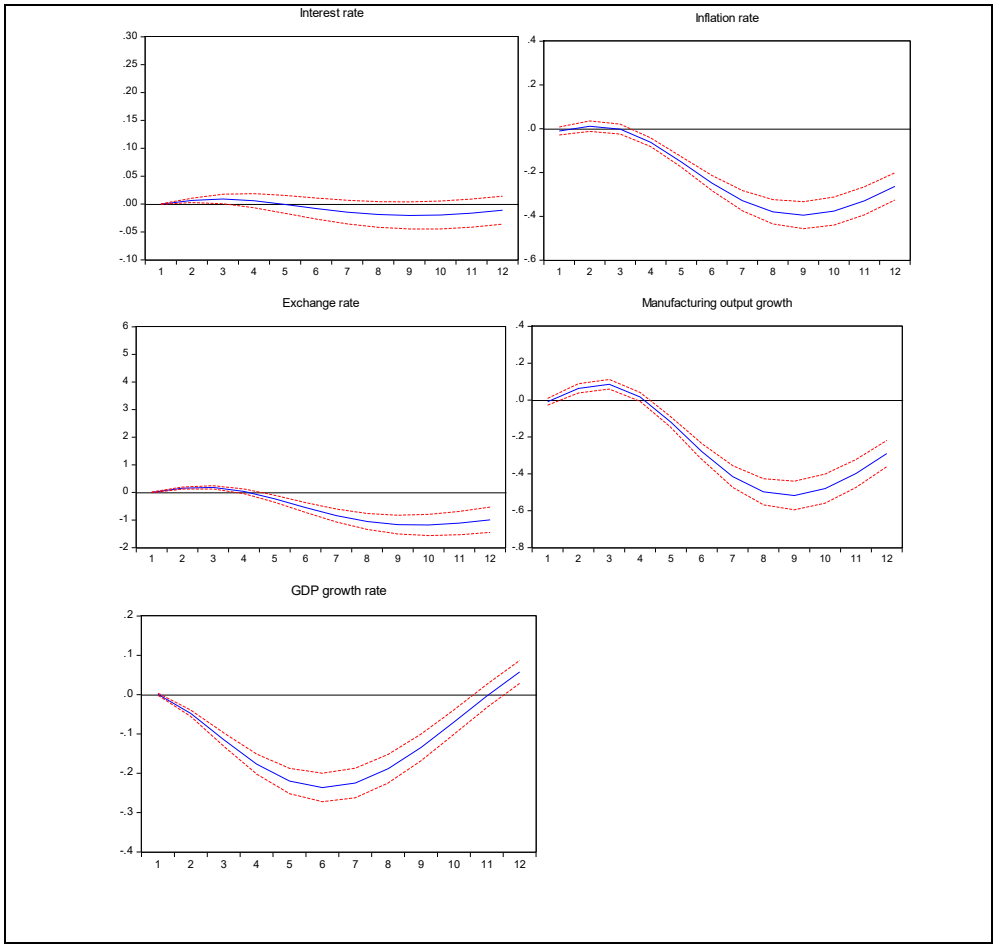
Cameroun, Central African Republic, Chad, Congo (Brazzaville), Equatorial Guinea and Gabon. All these countries, except Central African Republic, are net oil exporters. These countries are under one monetary system and a common central bank called BEAC. Whenever there is an increase in interest rates, it makes the Gabonese currency depreciate in real value (see Zafar, 2004; IMF, 2010; World Bank, 2012). The implication as noticed in the impulse response function is that an interest rate shock leads to a fall in money supply growth rate, inflation falls and manufacturing output growth rises initially at least up to the fourth period before falling. This might not be unconnected to the action of the monetary authority its effort to avoid the real exchange rate depreciation and will cause manufacturing output to fall as the period progresses. GDP growth rate also falls initially before picking up, in response to the shock.

These results further justify the findings from Nigeria and Algeria that a currency appreciation is possibly going to have a detrimental effect on output growth of the manufacturing sector in an oil exporting country. However, currency depreciation will have a positive effect on manufacturing output. On the whole, interest rate shock appears not to have any positive effect on the manufacturing output in Gabon.

We also examine the impulse response to a money supply growth rate shock (see Figure 4.22). The responses are dictated by the fixed exchange rate system in Gabon. A money supply shock characterised by an increase in money supply might not have a positive influence on the manufacturing growth rate as a result of the pegged exchange rate. Manufacturing output growth rate initially rises until the third period; then it starts falling, a process that goes on until the ninth period. Thereafter, it starts picking up. This is an indication that expansionary monetary policy is not very effective in promoting growth under fixed exchange rates. The overvaluation resulting from the pegged exchange rate system does not seem to have a good result on the manufacturing output growth. The real exchange rate response which shows that the currency appreciates has a negative impact on the manufacturing output growth by causing it to fall sharply. Generally, the response of manufacturing output growth shows that it initially increases, then falls before rising again. But for most of the periods

manufacturing output is falling. Precisely out of the 12 periods, the manufacturing output falls between the second period and the tenth period. This fall can be associated with the currency that appreciates.

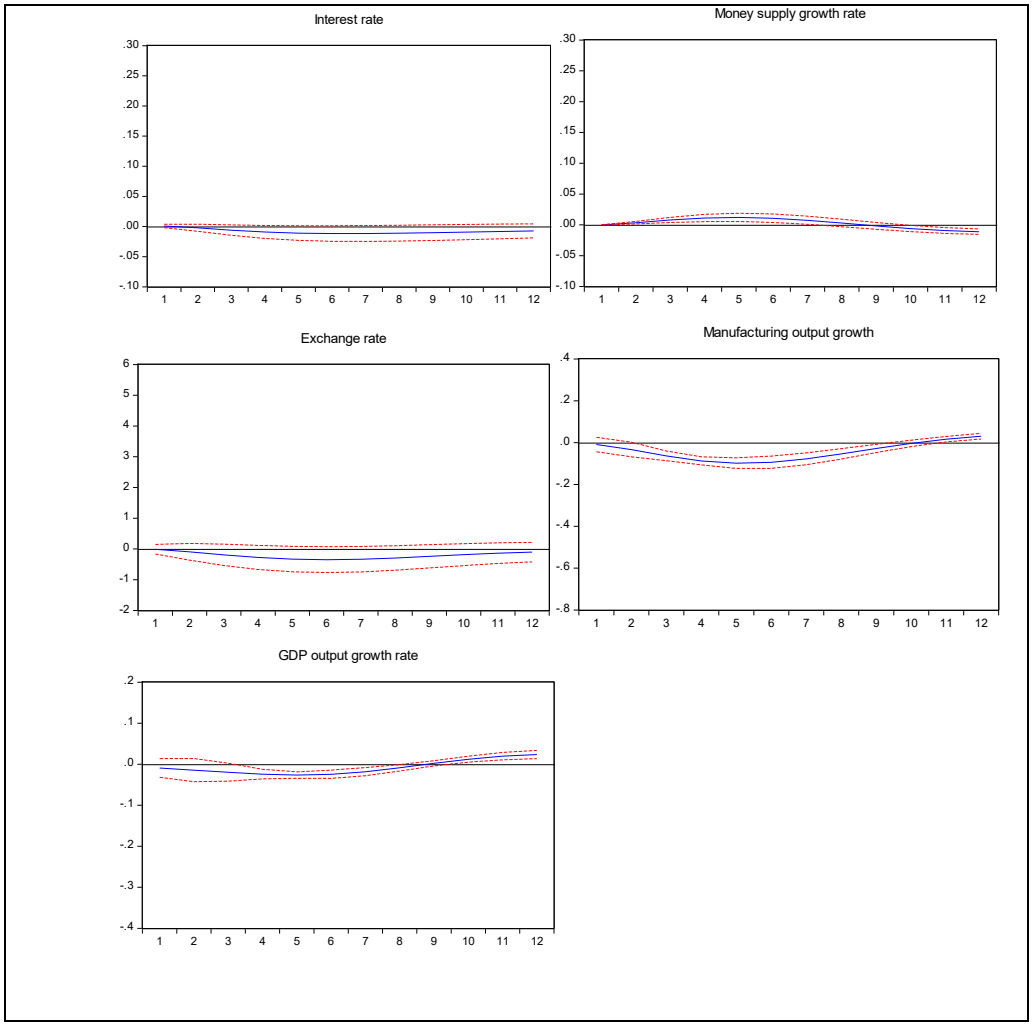
.Figure 4.22: Impulse responses to money supply growth shock (Gabon)



However, Gabon has benefited from the stable exchange rate in terms of internal economic stability; but the negative impact has been in the area of international trading as it discourages importation of goods used in the domestic manufacturing industry (Zafar, 2004). According to the World Bank (2010) the external reserve is used to maintain the fixed exchange rate. The monetary policy instruments in Gabon are usually used for maintaining economic stability in the face of the unrealistic exchange rate.

Since the exchange rate is pegged, most often the economic stabilization effort works at variance to the growth of the non-oil sector, therefore limiting the effectiveness of monetary policy instruments in promoting the output growth.

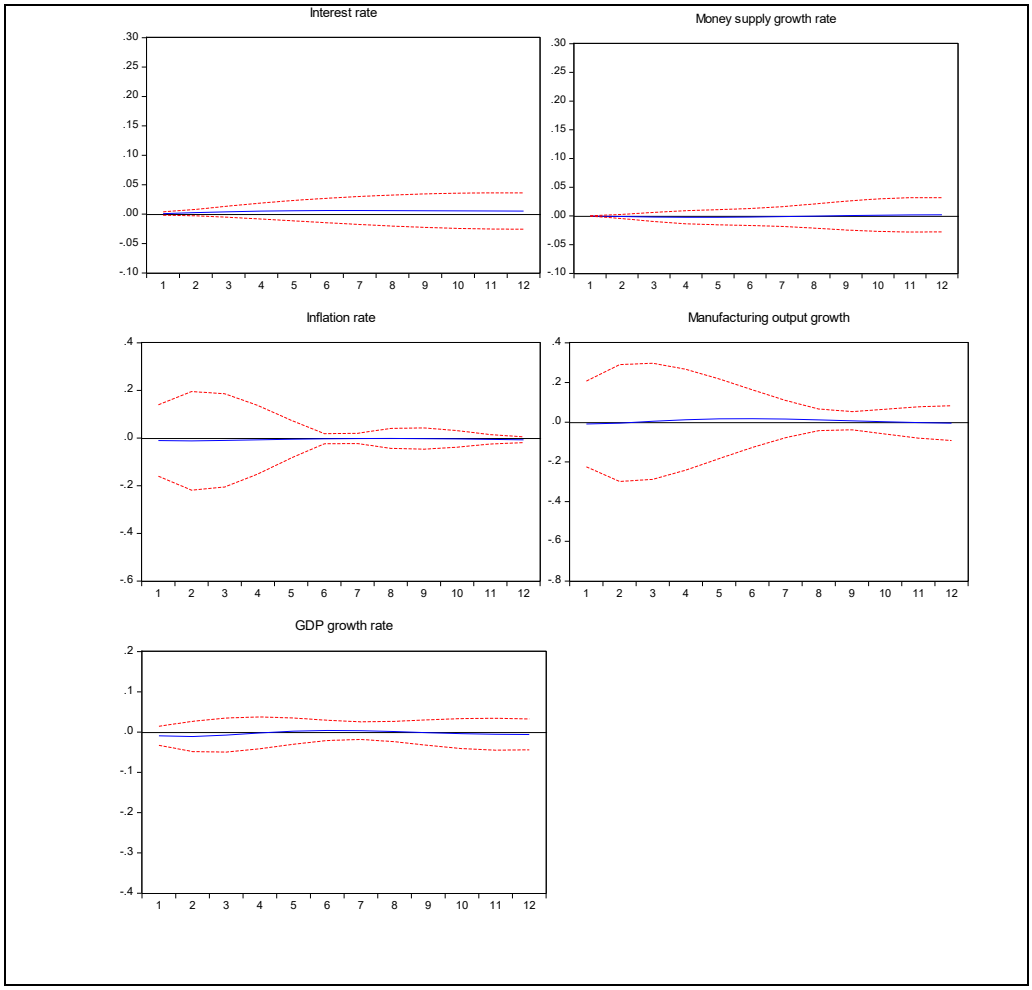
Figure 4.23: Impulse responses to an inflation rate shock (Gabon)



The major limitation of the fixed exchange rate regime in Gabon is the inability of the Gabonese economy to cope with any external shock (IMF, 2010). Nevertheless the inflation rate is controlled through monetary policy instruments. In response to an inflation shock, Figure 4.23 shows that interest rates fall and money supply rises. To correct the inflation pressure, interest rates later pick up while money supply begins to

fall. The corresponding effect on the manufacturing sector indicates that as soon as interest rates start rising and money supply falls, manufacturing output growth starts falling. Therefore, it follows the same trend explained in Figure 7.34 that as the monetary policy tries to control the economic instability it affects the manufacturing sector of Gabon negatively. Again, the shock causes the real exchange rate to fall steadily with the resultant appreciation in currency possibly being responsible for the steady fall in the manufacturing output until the seventh period before it starts picking up. This adjustment to the corresponding rise in the real exchange rate is in the seventh period.

Figure 4.24: Impulse responses to an exchange rate shock (Gabon)



The impulse responses as shown in Figure 4.24 indicate that the variables in the system are hardly affected by any shock from the exchange rate. This is because the exchange rate in Gabon is fixed and hence may not constitute any significant influence on the monetary policy transmission mechanism since external reserves are always used as a buffer to sustain the fixed exchange rate.

4.6.5.2 Variance decomposition analysis on Gabon

In this section, we explore the contribution of various shocks to the behaviour of monetary policy variables and manufacturing output growth. We begin with the monetary policy instruments.

Table 4.17: Variance decomposition of interest rates (Gabon)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	1.115667	0.158539	97.36436	0.194595	0.064858	0.037551	0.064453	0.999973
6	1.050368	0.739324	96.68273	0.139356	0.235326	0.075228	0.295775	0.781894
9	0.939868	1.334849	95.67908	0.501452	0.308630	0.095282	0.578975	0.561864
12	0.884717	1.752597	94.99554	0.664352	0.318499	0.105867	0.823813	0.454620

Table 4.17 shows that the response of interest rate to an oil price shock is the highest. This confirms the position of various studies that monetary policy instruments are affected by oil price fluctuations in the Gabonese economy. Any external shock is augmented through an adjustment of monetary policy instruments so as to maintain domestic economic instability (see Zafar, 2004). As observed in both Nigerian and Algerian economies, interest rates are more responsive to oil price shocks than oil output growth shocks. This confirms that in Gabon, the effect of oil price shocks to the MTM is similarly not likely to have passed through oil output growth rate.

Table 4.18: Variance Decomposition of money supply growth rate (Gabon)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	1.287367	0.000751	0.250237	98.33664	0.091993	0.005325	0.023287	0.004404
6	2.016468	0.011618	0.156453	97.51665	0.184666	0.007516	0.104806	0.001822
9	2.576253	0.053567	0.150710	96.87343	0.149715	0.005805	0.189023	0.001503
12	2.770539	0.073474	0.872658	95.81687	0.209671	0.008014	0.246073	0.002702

The results found in the response of interest rates to an oil price shock are also observed here. Money supply is mostly affected by oil price shocks, according to Table 4.18. Even GDP growth rate and interest rate shocks do not explain a large part of the behaviour of money supply growth rate. It should also be noted that the contribution of oil output growth shock to the variations of money supply is very low.

Table 4.19: Variance decomposition of inflation rate (Gabon)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.092216	0.878739	0.305303	0.563120	95.06802	0.792750	0.521942	1.777908
6	1.606521	0.566152	9.327458	54.70956	30.64856	0.259949	0.279272	2.602526
9	3.126410	1.151951	15.14862	72.39876	7.351189	0.062891	0.092039	0.668140
12	3.940007	1.668772	16.58802	72.67836	4.512416	0.046683	0.076170	0.489574

The response of inflation rate to shocks from the monetary policy transmission mechanism is shown in Table 4.19. Although the oil price shock does not contribute the highest shock to inflation rate fluctuations, it has an increasing contribution as the period progresses. Despite this, the finding confirms our earlier results under impulse response analysis that inflation changes are predominantly driven by monetary policy instruments in the Gabonese economy. The contributions of interest rates and monetary policy shocks are the highest. This is an indication that the pace of inflation in the Gabonese economy is dictated by the monetary policy instruments and GDP growth rate.

Table 4.20: Variance decomposition of exchange rate (Gabon)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	2.704449	1.700820	79.19261	4.498067	3.580680	6.747723	1.515976	0.059678
6	1.207263	0.436361	89.34446	2.985810	2.561660	1.936645	1.153484	0.374320
9	0.576559	0.147385	86.51077	8.365292	1.420279	0.970746	0.967886	1.041088
12	0.404418	0.105673	87.47833	8.544124	0.798729	0.598482	0.870649	1.199597

Since a fixed exchange rate is practiced in Gabon, any shock received by the exchange rate is passed to the monetary policy instruments and the inflation rate. In other words, any negative effects that come from the exchange rate shock are augmented by the external reserve and through the components of the monetary policy transmission mechanism; and stability in the domestic economy is maintained. This assertion is deduced from what we observe in Table 4.20 where interest rate, money supply and inflation rate shock make the highest contribution to exchange rate fluctuations. This explains why the response of the exchange rate to these variables is the highest.

Table 4.21: Variance decomposition of manufacturing output growth (Gabon)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	2.888955	0.210253	27.09687	14.82686	6.714051	0.164277	48.07132	0.027410
6	2.035597	0.315008	18.09457	46.13403	13.88379	0.387522	19.04165	0.107826
9	3.270043	0.150579	8.134385	79.59973	4.128187	0.131444	4.543552	0.042081
12	4.041589	0.358769	7.516940	82.12962	2.744974	0.086899	3.093599	0.027614

The results, as shown in Table 4.21, are consistent with what we obtained under impulse response analysis. The interest rate appears to be the variable affecting manufacturing output growth the most. This is followed by money supply growth rate. It should be noted, however, that from the impulse response analysis, The exchange rate shock appears to be the weakest of the shocks explaining variations in manufacturing output, probably because it is fixed. Although the oil price shock has an increasing contribution to fluctuations in manufacturing output growth, its impact is not as high as that of monetary policy instruments and inflation rate shocks.

4.6.5.3 Inferences and comparison with other empirical studies (Gabon)

There is scarcity of literature on research related to monetary policy and manufacturing sector growth in Gabon. Only one or two studies have investigated issues relating to oil price shocks and monetary policy in the Gabonese economy.

It is apparent from our findings that the behaviour of monetary policy transmission mechanisms in a fixed exchange rate regime is different from that of a flexible exchange rate regime. Any external shock to the exchange rate is absolved by the external reserves while the monetary policy instruments are used to maintain internal economic stability. That is, the monetary policy instruments are adjusted to achieve domestic economic stability in terms of controling inflation. Often, this action makes MPIs ineffective in promoting growth as observed in the impulse response analysis of money supply where expansionary monetary policy fails to stimulate the growth of the manufacturing sector. In the flexible exchange rate system, the exchange rate and monetary policy instruments play an active role in maintaining economic stability. For instance, in Nigeria and Algeria, expansionary monetary policy leads to a steady increase in manufacturing output

In line with our findings in both the Nigerian and Algerian economies, the response of MPIs to an oil output growth rate shock is also very low in Gabon. This further justifies refuting the claims of Berument etal., (2009) that oil price shocks pass through the oil output of oil exporting countries to influence economic policies.

Due to the restrictions imposed by the fixed exchange rate system, authorities are concerned about using monetary policy to maintain economic stability domestically more than to promote manufacturing output growth in Gabon. This is evident in the fact that the automatic adjustment of the monetary policy mechanism in maintaining economic stability usually runs contrary to conditions that would have enhanced the growth of the manufacturing sector.

In Gabon, an oil price shock remains an important shock in the monetary transmission mechanism despite the fixed exchange rate system in practice. The loss of flexibility as a result of the fixed exchange rate system has made the manufacturing sector in Gabon highly susceptible to external shocks. The monetary policy instruments find it difficult to stimulate the manufacturing sector in this situation since they are meant to absorb economic instability that might have resulted from the rigidity of the exchange rate (Zafar, 2004).

In addition, it appears that inflation in Gabon is not as a result of money supply increase, as evidenced by both the impulse response and variance decomposition analysis that show that an increase in money supply does not necessarily lead to inflation. This shows that inflation in Gabon is most likely a structural phenomenon and not a monetary issue. As earlier explained, the low inflation policy is achieved through the use of MPIs and this is followed strictly by the Gabonese monetary authority since the fixed exchange rate has limited the effectiveness of the MPIs in promoting output growth of the manufacturing sector.

Findings from our previous analyses have also shown that the oil output growth rate shock has an adverse impact on manufacturing output growth in Gabon. Gabonese oil production has found it difficult to cope with sudden pressure from an increased demand in oil. This exposes the monetary policy transmission mechanism to the adverse effect of the oil output growth rate shock. The major reason for this has been the dwindling nature of the oil reserves in the country (see IMF, 2010).

4.6.6 Structural VAR estimation results for Libya

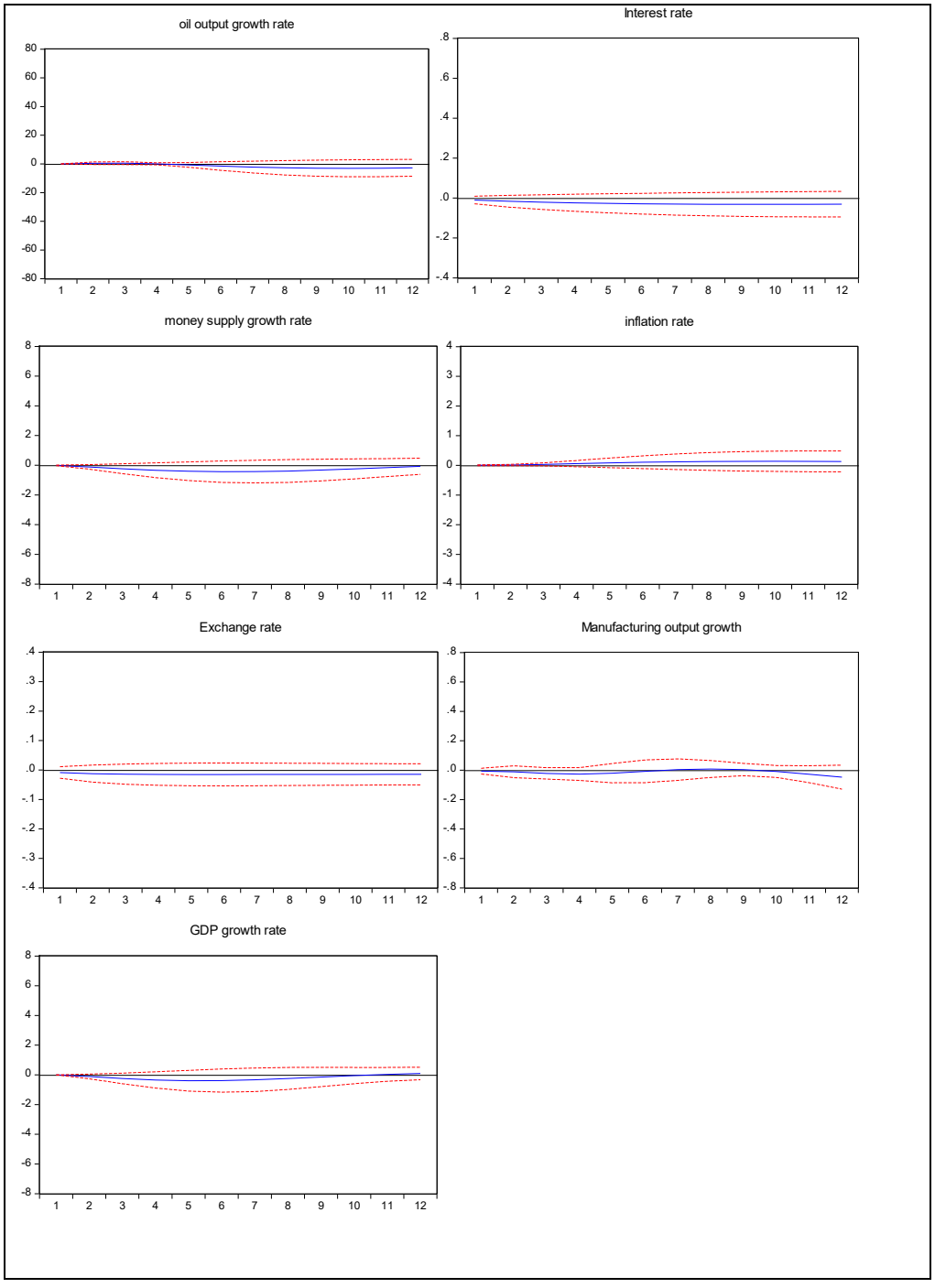
4.6.6.1 Impulse response function analysis on Libya

Like other big net oil exporters, Libya's impulse response functions show a strong influence of oil prices on the system. Our analysis of the impulse response functions on the Libyan economy also starts from the oil price shocks which is the exogenous variable in the model. Figure 4.25 shows the response of all variables to the oil price shock.

The impulse response functions in Figure 4.25 shows similar patterns of responses noticed in most of the previous countries analysed. The oil price shock as usual has a negative effect on the oil output growth rate, although the effect is insignificant. Interest rates fall after a brief initial rise and money supply growth rate also follows in the same direction so that it falls initially and later rises.

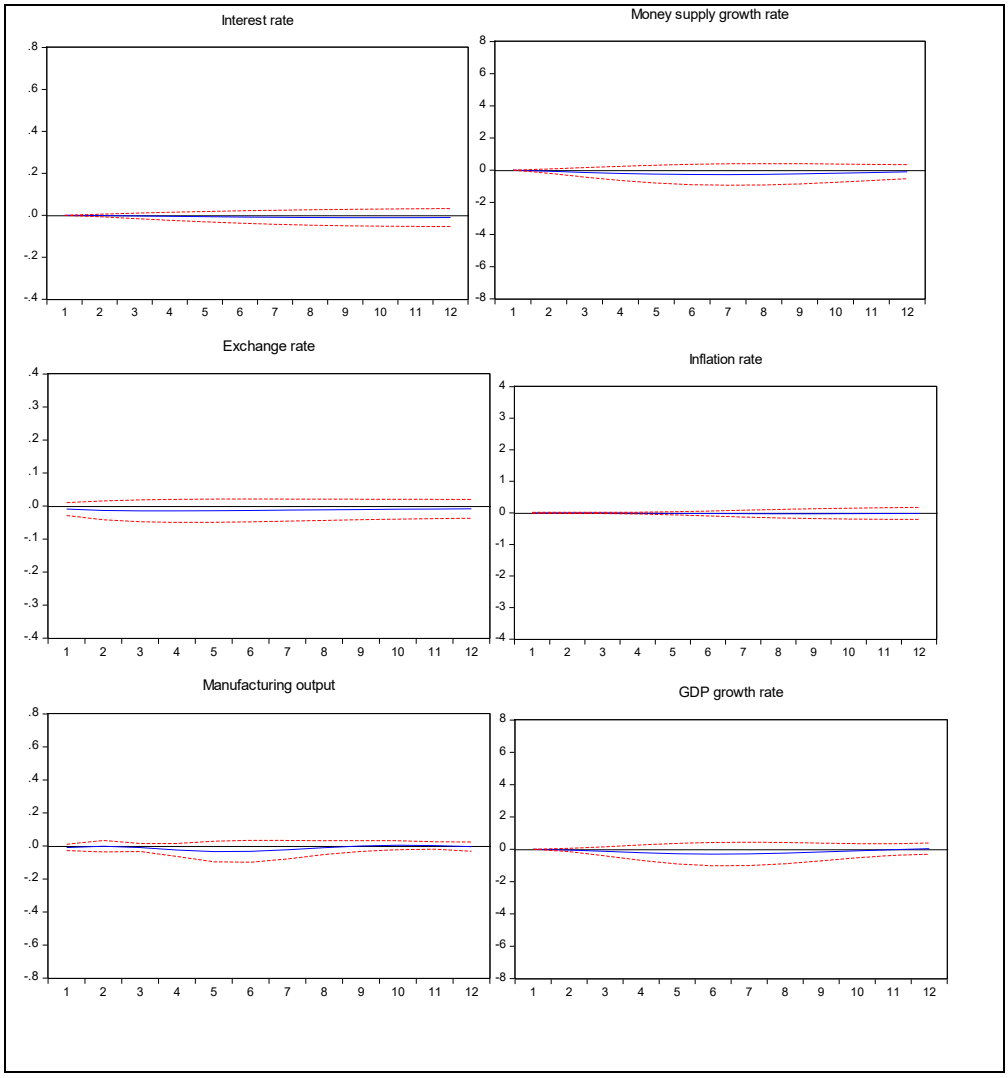
However, the initial fall in the money supply does not seem to affect the inflation rate as it rises steadily showing that inflation here might not be money supply motivated. The exchange rate, which is fixed during periods under study, did not show any significant movement but maintained almost a straight line movement along the origin. The manufacturing growth rate fell steadily. This again confirms another scenario of inverse relationship between inflation rate and the manufacturing output growth rate. The GDP growth rate also fell steadily and picked 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 Libyan economy as well. It is important to note that all impulse response functions in Figure 4.25 are insignificant.

Figure 4.25: Impulse responses to an oil price shock (Libya)



Impulse responses to the oil output growth shock is shown in Figure 4.26. The interest rate shows a less conspicuous falling trend while money supply also moves in the same direction but eventually starts rising.

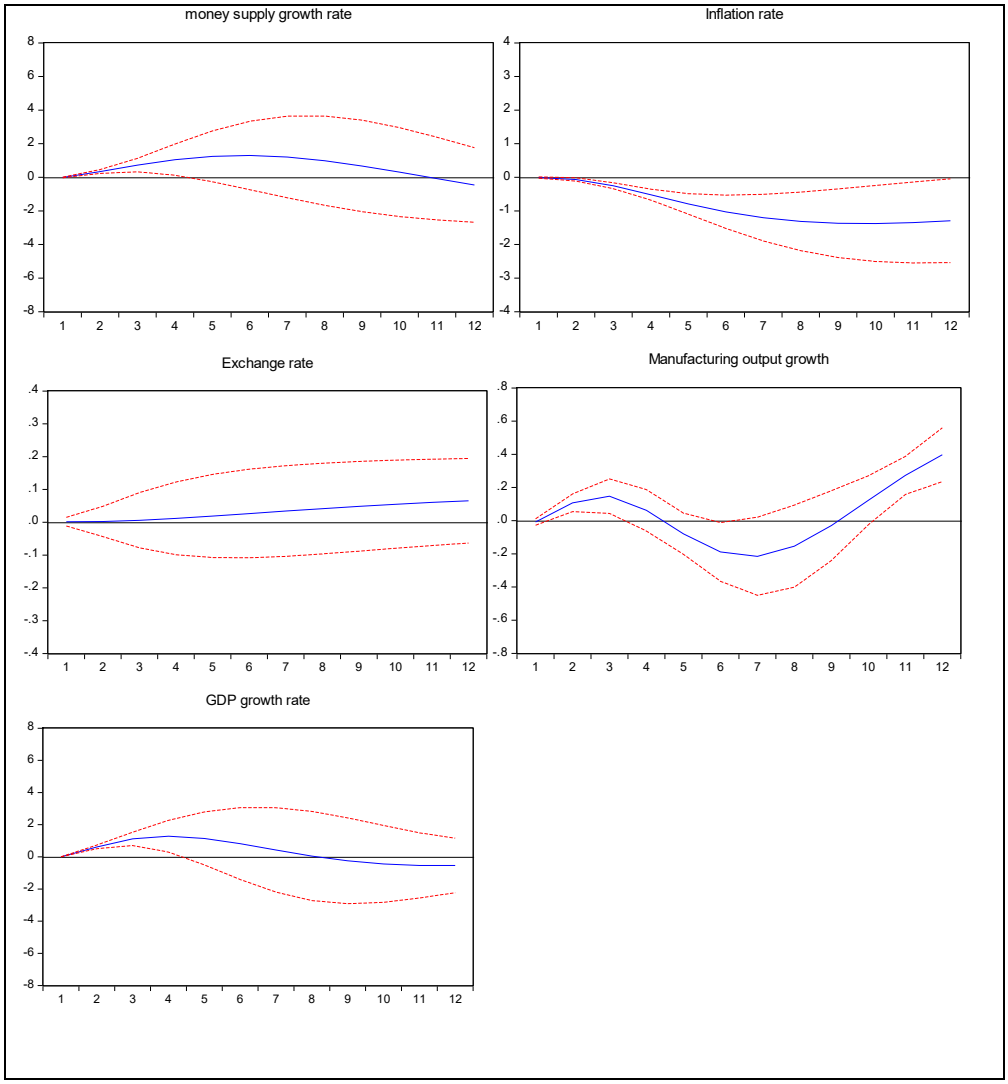
Figure 4.26: Impulse responses to an oil output growth rate shock (Libya)



However, the inflation rate seems to be neutral in its response. On the whole, none of the variables show a significant response to oil output growth shock. The manufacturing growth rate shows a more conspicuous downward movement and until period six when it gradually picks up. The pattern of movement of 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 4.27: impulse responses to an interest rate shock (Libya)



As observed in the case studies of other oil exporting countries previously analysed, most variables in the model respond significantly to an interest rate shock. The same is observed in Figure 4.27. The responses from all variables are sharp, thus confirming the importance of interest rates in the system. The shock causes an initial rise of money supply and a consequent fall beginning in period five. The shock causes the inflation

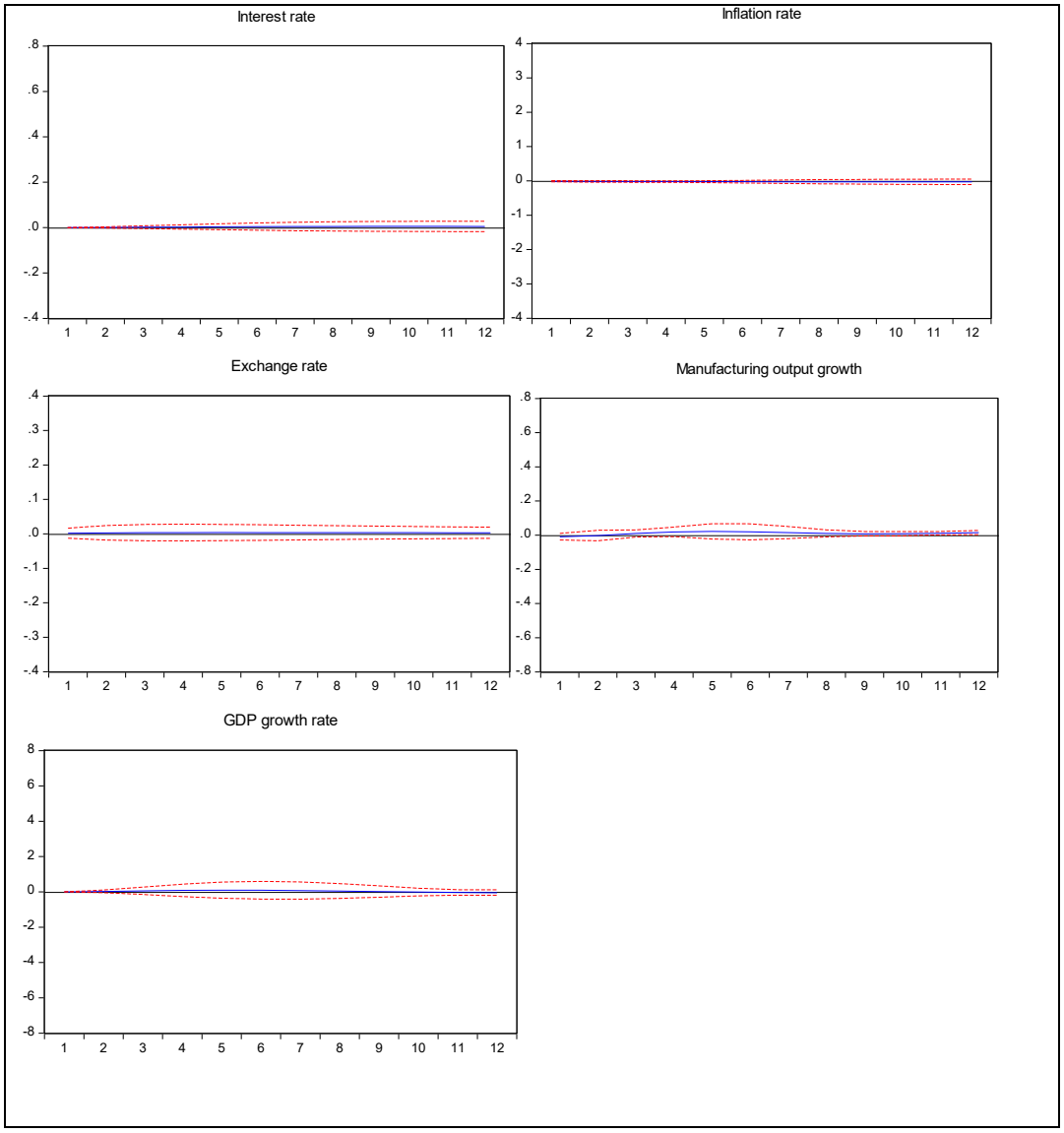
rate to fall sharply. The real exchange rate rises notably in response, partly because of Libya's fixed exchange rate. However, the manufacturing output growth shows a very brief initial rise in response to the depreciation in the real value of the Libyan Dinar before declining sharply. This might not be unconnected with the fact that the monetary authority intervenes to maintain a fixed exchange rate causing the currency to appreciate again and consequently lead to a fall in manufacturing output. This also confirms that a currency appreciation will have a negative effect on the growth of the manufacturing sector in Libya. Before falling steadily, the GDP growth rate has a more sustained upward movement than the manufacturing growth rate.

Figure 4.28 shows impulse responses of all variables to a money supply growth rate shock. As observed in the analysis of some countries earlier, it appears that generally the influence of money supply growth rate on most variables in the model is not significant. The implication of this is that the results fail to demonstrate any notable pattern of movement of the variables in response to a money supply growth rate shock.

Despite this, manufacturing growth rate shows some slight upward movement, which shows a very marginal rise in the manufacturing output growth in response to the money supply growth rate shock. However, the response from the GDP growth rate is not conspicuous. The results obtained in the previous impulse response analyses seem to be repeating themselves here. This is particularly on the relative influence of money supply and interest rates on the variables in the system. Comparatively, evidence from the situation seen in Figure 4.27 also confirms that interest rates are most likely to influence the variables in the system more than money supply.

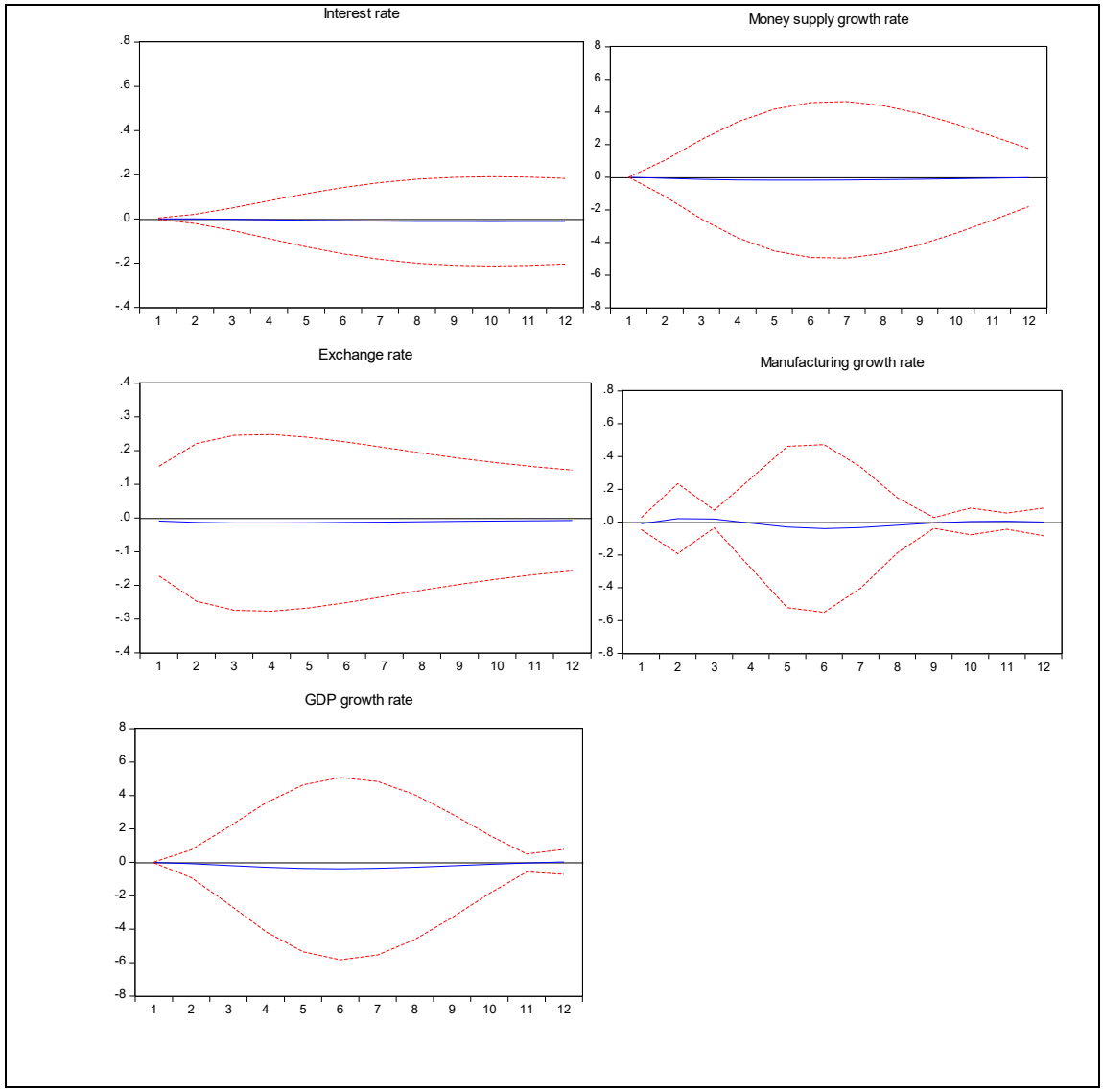
The response of the manufacturing growth rate to money supply growth rate shock has been positive for most of the impulse response functions for all the previous countries, especially Nigeria and Algeria, even though often sluggish.

Figure 4.28: Impulse responses to a money supply growth rate shock (Libya)



However, it cannot be ruled out that the shock from money supply appears to be having an initial positive influence on the manufacturing output growth, before falling steadily later.

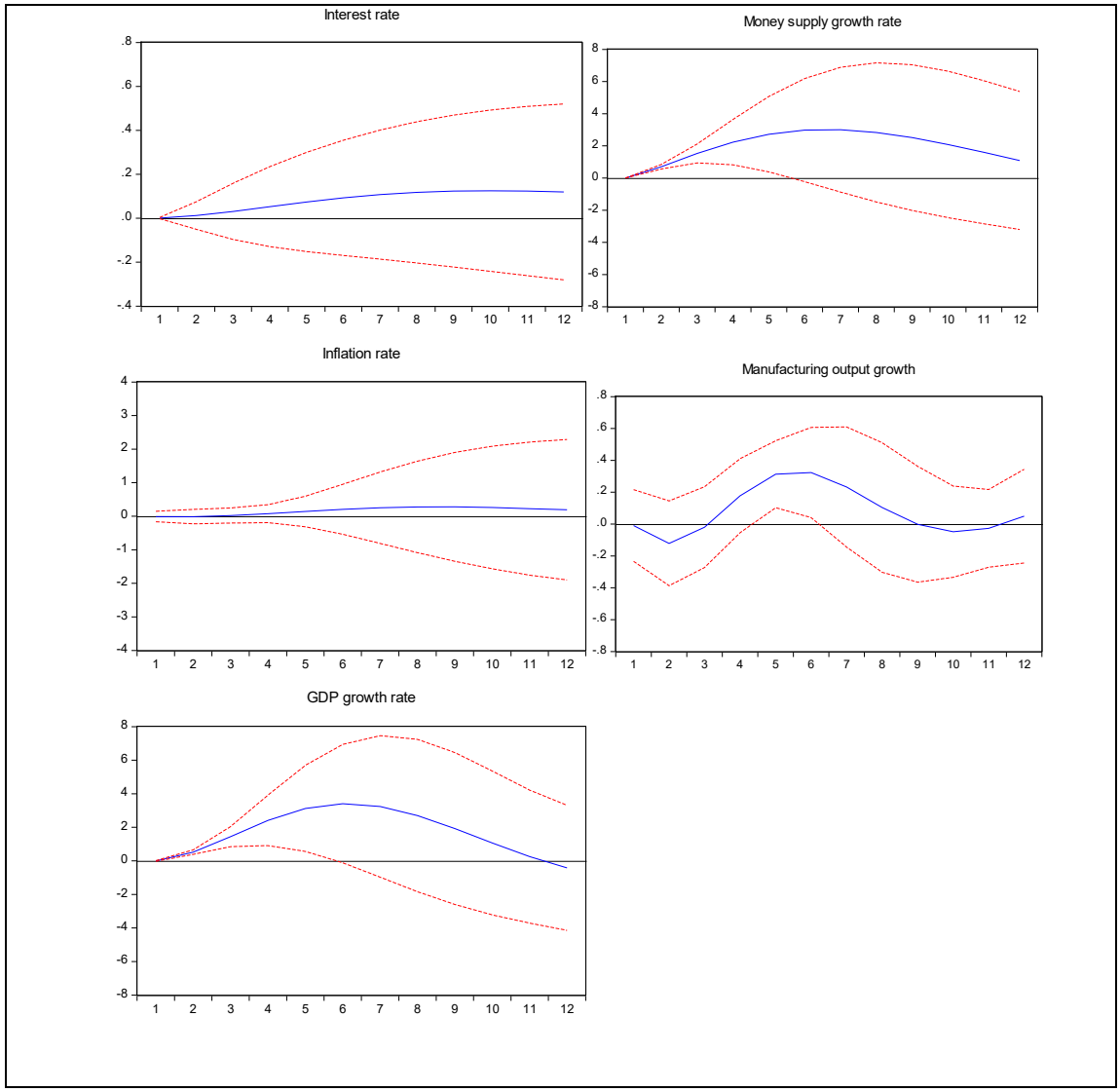
Figure 4.29: Impulse responses to inflation rate shock (Libya)



Most of the oil producing countries appear to be concerned with controlling inflation in their economies. Libya is another country that has a very strict inflation rate policy. The monetary authorities in Libya attempt to control inflation, which partly explains why increases in private and government expenditure do not always influence the inflation rate (Ali and Harvie, 2013). This situation is observed in Figure 4.29 where the responses to inflation rate shock fail to show any conspicuous direction.

However the effect of the inflation shock still shows a slight negative influence on manufacturing output growth. The falling movement becomes more conspicuous in period six. This confirms the negative influence of inflation shock on the growth of the manufacturing sector in Libya.

Figure 4.30: Impulse responses to exchange rate shock (Libya)



The conspicuous responses of all variables in the model to an exchange rate shock as seen in Figure 4.30 is a result of the unrealistic pegging of Libya's exchange rate.

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 a lack of competitiveness with other currencies in the foreign exchange market. This resulted in adverse effects on economic activity and created disturbances, causing economic instability whenever the exchange rate was adjusted (ADB 2012).

Manufacturing output responds by an initial rise as a result of the depreciation in the real value of the Libyan dinar. As the monetary authorities take action to maintain the fixed exchange rate, the depreciation is curtailed with the result that manufacturing output falls. That is, 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.

4.6.6.2 Variance decomposition analysis result on Libya

Table 4.22: Variance decomposition of interest rates (Libya)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	1.183792	0.013720	96.15540	0.004331	0.003808	1.692284	0.016598	0.930062
6	1.424414	0.071582	88.59660	0.019396	0.053204	8.909521	0.091547	0.833732
9	1.555554	0.127297	81.32898	0.030932	0.113047	15.91612	0.167415	0.760660
12	1.618177	0.154952	77.68739	0.036435	0.141775	19.42529	0.206948	0.729027

Table 4.22 shows the contributions of each shock in the model to the fluctuations in interest rates in Libya. As we noticed in our previous discussions, the oil price shock plays an important role in affecting interest rate variations in Libya. The contribution of the shock to interest rate fluctuations is very high compared to that of other shocks in the system, apart from exchange rates. However, the contribution of the exchange rate shock to interest rate fluctuations is a clear departure from what we have witnessed in most of the analyses done previously. Exchange rates here appear to be a key factor in influencing the rates of interest in Libya. The implication might not be unconnected with what has been discussed earlier. Libya is noted for practicing an unrealistic

pegging of its exchange rate. This has been affecting macroeconomic stability of the economy (ADB, 2010). In addition, the oil output growth rate shock seems not to have any significant influence on the behaviour on interest rates. 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 observed in previous countries analysed, the contribution of the oil output growth rate shock to interest rate fluctuations is very weak. This further strengthens our position that shocks from the oil price are not likely to pass through the oil output growth rate to influence the MTM.

Table 4.23: Variance decomposition of money supply (Libya)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	1.845489	0.630708	17.51214	2.300668	0.550180	76.39681	0.596379	0.167620
6	1.764798	0.653582	16.38847	0.867256	0.353093	79.19227	0.619149	0.161388
9	1.699479	0.679802	13.63002	0.682134	0.290562	82.23978	0.635800	0.142424
12	1.615468	0.694206	12.31713	0.664122	0.270165	83.68099	0.629818	0.128100

The Libyan economy is offering another dimension to the role of exchange rates in the model. The exchange rate has a very weak role in most of the previous analyses but appears to be the shock that influences most variables in the MTM the most in Libya. Table 4.23 indicates that the exchange rate shock makes the highest contribution to money supply growth rate variations followed by the interest rate shock and oil price shock in that order.

The reason again might not be unconnected with what has been 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 unrealistically fixed rate of exchange. This causes problems in the entire monetary policy transmission mechanism. The same outcome was noticed in Gabon where a fixed exchange rate is also practiced.

Just as we observed under the variance decomposition on interest rates, the contribution of oil output shock to the behaviour of money supply is also very low.

Table 4.24: Variance decomposition of inflation rate (Libya)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.966507	0.005636	61.11702	0.635934	36.19676	0.600223	0.004208	0.473710
6	1.019812	0.031536	92.60114	0.106298	2.297842	3.110816	0.008727	0.823834
9	0.948129	0.037144	93.63641	0.059180	0.681754	3.787703	0.014345	0.835335
12	0.953705	0.031941	94.35862	0.053028	0.404822	3.343034	0.016623	0.838230

Table 4.24 shows the contributions of each shock to fluctuations in inflation rates. The results show that the interest rate shock contributes the most to variations in the inflation rate, which is similar to the results obtained in the previous analysis. Again this underscores the importance of interest rates in the model. The dominance of the exchange rate shock among the shocks continues. It is second to the interest rate shock in its contribution to inflation rate variations. This finding is also a clear departure from our previous results. The oil price shock accounts for a very high proportion of the fluctuations in inflation rates after exchange rates and it appears that the effect of oil prices on inflation rate fluctuations is absorbed by the exchange rate and interest rates, thereby reducing the effect of the oil price shock and increasing the effect of the other two shocks.

It also appears that the exchange rate creates a powerful disturbance when it is fixed, culminating in the incessant unstable behaviour of the monetary policy instruments. The same thing happens in the case of Gabon where a fixed exchange rate is practiced.

Table 4.25: Variance decomposition of exchange rate (Libya)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.714311	0.783647	0.074215	0.040341	0.770807	96.65316	0.962738	0.000778
6	0.809505	0.776112	0.903281	0.047550	0.755791	95.73998	0.957266	0.010512
9	0.924902	0.755445	3.341308	0.053184	0.724440	93.22913	0.933972	0.037621
12	1.035564	0.722139	7.384436	0.057406	0.680984	89.14693	0.893002	0.079544

A symbiotic relationship is noted between the monetary policy instruments, namely, interest rates and exchange rates. In the analysis of the contributions of various shocks to interest rates in Table 4.25, it was the exchange rate that had the highest contribution. Now, the highest contribution to exchange rate fluctuations is from interest rate shocks. This shows that in Libya, the interest rate and exchange rate have a considerable effect on each other. Although, not initially, but as the period progresses the oil price shocks however has a relatively high contribution to changes in the exchange rate.

This result is similar to what has been found for other countries analysed in the previous sections. However, the relationship between interest rates and exchange rates iare stronger under fixed exchange rate regimes than it is under the flexible exchange rate regime.

Table 4.26: Variance decomposition of manufacturing output growth (Libya)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.712950	0.190408	36.53174	0.208016	0.978220	16.60568	42.41003	2.362961
6	0.477003	0.772451	20.51692	0.372742	0.874647	64.67463	10.94096	1.370644
9	0.368704	0.688843	28.59296	0.350095	0.930008	59.95133	8.062153	1.055906
12	0.641346	0.466397	50.74537	0.289891	0.628813	40.80708	5.402371	1.018731

It is observed from the beginning of the variance decomposition analysis of the Libyan economy, that the dominance of an oil price shock is relatively lower than that of an exchange rate shock. Again, the exchange rate shock constitutes the largest disturbance to the manufacturing output growth. Therefore, the behaviour of manufacturing output growth in Libya is mostly determined by the exchange rate shock and not the MPIs shocks as observed in the study of other countries especially Nigeria and Algeria.

The shock from the oil price appears to be weakened by the fixed exchange rate in operation in Libya. This makes the exchange rate shock to account for the highest contribution to the fluctuations in the performance of the manufacturing sector.

4.6.6.3 Inferences and comparisons with other empirical studies (Libya)

Related literature on the Libyan economy is relatively scarce with the work of Ali and Harvie (2013) appearing to be the only study available. Firstly, this study confirms that oil prices have a great influence on the monetary policy transmission mechanism in Libya. This is similar to the findings of Ali and Harvie (2013). Again, as we have seen in most of the analyses done on other countries, oil output growth rate declines in response to an oil price shock, and the shock does not contribute significantly to the behaviour of the MPIs.

Secondly, the Libyan economy appears to have a very distinctive feature which is different to other economies studied in the AOECs. This feature lies in the role of the exchange rate in the monetary policy transmission mechanism and its relationship with an oil price shock. In Libya, the exchange rate appears to have a very strong influence on the behaviour of the variables in the monetary policy transmission mechanism with the shock from the exchange rate having the highest influence on the output of the country. This is a result of the unrealistic exchange rate policy in operation in the country during the period under review. The fixed exchange rate practiced by the country within the past three decades has undergone different phases. In other words the pegging of the Libyan Dinar to the USD has been adjusted more than four times within the last three decades, causing disturbances to the domestic economic activities in the country (Ali and Harvie, 2013).The pegging would be adjusted whenever the monetary authorities in Libya noticed that the currency had lost competitiveness in the foreign exchange market. Most often these adjustments affect both the external reserve and monetary policy instruments in order to set another fixed nominal exchange rate. This had happened in 1980, 1986, 1990, 1999 and 2001 (IMF 2003).

It was shown in the analysis that the response of the manufacturing output growth to the exchange rate shock has not been positive. In other words, a shock from the exchange rate negatively influences manufacturing output. These findings are similar to those of Ali and Harvie (2013) where they concluded that flexible exchange rates will likely

benefit the private sector in the Libyan economy more so than the fixed nominal exchange rate policy. They argue that a flexible nominal exchange rate will lead to an increase in domestic production in the real sector of the economy through an accumulation of human and physical capital stocks via importation of goods and services.

The interest rate has also been shown to play a very important role in the monetary policy transmission mechanism in the Libyan economy. As with other countries, we noticed a sharp contemporaneous response from all variables in the model to the shock from the interest rate. Again, comparatively, the effect of the interest rate appears to be more dominant in the monetary policy transmission mechanism than money supply. However, similar to what we obtained in the Gabonese economy, the effect of the interest rate shock on the manufacturing sector has not been positive. An expansionary monetary policy also appears not to be having a conspicuous positive impact on manufacturing output growth. These findings are in line with Ali (2013), who found that interest rates might not play any significant positive role in economic activity in Libya.

The effect of inflation shock on the monetary policy transmission mechanism (MTM) has been nearly neutral. In other words inflation rate shock appears to have no pronounced effect on the MTM in Libya. Nevertheless, from all the shocks considered, it was noted that inflation in Libya is not likely to be a monetary phenomenon, indicating that output and prices are the most likely cause of inflation in the country. Accordingly, inflation may likely be a structural phenomenon in Libya (see IMF, 2010; ADB, 2012). In addition, despite the lack of any conspicuous response to the inflation rate shock, it is noted in the analysis that whenever there is a slight increase in inflation, manufacturing output falls and vice versa. The IMF (2010) stresses that the priority given to the control of inflation in Libya by the monetary authority has led to the low inflation rate usually observed despite increases in government expenditure.

The behaviour of manufacturing output behaviour in the monetary policy transmission mechanism in Libya is dictated by the exchange rate. The study discovered that changes in the manufacturing output were mostly affected by exchange rate shocks. Again, previous analyses of other countries show that the shock from the oil price is passed through the interest rate and money supply growth rate to the manufacturing output growth rate. However, this seems not to be the case in Libya. Findings from our analysis have shown that the effect of the oil price shock is likely to have been passed through the exchange rate to the manufacturing output growth rate. This has affected the manufacturing sector output in Libya negatively (see Ali, 2013; Ali and Harvie, 2013).

Generally, variables in the monetary policy transmission mechanism in Libya do not appear to have a favourable effect on manufacturing output. This might not be unconnected to the influence of the fixed exchange rate regime. It appears that the fixed exchange rate has incapacitated the two monetary policy instruments, namely interest rates and money supply, from influencing manufacturing output positively. The expansionary monetary policy fails to have a notable positive impact on output growth of the manufacturing sector. It should be noted that this is the same result obtained in the study of Gabon, which also practices a fixed exchange rate system.

4.6.7 Structural VAR result analysis for Egypt

Egypt is unique among the net oil exporters, in that the economy is more diversified than the others. The dominance of the oil sector is not as well pronounced as has been seen in the other countries analysed. Despite being an oil exporter, oil in Egypt contributed only 15 percent of the total GDP in 2011 and before the revolution. Nonetheless, oil is still one of the major determinants of the pace of economic activity in Egypt.

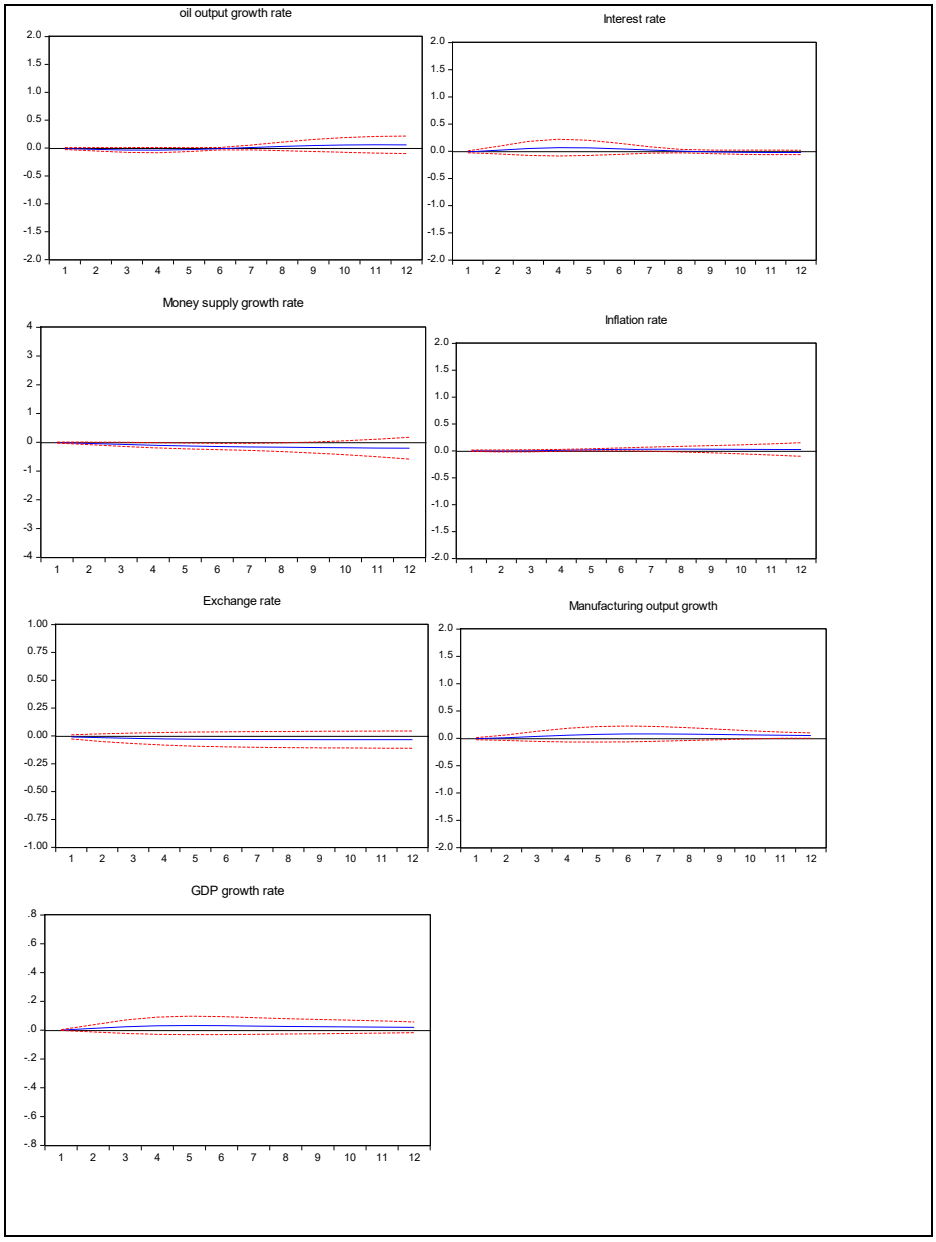
4.6.7.1 Impulse response function analysis on Egypt

We commence by analysing responses of the monetary policy instruments and the manufacturing sector to oil price shocks. Figure 4.31 shows the behaviour of variables in the model to a one standard deviation shock in the oil price. Generally, the responses of the variables to oil price shock are not significant.

The oil price shock has a unique influence on oil output growth. Unlike other economies analysed, the oil output growth in Egypt responds positively to the oil price shock. The response is nonetheless insignificant. Generally, the responses from other variables indicate that they show mild responses to the oil price shock. Egypt is the only country apart from Gabon, where the oil price shock leads to a positive response of manufacturing output growth. This is an indication that the manufacturing sector in Egypt appears is very strong and not driven by fluctuations from the international oil market. It was noted from the oil price shock that contrary to what has been observed in previous analyses, oil output growth rises indicating that Egypt's oil output can cope with sudden increases in global demands for oil.

When compared to other economies examined in this study, the economy of Egypt is less dependent on oil, and implies a reduced adverse effect that might emanate from the oil price shock. From the previous discussion of the Egyptian economy, it was observed that contributions from manufacturing and other non-oil sectors to the country's GDP are sometimes higher than contributions from the oil sector. This has somehow insulated the economy, especially the industrial sector, from fluctuations in the international oil market (Awad, 2011; Saleem, 2013; Mabrouk and Hassan, 2012).

Figure 4.31: Impulse responses to oil price shock (Egypt)



The responses from other variables have not been very pronounced. The impulse responses from other variables indicate that they are all insignificant. Therefore, oil price shock might not have any significant impact on the monetary policy transmission mechanism in Egypt.

Figure 4.32: Impulse responses to oil output growth rate (Egypt)

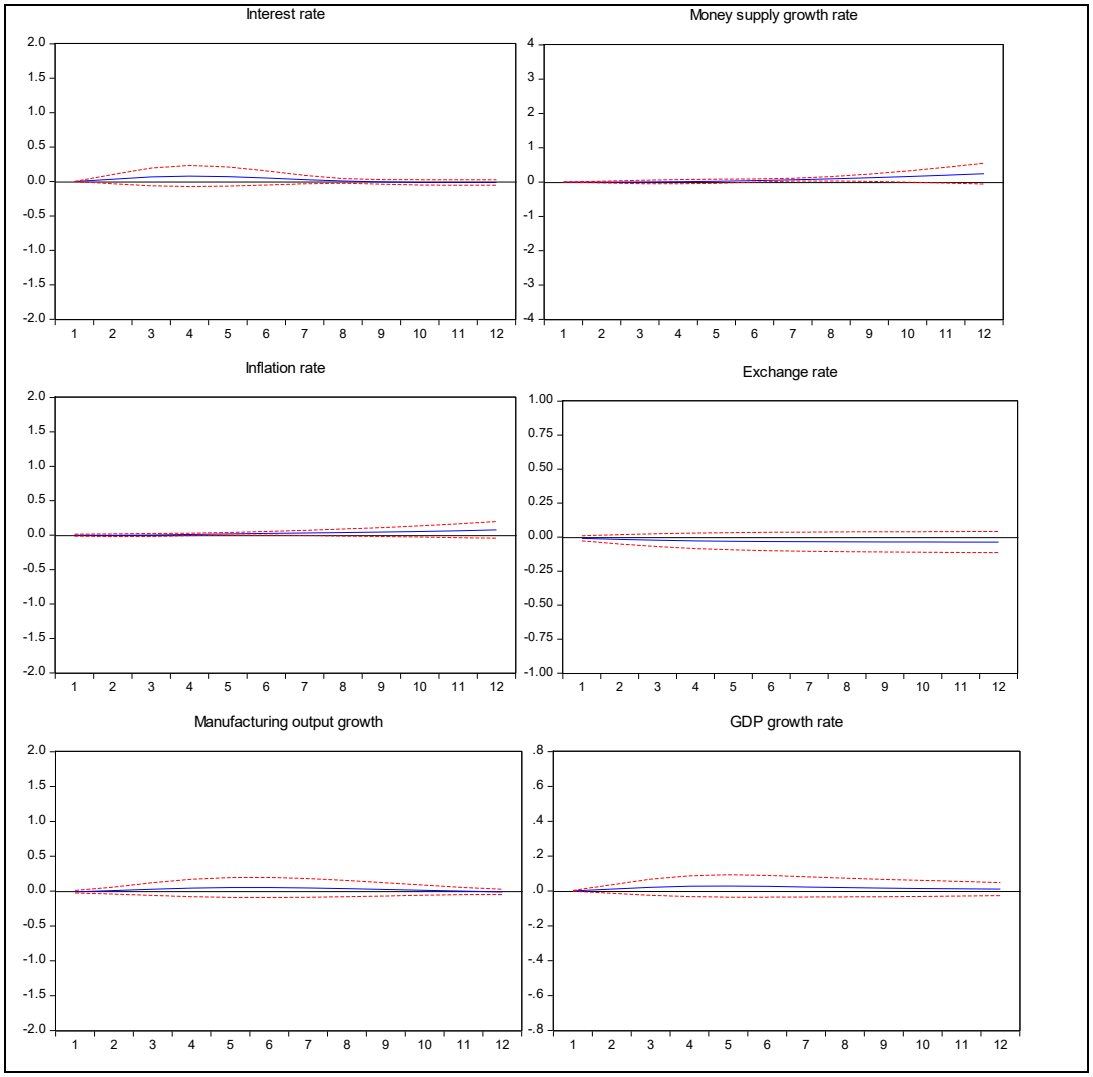
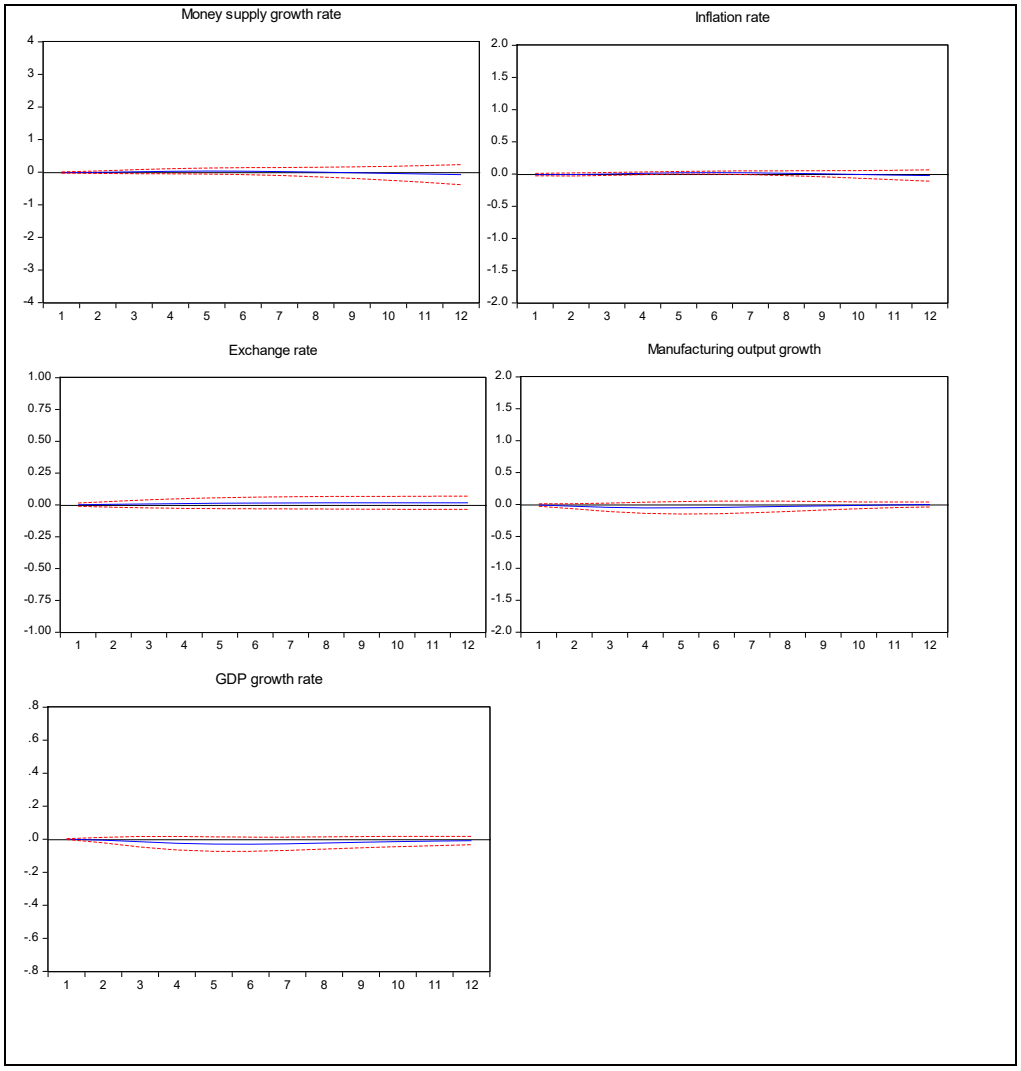


Figure 4.32 shows the responses of all the variables to oil output growth rate shock are insignificant. Notwithstanding, the shock causes interest rates to rise steadily initially and later fall; and an inverse relationship is noted with money supply growth rate. Again, the oil output growth shock makes the manufacturing output growth rate also rise steadily. In the two shocks we have analysed for Egypt we find that the trend of a rise in manufacturing output growth in response to an oil price shock still continues, though, it appears to start falling in period six. This might be in response to the currency

appreciation. The GDP growth rate follows the pattern of response displayed by the manufacturing output growth to the oil output growth rate shock.

Figure 4.33: impulse responses to an interest rate shock (Egypt)



The sharp responses from variables in the model to an interest rate shock observed in the previous analyses are not seen in Figure 4.33, which describes the impulse response functions to an interest rate shock in Egypt. The responses from the variables in the model are all insignificant. We, nonetheless, observe that there is a slight fall in the response of the manufacturing output to the shock. The GDP growth rate also shows a

steady fall as does the manufacturing sector growth. This again confirms the inverse relationship between interest rates and the output of the manufacturing sector.

Both money supply growth rate and inflation rate fail to show a definite pattern of movement. Again this is contrary to what was noticed in the previous analyses. It appears that the negative effect of an interest rate shock is more dominant in an economy that is heavily dependent on oil.

Figure 4.34: Impulse responses to a money supply growth rate shock (Egypt)

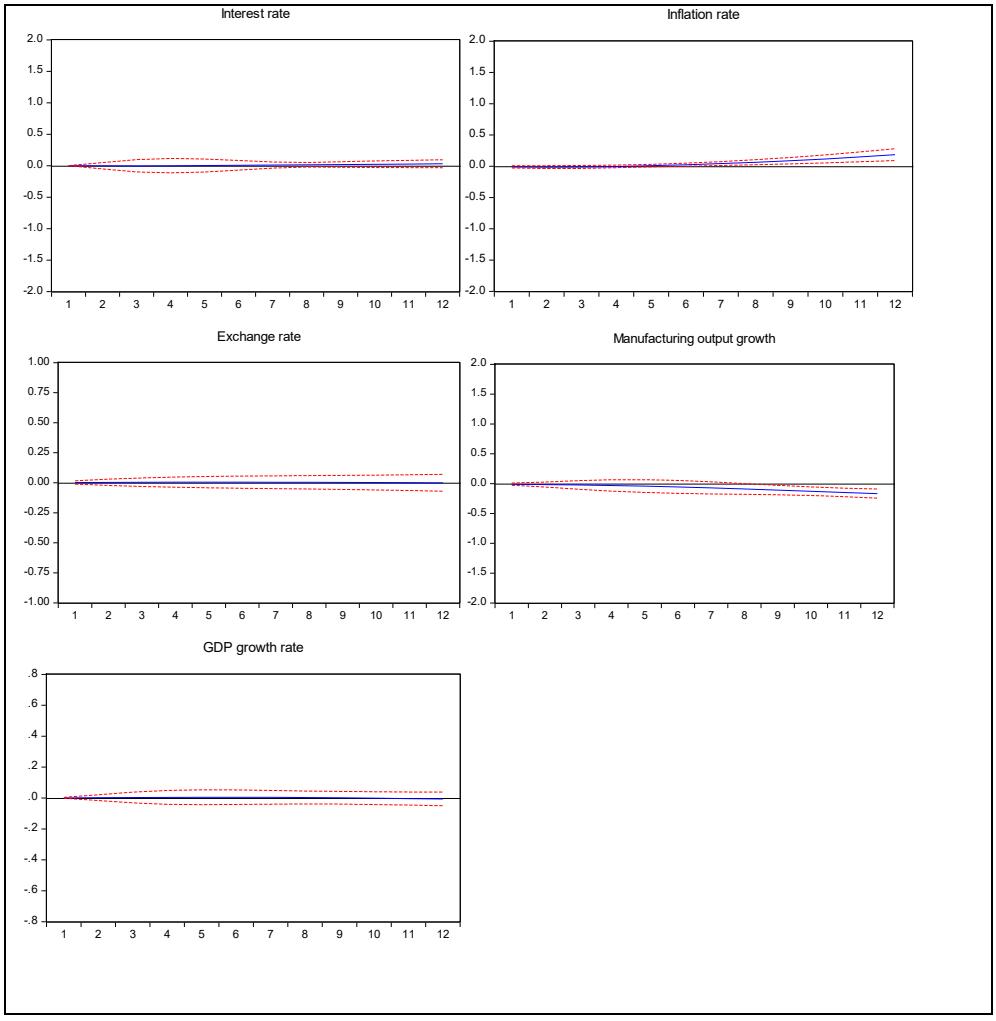
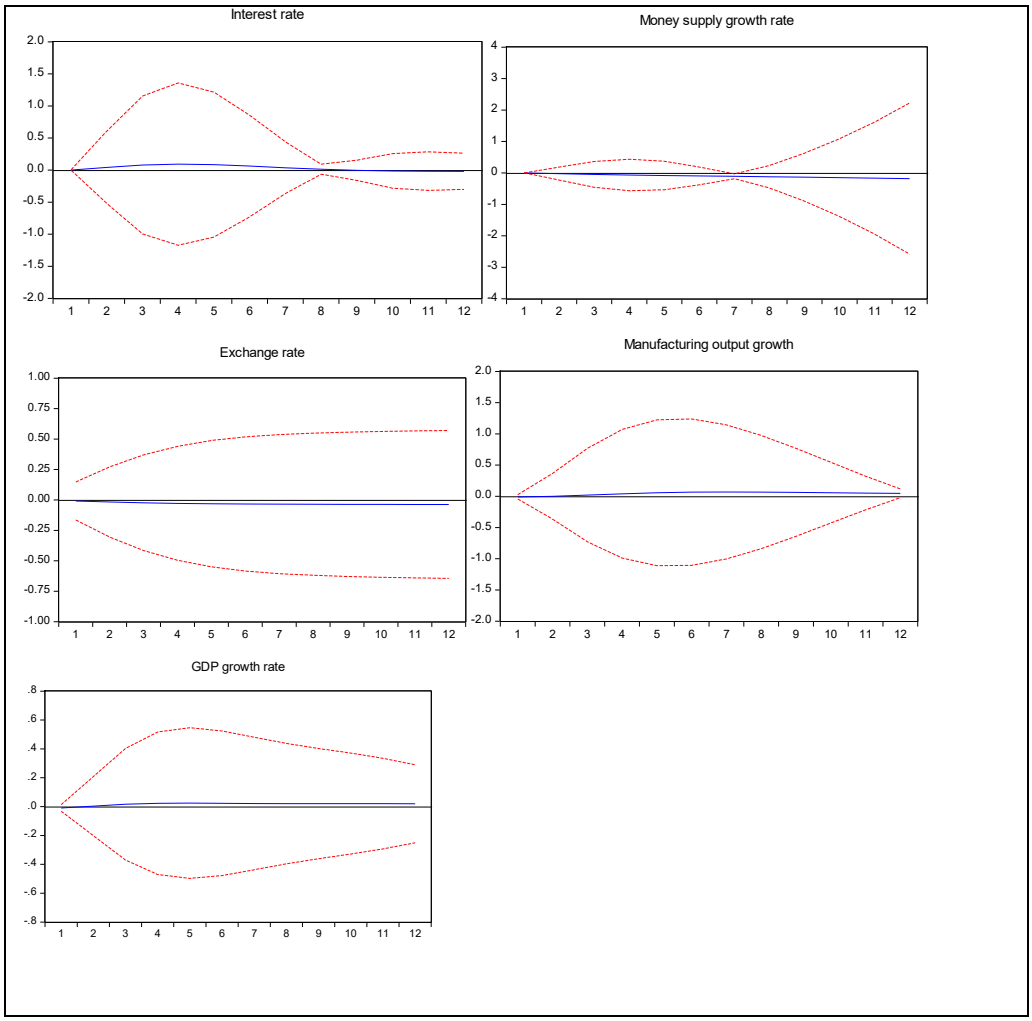


Figure 4.34 shows impulse responses of variables to a one standard deviation shock in a money supply growth rate shock. All of them are also not significant. Inflation rises

steadily after remaining neutral for the first five periods. The exchange rate response remains positive, though insignificant, while the manufacturing output growth falls steadily in response to the shock from the money supply growth rate. GDP is also neutral although it appears to fall slowly from the second period. The money supply growth rate shock also causes the inflation rate to rise.

Figure 4.35: Impulse responses to inflation rate shock (Egypt)



This shows that inflation in Egypt is most likely to be a monetary phenomenon, although this cannot be stated with certainty following the insignificance of the impulse response functions. The implication of this is a negative impact on the manufacturing

output growth. This implies that when money supply is accompanied by a rise in the inflation rate in Egypt, the effect on the manufacturing sector output will be negative.

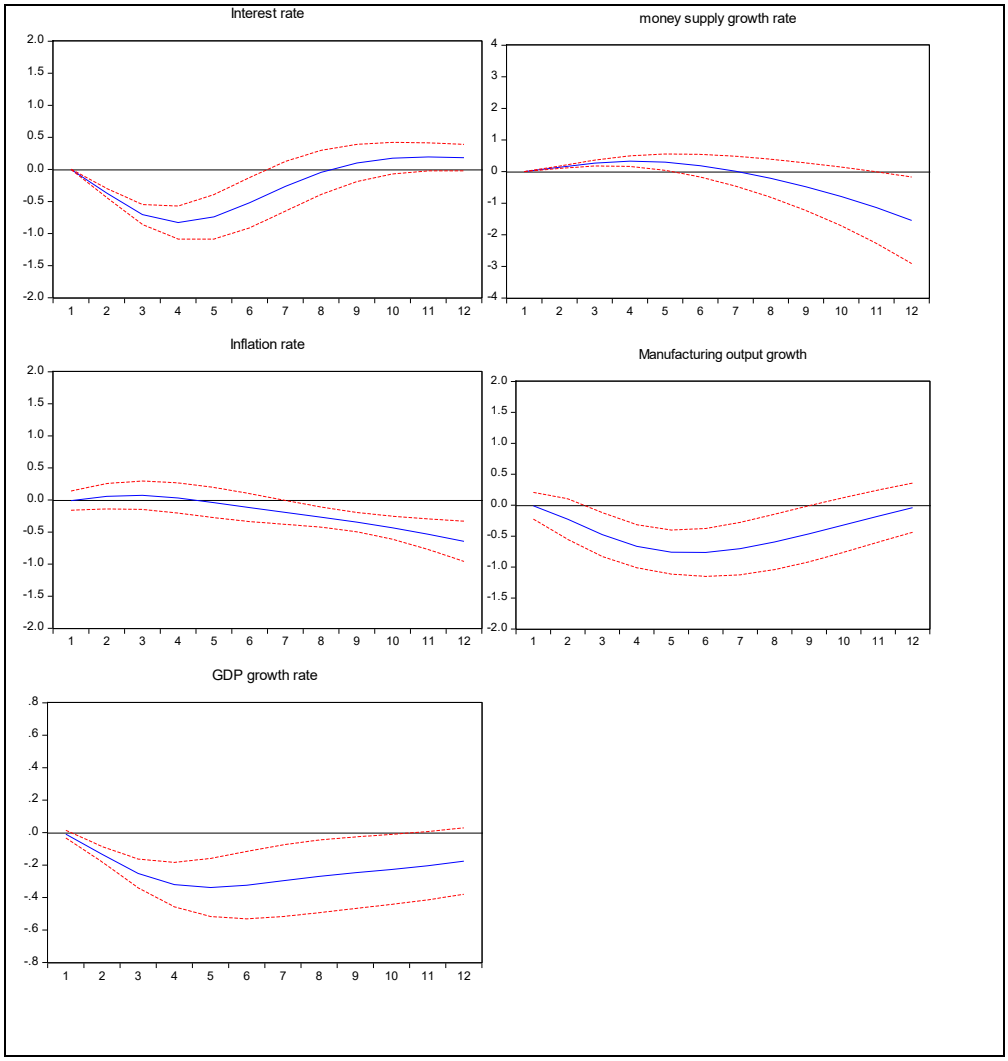
Another reason that can be adduced for the negative response to the money supply shock might not be unconnected to Saleem's(2013) belief that an increase in money supply growth rate to the Egyptian economy triggers competition among various non-oil sectors in the economy. Construction and agriculture are examples of vibrant non-oil sectors separate from the manufacturing industry. Since there many productive activities money supply can be channelled to, it may not have significant impact on manufacturing sector.

Inflation trends in Egypt have been effectively managed by the Central Bank of Egypt (CBE) over the years. The effect of this on economic activities has not been positive, although not pronounced due to priority given to the target set for inflation rate by the CBE. Virtually, all variables appear positive except the exchange rate that is negative in the impulse response analysis. There is no obvious direction in the movement of manufacturing output growth. The GDP growth rate also remains positive.

Figure 4.36 presents the impulse response functions to an exchange rate shock. We observe sharp impulse responses from all variables to the shock. In previous analyses, sharp impulse responses similar to these were recorded when analysing an interest rate shock. The implication is it appears that an oil exporting country that is less dependent on oil is possibly going to be affected by an exchange rate shock more than an interest rate shock and vice versa.

Although Egypt practices a controlled floating exchange rate system, the effect of the exchange rate regime appears to be stronger on the economy because oil is not the only major export in the country.

Figure 4.36: Impulse responses to an exchange rate shock (Egypt)



The export sector in Egypt is not dominated by the oil sector. The largest percentage of foreign exchange earnings come from the non-oil sector which is driven by manufacturing, construction and agriculture. Alwad (2010:p,12) states that "the diverse nature of export in Egypt makes it highly susceptible to fluctuations in the foreign exchange market".

It can be seen that the shock makes the interest rate fall and later rise while money supply follows as usual in the opposing direction. The inflation rate rises at the

beginning and later falls resulting in inverse behaviour from the manufacturing output growth; that is it falls briefly and rises sharply later in response to the currency depreciation. The inflation that occurs here appears to be a monetary phenomenon as it follows the pattern of response of money supply to the exchange rate shock. When the money supply rises, inflation also rises and when money supply begins to fall inflation also starts falling.

4.6.7.2 Variance decomposition analysis on Egypt

Table 4.27: Variance decomposition of interest rate (Egypt)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.472949	0.818358	3.944936	0.000878	1.151935	92.60982	0.850918	0.150209
6	0.606193	0.877096	1.257450	0.001981	1.220712	95.10284	0.823581	0.110143
7	0.610369	0.883609	1.244819	0.006206	1.237927	95.10137	0.808583	0.107113
9	0.611672	0.882437	1.249028	0.028903	1.238229	95.05317	0.823389	0.113168
12	0.634803	0.865764	1.202530	0.116068	1.216488	94.97989	0.851280	0.133172

Table 4.27 explains the contribution of each shock to the behaviour of interest rates as a monetary policy instrument. As observed in the impulse response analysis, the exchange rate shock contributes the highest percentage to the fluctuations in interest rates. This was not the situation in the study of Nigeria and Algeria. Inflation shock accounts for the second highest contribution to interest rate fluctuations.

The implication of this is that interest rate behaviour in Egypt is mostly a response to exchange rate movements as against the oil price noticed in the in Nigeria, Algeria, Libya and Gabon. However, the inflation rate also appears to be playing a significant role in dictating the behaviour of interest rates in the Egyptian economy. Contrary to what has been noticed in previous analyses, the contribution to interest rate fluctuations by oil output growth shock is more than that of the oil price shock.

Table 4.28: Variance decomposition of money supply growth rate (Egypt)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	2.882352	0.002558	0.123209	53.00414	1.217218	38.90868	0.061724	3.800115
6	4.058707	0.204024	0.229515	57.18929	1.757792	23.99649	0.238932	12.32525
9	3.426626	0.779179	0.089283	60.43908	1.646193	14.40817	1.878193	17.33329
12	1.834615	1.106545	0.096916	43.98007	1.062448	34.42860	3.035066	14.45575

The dominance of the exchange rate in the monetary policy transmission mechanism in Egypt is also observed with the large influence it has on the money supply growth rate. Table 4.28 again shows that the exchange rate shock contributes the highest percentage to the fluctuations of money supply growth rate in Egypt. This means that the pattern of behaviour exhibited by the money supply is mostly determined by the exchange rate. It should be noted here that the price of oil plays an important role in determining the money supply growth, but not as high as the exchange rate.

The effect of the oil price shock on the money supply as a monetary policy instrument is more pronounced than that of the interest rate. Inflation rate shock also contribute large shock to the money supply behaviour. This is an indication that the effect of the oil price on output of the manufacturing sector is likely to pass through the exchange rate and inflation rate. In addition, in line with our previous findings, the oil price shock contributes more than the oil output growth shock to fluctuations in money supply.

The result also shows that there is a strong linkage between money supply and GDP growth rate. It indicates that GDP fluctuations can have a very strong effect on the money supply growth rate in Egypt.

Table 4.29: Variance decomposition of inflation rate (Egypt)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.026666	0.016867	0.308461	0.947655	76.87957	18.77488	2.348216	0.697681
6	1.396478	1.121560	1.106616	1.148199	59.90568	25.73016	9.127256	0.464052
9	1.217637	1.492078	0.440852	4.027084	20.18283	69.01982	2.902696	0.716999
12	0.473962	1.286042	0.177336	6.058079	6.045270	81.13250	1.876648	2.950168

Table 4.29 shows that the inflation pattern in Egypt is mostly dictated by the exchange rate shock. The exchange rate shock accounts for the largest proportion of the fluctuations in inflation rates in Egypt. Money supply is another variable in the monetary policy transmission mechanism that plays a very important role in determining the level of inflation in Egypt. This affirms that inflation in Egypt is likely to be a monetary phenomenon. A strong linkage is also established between fluctuations in manufacturing output growth and inflation rate.

The conclusion from the table is that the inflation rate in Egypt is mostly driven by shocks from the exchange rate and money supply growth rate. Unlike other countries studied in the previous sections, the dominance of the interest rate in determining inflation rates is weak in Egypt.

Table 4.30: Variance decomposition of exchange rate (Egypt)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.707791	0.778798	0.077022	0.027127	0.798941	96.62677	0.976718	0.006834
6	0.715545	0.784927	0.132836	0.020220	0.817789	96.51526	0.990439	0.022986
9	0.713860	0.793649	0.154404	0.014230	0.830373	96.44662	1.005692	0.041175
12	0.707037	0.801226	0.160558	0.009597	0.836684	96.40000	1.025730	0.059164

Oil price, oil output growth rate, as well as manufacturing output growth account for a relatively large proportion of the variations in exchange rates in Egypt. As indicated previously in our explanation, the Egyptian economy has a very strong non-oil sector which generates substantial export earnings. Again, oil output is also traded in foreign currency which explains the strong linkages with the exchange rate. This is shown in Table 4.30 where oil output and oil price shocks make the highest contribution to fluctuations in the exchange rate. Output from the manufacturing sector is also an important shock influencing the behaviour of the exchange rates in Egypt.

After, these two shocks, inflation rate shocks also appear to be another strong determinant of exchange rates in Egypt. It should be noted that the two monetary policy instruments do not have a significant influence on the behaviour of exchange rates in Egypt.

Table 4.31: Variance decomposition of manufacturing growth (Egypt)

Period	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
3	0.405075	0.266771	0.805301	0.235182	0.132586	77.95759	19.05568	1.141806
6	0.798552	0.394174	0.505786	0.319176	0.466422	90.63480	6.189068	0.692018
9	1.063597	0.376468	0.413912	0.985100	0.721682	91.65815	4.290301	0.490791
12	1.274926	0.359240	0.391845	2.846497	0.913037	89.24534	4.037134	0.931984

Following the results obtained in the analysis of impulse response functions, manufacturing output growth rate is mostly influenced by the exchange rate shock. The results in Table 4.31 corroborate what has been observed so far about the dominance of the exchange rate in the monetary policy transmission mechanism and its effect on the manufacturing output in Egypt. The exchange rate shock appears to have overshadowed the contribution of all other shocks to manufacturing output fluctuations, making the behaviour of the manufacturing sector highly subject to the exchange rate shock.

The oil price shock also affects the manufacturing sector but the influence goes through the exchange rate which also confirms what has been observed in the previous analyses. A very important conclusion that can be drawn from the variance decomposition analysis on Egypt is the finding that the exchange rate is the most important factor that influences the structure of the monetary policy transmission mechanism in the country. In addition, this is the factor that influences the behaviour of the manufacturing sector the most.

4.6.7.3 Inferences and comparisons with other empirical studies (Egypt)

A number of studies have been carried out on the relationship between oil price, monetary policy and economic activity in Egypt. However, none of them has assessed the behaviour of the manufacturing sector in the relationship. Saleem (2013), Mabrouk and Hassan (2012) have analysed monetary policy and economic activity in the context of oil price shocks. These two studies form our major reference literature from which our inferences will are drawn. Reports of the African Development Bank (2011) and IMF (2012) will be useful as a basis of the comparative discussion.

Firstly, a major inference that can be drawn from our analysis on the Egyptian economy is that oil price shocks have a very limited effect on the monetary policy transmission mechanism. It should be noted that this is a departure from what has been observed in the study of Nigeria, Algeria, Libya and Gabon. This is an indication that the dominance of the oil sector noticed in the economies assessed previously is not evident in the Egyptian economy. This is similar to the findings of Mabrouk and Hassan (2012) who concluded that since the non-oil sector is more dominant in the Egyptian economy, oil shocks have relatively little effect on the economy when compared to other oil exporting economies in Africa.

Secondly, the response of the oil output growth to the shock from oil price, which usually makes the oil output of the countries examined earlier to fall, is not the same in the Egyptian economy. The oil price shock fails to have an initial negative impact on the growth rate of oil output as Egypt unlike other AOECs is not heavily dependent on oil. Therefore, the country does not find it difficult to cope with any oil price shocks. In addition, since the oil price shock doesn't have a significant influence on the MTM and output, the impact of the shock from oil output growth rate is also weak in the system. This also follows on what has been obtained in the countries that have been studied previously.

The study also finds that previously the exchange rate is a major disturbance to the monetary policy transmission mechanism in Egypt. Both the impulse response analysis

and variance decomposition have shown that the exchange rate is a dominant shock that influences the behaviour of monetary policy instruments. The shocks from the exchange rate are the major factors that explain the behaviour of the two monetary policy instruments in Egypt. The controlled floating exchange rate system in operation in Egypt has been dictating the pace of the economy for the past three decades (see Saleem, 2013).

After the exchange rate, inflation rate is another major factor that the monetary authorities respond to through monetary policy instruments in Egypt. Inflation rate shocks have a very strong linkage with the money supply and interest rates but the relationship with money supply appears to be stronger than with interest rates. This makes the nature of inflation in Egypt different from what we found in most of the AOECs examined. The type of inflation in Egypt appears to be more of a monetary than structural phenomenon. The implication is that money supply growth rates in the Egyptian economy may be inflationary. It is apparent from the impulse response analysis that an increase in money supply often leads to an increase in inflation rates and vice versa.

Findings from this study have shown that the exchange rate is a very important factor determining the pace of economic activities in Egypt. The sharp responses from all variables in the system to the exchange rate shock in the impulse response analysis are pointers to this fact. The controlled nominal exchange rate regime in operation in Egypt has a strong effect on the behaviour of the macroeconomic variables including monetary policy instruments (see Saleem, 2013; Mabrouk and Hassan, 2012). It appears that the reason for this is the fact that the economy is relatively more diversified than other AOECs. According to Saleem (2013) Egypt, apart from oil, exports many non-oil products ranging from manufacturing and agricultural products making the structure and nature of exports in the economy more diversified. The more diversified the nature of export, the more the influence of the exchange rate on the performance of the economy (see ADB, 2011; IMF, 2012). This means that unlike other AOECs, the exchange rate affects a variety of products apart from oil in Egypt.

The manufacturing sector in Egypt is relatively large and more vibrant than the manufacturing sector of other AOECs. This characteristic makes the response of the sector to external shocks different from other AOECs. The oil price shock, which is one of the major shocks affecting output growth of the manufacturing sector in Nigeria, Algeria and Libya does not have such an effect on the output of the manufacturing sector in Egypt. From the earlier discussion, it is obvious that the sector is mostly affected by the exchange rate and inflation rate. Since manufacture export is a major portion of the total export volume in Egypt, the influence of the exchange rate on the sector is understandable. This is a clear departure from what has been observed in other countries where they do not have sufficient manufactured goods for domestic consumption. Of importance here is that the direct impact of monetary policy instruments on manufacturing output growth, especially interest rates as observed in other AOECs, is not present in Egypt. This effect might have been largely transmitted to the manufacturing sector through the exchange rate.

4.6.8 Tabular comparative analysis of findings from the five AOECs

Tables 4.32 to 4.35 summarize and compare the findings from the sample of countries included in this study. The tables are divided into four, based on the major sub divisions in the model, namely, oil, monetary policy instruments (MPIs), policy variables and the monetary policy goals.

Table 4.32: Comparison of oil price and oil output growth rate shocks

Countries	Oil price shocks	Oil output growth rate shocks	Inferences
Nigeria	Sharp responses from all variables.Oil output falls, interest rates fall, money supply rises, currency appreciates and manufacturing output falls initially but	Sharp responses from all variables; follows the same pattern as in oil price shocks; and manufacturing output rises briefly and later falls sharply. They	MPIs are the medium through which oil price shocks influence manufacturing output.

	later rises sluggishly and remains negative. The shocks make a large contribution to variations in MPIs and manufacturing output.	contribute little to variations in MPIs	
Algeria	Sharp and distinctive responses from the variables. Oil output growth rate falls, interest rates fall but rise later, money supply falls sharply and inflation rises. Exchange rate sluggishly falls and manufacturing output as well as GDP growth rate falls steadily. The shocks make a large contribution to fluctuations in MPIs.	Sharp and conspicuous responses from all the variables causing interest rates to fall, money supply to rise, inflation to increase and exchange ratesto fall and later to rise slowly. The manufacturing output and GDP growth rate fall sharply. The shock accounts for a small proportion of the variations in MPIs, especially interest rate.	Growth rate of output also responds negatively to oil price shocks just as observed in the case of Nigeria. The oil price has a higher effect on MPIs and influences the manufacturing sector through them. Generally manufacturing output appears to be negatively affected.
Libya	Sharp and conspicuous responses from all variables except the exchange rate. Oil output growth rate falls. Interest rates fall and money supply rises; inflation rises; and the manufacturing output falls. Oil price and exchange rate shocks makes the highest contribution to	There are no distinctive responses from the variables. Manufacturing output falls though not conspicuously. The shock has very little influence on the MPIs	Generally, oil price is a very important shock affecting manufacturing output. The fixed exchange rate system makes the exchange rate another dominant factor that influences the MPIs in Libya. The general effects of the two shocks do not have positive effects on the manufacturing output.

	variations in MPIs		
Egypt	No sharp or distinctive responses from the variables. All movements are very close to the origin and insignificant. The oil output rises steadily. Interest rates rise, money supply falls, exchange rate falls and manufacturing output rises steadily. The shocks make a small contribution to variations in most variables except money supply. The shocks generally do not influence the MPIs much.	The shocks share the same influence on the variables in the model as the oil price shocks. However, some of the variables show distinctive responses to it. Interest rates appear to rise and fall, money supply moves in the opposite direction and inflation rates start picking up in the middle of the sample period. Exchange rates fall and manufacturing output growth falls steadily.	The influence of oil price shocks is very limited. The oil output appears to have more influence than oil prices but it is also not significant. Generally, the behaviour of the manufacturing output has been positive under oil price shocks. This shows that the oil price shocks are not likely to be affecting the manufacturing output negatively.
Gabon	Sharp and very definite responses from all the variables in the system. Oil output falls initially and picks up later, interest rates fall, money supply falls, inflation rates rise steadily, real exchange rates fall and later rises and manufacturing output picks up. Oil price shocks makes the highest contribution to	Sharp but not distinctive responses from the variables. Interest rates rise, money supply falls, real exchange rate appears to be relatively stable, and manufacturing output rises and falls but the responses are not distinctive. The Shocks account for a small proportion of the fluctuations in MPIs and	An oil price shock has a pronounced effect on the behaviour of the MPIs and generally affects the whole MTM. It appears that the effect on the manufacturing output passes through the MPIs. Generally the effect is high on the manufacturing output.

	variations in MPIs, inflation rates, exchange rate and the manufacturing output	other variables	

Table 4.33: Comparison of monetary policy instruments (MPI) shocks

Countries	Interest rate shock	Money supply growth rate shock	Inferences
Nigeria	Very sharp responses from all the variables. Money supply falls, inflation rises and manufacturing output falls. The shock makes the highest contribution to money supply and manufacturing output fluctuations.	Sharp responses from all variables. Inflation falls, exchange rates rise (currency depreciates) and manufacturing output rises steadily. The shock accounts for a large proportion of variations in inflation and exchange rates.	It is observed that the two MPIs are important tools for controlling output of the manufacturing sector but are often affected by oil price shocks. Money supply shocks appear to have a positive effect on manufacturing output.
Algeria	Very sharp and distinctive response from the variables in the model. Money supply rises while inflation and exchange rates fall. Manufacturing output falls and later rises sharply. GDP growth rate also follows the same path. The shock contributes the most to variations of all variables	There are no sharp and distinctive responses from all variables but inflation rates appear to fall initially and rise steadily later. The exchange rate did not show a conspicuous pattern of movement, manufacturing output appears to fall steadily and GDP growth rate takes a downturn. The shock makes a relatively small contribution to variations of moat variables in the model.	The MPIs appear to make large contributions to the fluctuations of output levels in Algeria. Interest rates especially appear to be a stronger tool in controlling output level than money supply.

	in the model.		
Libya	Sharp and distinct responses from all variables. Money supply rises briefly and later falls sharply, inflation rate falls, the real exchange rate rises and manufacturing output rises initially and later falls sharply. GDP growth rate also follows the same pattern of movement. Jointly with the exchange rate, it contributes the highest to the variations in money supply growth rate and inflation rate	Not very distinctive responses as most of the variables are insignificant. A little rise in the manufacturing output is noticed, nonetheless. The shock makes a small contribution to the variations of the variables in the model including manufacturing output.	It can be inferred from the findings that interest rates and exchange rates are dominant factors affecting manufacturing output. Money supply seems not to be playing any significant role in the determination of the behaviour of the variables including inflation rates. Currency depreciation appears to have a positive impact on output of the manufacturing sector. Generally, the MPIs' shocks do not have a positive impact on manufacturing output.
Egypt	There are no distinctive sharp responses from the variables. There are no clear responses from the variables; they are all insignificant. However, it appears that the exchange rate rises and manufacturing output only rises slowly when the exchange rate falls. The shock does not make any significant contribution to the variations in manufacturing output	The responses here are clearer than those from an interest rate shock. Inflation rises and manufacturing output falls steadily after an initial rise. The shock from money supply appears not to have a positive influence on the output growth of the manufacturing sector. It contributes a large proportion to the fluctuations of inflation rates and manufacturing output growth.	On comparative grounds it appears that money supply as a tool of monetary policy is more effective than interest rates. MPIs, especially money supply, have a significant effect on inflation and manufacturing output.

	and other variables in the system.		
Gabon	Sharp and definite responses from the variables. Money supply rises steadily and inflation falls. The real exchange rate rises sharply, while the manufacturing output rises initially and later falls sharply, a path that is also followed by GDP growth rate. The shock makes a large contribution to variations in money supply, inflation rates, exchange rates and manufacturing output.	Sharp and definite responses from all variables. Interest rates fall, inflation rates fall, exchange rates fall, manufacturing output rises briefly and later falls sharply and GDP growth rate falls sharply. The shock makes a large contribution to fluctuations in interest rates, exchange rates, inflation rates and manufacturing output.	Generally, the MPIs' shocks have a great influence on the MTM.. It appears that the effect of the oil price shock passes through the MPIs to the manufacturing output as well as GDP growth rate. However, the impact of MPIs' shocks is not positive on manufacturing output. Expansionary monetary policy appears not to be effective in promoting output

Table 4.34: Comparison of policy variables shocks

Countries	Inflation rate shock	Exchange rate shock	Inferences
Nigeria	Sharp responses from all variable. Interest rates rise and money supply falls, exchange rates fall and manufacturing output falls. The shock makes a large contribution to the variations in exchange rates.	There are no distinctive responses from any of the variables. Interest rates rise sluggishly, money supply falls steadily and the effect on manufacturing output as well as GDP growth rate is not significantly positive. The shock makes an insignificant contribution to fluctuations of	It is observed that inflation rates are likely to affect manufacturing output more than exchange rates. The nature of inflation in Nigeria is both monetary and structural in nature

		the MPIs	
Algeria	There are no distinctive responses from the variables. However, manufacturing output shows a negative response to the shock. The shock generally makes a small contribution to the variations of the variables in the system except manufacturing output, where the contribution of the shock is relatively high.	The responses of the variables are relatively mild. Mostly, they all (including manufacturing output) react negatively to the shock. The shock makes a small contribution to fluctuations in the variables of the model	It appears that both inflation and exchange rate polices in Algeria are effective because they do not constitute too much disturbance to the system. However, they don't seem to have a positive influence on the manufacturing output growth. In addition, most of the inflation rate behaviour indicates that inflation in Algeria is likely to be caused by structural rigidities of the economy.
Libya	No conspicuous dimension of responses from the variables. The impulse response functions of almost all the variables are insignificant, although it appears that manufacturing output responds negatively to the inflation rate shock. The shock makes a small contribution to fluctuations in the variables of the model.	Sharp and distinctive responses from most variables. The shock causes both interest rates and money supply to rise sharply. Inflation rates also rise. Manufacturing output rises initially and later begins to fall sharply. GDP growth rate also follows the same pattern. The shock contributes the highest proportion of the variations in MPIs as well as the manufacturing growth rate.	The exchange rate shock appears to pose a significant disturbance in the Libya economy. It is one of the variables that dictate the operations of the MTM. It has a very significant effect on manufacturing output, although the effect appears not to be generally positive. We also observe that inflation in Libya is likely not to be a monetary phenomenon.

Egypt	Impulse responses from the variables in the model do not show any definite direction. They are mostly insignificant. We nonetheless observe a slight fall in exchange rates, which make the manufacturing output rise steadily. The inflation shock affects the MPIs but the impact is small compared to that of the exchange rate shock. The inflation shock has a strong linkage with money supply	Very sharp responses from all the variables. It causes interest rates to rise after an initial fall, money supply follows in the opposite direction, inflation rate fall and manufacturing output growth rate falls initially and later rises sharply as a result of the currency depreciation. The GDP growth rate falls sharply. The shock makes the highest contribution to fluctuations in all variables in the MTM.	The exchange rate shock is a major shock to the MTM and the behaviour of manufacturing output in Egypt. However, it does not have a favourable impact on the growth of the manufacturing sector. It follows the usual pattern that overvaluation of currency may be inimical to the growth of the manufacturing sector. Inflation also appears to be a monetary phenomenon
Gabon	Not very distinct responses. However, the inflation shock does affect output growth of the manufacturing sector negatively. The shock makes a relatively large contribution to variations in exchange rate variations (in comparison to MPI and oil price shocks) and a small contribution to variations in the MPIs.	There are no sharp or distinctive responses from the variables. The exchange rate shock accounts for a very small proportion of the fluctuations in the MPIs and other variables in the model, since the country has adpted a fixed exchange rate regime.	The fixed nominal exchange rate practice reduces the influence of its shock on the MPIs and the outputs. Despite this, the inflation shock appears to be stronger and it is mostly structural in nature.

Table 4.35: Comparison of the output behaviours

Countries	Manufacturing output growth	GDP growth rate	Inferences

Nigeria	Generally manufacturing output is mostly influenced by the MPIs and oil price shocks. However, expansionary monetary policy has a significant positive impact on manufacturing output.	For the most part of the analysis it follows the same pattern of behaviour as manufacturing output growth. It is mostly influenced by MPIs and oil output growth rate.	The implication of the results for the Nigerian economy is that the manufacturing output is highly susceptible to oil price fluctuations. The sector can also be influenced by the MPIs. However, there is evidence that money supply can promote the growth of the manufacturing sector.
Algeria	Mostly influenced by interest rates, inflation rates and oil price shocks. Both inflation and oil price manufacturing output growth negatively. The MPIs shocks have a positive impact on the output growth of the manufacturing sector.	In most of the analysis, the pattern of behaviour of GDP growth rate in response to all shocks is almost the same except in a few cases. It is mostly influenced by the oil output growth rate and inflation rates.	Both manufacturing output growth and GDP growth rate follow the same pattern of behaviour. Both are mostly affected by oil prices, oil output, inflation and interest rates. Expansionary monetary policy also has a positive impact on the growth of manufacturing output.
Libya	Interest rates, exchange rates and oil price shocks are major factors determining the behaviour of manufacturing output. Generally, the behaviour of manufacturing output has not been positive. It only showed a brief positive response to exchange rate shocks before falling sharply.	The variable has been following the pattern of behaviour of manufacturing output. It is mostly affected by exchange rate and oil output growth. However, at times it has a more sustained positive	The two output measures are highly influenced by interest rates, exchange rates and oil price shocks. Often, interest rates, exchange rates and oil price shocks do not have a positive

	Manufacturing output growth responds negatively to the MPIs shocks.	response to some of the shocks than manufacturing output growth.	influence on them. Notwithstanding this, manufacturing output is negatively affected by the MPIs shocks. Expansionary monetary policy does not seem to promote output growth
Egypt	Manufacturing output has been mostly affected by the exchange rate shock. Generally, on comparative grounds, the behaviour of manufacturing output is more positive than negative in all the shocks considered. Its behavious, however, is also influenced by money supply and inflation rates.	GDP growth rate has followed the pattern of behaviour exhibited by manufacturing output. There has been no distinct difference in the reaction of either to different shocks.	It can be deduced from these findings that output which includes both manufacturing and GDP growth rate is mostly influenced by the exchange rate. The MPIs, especially money supply appear to be another factor that drives output growth in the economy.
Gabon	Manufacturing output growth has not been positive in all the impulse responses considered. Notwithstanding, MPIs and oil price shocks are the most important shocks affecting the growth of the manufacturing sector. Manufacturing output growth has been generally sluggish. The MPIs' shocks do not have a positive impact on this variable.	GDP growth rate displays almost a similar pattern of behaviour like manufacturing output growth except in a few instances where it reacts positively while manufacturing output responds otherwise. The variable is negatively influenced by the MPIs, oil prices and oil output growth rate.	The MPIs and oil prices are dominant factors affecting output generally in Gabon. Oil output growth also affects GDP growth rate. Manufacturing output has not fared well under most of the shocks examined. It is also observed that expansionary monetary policy does not promote output growth of the manufacturing sector.

4.6.8.1 Discussions of the tables

Nigeria, Algeria and Libya are the largest net oil exporters in Africa and they can be used as case studies for oil exporting countries in Africa. Notwithstanding, this study opines that their behaviour to oil price shocks might be different from other countries who do not produce as much oil as these three do. Therefore we included Gabon, a smaller net oil exporter in Africa. We also included Egypt, which falls in the middle stratum of net oil exporters in Africa. The interesting aspect of the study is that all the small net oil exporting countries, that is those exporting below 500,000 barrels of oil per day (OPEC, 2010), belong to the same monetary zone, the Central African Economic and Monetary Union (CEMAC) (*CommunauteEconomiqueet Monetairede l' AfriqueCentrale*). Members of CEMAC include Chad, Gabon, Equatorial Guinea, Cameroun and Congo. These countries practice a unified monetary system controlled by one central bank and oil contributes more than 50 percent of their GDP. Therefore this underscores the suitability of Gabon as a representative of the small net oil exporters in Africa.

Firstly, in Table 4.32, we summarised the impulse response analysis regarding the reaction of the monetary policy instruments (MPIs), the manufacturing sector and other variables to oil price shocks in the monetary policy transmission mechanism (MTM). It appears that except for Egypt all the five countries share similar experiences. The oil price shock depresses oil output growth rate. The latter later gradually recovers. In Nigeria, Algeria, Libya and Gabon, the oil price shock has a significant effect on the behaviour of the MPIs, but comparatively, the shock affects interest rate more than money supply. However, the influence of oil price shocks on the MPIs in the monetary policy transmission mechanism (MTM), causes manufacturing output growth to respond sluggishly to the shock or sometimes negatively. Egypt does not share this kind of response because it has a relatively developed manufacturing sector which lessens dependence on oil as a major source of revenue. In 2007, the manufacturing sector contributed 17percent to GDP, while the oil sector contributed 15.5percent (see World

Bank, 2010). It appears that the more developed the manufacturing sector of an oil exporting country is,the less the effect of oil price shock on it.

An oil price shock does not substantially influence the behaviour of the MPIs much in the MTM in Egypt as with other countries. This has to do with the fact that the economy is more diversified than other AOECs. According to Mordi and Adebiyi (2010) macroeconomic variables are less prone to the disturbance of oil price shocks when an oil exporting country is diversified. This also shows that the more diversified an oil exporting country is, the less the influence of an oil price shock on the MPIs and the entire MTM. Therefore, interest rates and money supply in these countries, apart from Egypt, are more prone to fluctuations in the global oil price.

Oil output growth shocks fail to have a significant effect on the MPIs. In all the countries studied, the contribution of the oil price shocks to the behaviour of the MPIs is much higher than that of oil output growth rate shock. This contradicts Berumentet. al., (2004), who maintains that the effect of the oil price shock on economic policies in an oil exporting country is transmitted through the quantity of oil output supplied to the global oil market. Therefore, there is an indication that for the AOECs, the oil price shock has a direct effect on their economic policies without necessarily passing through their oil output growth rate.

Secondly, we examine the effectiveness of the MPIs and their influence on the manufacturing output of the AOECs. As indicated in Table 4.33, virtually all the five countries' MPIs are dominant in affecting the nature of the MTM and dictating the behaviour of manufacturing output. Comparatively, interest rate shocks appear to have more influence in the MTMs of Nigeria, Algeria, Libya and Gabon. In Egypt, on the other hand, money supply appears to have more influence on manufacturing output than interest rate in the MTM.

Thirdly, the role of inflation in all the countries appears to be the same. Inflation mostly shows an inverse relationship throughout with the growth of manufacturing output. Table 4.34 reveals that this study supports the economic theory that inflation may

adversely affect production. The effect of an inflation shock is not generally pronounced on the MPIs and the manufacturing output in the countries where a fixed exchange rate is practiced, especially Libya and Gabon. Algeria also falls in this category though it practices a controlled floating exchange rate. It is common in the three countries that the effect of inflation shock is put under check because they have a very strong inflation monetary policy. Since they practise rigid exchange rate system, the Central Banks of these countries are more concerned with achieving low inflation rates.

It was noted in past empirical studies that even when government expenditure increases in these countries, it does not affect the inflation rate (see ADB 2010; IMF 2012). The nature of inflation observed in these three countries is more structural than monetary. The type of inflation that occurs is as a result of imbalances between output and prices, or imported inflation, but not as a result of an increase in money supply.

Nigeria and Egypt share almost a similar pattern of inflation. Inflation appears to have a relatively high effect on output and MPIs in the two countries. This might not be unconnected with the controlled floating exchange rate regime in operation in these two countries. Their own floating exchange rate does not stipulate minimum or maximum ranges, as the case of Algeria where a controlled flexible exchange rate is practiced. The inflation in the two countries is more of monetary than structural in nature.

The role of an exchange rate shock in the MTM and its influence on manufacturing sector growth as shown in Table 4.34 is diverse across the countries. It is observed in this study that the two factors that determine the influence of an exchange rate shock are developments in the manufacturing sector and exchange rate policy in practice. An exchange rate shock appears to have a minimal effect on MPIs and manufacturing output in Nigeria and Algeria, countries that practice a controlled floating exchange rate. The manufacturing sector in both countries is underdeveloped. Since the exchange rate is floating, MPIs are easily manipulated and adjust to changes with ease hence it is least affected by exchange rate shock. In addition, since they do not export many

manufactured goods, the exchange rate is not likely to have a large effect on the output of the manufacturing sectors of the two countries.

The effect of an exchange rate shock on both MPIs and the growth of manufacturing output in Libya is very strong. This might not be unconnected with the fixed exchange rate system in practice in the country. Findings reported in Table 4.34 indicate that generally, the exchange rate has a very high impact on the nature of the MTM. The reason for this might not be unconnected with the fixed exchange rate system in practice which is often subjected to changes. The fixed nominal exchange rate has been pegged more than four different times within the last three decades in 1980, 1985, 1990, 1999 and 2001(see Ali and Harvie, 2013). This pegging has affected the behaviour of the MPIs and output of the manufacturing sector. In Gabon, an exchange rate shock has little influence on the MTM, and manufacturing output in particular. The real exchange rate in the country is mostly affected by the MPIs. Gabon's monetary authorities usually fall back on the country's external reserves to maintain its nominal exchange rate and use MPIs to achieve domestic economic stability.

Therefore Gabon still maintains the fixed nominal exchange rate without changing the peg. This is in contrast to Libya where the exchange rate is pegged at a different rate whenever it loses competition in the foreign exchange market. However, it appears that MPIs are affected more under the fixed nominal exchange rate system than under the floating exchange rate system, rendering them powerless in promoting output growth of the manufacturing sector in fixed exchange rate practicing countries.

In addition, for most part of the study, it is noted that whenever an oil price shock causes an exchange rate to appreciate, it leads to a fall in the growth of manufacturing output. This is another confirmation of the existence of Dutch Disease in the AOECs. It is observed that the increase in the oil price leads to an increase in the money stock and consequently pushes up domestic prices of the manufactured goods and other tradable/consumable goods, causing the currency to appreciate. This leads to a fall in

output of the manufacturing sector *(exchange rate effect of Dutch Disease)*(see Bhattacharya and Ghura,2006).

Egypt's economy is more diversified than other AOECs, where aoart from oil manufacturing output constitutes a major foreign exchange earning source. Accordingly, there is a relatively high impact of the exchange rate on output and the MPIs. Total exports from Egypt are composed of agricultural, manufacturing and oil products. With many goods being traded in the international market, a greater effect is felt following an exchange rate shock than in other countries practicing a controlled floating exchange rate.

Finally, Table 4.35 compares the behaviour of output in the five economies. It is common to all the five countries that manufacturing output growth is affected by at least one of the MPIs' shocks (interest rate shock or money supply growth rate shock). In addition, oil price shock constitutes a major shock influencing the pattern of manufacturing output growth in four out of the five countries, namely Nigeria, Algeria, Libya and Gabon. It should be noted that these are the countries where the economies depend primarily on oil. Egypt's manufacturing output growth is not significantly influenced by oil price shocks but by money supply and exchange rates. The exchange rate also plays an important role in determining the direction of manufacturing output for both Libya and Egypt.

In addition, the MPIs appear to have a positive effect on output in the countries that practice a floating exchange rate. The results further show that an expansionary monetary policy does not have a positive impact on manufacturing output in Gabon and Libya, which are the two countries that practice a fixed exchange rate. This is in line with the Mundel-Fleming model and other studies that have demonstrated that MPIs are ineffective in stimulating output in a fixed exchange rate system (see Yiqing, 2006; Mundel, 1963).

4.7 Conclusions

With the exception of Egypt, it can be concluded from this study that the oil price has a large impact on the oil output growth of these countries. It is observed that the oil price shocks have a negative effect on the manufacturing sector of the AOECs. In the same vein, the study has also confirmed the effect of oil price shocks on the monetary policy transmission mechanism in the AOECs. The monetary policy instruments (MPIs) i.e both interest rates and money supply, are strongly affected by the shock from oil prices, as are inflation and exchange rates.

Generally, it is common to all countries examined that oil price shocks lead to currency appreciation. This is very conspicuous in Nigeria, Algeria, Gabon and Libya. In all these countries, the oil price shocks lead to an exchange rate fall, which is synonymous with currency appreciation. In all, the resultant effect on manufacturing output has been negative.

The study has also refuted the claim of Berument etal., (2009) that the oil price shock affects economic policies of oil rich countries through the output they contribute or supply to the global oil market. It is evident from the findings of this study that the oil price affects the monetary policy transmission mechanism directly without passing through the oil output growth rate as claimed by Berument etal., (2004). This might not be unconnected with the fact that most of the AOECs are relatively open and as such, they are highly susceptible to external shocks without the need of any intermediary to transmit the effect of the shock to the economy.

The study has also established the effectiveness of the MPIs in the monetary policy transmission mechanism. Both interest rates and money supply are found to be effective tools of monetary policy in that they can be used to influence output growth of the manufacturing sector. It is evident that the effects of an oil price shock are transmitted to manufacturing output through the monetary policy instruments (MPIs). However, interest rate shocks appear to have a negative effect on the manufacturing output

growth, while a money supply shock appears to have a positive effect, especially in the other four countries, with the exception of Egypt.

This study has also supported the need for an improvement in investments in the manufacturing sector as a panacea for the negative effect of the oil price shocks (see Ismail 2010). Egypt, which is the only country among the AOECs with a relatively high investment in the manufacturing sector, is the only country that is not negatively affected by oil price shocks. In other words, the more capital intensive the manufacturing sector is, the more the output and the more the sector is insulated against the oil price shocks.

The study further finds that inflation often acts as a disincentive to output growth in the AOECs. For the most part of the analysis, manufacturing output and inflation rate move in opposing directions. It is also observed that the inflation in the AOECs that practice a fixed exchange rate is more of a structural than a monetary phenomenon. That is, inflation in these countries is largely as a result of imbalances between price and output or it is imported. According to Ali and Harvie (2013), a fixed nominal exchange rate often leads to high domestic price levels in the short run (rise in inflation) and appreciation of the real exchange rate. This implies a bad climate for the manufacturing sector in which to thrive. In the countries that practice a flexible exchange rate their nature of inflation is more monetary than structural, although Nigeria shows a mixture of both.

It is also evident from the study that the effect of an inflation shock on the monetary policy instruments, manufacturing output and economic activities are not very pronounced in AOECs where a fixed exchange rate is practiced. This suggests that these countries usually have very effective inflation policies.

It can be concluded from the findings in this study that monetary policy instruments (MPIs) are more affected by exchange rate shock under a fixed exchange rate regime than under a flexible exchange rate regime. Due to the way they are affected in the fixed exchange rate countries, they are almost inactive in promoting output growth. Exchange

rates tend to have a stronger effect on other variables in the monetary policy transmission mechanisms in the countries where a fixed exchange rate is practiced than where a floating exchange rate is practiced. In other words, these findings have contributed to the growing consensus that monetary policy instruments (MPIs) are more effective in the countries that practice a flexible exchange rate. In addition, any country among the AOECs with a more diversified export market is likely to be more affected by exchange rate shocks than the ones with a narrow export base.

The study has also contributed to the growing literature that currency depreciation is likely to promote domestic output more than a currency appreciation in an oil exporting country. A fall in the exchange rate, that is a currency appreciation, for most part of the analysis in this study has led to a fall in manufacturing output growth and GDP growth rate. It can also be concluded from the findings in our study that an over-valued currency is an impediment to the growth of the manufacturing sector in the AOECs. This might have informed the conclusion of Olomola (2006), who maintains that currency appreciation in Nigeria, is capable of squeezing out the tradable sector.

Manufacturing output growth and the growth rate of GDP have not fared well in most of the countries analysed due to the negative effect of the oil price shocks. It appears that the manufacturing sector is vulnerable to external shocks under a fixed exchange rate system more than under a floating exchange rate system. That is, manufacturing output growth is negatively affected under a fixed exchange rate more than under a flexible exchange rate system. The implication of this is that a fixed exchange rate exposes AOECs real sectors to external shock.

Findings of this study also support studies that have used GDP growth rate as a proxy for economic performance. GDP growth for the largest part of the findings in this study moves in the same direction as manufacturing output growth. There is consensus in the literature that there is a strong linkage between the development of a country and the vibrancy of the manufacturing sector.

Finally, it can be concluded that the relationship between oil price shocks and manufacturing output in the (MTM) in AOECs depends on the following:

(i) The system of exchange rate in the country;
(ii) The breadth of the export base or level of economic diversification of the country;
(iii) The nature of inflation in the country;
(iv) The objectives of the monetary authority;

CHAPTER FIVE

Summary, Policy implications and Recommendations

5.1 Summary

The study investigates monetary policy and the manufacturing sector of AOECs. Some of the major justifications for the study include the need to understand the poor state of the manufacturing sector in AOECs and to contribute to the literature by assessing the level and the cause of the decline in manufacturing output, and discuss ways in which these countries can solve this problem. Considering the fact that these are oil rich economies, it is apparent that they are prone to the Dutch Disease problem. One of the ways by which the status of the manufacturing sector can be assessed in oil rich economies is to examine its relationship with the oil sector. This, among others, exposes the existence or otherwise of the Dutch Disease problem. There is near consensus that economic diversification is one of the solutions to this problem and the manufacturing sector has been tipped to be an important sector that can be used as an alternative mainstay of the AOECs. Accordingly, this study investigates the existence of Dutch Disease as it affects the manufacturing sector in the AOECs.

In solving the problem of the manufacturing sector in the AOECs, the role of monetary policy has been questioned. Precisely, the relevance of monetary policy in promoting the growth of the manufacturing sector of a resource rich country has been discussed by Mohamed, 2011; Corden and Neary,1982; Lama and Medina, 2010 among others. The common conclusion from these studies is that assessment of the relationship between the manufacturing sector of these economies and the monetary policy will definitely lead to policy framework that will improve the contributions of monetary policy to the growth of manufacturing sector of a resource endowed countries like AOECs

Again, the efficacy of monetary policy in promoting the growth of the manufacturing sector hinges on the effectiveness of the monetary policy transmission mechanism. The composition, structure and the vulnerability of variables in the transmission process of

monetary policy to various internal and external shocks also plays an important role in determining its efficiency in influencing growth of the manufacturing sector. As most studies agree, oil rich economies are most likely to be highly susceptible to both internal and external shocks, particularly oil price shocks. The current research also has as its major objective examination of output growth of the manufacturing sector in the AOECs within the framework of the monetary policy transmission mechanism.

Assessment of the impact of the oil sector on the growth of the manufacturing sector in AOECs is carried out. This is achieved through the application of panel data analysis. Using an endogenous growth model with public good (see Barro and Lee,1993), a growth model is formulated. The model expresses manufacturing sector output growth rate as a function of oil revenue and capital formation while per capita income, real exchange rate and electricity generation are used as control variables. The study explores both the static panel models (fixed effects within regression and least square dummy variable (LSDV)), and dynamic panel models (that is generalised method of moments (GMM) and systemic generalised method of moments (SYS-GMM)). The research focuses on six major net oil exporters in Africa, namely Nigeria, Cameroun, Gabon (Sub-Saharan Africa), Egypt, Algeria, and Libya (non-Sub-Saharan Africa).

Results from the panel data analysis show that in the fixed effects model none of the explanatory variables have a significant impact on the growth rate of the manufacturing sector. Although the oil revenue shows a negative relationship with the manufacturing sector growth rate, the coefficient is not statistically significant. The LSDV fixed effects' results further indicate that some of the countries' dummies are significant showing that there is a relative country-specific effect in the result. The fixed effects model is also statistically significant.

The dynamic panel data analysis which is explored to obtain more efficient estimates indicates that for both the GMM and SYS-GMM, exchange rates and oil revenue show a significant relationship with growth of the manufacturing sector. The oil revenue in particular, shows a significant negative relationship confirming the existence of the

Dutch Disease problem in the AOECs. Capital formation shows a positive relationship but it is not significant; and the same relationship is exhibited by per-capita income and electricity generation.

Considering the second major objective, the study assesses the relationship between monetary policy and manufacturing sector growth in the AOECs. The empirical literature on the subject shows that there are divergent views on the exact relationship that should exist between the two variables. While some schools of thought agree that there should be a long run relationship, others are of the opinion that the relationship between the two is just transitory. Findings of the study support the view that the relationship between manufacturing output and monetary policy might be more of a transitory nature.

The model for the second objective is a variant of the endogenous growth model propounded by Romer (1996). The model expresses manufacturing sector growth of the AOECs as a function of monetary variables, namely monetary policy instruments (interest rates and money supply), policy variables (inflation and exchange rates) and a financial sector indicator (net domestic credit). Gross capital formation is used as a control variable. Based on data availability, nine net oil exporters in Africa are used, as follows: Nigeria, Algeria, Libya, Chad, Egypt, Cameroun, Gabon, Democratic Republic of Congo and Equatorial Guinea. Panel cointegration analysis (Westerlund, 2007) is applied to examine the existence of a long-run relationship between these variables and manufacturing sector growth of the AOECs.

Results of the analysis show that there exists a very weak long-run relationship between the manufacturing sector growth and the explanatory variables, which include monetary variables and the capital formation. The analysis takes into consideration the likelihood of the existence of cross-sectional dependence among the cross-sectional units by using the robust P values. It is found that the existence of cointegration is very weak. Out of the four tests of cointegration developed by Persyn and Westerlund(2008), cointegration is confirmed from only one. The results ofthe fixed effects model show that none of the

explanatory variables is statistically significant in the long-run while money supply, exchange rate, capital formation and net domestic credit have a significant impact in the short-run.

In addition the results also show that net domestic credit is inversely related to the growth of the manufacturing sector in the AOECs. However, exchange rates, money supply and capital formation exhibit a positive or direct relationship with manufacturing sector growth. The overall test of statistical significance shows that both static and dynamic panel models are statistically significant.

The third broad objective of the study is the assessment of how manufacturing output growth is related to other variables in the monetary policy transmission mechanisms in various AOECs. Findings from the empirical analysis support the existing literature that monetary policy is most likely to have a more significant impact on output in the short-run than in the long-run. In other words, there is almost a consensus that monetary policy tends to have a transitory effect rather than a permanent effect on output. Therefore, the second broad objective serves as a precursor for the third broad objective.

Based on the foregoing, the major focus of the third objective is to examine how output growth of the manufacturing sector in the AOECs is related to other variables in the respective monetary policy transmission mechanisms. Another germane reason behind the assessment of this relationship is that despite the fact that these countries share common characteristics of being net oil exporters in Africa; the two previous broad objectives which made use of panel data analysis have clearly shown the existence of cross-sectional dependence among the cross-sectional units. This calls for an individual assessment of the countries in order to examine individual structural or institutional influences on the role of monetary policy in promoting the growth of their manufacturing sectors.

Therefore, the third objective does not only focus on the short-run analysis but also examines individual countries' specific characteristics since they belong to different

monetary zones and practice different forms of monetary policies. These range from different exchange rate regimes to different inflation policies. Taking cognisance of these, the study examines individual countries separately and discovers institutional and structural framework influences on the relationship between individual countries' monetary policy transmission mechanisms and the output growth of their manufacturing sectors.

Considering the various strata that these countries belong to in terms of oil production per day, Nigeria, Algeria, Libya, Egypt and Gabon are chosen for the purpose of the study. Reasons behind the selection of the five countries are stated in chapter four. After a brief overview of individual countries' monetary systems and the status of their manufacturing sectors, a monetary policy transmission mechanism framework is built for the countries following existing literature. As we are interested in the short run analysis, structural vector auto-regression (SVAR) is chosen as the estimating technique.

The variables in the SVAR model describe the monetary policy transmission mechanism which comprises of the monetary policy instruments, policy variables or intermediate targets and the output variables. Oil price and oil output growth rate are purely exogenous. Data on all the variables are sourced from the World Bank and the Organisation of Petroleum Exporting Countries (OPEC).

Preliminary analysis of the SVAR starts with the normality test to verify the suitability of the model for SVAR analysis before examining the impulse response functions as well as the variance decomposition. The country-based analysis starts with Nigeria and is followed by Algeria, Gabon, Libya and Egypt in that order.

Findings on both Nigeria and Algeria are almost similar because they both practise a flexible exchange rate. The impulse response analysis on both countries shows that all variables in the MTM, including output, respond sharply to oil price shocks. It is also observed that oil price shocks account for a large proportion of the variations in the monetary policy instruments and both monetary policy shocks and oil price shocks

account for most of the variations in manufacturing output growth rate. However a slight difference between the results obtained on both countries is in the nature of inflation and exchange rate shocks. The responses of the variables in the model to both exchange and inflation rate shocks in Nigeria are sharper than in Algeria. Furthermore, inflation appears to be caused by structural rigidities in Algeria while in Nigeria, it appears to be a monetary phenomenon. In addition, the exchange rate is controlled in Algeria while a free floating system is in place in Nigeria.

The impulse response functions and variance decomposition on Libya and Gabon are almost similar, probably because they both practice a fixed exchange rate system, although with some slight differences. Generally, oil price shocks constitute a major shock affecting most variables in the MTM, including manufacturing output. The real exchange rate shock makes the largest contribution to fluctuations in the monetary policy instruments in both countries. The influence of exchange rate shocks on output is more pronounced than that of interest rates and money supply shocks. In the variance decomposition analysis it appears that manufacturing output growth rate is responsive to real exchange rate shocks more than to both interest rate and money supply growth rate shocks. All these are more evident in the Libyan economy than in Gabon because of the pegging of the exchange rate in the former.

Result of the analysis on Egypt are different in that oil price shocks fail to constitute a major disturbance to the variables in the MTM, which is contrary to findings from the other four countries examined. Although Egypt practices a flexible exchange rate system, it has a very developed non-oil sector when compared to other countries under examination. The behaviour of manufacturing output growth is not significantly influenced by oil price shocks. Furthermore, exchange rate shocks appear to account for the highest proportion of fluctuations in manufacturing output in Egypt.

Lastly, the results in all the countries generally support the view that currency appreciation inhibits the growth of real output. It is common to all the countries

analysed that whenever a currency appreciates, it brings about a fall in manufacturing output, but when the currency depreciates the manufacturing output seems to rise.

5.2 Policy Implications

Apart from the identification of the Dutch Disease as a factor inhibiting the growth of the manufacturing sector, other variables included in the model, especially capital formation and electricity generation, fail to show a significant impact on the growth of the manufacturing sector. This is a pointer towards the fact that the manufacturing sector of the AOECs is short of adequate capital in order to compete with other productive sectors in the AOECs'. Therefore, findings from the current study support the position of some previous authors who have concluded that the more capital intensive the manufacturing sector of an economy is, the less the sector is affected by the Dutch Disease problem (Ismail, 2010). The implication here is that the problem of the manufacturing sector in the AOECs is aggravated by a lack of positive synergy between the oil sector and the manufacturing sector. It is evident, therefore, that governments of the AOECs have failed to put back into the manufacturing sector the huge revenue made from oil to enable improvements in the level of investment of these sectors.

Having, identified the level of the problem confronting the manufacturing sector in the AOECs, the second broad objective of the study is to examine the relationship between monetary policy and manufacturing output growth in the AOECs. This is with a view to assessing possible ways through which monetary policy can be used to revamp the ailing manufacturing sectors of the AOECs. Some germane policy implications are also drawn from the findings.

Firstly, a very weak long run relationship is confirmed between manufacturing sector output growth and monetary variables which include monetary policy instruments (i.e. interest rates and money supply), policy variables (inflation rate and exchange rate), a financial sector indicator (net domestic credit) and capital formation. This finding is further supported in the panel model's estimation. The finding indicates that none of the

explanatory variables has a significant impact on the manufacturing sector's output growth in the long-run model. However, money supply, exchange rate and net domestic credit all have a significant impact on the manufacturing output growth in the short-run model. The implication of this result is that monetary policy is most likely to have more of a transitory effect on manufacturing output in the AOECs. This implies that the existence of a very weak long-run relationship in the model might not be unconnected with the influence of the other variables present which are not monetary policy instruments in the model.

Again, the result shows that there is a significant inverse relationship between net domestic credit and manufacturing sector output growth in the AOECs. The implication of this result is that an increase in net domestic credit might not lead to an increase in output of the manufacturing sector. This simply implies that the share of the manufacturing sector out of the net domestic credit in the economy might not be having the expected positive effect on the growth of the sector. Further findings on this reveal that most of the AOECs in their monetary policy framework practice selective credit control which is aimed at boosting credit supply to certain sectors of their economies. However, it was further discovered that most of the credit meant for the manufacturing sector is often diverted to other sectors where the financial institutions believe that loan recovery will be easier and more guaranteed. This tendency has aggravated the problem of a lack of adequate investment in the manufacturing sector of the AOECs.

In addition, findings from the analysis of the second broad objective show that exchange rates exhibit a positive and significant relationship with manufacturing output. The implication of this result is that currency depreciation might promote growth of output of the manufacturing sector. This supports the existing literature that currency appreciation has the tendency to squeeze out the tradable sector of a developing economy (Olomola, 2007). However, the existence of a relationship of this nature in a resource endowed country has been viewed as a symptom of Dutch Disease (see Rodrik, 2008).

The panel cointegration result also shows the presence of cross sectional dependence in the model. This implies that some of the countries investigated exhibit peculiar characteristics that might influence our results. This necessitated the use of robust P values in the cointegration test. This revelation indicates that apart from the fact that these countries have an important common characteristic of being major net oil exporters in Africa, they still possess some individual characteristics that might distinguish them from one another in terms of monetary policy administration and the status of their manufacturing sectors. It should be noted that the same result was obtained in the analysis of the first broad objective under the LSDV model where cross sectional unit differences were noticed. This further implies that the AOECs can also be assessed individually to get a better and more reliable result. This is what led to the third broad objective where the analysis was carried out based on individual countries.

Based on the findings obtained from the analysis of the second broad objective, the third objective is based on individual country analysis of the monetary policy transmission mechanism, with particular interest on how monetary policy is transmitted to output growth of the manufacturing sector in the AOECs. The study finds that there is a weak long-run relationship between monetary policy and manufacturing output growth. Consequently, the analysis of the third objective is based on short-run analysis.

In the last part of the study, oil price shocks have been shown to be a major shock affecting most variables in the monetary policy transmission mechanism including output in the AOECs. However, the severity of the effect varies from country to country. Egypt, which has a relatively more developed non-oil sector with greater investments in the manufacturing sector than the others, appears to be least affected by oil price shocks. The implication is that the manufacturing sector with a large quantity of investments might not be severely affected byan oil price shock. This was one of the conclusions in the first objective analysis where it was inferred from the results that the more capital intensive the manufacturing sector is, the less adverse is the effect of Dutch Disease.

Contrary to the position of some studies that oil output growth serves as a medium of transmission for the effect of oil price shocks to the domestic economy, the findings from the SVAR analysis have shown that oil price shocks have a direct effect on variables, including output, in the monetary policy transmission mechanisms of the AOECs. This further justifies the severity of the effect of oil price shocks on manufacturing output of the AOECs. In addition, the monetary policy transmission mechanism (MTM) has been shown to be greatly influenced by oil price shocks. The implication of this is that one of the major inhibiting factors to the efficacy of monetary policy in the AOECs is the oil price shock. In other words, it appears that oil price shocks constitute a major impediment to the effectiveness of monetary policy in promoting growth of the manufacturing sector in AOECs.

In addition, the system of exchange rates practiced by these countries has been shown to be a major determining factor in the effectiveness of monetary policy in the AOECs. In both the impulse response and variance decomposition analyses, it is confirmed that manufacturing output response to monetary policy instrument shocks is more pronounced in the countries practicing a flexible exchange rate than the ones practicing a fixed exchange rate. The implication of this is that a less rigid exchange rate system is likely to provide a better atmosphere for monetary policy to be more effective in promoting growth of the manufacturing sector in the AOECs.

Inflation has been shown to be a hindrance to the growth of the manufacturing sector but the severity of this problem also varies from one country to the other. Manufacturing output has been shown to have a sharper response to an inflation shock in the countries with a flexible exchange rate system than in those with a rigid exchange rate system. The implication is that inflation is better controlled in the AOECs with a fixed exchange rate system. In these countries, the nature of inflation is often structural and not monetary. Therefore structural imbalances with respect to output and prices appear to be major causes of inflation in the fixed exchange rate AOECs, while money supply appears to be a major cause of inflation in the AOECs with a flexible exchange rate regime.

Unlike the findings of some studies that maintain that an oil price shock makes the currency of some oil exporting countries depreciate, it appears that in most AOECs, a positive oil price shock makes the local currency appreciate. Furthermore, as the currency appreciates the results from almost all the countries under study show that manufacturing output tends to fall. It is also noticed that any shock that produces a rise in exchange rate (currency depreciation) leads to a rise in manufacturing output. The implication of this is that findings from this research work are in support of the school of thought that maintains that currency depreciation boosts domestic output. It will be recalled that similar results were obtained in the second objective analysis where a significant positive relationship was confirmed between the exchange rate and manufacturing output growth.

Both interest rates and money supply, which are the two monetary policy operating targets used in the analysis, constitute major determinants of the behaviour of the manufacturing output in the AOECs. While interest rate shocks often lead to a fall in manufacturing output, money supply growth rate shocks often lead to a rise in manufacturing output but the rise is usually not pronounced or sustained. The reason for this might not be unconnected with one of the findings in chapter three, that net domestic credit does not have a positive impact on the growth of the manufacturing sector. Since domestic credit constitutes an important part of the total money supply this will no doubt affect the effectiveness of expansionary monetary policy on the growth of the manufacturing sector in the AOECs.

In addition, the effectiveness of the monetary policy instruments in promoting the growth of manufacturing output also depends on the system of exchange rates. For instance, in Libya where a fixed exchange rate is practiced, exchange rate shocks appear to be the most influential factor affecting manufacturing output. This also implies that exchange rate shocks are likely to have a more pronounced effect than monetary policy shocks in the fixed exchange rate systems in AOECs.

Finally, the exchange rate system, monetary policy system (monetary zone), current level of investment in the manufacturing sector and objectives of the local monetary authorities all appear to be major factors that affect monetary policy relationship with the growth of the manufacturing sector in the AOECs.

5.3 Policy Recommendations

Based on the findings in this study, some course of action is imperative if manufacturing output in the AOECs is to be improved through monetary policy administration. The course of action recommended is as follows:

(i) It has been observed that the exchange rate policy that favours the manufacturing sector in the AOECs is the type that does not encourage over-valuation of a local currency. In other words currency appreciation appears to be a disincentive to manufacturing output growth in the AOECs. This is an indication that a monetary policy that will discourage currency appreciation might have a positive and significant impact on manufacturing growth at least in the short run. This type of exchange rate policy has the tendency to discourage importers and thus boost local content in the domestic output and consequently promote the growth of the manufacturing sector. On this note, the monetary authorities of the AOECs are advised to adopt an exchange rate policy that will not squeeze out the tradable sector through over-valuation of local currency.

(ii) The study findings have shown that monetary policy instruments appear to thrive very well under a flexible exchange rate regime rather than a fixed exchange rate. In other words, monetary policy instruments are able to be used more effectively to achieve the aims of economic stability and output growth under a flexible exchange rate system rather than under a fixed exchange rate system. It is recommended that any AOECs that are interested in promoting the growth of their manufacturing sectors through monetary policy should embrace a flexible exchange rate system.

(iii) The study has also revealed that the nature of inflation in the AOECs differs from one country to another. For instance inflation in the countries that are practicing a flexible exchange rate is more of a monetary phenomenon, while that of the countries that practice a fixed exchange rate is more structural in nature. Therefore tackling the inflation problem, which has been shown to have a negative effect on the growth of the manufacturing sector, should be based on these two perspectives. For example countries like Libya, where a fixed exchange rate is practiced, should be more concerned about curbing inflation from a structural angle as research has shown that money supply might not be their major cause of inflation but rather imbalances between price and output.

(iv) Minimizing the effects of oil price shocks has been shown to be dependent on the level of investment in the manufacturing sector (Egypt case). This implies that AOECs should look for ways of attracting investors into their manufacturing sectors. This can be done by creating an enabling environment for investment in terms of power supply and the prevention of political and environmental violence which can discourage investors.

(v) From the study findings, it has been inferred that the inability of expansionary monetary policy to be effective in promoting the growth of the manufacturing sector in the AOECs might not be unconnected with credit diversion that is prevalent in some AOECs. This is because the selective credit control policy of the Central Banks in some AOECs is sometimes violated by commercial banks. This has led to credit diversion to sectors other than the sector the credits were originally destined for. This implies that there should be more commitment on the part of the monetary authorities in the AOECs in monitoring and controlling the implementation of selective credit control in the AOECs.

(vi) The study also found that Egypt, which is the only country with a broad export base, is the least affected by the oil price shock. This suggests that the manufacturing sector of a country with a broad export base is likely to be

less susceptible to the adverse effects of oil price shocks. Based on the foregoing, it follows that the policy that will expand the export base of the AOECs will benefit their manufacturing sector and also minimize the effect on economic instability occasioned by oil price shocks.

(vii) Results from this study have also shown that the growth rate of GDP often responds to shocks in the same way manufacturing output growth rate does. Therefore, to achieve sustainable economic growth, AOECs should formulate and implement policies that support growth of the manufacturing sector

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Appendix

Impulse response result on Nigeria

Variance decomposition results on Nigeria

Oil price:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100000	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.175924	82.39728	0.955398	16.30110	0.036423	0.020907	0.002128	0.272037	0.014732
3	0.237188	70.29222	3.315177	25.10840	0.058216	0.014241	0.083422	0.984253	0.144074
4	0.275154	66.56463	6.976654	21.59719	1.226006	0.035141	0.357599	2.028175	1.214604
5	0.318235	57.76501	9.970972	19.43692	5.818864	0.163669	0.755164	2.720902	3.368500
6	0.413054	37.86983	8.935860	33.48379	11.83914	0.297396	0.882260	2.223007	4.468714
7	0.574093	21.02449	5.985748	51.93130	14.84914	0.306379	0.727322	1.337276	3.838352
8	0.783550	11.87848	3.747091	64.62440	15.39054	0.248507	0.544630	0.754400	2.811951
9	1.019724	7.288532	2.405529	72.35368	14.92934	0.183115	0.411686	0.447657	1.980463
10	1.265745	4.874180	1.622535	77.25566	14.10489	0.129901	0.323194	0.291649	1.397997
11	1.509037	3.513209	1.155570	80.60757	13.14606	0.092600	0.264672	0.210807	1.009506
12	1.740031	2.697049	0.869990	83.06221	12.14763	0.070103	0.225662	0.167297	0.760062

Oil output growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100499	0.990099	99.00990	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.180053	1.502733	89.58806	5.435905	3.062012	0.066363	0.000107	0.027420	0.317401
3	0.255354	1.907488	72.43218	16.18168	8.409702	0.129854	0.003438	0.087458	0.848197
4	0.325415	2.169850	56.11372	27.18163	12.94271	0.135144	0.022732	0.138336	1.295888
5	0.385531	2.349643	44.17715	36.10108	15.44220	0.107315	0.061443	0.158106	1.603063
6	0.432074	2.509103	36.45633	42.81045	16.04547	0.086297	0.113579	0.153300	1.825472
7	0.464744	2.681056	31.78077	47.73263	15.38653	0.094344	0.169646	0.139744	2.015283
8	0.486117	2.870966	29.06073	51.11921	14.27793	0.132124	0.220325	0.128285	2.190429
9	0.500144	3.064256	27.47355	52.98335	13.57509	0.184529	0.258601	0.121246	2.339387
10	0.510675	3.234932	26.43481	53.30197	13.96291	0.231020	0.281211	0.116351	2.436804
11	0.520526	3.356317	25.56633	52.25394	15.70201	0.257124	0.288977	0.112266	2.463036
12	0.531225	3.410864	24.67025	50.31422	18.52893	0.260969	0.285616	0.110542	2.418617

Interest rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100935	0.993092	6.68E-05	98.01009	6.68E-05	0.008249	0.008249	8.25E-05	0.980101
2	0.190748	0.944624	0.003914	97.93149	0.326824	0.004368	0.028166	0.002922	0.757691
3	0.275138	0.883139	0.016926	97.57888	0.940918	0.002666	0.048572	0.008403	0.520500
4	0.352468	0.823838	0.039202	97.10506	1.607966	0.001956	0.066783	0.016008	0.339185
5	0.422700	0.774940	0.066597	96.64177	2.169976	0.001827	0.082571	0.025260	0.237061
6	0.486031	0.739789	0.094220	96.27396	2.552845	0.002222	0.096670	0.035502	0.204789
7	0.542578	0.718940	0.118918	96.03604	2.746829	0.003148	0.109943	0.045856	0.220330
8	0.592401	0.711630	0.139712	95.92384	2.779608	0.004527	0.123060	0.055365	0.262256
9	0.635585	0.716581	0.157071	95.91015	2.695411	0.006166	0.136436	0.063236	0.314950
10	0.672299	0.732325	0.172025	95.95695	2.542694	0.007809	0.150285	0.069029	0.368879
11	0.702823	0.757282	0.185565	96.02373	2.367827	0.009211	0.164676	0.072702	0.419003
12	0.727559	0.789727	0.198371	96.07281	2.211753	0.010194	0.179590	0.074539	0.463017

Money supply growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100913	0.794376	6.68E-07	0.980531	98.21512	8.25E-05	8.25E-05	8.25E-07	0.009805
2	0.208487	0.690536	0.001727	5.050738	94.19837	0.007023	0.010121	0.032863	0.008619
3	0.326395	0.535260	0.004388	12.03762	87.27367	0.019953	0.025656	0.099906	0.003552
4	0.452316	0.372264	0.005090	21.33889	78.02737	0.034834	0.041653	0.170410	0.009487
5	0.585576	0.238965	0.003710	31.80974	67.58490	0.048511	0.055946	0.221455	0.036771
6	0.724923	0.156251	0.002532	42.22200	57.16062	0.059279	0.068004	0.245606	0.085709
7	0.867607	0.127573	0.004129	51.66544	47.66052	0.066766	0.078185	0.247353	0.150034
8	1.009498	0.145120	0.009997	59.67667	39.55177	0.071379	0.087158	0.235461	0.222453
9	1.145779	0.196944	0.020434	66.15114	32.94691	0.073777	0.095567	0.217681	0.297551
10	1.271777	0.271493	0.034982	71.18992	27.75414	0.074569	0.103895	0.199009	0.372002
11	1.383645	0.359392	0.052843	74.97645	23.79899	0.074216	0.112449	0.181993	0.443670
12	1.478813	0.453564	0.073099	77.70602	20.89453	0.073042	0.121385	0.167609	0.510754

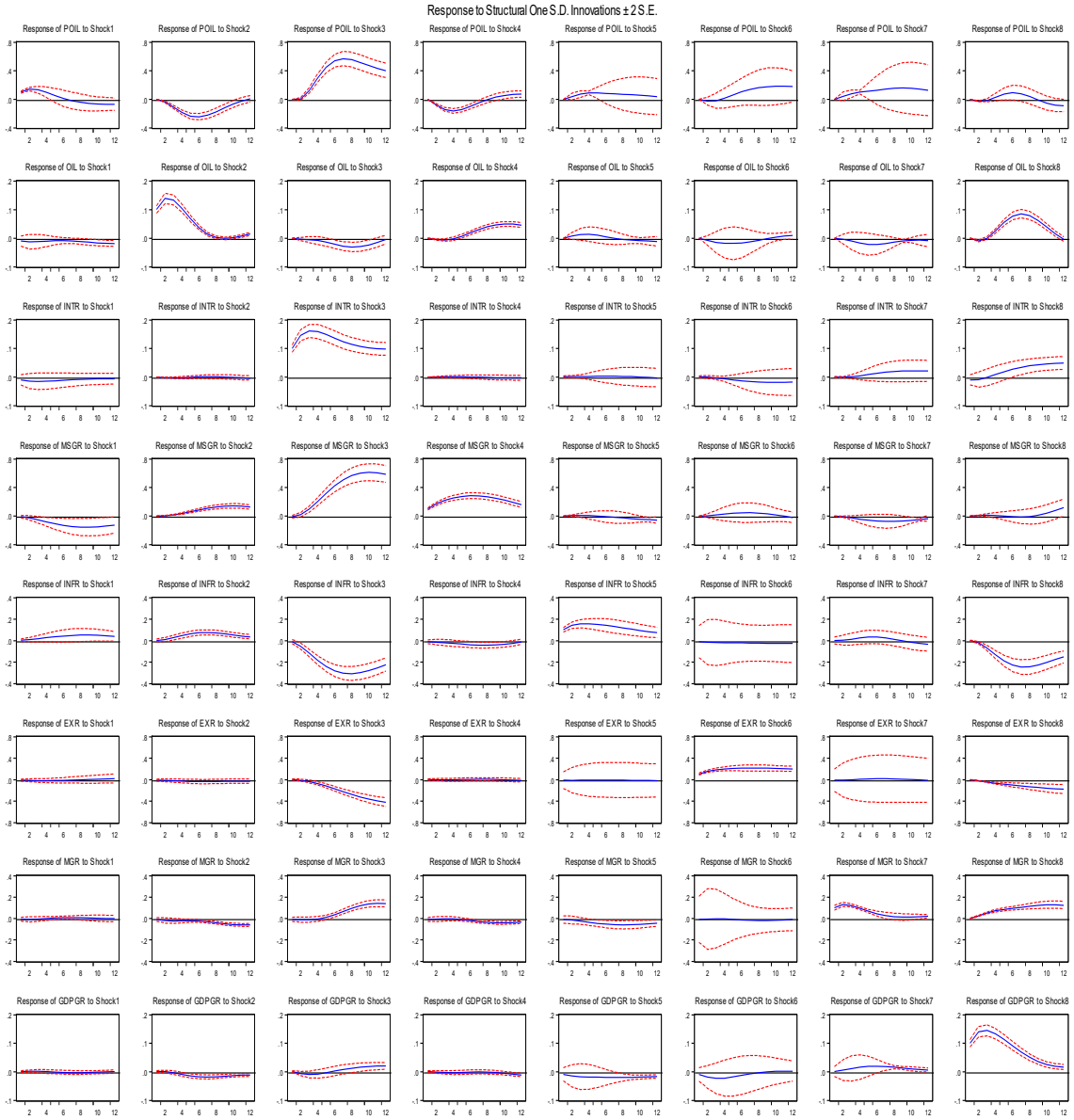
Inflation rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.102329	0.073163	0.008171	0.802611	0.990878	97.09827	1.008794	0.010088	0.008026
2	0.199377	0.691032	0.123143	2.409503	8.345056	85.32409	1.362719	0.004124	1.740328
3	0.297589	1.109146	0.922942	1.429209	16.85416	72.09112	1.675197	0.001891	5.916341
4	0.395966	1.193413	2.400165	1.206581	23.21276	59.10811	1.844512	0.004783	11.02967
5	0.493701	1.071311	4.020877	3.475896	26.45392	47.77213	1.856013	0.019023	15.33084
6	0.587097	0.889970	5.304519	7.753942	27.31903	38.89006	1.767592	0.049555	18.02534
7	0.671711	0.726384	6.081791	12.98731	26.90313	32.36708	1.641410	0.095021	19.19787
8	0.745058	0.601546	6.397439	18.47447	25.94361	27.67051	1.513423	0.147478	19.25153
9	0.807324	0.512949	6.372189	23.90038	24.78931	24.24223	1.397244	0.195932	18.58977
10	0.860536	0.452722	6.131492	29.13753	23.56537	21.65203	1.295013	0.231195	17.53464
11	0.907270	0.413849	5.779644	34.10587	22.30955	19.61250	1.204976	0.249394	16.32422
12	0.949635	0.391131	5.392751	38.72105	21.04617	17.95055	1.125237	0.252344	15.12076

Exchange rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103671	0.692304	0.783379	0.028229	0.034851	0.780407	96.71341	0.967134	0.000282
2	0.193309	0.906497	1.094470	4.919443	1.142381	0.764647	89.73465	1.113911	0.324000
3	0.287065	1.514537	1.419183	10.72038	4.980498	0.773494	78.28305	1.143999	1.164867
4	0.387478	2.446056	1.612448	14.17689	11.59766	0.816530	66.27695	1.053155	2.020312
5	0.494978	3.518759	1.613134	15.47576	19.48621	0.899534	55.67538	0.886993	2.444239
6	0.606537	4.579294	1.466473	15.50820	26.98432	1.030755	47.33960	0.706468	2.384897
7	0.716803	5.572161	1.254635	14.90413	33.14764	1.219195	41.30916	0.551172	2.041904
8	0.820032	6.513958	1.042599	13.94158	37.71344	1.473427	37.24103	0.434443	1.639528
9	0.911644	7.449211	0.865589	12.71493	40.76961	1.800569	34.71960	0.353753	1.326738
10	0.989319	8.418446	0.735981	11.31553	42.49038	2.203427	33.36391	0.300421	1.171893
11	1.053819	9.432885	0.652448	9.993476	42.98490	2.673762	32.81213	0.264933	1.185473
12	1.109657	10.44611	0.605665	9.304812	42.23153	3.180375	32.65451	0.239103	1.337897

Manufacturing growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103132	0.398320	0.790161	0.640031	0.790161	0.804448	0.804448	95.76603	0.006400
2	0.165450	1.321111	0.360267	0.469775	1.081786	0.902054	0.670110	95.07335	0.121549
3	0.198445	2.526945	1.446064	0.326550	1.633574	0.995286	0.547589	92.40905	0.114939
4	0.216978	3.519631	3.666697	3.031914	2.132012	1.001943	0.458813	84.70869	1.480297
5	0.243420	3.532864	5.316171	14.96399	2.034975	0.835938	0.380524	67.95310	4.982438
6	0.286878	2.763763	5.279617	32.85794	1.498172	0.603085	0.301960	48.96858	7.726886
7	0.340164	1.996992	4.426185	48.70060	1.094082	0.431883	0.235718	35.06181	8.052729
8	0.393378	1.493273	3.582764	60.06311	0.989932	0.330024	0.186931	26.37432	6.979639
9	0.440767	1.195773	2.960102	67.55929	1.105370	0.268691	0.152748	21.04847	5.709552
10	0.480180	1.019081	2.536839	72.20146	1.333158	0.228568	0.129398	17.73541	4.816088
11	0.511310	0.909710	2.256771	74.88834	1.591596	0.201628	0.114132	15.65254	4.385281
12	0.534697	0.839729	2.074700	76.34862	1.824919	0.185623	0.105112	14.34127	4.280030

GDP growth									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100779	0.003379	0.006703	0.005429	0.006703	0.827494	0.827494	0.008275	98.31452
2	0.165839	0.007367	0.150015	0.141699	0.193713	0.896338	0.659175	0.004314	97.94738
3	0.206110	0.007024	0.607489	0.189393	1.485102	0.906171	0.490188	0.011723	96.30291
4	0.231913	0.012350	1.393712	2.235470	4.701782	0.835955	0.389807	0.062718	90.36821
5	0.254945	0.060308	2.194643	7.820583	9.292997	0.709055	0.393017	0.150012	79.37938
6	0.278983	0.143328	2.667268	15.16390	13.47567	0.593316	0.468249	0.226080	67.26219
7	0.300840	0.215779	2.798615	21.51548	16.17847	0.529116	0.565646	0.263899	57.93299
8	0.316665	0.249740	2.758201	25.78554	17.47134	0.511966	0.662731	0.271464	52.28902
9	0.325496	0.250379	2.683246	28.18049	17.82405	0.521227	0.756057	0.266450	49.51811
10	0.329074	0.245393	2.634293	29.27800	17.72320	0.537436	0.844409	0.261239	48.47603
11	0.330171	0.269154	2.617698	29.60554	17.60772	0.547642	0.923376	0.260534	48.16834
12	0.331056	0.344231	2.614282	29.51935	17.80860	0.547773	0.987823	0.263650	47.91429

Impulse response result on Algeria



Variance decomposition result on Algeria

Oil price:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100000	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.206046	71.56736	3.222862	0.037951	14.37146	3.377708	1.747200	3.832780	1.842678
3	0.346476	40.21626	11.33654	12.70243	22.09776	5.498607	0.989350	6.307392	0.851654
4	0.546070	19.32824	16.28538	34.71563	17.86930	4.818473	0.470261	5.876131	0.636591
5	0.780754	9.901936	17.13052	50.07516	12.14274	3.662962	0.847039	5.021315	1.218327
6	1.008088	5.953473	16.27300	58.81694	8.285299	2.874537	1.586973	4.623972	1.585805
7	1.202102	4.213572	14.86605	63.85887	6.005721	2.416424	2.444010	4.648423	1.546935
8	1.357059	3.402700	13.33050	66.82694	4.714003	2.156960	3.340111	4.929083	1.299698
9	1.478962	3.012751	11.87302	68.47528	4.010446	2.001695	4.227407	5.301247	1.098150
10	1.576719	2.823526	10.62198	69.24966	3.645405	1.892183	5.058603	5.629521	1.079124
11	1.657317	2.732614	9.633668	69.52561	3.463158	1.796253	5.796048	5.835945	1.216700
12	1.724948	2.691044	8.894186	69.62340	3.370593	1.701344	6.421267	5.906864	1.391298

Oil output growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100499	0.990099	99.00990	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.172668	0.860021	98.29363	0.037259	0.083393	0.193385	0.209764	0.032385	0.290159
3	0.219622	0.826700	97.51263	0.078896	0.141411	0.479065	0.558510	0.223334	0.179451
4	0.246187	0.836239	95.32967	0.171795	0.120741	0.693005	0.959860	0.667273	1.221412
5	0.263635	0.849116	89.73041	0.427037	0.175254	0.757115	1.312804	1.261833	5.486432
6	0.280159	0.851755	81.13137	0.957711	0.594231	0.703459	1.506047	1.737493	12.51793
7	0.297178	0.865786	72.33173	1.725070	1.555234	0.625194	1.522728	1.949754	19.42450
8	0.312325	0.925332	65.49152	2.535219	3.032510	0.583239	1.439392	1.972948	24.01984
9	0.323654	1.052862	60.98763	3.180646	4.886470	0.589306	1.344321	1.931996	26.02677
10	0.331218	1.249939	58.23718	3.542248	6.908595	0.634341	1.293660	1.895060	26.23897
11	0.336424	1.494861	56.50175	3.627050	8.830373	0.706743	1.303446	1.880899	25.65488
12	0.340773	1.748678	55.24467	3.554761	10.38942	0.797635	1.354707	1.895857	25.01427

Interest rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100935	0.993092	6.68E-05	98.01009	6.68E-05	0.008249	0.008249	8.25E-05	0.980101
2	0.178421	0.966840	0.010488	98.43570	0.000341	0.010959	0.003264	0.001128	0.571283
3	0.241012	0.936829	0.017356	98.69360	0.001520	0.012655	0.019942	0.001708	0.316393
4	0.289432	0.904177	0.016980	98.66027	0.002557	0.014877	0.069187	0.022028	0.309923
5	0.326570	0.870185	0.013924	98.28383	0.002755	0.018084	0.156290	0.087409	0.567520
6	0.355559	0.835934	0.011856	97.58076	0.002400	0.021771	0.277225	0.210049	1.060003
7	0.378990	0.802293	0.011098	96.62045	0.002237	0.024701	0.420522	0.382467	1.736231
8	0.398747	0.769962	0.010493	95.49806	0.002822	0.025725	0.571959	0.583448	2.537526
9	0.416112	0.739469	0.009643	94.30725	0.004277	0.024733	0.718717	0.788827	3.407084
10	0.431936	0.711173	0.009579	93.12300	0.006391	0.022958	0.851462	0.979577	4.295864
11	0.446784	0.685291	0.012137	91.99631	0.008818	0.022479	0.964648	1.144714	5.165598
12	0.461031	0.661947	0.018976	90.95664	0.011230	0.025352	1.055934	1.280472	5.989451

Money supply growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100913	0.794376	6.68E-07	0.980531	98.21512	8.25E-05	8.25E-05	8.25E-07	0.009805
2	0.200831	2.046929	0.071012	1.160346	96.20256	0.090671	0.051769	0.224224	0.152487
3	0.319537	3.575931	0.317982	9.624737	85.17430	0.111178	0.247669	0.744989	0.203216
4	0.468123	4.726782	0.734554	23.48609	69.13702	0.069532	0.477657	1.233016	0.135343
5	0.645816	5.331561	1.235467	36.68840	54.51180	0.036547	0.622942	1.501923	0.071368
6	0.841934	5.564502	1.746828	46.86021	43.49735	0.032267	0.666155	1.581269	0.051423
7	1.042987	5.602353	2.225043	54.20773	35.67985	0.050323	0.636221	1.550996	0.047488
8	1.237178	5.545787	2.642826	59.51966	30.13845	0.082925	0.565218	1.468278	0.036857
9	1.416207	5.442392	2.980515	63.45253	26.12216	0.126233	0.478793	1.364032	0.033344
10	1.575557	5.312528	3.224221	66.42753	23.11915	0.179325	0.396974	1.253270	0.087009
11	1.713995	5.164168	3.367031	68.68088	20.79702	0.242526	0.335553	1.143428	0.269392
12	1.832696	5.000503	3.410883	70.33137	18.94270	0.316203	0.306221	1.039257	0.652857

Inflation rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.102329	0.073163	0.008171	0.802611	0.990878	97.09827	1.008794	0.010088	0.008026
2	0.186039	0.261265	0.273537	8.032083	0.912583	88.36850	0.885773	0.037943	1.228314
3	0.281932	0.516769	1.069329	20.58701	0.865833	69.24148	0.757319	0.248144	6.714122
4	0.400473	0.721644	1.948560	31.40430	0.840451	49.71021	0.610833	0.544249	14.21975
5	0.534325	0.861309	2.538870	38.07849	0.845077	36.00314	0.492730	0.710014	20.47037
6	0.669029	0.970810	2.838451	41.98115	0.871760	27.53939	0.416223	0.710831	24.67139
7	0.792639	1.072264	2.944938	44.50394	0.906682	22.39018	0.375068	0.616039	27.19089
8	0.898451	1.170716	2.937333	46.36044	0.936638	19.19312	0.360674	0.501595	28.53949
9	0.984337	1.261831	2.868420	47.83664	0.950501	17.16261	0.365950	0.418090	29.13596
10	1.051223	1.337883	2.774388	49.02197	0.941213	15.85620	0.384701	0.387904	29.29574
11	1.101670	1.391927	2.680287	49.93255	0.908892	15.01627	0.410859	0.412005	29.24721
12	1.138859	1.420550	2.601777	50.56804	0.863324	14.48438	0.438649	0.479145	29.14413

Exchange rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103671	0.692304	0.783379	0.028229	0.034851	0.780407	96.71341	0.967134	0.000282
2	0.189465	0.739346	0.711532	0.347013	0.011136	0.570888	95.87686	0.490202	1.253022
3	0.271925	0.742382	0.844015	1.889646	0.011991	0.397429	92.43763	0.239517	3.437389
4	0.353803	0.688145	1.072044	5.212213	0.008386	0.279159	86.97417	0.182225	5.583659
5	0.438411	0.585027	1.267067	10.57051	0.006787	0.203831	79.85194	0.214488	7.300350
6	0.528697	0.460013	1.340992	17.58272	0.012474	0.156851	71.62539	0.253684	8.567877
7	0.626187	0.342984	1.290350	25.33212	0.019311	0.128655	63.12720	0.262175	9.497201
8	0.730523	0.252622	1.165723	32.85522	0.020802	0.113213	55.15341	0.237831	10.20117
9	0.839913	0.193791	1.020606	39.53477	0.017257	0.106281	48.18137	0.195773	10.75015
10	0.952032	0.162778	0.887316	45.15964	0.013569	0.104656	42.34369	0.153797	11.17456
11	1.064805	0.152990	0.778242	49.78505	0.014574	0.105810	37.55382	0.124854	11.48466
12	1.176813	0.158075	0.694539	53.57782	0.022548	0.107686	33.63627	0.114981	11.68808

Manufacturing growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103132	0.398320	0.790161	0.640031	0.790161	0.804448	0.804448	95.76603	0.006400
2	0.170932	0.393906	1.634644	0.605623	0.427075	0.986517	0.381011	93.63653	1.934696
3	0.218643	0.309415	2.190588	0.574823	0.273215	1.731715	0.239293	87.96335	6.717605
4	0.252894	0.231677	2.447407	0.456919	0.223545	3.168809	0.196449	80.01682	13.25837
5	0.280670	0.213038	2.577088	0.515875	0.316512	5.167378	0.246111	70.81821	20.14579
6	0.308444	0.234693	2.739144	1.727245	0.687814	7.235354	0.397010	60.73537	26.24337
7	0.341449	0.248944	3.048584	5.084749	1.314183	8.743888	0.579358	50.22461	30.75569
8	0.381866	0.233842	3.550404	10.33246	1.963203	9.371542	0.702521	40.36587	33.48016
9	0.428009	0.200103	4.183053	16.10652	2.426450	9.273727	0.736962	32.22488	34.84830
10	0.475746	0.165193	4.831373	21.19991	2.664293	8.806341	0.708233	26.16164	35.46302
11	0.520750	0.137996	5.403786	25.15125	2.743074	8.246303	0.651715	21.94161	35.72427
12	0.559992	0.119686	5.857290	28.02267	2.741843	7.731906	0.590879	19.13293	35.80279

GDP growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100779	0.003379	0.006703	0.005429	0.006703	0.827494	0.827494	0.008275	98.31452
2	0.174471	0.010702	0.002860	0.128843	0.004298	0.970108	1.409198	0.102614	97.37138
3	0.229547	0.011484	0.023665	0.255729	0.014379	1.116040	1.822775	0.313735	96.44219
4	0.267727	0.008890	0.136177	0.277912	0.022673	1.288186	2.029784	0.611128	95.62525
5	0.292839	0.008392	0.361850	0.243095	0.024411	1.499967	2.072020	0.937480	94.85279
6	0.308655	0.012314	0.658317	0.226842	0.023045	1.754650	2.024684	1.241252	94.05890
7	0.318258	0.019221	0.956493	0.276776	0.021840	2.044838	1.952536	1.491020	93.23728
8	0.323993	0.026096	1.205886	0.411417	0.021864	2.353894	1.891239	1.675035	92.41457
9	0.327545	0.030600	1.391890	0.632361	0.027674	2.660383	1.850455	1.795968	91.61067
10	0.330012	0.032166	1.526208	0.928923	0.051913	2.944094	1.825653	1.865582	90.82546
11	0.332020	0.031941	1.630048	1.276153	0.112351	3.190589	1.808716	1.899462	90.05074
12	0.333871	0.032058	1.723806	1.634635	0.223425	3.392503	1.793634	1.912263	89.28768

Impulse response results on Gabon

Variance decomposition result on Gabon

Oil price:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100000	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.181519	95.77021	1.093325	0.822977	2.295273	9.88E-06	0.005124	0.013076	7.70E-09
3	0.255832	90.04208	3.429450	2.670148	3.665155	0.010909	0.024189	0.011909	0.146163
4	0.322145	84.30775	6.263543	5.180565	3.484949	0.087086	0.059869	0.008026	0.608214
5	0.379755	79.21556	8.985140	7.586417	2.648921	0.307076	0.106992	0.005846	1.144052
6	0.427732	75.04342	11.28261	9.054220	2.266508	0.721682	0.156639	0.005331	1.469589
7	0.467276	71.28009	12.99975	9.168966	3.509870	1.313720	0.200070	0.008310	1.519225
8	0.503124	66.78192	13.94609	8.215321	7.446904	1.974427	0.229230	0.016870	1.389234
9	0.541984	60.59678	13.94027	7.133814	14.33656	2.523112	0.238222	0.030434	1.200807
10	0.588875	52.89413	13.04475	6.959561	22.99557	2.809036	0.227343	0.045329	1.024276
11	0.644344	44.89173	11.62957	8.116256	31.40730	2.815355	0.203870	0.057372	0.878548
12	0.704725	37.81977	10.12927	10.34581	38.06330	2.638617	0.176899	0.064419	0.761921

Oil output growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100499	0.990099	99.00990	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.183051	1.615811	88.37416	9.742464	0.005080	0.060879	0.007391	0.073851	0.120362
3	0.253155	1.869292	79.01746	16.75963	0.024842	0.456863	0.019015	0.395128	1.457771
4	0.301814	1.787173	74.33491	16.49833	0.090885	1.309611	0.028213	0.983897	4.966989
5	0.336870	1.494088	69.85643	13.27293	1.265068	2.396827	0.032102	1.688594	9.993963
6	0.375572	1.239932	61.00016	14.04043	4.582707	3.114222	0.029677	2.168240	13.82463
7	0.426575	1.203851	49.17035	21.19052	8.511643	3.111979	0.023745	2.232521	14.55539
8	0.483674	1.307015	38.86117	31.15254	10.64219	2.692628	0.018478	2.046415	13.27957
9	0.536162	1.400541	31.77489	40.62973	10.47777	2.243004	0.015949	1.813324	11.64480
10	0.578847	1.408272	27.27621	48.29917	9.156803	1.924742	0.016834	1.610088	10.30789
11	0.614153	1.323210	24.23317	53.38966	8.572546	1.752840	0.021335	1.439734	9.267512
12	0.648907	1.188594	21.73243	55.17846	10.56250	1.680092	0.028719	1.290246	8.338955

Interest rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100935	0.993092	6.68E-05	98.01009	6.68E-05	0.008249	0.008249	8.25E-05	0.980101
2	0.182447	1.081540	0.044266	97.67406	0.128749	0.016435	0.022158	0.019733	1.013062
3	0.252897	1.115667	0.158539	97.36436	0.194595	0.064858	0.037551	0.064453	0.999973
4	0.311942	1.112639	0.326015	97.14027	0.163949	0.127412	0.052176	0.128869	0.948669
5	0.361009	1.087071	0.525929	96.93397	0.122732	0.186975	0.064848	0.207555	0.870923
6	0.401888	1.050368	0.739324	96.68273	0.139356	0.235326	0.075228	0.295775	0.781894
7	0.436179	1.010537	0.951453	96.37086	0.227987	0.270583	0.083493	0.389454	0.695637
8	0.465158	0.972699	1.152085	96.02236	0.362440	0.294179	0.090041	0.484962	0.621233
9	0.489815	0.939868	1.334849	95.67908	0.501452	0.308630	0.095282	0.578975	0.561864
10	0.510930	0.913710	1.496370	95.38085	0.608333	0.316336	0.099541	0.668472	0.516392
11	0.529153	0.895136	1.635486	95.15219	0.662451	0.319176	0.103030	0.750807	0.481724
12	0.545051	0.884717	1.752597	94.99554	0.664352	0.318499	0.105867	0.823813	0.454620

Money supply growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100913	0.794376	6.68E-07	0.980531	98.21512	8.25E-05	8.25E-05	8.25E-07	0.009805
2	0.194120	1.039012	0.000880	0.492608	98.41913	0.032259	0.002462	0.006570	0.007084
3	0.284214	1.287367	0.000751	0.250237	98.33664	0.091993	0.005325	0.023287	0.004404
4	0.366856	1.537345	0.000702	0.154418	98.10362	0.146644	0.007228	0.047366	0.002681
5	0.438925	1.782720	0.003719	0.140380	97.80967	0.178276	0.007849	0.075401	0.001987
6	0.498072	2.016468	0.011618	0.156453	97.51665	0.184666	0.007516	0.104806	0.001822
7	0.542985	2.231576	0.024046	0.165969	97.26186	0.173989	0.006763	0.134080	0.001721
8	0.573767	2.420807	0.038970	0.156686	97.05500	0.158495	0.006079	0.162396	0.001568
9	0.592089	2.576253	0.053567	0.150710	96.87343	0.149715	0.005805	0.189023	0.001503
10	0.600999	2.689689	0.065080	0.208734	96.66055	0.155281	0.006099	0.212881	0.001690
11	0.604368	2.754706	0.071702	0.420262	96.33496	0.176880	0.006915	0.232437	0.002141
12	0.606077	2.770539	0.073474	0.872658	95.81687	0.209671	0.008014	0.246073	0.002702

Inflation rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.102329	0.073163	0.008171	0.802611	0.990878	97.09827	1.008794	0.010088	0.008026
2	0.167681	0.077547	0.479668	0.366984	0.845078	96.71795	0.865200	0.192018	0.455552
3	0.207088	0.092216	0.878739	0.305303	0.563120	95.06802	0.792750	0.521942	1.777908
4	0.235235	0.126198	0.837659	0.789138	7.346122	85.88236	0.706664	0.700437	3.611418
5	0.292843	0.713367	0.562346	4.510554	31.62963	57.68010	0.481485	0.525087	3.897433
6	0.402337	1.606521	0.566152	9.327458	54.70956	30.64856	0.259949	0.279272	2.602526
7	0.545467	2.288640	0.754541	12.43171	66.01183	16.70162	0.142430	0.158609	1.510622
8	0.694240	2.763250	0.961319	14.14857	70.60996	10.38262	0.088417	0.111681	0.934190
9	0.827900	3.126410	1.151951	15.14862	72.39876	7.351189	0.062891	0.092039	0.668140
10	0.934788	3.431874	1.330572	15.79278	72.97628	5.781798	0.050810	0.082512	0.553368
11	1.011138	3.701621	1.502909	16.24868	72.97417	4.941744	0.046235	0.077781	0.506854
12	1.059187	3.940007	1.668772	16.58802	72.67836	4.512416	0.046683	0.076170	0.489574

Exchange rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103671	0.692304	0.783379	0.028229	0.034851	0.780407	96.71341	0.967134	0.000282
2	0.489296	3.263641	2.190840	62.03314	10.15918	3.669329	16.70426	1.773461	0.206152
3	1.132273	2.704449	1.700820	79.19261	4.498067	3.580680	6.747723	1.515976	0.059678
4	1.919886	2.111911	1.113623	86.54575	1.602981	3.325023	3.902694	1.355738	0.042280
5	2.791165	1.605133	0.695470	89.23962	1.442504	2.973928	2.640048	1.242875	0.160424
6	3.711076	1.207263	0.436361	89.34446	2.985810	2.561660	1.936645	1.153484	0.374320
7	4.655679	0.915810	0.285749	88.33031	5.133197	2.138687	1.491172	1.079325	0.625746
8	5.604560	0.712929	0.198941	87.20724	7.065724	1.749754	1.187439	1.017908	0.860059
9	6.540417	0.576559	0.147385	86.51077	8.365292	1.420279	0.970746	0.967886	1.041088
10	7.450938	0.487923	0.116996	86.39405	8.951024	1.156669	0.811204	0.927699	1.154431
11	8.329121	0.433608	0.103107	86.77622	8.944377	0.953141	0.690888	0.895712	1.202949
12	9.171511	0.404418	0.105673	87.47833	8.544124	0.798729	0.598482	0.870649	1.199597

Manufacturing growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103132	0.398320	0.790161	0.640031	0.790161	0.804448	0.804448	95.76603	0.006400
2	0.193477	2.287719	0.243264	13.66363	10.97864	3.168880	0.288221	69.32776	0.041874
3	0.278034	2.888955	0.210253	27.09687	14.82686	6.714051	0.164277	48.07132	0.027410
4	0.325469	2.658057	0.380061	33.86627	11.09757	12.12300	0.263632	39.57946	0.031948
5	0.369618	2.083036	0.465677	29.87131	19.18384	16.46140	0.411839	31.43823	0.084670
6	0.474967	2.035597	0.315008	18.09457	46.13403	13.88379	0.387522	19.04165	0.107826
7	0.644147	2.470486	0.172164	11.11088	66.46912	8.999381	0.269339	10.42480	0.083827
8	0.831201	2.911673	0.130413	8.794277	75.72017	5.825349	0.181752	6.378286	0.058076
9	0.996906	3.270043	0.150579	8.134385	79.59973	4.128187	0.131444	4.543552	0.042081
10	1.121214	3.569015	0.204024	7.895343	81.25262	3.264601	0.104399	3.676550	0.033451
11	1.200124	3.826335	0.276773	7.711165	81.92980	2.867952	0.091300	3.267464	0.029209
12	1.240615	4.041589	0.358769	7.516940	82.12962	2.744974	0.086899	3.093599	0.027614

GDP growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100779	0.003379	0.006703	0.005429	0.006703	0.827494	0.827494	0.008275	98.31452
2	0.170065	0.345778	0.064821	2.723534	7.918641	1.011145	0.707018	0.090098	87.13896
3	0.236822	1.105634	0.248118	7.155289	27.41976	1.202479	0.463131	0.097930	62.30766
4	0.313621	1.915702	0.417643	9.836860	47.34378	1.280868	0.268339	0.057083	38.87972
5	0.396702	2.541905	0.448007	10.66356	60.27445	1.244174	0.171023	0.055408	24.60148
6	0.473898	3.019794	0.382248	10.90241	67.08641	1.140289	0.127454	0.101168	17.24023
7	0.535199	3.423776	0.305535	11.24490	70.22180	1.010494	0.104237	0.165133	13.52412
8	0.576408	3.784371	0.270453	11.84301	71.23426	0.893845	0.090363	0.223420	11.66028
9	0.598788	4.095017	0.290169	12.59410	71.03283	0.829610	0.084321	0.264957	10.80900
10	0.607592	4.326576	0.349340	13.28077	70.31002	0.845881	0.085839	0.287997	10.51358
11	0.610249	4.441883	0.417965	13.66701	69.70232	0.941884	0.092727	0.295634	10.44058
12	0.614129	4.419339	0.466494	13.61577	69.70645	1.078437	0.100788	0.292739	10.31998

Impulse response result on Libya

Variance decomposition result on Libya

Oil price:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100000	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.458749	9.461749	0.767338	4.340086	0.314346	0.824024	83.90492	0.387468	6.73E-05
3	1.740570	0.668027	0.832934	0.412858	0.165049	0.600689	96.59845	0.714638	0.007357
4	3.781955	0.410411	0.820387	0.161146	0.115153	0.508672	97.15477	0.818016	0.011443
5	6.257727	0.511536	0.809395	0.323406	0.092362	0.467919	96.91654	0.865254	0.013588
6	8.847111	0.604516	0.801523	0.536654	0.079763	0.449833	96.62291	0.889881	0.014915
7	11.32014	0.670267	0.795817	0.740415	0.072018	0.444249	96.35802	0.903309	0.015908
8	13.55219	0.715936	0.791567	0.924835	0.066949	0.446493	96.12678	0.910639	0.016803
9	15.50050	0.748437	0.788298	1.092403	0.063499	0.453795	95.92133	0.914505	0.017736
10	17.17151	0.772653	0.785665	1.250775	0.061088	0.464132	95.73051	0.916359	0.018815
11	18.59420	0.791955	0.783386	1.410907	0.059373	0.475857	95.54137	0.917007	0.020140
12	19.80378	0.808684	0.781219	1.586055	0.058139	0.487625	95.33959	0.916871	0.021820

Oil output growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100499	0.990099	99.00990	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	4.791646	0.967999	1.382259	6.079828	0.001416	1.242371	89.98135	0.338143	0.006631
3	6.834360	1.049694	1.283799	12.43529	0.016138	1.357547	83.67065	0.178487	0.008398
4	7.279231	0.932327	1.133060	20.35573	0.169367	1.235750	75.50429	0.659809	0.009666
5	11.28707	0.759956	0.838376	9.711335	0.285837	0.719358	86.28971	1.390910	0.004520
6	19.19985	0.871760	0.780687	3.518225	0.248653	0.582721	92.69709	1.293140	0.007720
7	28.29550	1.006813	0.772525	3.095701	0.218991	0.557264	93.21127	1.119953	0.017485
8	37.09291	1.118983	0.762345	4.512638	0.204002	0.542041	91.83450	0.994071	0.031419
9	44.91806	1.206329	0.748440	6.420698	0.196710	0.527246	89.94482	0.908143	0.047614
10	51.50396	1.270916	0.734186	8.226688	0.193187	0.514096	88.14591	0.851061	0.063957
11	56.80045	1.316187	0.722115	9.657900	0.191490	0.503759	86.71508	0.814806	0.078666
12	60.88031	1.346280	0.713226	10.64969	0.190653	0.496232	85.71999	0.793205	0.090728

Interest rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100935	0.993092	6.68E-05	98.01009	6.68E-05	0.008249	0.008249	8.25E-05	0.980101
2	0.182571	1.086460	0.003791	97.47931	0.001108	0.003067	0.464636	0.004408	0.957222
3	0.257189	1.183792	0.013720	96.15540	0.004331	0.003808	1.692284	0.016598	0.930062
4	0.325788	1.275906	0.029677	94.06087	0.008991	0.013617	3.675263	0.036807	0.898873
5	0.389630	1.356877	0.049805	91.43367	0.014246	0.031268	6.185429	0.062850	0.865860
6	0.449518	1.424414	0.071582	88.59660	0.019396	0.053204	8.909521	0.091547	0.833732
7	0.505754	1.478848	0.092713	85.84396	0.023999	0.075717	11.56016	0.119880	0.804723
8	0.558331	1.521867	0.111576	83.38389	0.027853	0.096132	13.93288	0.145608	0.780194
9	0.607143	1.555554	0.127297	81.32898	0.030932	0.113047	15.91612	0.167415	0.760660
10	0.652138	1.581844	0.139618	79.71311	0.033310	0.126079	17.47524	0.184793	0.745998
11	0.693398	1.602315	0.148703	78.51624	0.035103	0.135472	18.62866	0.197822	0.735690
12	0.731143	1.618177	0.154952	77.68739	0.036435	0.141775	19.42529	0.206948	0.729027

Money supply growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100913	0.794376	6.68E-07	0.980531	98.21512	8.25E-05	8.25E-05	8.25E-07	0.009805
2	0.820847	1.956339	0.600802	17.38460	5.770575	0.655001	72.88763	0.576688	0.168369
3	1.922375	1.845489	0.630708	17.51214	2.300668	0.550180	76.39681	0.596379	0.167620
4	3.172203	1.803633	0.640716	17.31529	1.415456	0.461775	77.59280	0.604294	0.166035
5	4.407673	1.782029	0.647063	16.96327	1.050719	0.397517	78.38339	0.611631	0.164384
6	5.515423	1.764798	0.653582	16.38847	0.867256	0.353093	79.19227	0.619149	0.161388
7	6.427755	1.746251	0.661406	15.58679	0.766803	0.323272	80.13276	0.626220	0.156502
8	7.118444	1.724534	0.670433	14.62551	0.711158	0.303581	81.18285	0.632019	0.149924
9	7.595708	1.699479	0.679802	13.63002	0.682134	0.290562	82.23978	0.635800	0.142424
10	7.892890	1.671859	0.688104	12.77343	0.669293	0.281680	83.14347	0.636957	0.135214
11	8.058457	1.643159	0.693544	12.26381	0.665314	0.275211	83.69406	0.635043	0.129857
12	8.146602	1.615468	0.694206	12.31713	0.664122	0.270165	83.68099	0.629818	0.128100

Inflation rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.102329	0.073163	0.008171	0.802611	0.990878	97.09827	1.008794	0.010088	0.008026
2	0.179896	0.397879	0.008915	13.79826	1.077981	83.69922	0.933393	0.003457	0.080893
3	0.335082	0.966507	0.005636	61.11702	0.635934	36.19676	0.600223	0.004208	0.473710
4	0.633019	1.092718	0.016091	84.37125	0.294096	11.89974	1.606234	0.005901	0.713974
5	1.032541	1.063892	0.025240	90.77516	0.161447	4.688139	2.483070	0.007129	0.795924
6	1.478982	1.019812	0.031536	92.60114	0.106298	2.297842	3.110816	0.008727	0.823834
7	1.930200	0.984214	0.035425	93.17835	0.080054	1.350119	3.528295	0.010686	0.832858
8	2.358183	0.960542	0.037177	93.42901	0.066443	0.911970	3.747104	0.012674	0.835079
9	2.746869	0.948129	0.037144	93.63641	0.059180	0.681754	3.787703	0.014345	0.835335
10	3.089035	0.944817	0.035859	93.87070	0.055423	0.547300	3.694777	0.015520	0.835605
11	3.383284	0.947710	0.033945	94.12206	0.053675	0.462054	3.527781	0.016222	0.836551
12	3.631599	0.953705	0.031941	94.35862	0.053028	0.404822	3.343034	0.016623	0.838230

Exchange rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103671	0.692304	0.783379	0.028229	0.034851	0.780407	96.71341	0.967134	0.000282
2	0.181668	0.695991	0.783953	0.026915	0.037639	0.774826	96.71671	0.963714	0.000252
3	0.245738	0.714311	0.783647	0.074215	0.040341	0.770807	96.65316	0.962738	0.000778
4	0.297289	0.741347	0.782364	0.210365	0.042916	0.767011	96.49148	0.962143	0.002372
5	0.338629	0.773749	0.779913	0.475997	0.045324	0.762262	96.19666	0.960582	0.005514
6	0.371948	0.809505	0.776112	0.903281	0.047550	0.755791	95.73998	0.957266	0.010512
7	0.399108	0.847276	0.770812	1.516042	0.049597	0.747274	95.09968	0.951792	0.017531
8	0.421655	0.886032	0.763922	2.328301	0.051472	0.736737	94.26292	0.944011	0.026601
9	0.440838	0.924902	0.755445	3.341308	0.053184	0.724440	93.22913	0.933972	0.037621
10	0.457630	0.963151	0.745494	4.541596	0.054740	0.710764	92.01202	0.921882	0.050356
11	0.472756	1.000185	0.734292	5.901822	0.056146	0.696137	90.63887	0.908083	0.064464
12	0.486719	1.035564	0.722139	7.384436	0.057406	0.680984	89.14693	0.893002	0.079544

Manufacturing growth									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103132	0.398320	0.790161	0.640031	0.790161	0.804448	0.804448	95.76603	0.006400
2	0.235664	0.296447	0.155886	20.91343	0.162262	0.959789	26.60769	50.00090	0.903593
3	0.302072	0.712950	0.190408	36.53174	0.208016	0.978220	16.60568	42.41003	2.362961
4	0.365132	1.020319	0.574679	27.89055	0.420923	0.698209	35.04688	31.39007	2.958364
5	0.491713	0.734470	0.790406	17.97915	0.434278	0.758370	59.83480	17.42270	2.045835
6	0.620594	0.477003	0.772451	20.51692	0.372742	0.874647	64.67463	10.94096	1.370644
7	0.698103	0.379592	0.718166	25.69918	0.339629	0.918373	62.18827	8.656659	1.100132
8	0.722802	0.366864	0.690286	28.48978	0.337764	0.927310	60.07678	8.075873	1.035344
9	0.723561	0.368704	0.688843	28.59296	0.350095	0.930008	59.95133	8.062153	1.055906
10	0.735964	0.371368	0.669413	30.44252	0.352351	0.902037	58.37689	7.799950	1.085464
11	0.786357	0.445278	0.587521	38.68036	0.329376	0.795707	51.25184	6.833642	1.076279
12	0.884695	0.641346	0.466397	50.74537	0.289891	0.628813	40.80708	5.402371	1.018731

GDP growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100779	0.003379	0.006703	0.005429	0.006703	0.827494	0.827494	0.008275	98.31452
2	0.833825	1.743276	0.305524	55.10110	0.097681	0.961600	38.91766	0.468394	2.404771
3	2.040215	1.709561	0.444965	39.17248	0.098909	1.027990	56.44144	0.669883	0.434770
4	3.457202	1.597863	0.539376	27.41542	0.094110	1.086571	68.30812	0.807104	0.151430
5	4.849861	1.478061	0.601970	19.52278	0.086746	1.118899	76.21264	0.900910	0.077991
6	6.030360	1.370965	0.641643	14.48340	0.078741	1.132494	81.27712	0.964437	0.051200
7	6.892818	1.283482	0.665067	11.46720	0.071291	1.136034	84.33080	1.006824	0.039303
8	7.422726	1.217743	0.676926	9.893020	0.065273	1.135510	85.94389	1.033678	0.033956
9	7.680719	1.174269	0.680680	9.343220	0.061421	1.133948	86.52595	1.048189	0.032320
10	7.769036	1.151993	0.679384	9.457086	0.060220	1.131734	86.43403	1.052601	0.032950
11	7.791824	1.146887	0.676069	9.872463	0.061574	1.127509	86.03126	1.049591	0.034651
12	7.822438	1.151661	0.673342	10.26369	0.064627	1.119827	85.64779	1.042742	0.036320

Impulse response result on Egypt

Variance decomposition result on Egypt

Oil price:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100000	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.196143	71.91690	1.597387	0.017001	1.026900	0.449013	23.02707	0.149145	1.816581
3	0.390908	28.06356	3.354045	0.028986	1.808762	0.642436	61.34829	0.064111	4.689811
4	0.675118	11.47936	3.681793	0.036056	1.966667	0.562671	76.22696	0.022270	6.024219
5	0.991016	5.840303	3.574238	0.038766	2.039933	0.472741	81.56740	0.015468	6.451146
6	1.306669	3.510938	3.344075	0.033884	2.102824	0.395842	84.39764	0.008905	6.205896
7	1.621763	2.327501	3.055989	0.023772	2.120919	0.321674	86.72177	0.023862	5.404517
8	1.956905	1.610537	2.731003	0.017621	2.055706	0.246725	88.95091	0.102942	4.284551
9	2.340528	1.126271	2.392892	0.024497	1.897701	0.177600	90.96819	0.262653	3.150198
10	2.796867	0.791946	2.073889	0.045419	1.674515	0.124430	92.59496	0.473554	2.221287
11	3.337790	0.570547	1.801672	0.073724	1.431827	0.092582	93.78178	0.685791	1.562076
12	3.961144	0.433450	1.587480	0.101653	1.206697	0.080369	94.59662	0.864237	1.129495

Oil output growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100499	0.990099	99.00990	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.192494	1.870886	64.29260	0.522328	0.630149	0.578690	31.03880	0.240036	0.826504
3	0.309718	2.042725	33.72296	0.681996	1.317931	1.021292	59.54632	0.096031	1.570744
4	0.404635	2.054039	21.72586	0.577036	2.047561	1.317885	70.06457	0.588248	1.624801
5	0.447273	2.085636	18.21117	0.482908	3.218833	1.759020	70.60406	2.235379	1.402997
6	0.461460	2.017640	17.23298	0.494925	4.866083	2.372056	66.33263	5.121379	1.562305
7	0.521350	1.616227	13.59990	0.540447	5.517848	2.546123	66.71164	6.959320	2.508489
8	0.678872	1.146152	8.160214	0.476168	4.411507	2.025509	74.76425	5.860917	3.155284
9	0.909997	0.887749	4.720338	0.372698	3.198984	1.498045	82.04918	4.168632	3.104380
10	1.169607	0.759957	3.056660	0.295017	2.469212	1.173049	86.38494	3.038239	2.822925
11	1.427394	0.679906	2.255486	0.246038	2.095679	0.980939	88.80317	2.388460	2.550322
12	1.668572	0.615637	1.847450	0.216941	1.939039	0.857260	90.14889	2.028596	2.346193

Interest rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100935	0.993092	6.68E-05	98.01009	6.68E-05	0.008249	0.008249	8.25E-05	0.980101
2	0.403266	0.315237	0.725316	13.39238	0.001296	1.060236	83.48795	0.763866	0.253716
3	0.824965	0.472949	0.818358	3.944936	0.000878	1.151935	92.60982	0.850918	0.150209
4	1.180437	0.551277	0.848354	1.970234	0.000471	1.177223	94.46713	0.859366	0.125947
5	1.400569	0.589709	0.865595	1.404454	0.000544	1.198564	94.97986	0.845081	0.116194
6	1.497338	0.606193	0.877096	1.257450	0.001981	1.220712	95.10284	0.823581	0.110143
7	1.521583	0.610369	0.883609	1.244819	0.006206	1.237927	95.10137	0.808583	0.107113
8	1.522540	0.610218	0.885087	1.254133	0.014793	1.243690	95.07433	0.809416	0.108331
9	1.526188	0.611672	0.882437	1.249028	0.028903	1.238229	95.05317	0.823389	0.113168
10	1.536877	0.616828	0.877379	1.232602	0.049435	1.228190	95.03658	0.839486	0.119497
11	1.550109	0.624969	0.871494	1.215592	0.077755	1.220036	95.01480	0.849300	0.126051
12	1.561829	0.634803	0.865764	1.202530	0.116068	1.216488	94.97989	0.851280	0.133172

Money supply growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100913	0.794376	6.68E-07	0.980531	98.21512	8.25E-05	8.25E-05	8.25E-07	0.009805
2	0.261343	2.249473	0.000437	0.152383	68.03470	0.763162	27.16166	0.058081	1.580108
3	0.484151	2.882352	0.002558	0.123209	53.00414	1.217218	38.90868	0.061724	3.800115
4	0.719877	3.349863	0.023836	0.200786	49.97384	1.459954	38.61572	0.030242	6.345766
5	0.944454	3.765229	0.084953	0.243130	52.50245	1.632248	32.45988	0.052843	9.259265
6	1.162441	4.058707	0.204024	0.229515	57.18929	1.757792	23.99649	0.238932	12.32525
7	1.397790	4.116112	0.380581	0.178673	61.23621	1.812702	16.60153	0.653378	15.02081
8	1.681419	3.884789	0.586039	0.124006	62.51997	1.773409	13.09391	1.246954	16.77092
9	2.041558	3.426626	0.779179	0.089283	60.43908	1.646193	14.40817	1.878193	17.33329
10	2.500146	2.867646	0.932072	0.078511	55.82430	1.463035	19.53032	2.414942	16.88918
11	3.073921	2.317138	1.038678	0.083981	49.98712	1.259808	26.69943	2.798759	15.81509
12	3.776591	1.834615	1.106545	0.096916	43.98007	1.062448	34.42860	3.035066	14.45575

Inflation rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.102329	0.073163	0.008171	0.802611	0.990878	97.09827	1.008794	0.010088	0.008026
2	0.168890	0.034204	0.009495	0.511902	1.106265	85.28898	12.12999	0.474406	0.444761
3	0.217825	0.026666	0.016867	0.308461	0.947655	76.87957	18.77488	2.348216	0.697681
4	0.246278	0.216143	0.182106	0.444472	0.756363	75.76178	16.31962	5.688601	0.630912
5	0.272440	0.775338	0.613928	0.850988	0.734982	72.11046	15.56626	8.817548	0.530497
6	0.316122	1.396478	1.121560	1.106616	1.148199	59.90568	25.73016	9.127256	0.464052
7	0.385489	1.643139	1.433259	0.988797	1.991916	43.98220	42.67394	6.971421	0.315325
8	0.481967	1.513972	1.524216	0.696615	3.025605	30.22018	58.18099	4.525016	0.313402
9	0.607617	1.217637	1.492078	0.440852	4.027084	20.18283	69.01982	2.902696	0.716999
10	0.765665	0.910843	1.417971	0.285124	4.874621	13.37427	75.55320	2.129897	1.454078
11	0.958573	0.659569	1.344279	0.209108	5.541369	8.918578	79.17941	1.882385	2.265302
12	1.187105	0.473962	1.286042	0.177336	6.058079	6.045270	81.13250	1.876648	2.950168

Exchange rate:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103671	0.692304	0.783379	0.028229	0.034851	0.780407	96.71341	0.967134	0.000282
2	0.218195	0.701463	0.779473	0.052272	0.030357	0.790363	96.67131	0.971814	0.002944
3	0.340500	0.707791	0.778798	0.077022	0.027127	0.798941	96.62677	0.976718	0.006834
4	0.461615	0.711948	0.779974	0.099677	0.024555	0.806188	96.58458	0.981474	0.011601
5	0.576606	0.714402	0.782189	0.118477	0.022314	0.812381	96.54718	0.985995	0.017062
6	0.683506	0.715545	0.784927	0.132836	0.020220	0.817789	96.51526	0.990439	0.022986
7	0.782197	0.715694	0.787865	0.143059	0.018182	0.822572	96.48846	0.995063	0.029106
8	0.873478	0.715082	0.790809	0.149940	0.016176	0.826778	96.46591	1.000101	0.035203
9	0.958425	0.713860	0.793649	0.154404	0.014230	0.830373	96.44662	1.005692	0.041175
10	1.038046	0.712106	0.796334	0.157276	0.012413	0.833283	96.42967	1.011866	0.047054
11	1.113146	0.709840	0.798852	0.159186	0.010825	0.835416	96.41432	1.018575	0.052982
12	1.184323	0.707037	0.801226	0.160558	0.009597	0.836684	96.40000	1.025730	0.059164

Manufacturing growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.103132	0.398320	0.790161	0.640031	0.790161	0.804448	0.804448	95.76603	0.006400
2	0.299195	0.179948	0.152108	0.968649	0.376410	0.095639	57.14643	40.10432	0.976497
3	0.596466	0.405075	0.266771	0.805301	0.235182	0.132586	77.95759	19.05568	1.141806
4	0.916251	0.571379	0.346500	0.668172	0.211259	0.249504	85.49260	11.43131	1.029272
5	1.205640	0.695610	0.382357	0.572041	0.241586	0.363656	88.90732	7.981321	0.856112
6	1.438500	0.798552	0.394174	0.505786	0.319176	0.466422	90.63480	6.189068	0.692018
7	1.608482	0.891169	0.393486	0.461040	0.454620	0.558831	91.48678	5.186949	0.567128
8	1.721291	0.978885	0.386396	0.431911	0.667784	0.643295	91.78240	4.612442	0.496883
9	1.788640	1.063597	0.376468	0.413912	0.985100	0.721682	91.65815	4.290301	0.490791
10	1.824321	1.144233	0.366489	0.403336	1.436696	0.794328	91.17397	4.124301	0.556648
11	1.841959	1.216847	0.359504	0.396938	2.051088	0.859440	90.36010	4.054212	0.701868
12	1.853902	1.274926	0.359240	0.391845	2.846497	0.913037	89.24534	4.037134	0.931984

GDP growth:									
Period	Standard error	Oil price	Oil output growth	Interest rate	Money supply growth	Inflation rate	Exchange rate	Manufacturing growth	GDP growth
1	0.100779	0.003379	0.006703	0.005429	0.006703	0.827494	0.827494	0.008275	98.31452
2	0.209328	0.342349	0.283883	0.071145	0.011258	0.215752	40.66901	0.632944	57.77366
3	0.348748	0.583235	0.474743	0.219829	0.012092	0.295038	66.75793	1.435790	30.22134
4	0.486279	0.692795	0.559659	0.364229	0.013082	0.378198	77.74180	2.110677	18.13956
5	0.601536	0.744076	0.592686	0.479663	0.014632	0.412368	82.44623	2.642342	12.66800
6	0.690157	0.770372	0.599003	0.556608	0.016142	0.424758	84.64755	3.027555	9.958009
7	0.756509	0.785823	0.591406	0.595163	0.016841	0.433268	85.82338	3.266866	8.487255
8	0.807075	0.797090	0.577765	0.603775	0.016354	0.445419	86.56934	3.376575	7.613679
9	0.846939	0.807587	0.562961	0.594428	0.015082	0.463252	87.12238	3.388307	7.046002
10	0.878853	0.819039	0.549751	0.577747	0.014156	0.485916	87.56608	3.340237	6.647075
11	0.903711	0.832016	0.539393	0.560880	0.015044	0.510940	87.91786	3.267754	6.356116
12	0.921599	0.846160	0.532061	0.547584	0.019177	0.535412	88.17223	3.197343	6.150030