Democratic and Popular Republic of Algeria

Ministry of Higher Education and Scientific Research

Abou bakr Belkaid University, Tlemcen

Faculty of management and economic sciences

Department of Economics

Oil price volatility and economic growth in Algeria

New channel for the "resource curse"

Dissertation submitted in partial fulfillment of the requirement for the degree of Master in economic Science

Option: Banking and Financial econometrics

Presented by: **Supervised by**:

Miss. Farah ELIAS ELHANNANI   Pr. Mohamed BENBOUZIANE

Board of Examiners

President: Dr. Abdelkader Derbal   University of Oran

Supervisor: Dr. Mohamed Benbouziane   University of Tlemcen

Examiner: Dr. Abdelnacer Bouteldja   University of Tlemcen

Examiner: Dr. Sidi Mohamed Chekouri   University of Tlemcen

Academic Year: 2012-2013

Acknowledgement

I would like to thank those who generously made this dissertation possible with their support and encouragement.

Dedication

This work is dedicated to……

My parents

Sister and brothers

All my friends

List of contents:

Appendices

    Appendix1: Unit root tests

    Appendix2: Residual tests

    Appendix3: ARCH and GARCH models and volatility estimation

Abstract (English

Abstract (Arabic)

Abstract (French)

List of figures :

List of tables :

It has been observed for many decades that countries endowed with natural resources such as: oil, gold, silver and diamond perform worse than countries poor in such resources. For instance, people in many African countries rich in gold and diamond, continue to experience low quality of life, while countries like Korea, Singapoore and China record high economic growth and perform better. In fact, neither economic history, nor the recent studies contradicts this observation.

John Bodin (1560) claimed that fertile soil makes its owner more effeminate and coward. During the same century, the Spanish adventurer author Miguel De Sarvantez Saavedra mentioned in his famous book "Don Quixote De la Mancha" that wealth profit does not come only from its possession but it is rather the way in which this wealth is managed. Adam Smith in his "Wealth of Nations" also showed that the projects of mining absorb capital and stock in lieu of replacing capital employed in them with ordinary profits of stock.

Many recent studies have confirmed the negative association between natural resource abundance and economic performance: Auty(1993), Sachs and Warner (1995,1997,2001), Gylfason(2000), Gylfason and Zoega(2003), Gelb(1988), Arezki and Van der Ploeg(2007) among many others who showed this negative relationship which was named "the natural resource curse". This term was first introduced by Auty(1993).

Most of natural resources have two main characteristics: exhaustibility and price volatility (high fluctuations in the price). This has divided the studies on the natural resource curse into two sides: one arguing that the resource abundance leads to the curse and the other showing the contrary that is rather a matter of price volatility than the abundance.

This study tackles the two ideas by providing theoretically the different channels and explanations of the natural resources curse:

- The Dutch Disease explained in three theoretical models (Gregory 1976, Cordon 1984 and Edawards 1986) which show the existence of a negative impact of the boom in resource sector on the non-resource tradable sectors. The Disease has been observed in Netherlands after the discovery of natural gas in the North Sea in 1960s.

- Procyclicality in fiscal policy and volatility: the high volatility in the natural resource prices, affects negatively the economic growth in resource dependent countries (Aghion and Banarjee 2005, P.Collier and B.Goderis 2003, F.Van Der Ploeg and Poelhekke 2008…). Such volatility leads to the so-named « procyclicality » of fiscal policy: contractionary in bad times (when the resource receipts decline) and expansionary in good times (in a boom) (Kaminsky, Reinhart and Végh 2005, Havard Halland 2009, Frenkel 2012).

- The institutional explanation: this explanation answers the question of why resource rents are managed so poorly?. In fact, it has been observed obviously that countries with good institutions and good politicians perform better (Ross 1999, Acemoglu 2003, Gelb 1988, Mehlum and Torvik 2005 and Auty 2001…). This includes also the corruption which records high rates in resource rich economies then it impedes their good performance.

The crude oil remains the most important commodity among different natural resources. However, it is the most volatile. Such volatility represents a challenge for oil rich countries. In our work we show the exogeneity of the causes of this volatility, we then explain its impact on the macro-economy of the oil exporters particularly their economic growth.

Algeria is one of the oil rich countries that may be affected by the so-called natural resource curse. It is one of the most important producers and exporters of hydrocarbon products (oil and gas) in the world, its exports from this sector represent about 98% of its total exportation.

Introduction

After a black decade of civil conflict and economic and financial difficulties (when the authorities had to payout the large amount of the external debts and to insure security among people), Algeria records, since 2000, solid growth and financial soundness due to the large increase in oil prices. Nevertheless, the structure of the national economy has not been changed since the state's independence in 1962, the hydrocarbon sector remains the dominant sector despite the economic reforms adopted in the last decade. This sector contributes with about 40% of GDP, 98% of total exports and almost 70% of total budget revenues.

From the previous brief synthesis, this work seeks to answer the following question: ***does the Algerian economy face the oil curse, and what is the effect of the oil price volatility on the Algerian economic growth?.***

In order to answer this question, the following sub-questions have been extended:

-What explain the traditional natural resource curse thesis?

-How can the volatility of oil prices affect negatively the economic growth of oil exporting countries?

-Which elements contribute in reducing such impact?

- What explain the Algerian dependence on oil and which policies are adopted to reduce the volatility effect?

The methodology of the study:

To get the objective showed above, the analytical approach has been used to explain theoretically the natural resource curse hypothesis and the effects of oil price volatility. The econometric approach using the ordinary least squares multiple linear regressions has also been followed to show the impact of oil volatility and the oil curse in the Algerian economy.

The study is constructed basing on the **following hypotheses**:

- There is a negative association between natural resource abundance and economic growth in resource rich countries which lead to the so-called "resource curse thesis";

- The large fluctuations in the oil market do matter for oil exporting economies and expose them to the oil curse phenomenon via the oil price volatility;

- The Algerian economy is affected by the oil price volatility and it is not immune to the oil curse hypothesis although the economic policies adopted since the year 2000.

Accordingly, this work is divided as follows:

The first part tackling the theoretical framework which contains two sections, the first explains in details the different channels of the natural resource curse thesis: economic explanation including the Dutch Disease channel, the Pro-cyclicality of fiscal policy and the volatility channel; the political and institutional view which shows the role of political and economic institutions and the corruption coming from the rent-seeking behavior that appears in the natural resource rich countries in which the rent activities become more attractive relative to the productive activities. The second section deals with the issue of oil price volatility showing its causes and effects on the economic growth and other macroeconomic variables in the oil exporters economies. This section also presents the three main solutions to reduce the impact of large oil fluctuations: the financial development reported by Aghion and Banarjee in their book of "Volatility and Growth" in 2006; the sound fiscal policy using the oil funds, the budgetary oil prices and the fiscal rules, these three ways of fiscal policy are suggested by many studies of the international monetary fund and the World Bank; and finally the role of economic diversification argued by Gelb 2011.

In the second part, a set of empirical working examining the natural resource curse is provided. Indeed, we divide this empirical evidence into two groups: one including the studies which support the idea that the resource abundance affects negatively economic growth in resource rich countries (Sachs and Warner 1995, Gylfason and Zoega 2002, Papyrakis and Gerlah 2003, Alicia Rambaldi, Greg Hall and Richard Brown 2006, Rabeh Arezki and Van der Ploeg 2007, Ali Alichi and Rabah Arezki 2009, Kareem Ismail 2010, Gylfason 2011,

Elbadawi and Soto 2012, Kabbashi Suliman 2012 and Akinwale Yusuf Opeyemi 2012). The other group of studies argues that it is rather a problem of volatility than of resource abundance and they showed empirically the existence of a negative relationship between volatility and economic growth while the resource abundance affected positively the growth (Van der Ploeg and Poelhekke 2008, Paul Collier and Benedikt Goderis 2008, Michael Bleany and Havard Halland 2009, Rabah Arezki and Thorvaldur Gylfason 2011, Tiago, Cavalcanti, Mohaddes and Raissi 2011, Samimi, Sadeghi and Sadeghi 2011, Weishu Leong and Kamiar Mohaddes 2012, Rabah Arezki and Mustapha K.Nabli 2012 and Ahmed S. Mahmud and Syed Abdul Basher 2013).

   The third part investigates empirically in the existence of the volatility curse in Algeria. It describes in a first section the oil economics in Algeria discussing how the Algerian government has managed the oil windfalls during the last decade (2000-2012) showing that Algeria has benefited from the recent increase in the international oil prices by creating the oil stabilization fund and applying the budgetary oil price. However, this has not been the perfect management which does not make the Algerian economy immune to the oil curse and we confirm this by analyzing the Algerian economic growth and its determinants. The econometric model examines the relationship between the oil price volatility and economic growth in Algeria using the ordinary least squares estimation (OLS). The model includes six linear equations which regress the oil price volatility on the economic growth as basic equation for the first four models. The empirical models further show the impact of fiscal policy, economic diversification and financial development on the oil price volatility effect. In order to compare this effect with the traditional oil curse hypothesis the study also tests the oil rent impact on the economic growth. The period taken for the econometric study is extended with five years for the goodness of the model results and it covers 1995-2011.

Finally, the results of our econometric study and a synthesis about the oil price volatility effect on the Algerian economic growth as a channel of the oil curse are presented in the last section of part three.

Chapter introduction:

Oil, gas, gold, silver or other valuable minerals and natural resources should be a blessing for countries that are endowed with such resources. However, it has been observed for many decades that those countries don't necessarily realize good economic position; they record lower income per capita, slow economic performance and weak social and economic development. For instance, people in many African countries rich in gold and diamond, continue to experience low quality of life. Most of Arab countries with oil and gas abundance remain dependent on the exports of these two commodities and they record low income per capita. Meanwhile, countries such as Korea, Japan, Singapoor and other resource poor economies experience higher economic growth and better performance. This situation makes such countries cursed by natural resources instead of being blessed. The natural resource curse was explained by the Dutch Disease theory and pro-cyclical fiscal policy. Otherwise, the large volatility existing in the prices of natural resources particularly oil represents a challenge for oil exporters and is considered as a new explanation for the natural resource curse.

This chapter provides the theoretical aspect of the dissertation and is divided into two sections; the first dealing with the traditional natural resource curse hypothesis; and the second which represents the different issues of the oil price volatility.

II. 1- The resource curse hypothesis :

The puzzled situation so-named « natural resource curse » has been first tested by Sachs and Warner (1995) where they found a negative association between resource abundance and economic growth, and Auty(1993) was the first who coined the phrase « resource curse » to explain that paradox.

Although the term « natural resource curse » is recent, economic history shed light on the phenomenon.

In the sixteenth century, the French Jean BODIN claimed that : « *Men of a fat and fertile soil, are most commonly effeminate and cowards ; whereas contrariwise a barren country make men temperate by necessity, and by consequence careful, vigilant and industrious.* »[1]

Adam SMITH in his « Wealth of Nations » said : « *Projects of mining, instead of replacing capital employed in them, together with ordinary profits of stock, commonly absorb both capital and stock. They are the projects, therefore, to which of all others a prudent law-giver, who desired to increase the capital of his nation, would least choose to give any extraordinary encouragement…* »[2]

The key question is whether this phenomenon is a destiny or it is conditional on other elements. Contemporary literature explains the curse paradox by many channels, in this section we distinguish between the economic and political explanations.

I. 1-1. Economic explanation :

I. 1-1-1.Dutch Disease :

The term Dutch Disease is used to describe the negative impact of the boom in resource sector on the non-resource tradable sectors. This term was first coined in an article in the magazine « The economist » in 1977 after the discovery of natural gas in the North Sea by the

---

[1] Quoted in Sachs and Warner 1995,P4.
[2] SMITH A., « An inquiry into the nature and causes of the wealth of nations »,1776,p453.

Netherlands in 1960s, such discovery raised the Dutch exports of the natural gas while the manufacturing sector has known a slop in its production and employment. The article stated: « *The Netherlands experienced external health and internal ailment* ».

Table 1 : Manufacturing production and employment in the Netherlands

Manufacturing in the Netherlands: Average Annual Percentage Change		
1963/73	1974/78	1979/83
6.5	0.9	0.3

Manufacturing Employment in the Netherlands: Average Annual Percentage Change		
1963/73	1974/78	1979/83
-0.5	-2.7	-2.8

Source : Rudd David « An empirical analysis of the Dutch Disease : developing and developed countries », 1966, P2.

The Dutch Disease has been generalized to all resource rich countries facing the same process of the Netherlands in 1960s. Thus, this phenomenon can be explained by three key models:

   a) Gregory model 1976

   b) The core model (Cordon and Neary 1982)

-Spending effect

-Resource movement effect

   c) The monetary effect (Edwards 1985).

   I.   **1-1-1-a. Gregory model :**

 Although that the term « Dutch Disease was first stated in 1977, one year before, Gregory[1] has suggested a simple model to explain the same Dutch symptoms in the Australian economy. In his model, Gregory argued that the rapid growth in a new export sector (resource

---

[1] Gregory R.G., « Some implication of the growth mineral sector »,The Australian journal of agricultural economcs, Vol20, August 1976, P71.

sector) will affect other export and import competing sectors (non resource sectors) through the effect of the balance of payments and real exchange rates and relative rates of inflation. Gregory built his model starting with the following assumptions:

-The world prices of traded goods are given and unaffected by the demand for imports or the supply of exports in Australia;

- The model abstracts from capital flows and focus on the balance of trade.

The graph below shows the model built by Gregory.

Figure 1: Exports, imports and relative prices.
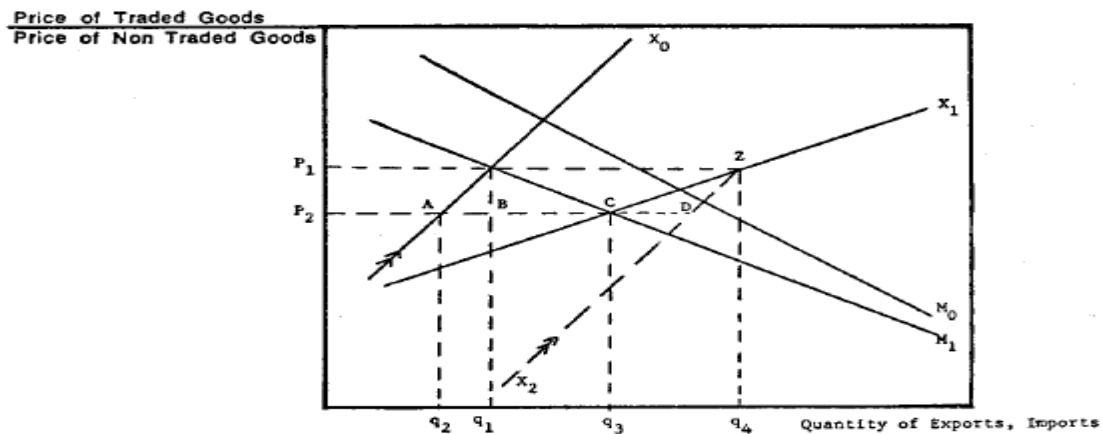
Source : Gregory R.G., « Some implication of the growth mineral sector »,The Australian journal of agricultural economics, Vol20, August 1976,P74.

The curve X_1 represents the supply of mineral exports in addition to the traditional exports X_0. The vertical axis represents the price of traded relative to non traded goods, the quantities of Australian imports and exports are shown in the horizontal axis.

The figure shows that an emergence in new export sector(mineral sector) X_1 causes the relative price of traded to non traded goods to fall from P_1 to P_2 (new equilibrium price). This price reduction has a number of effects on the traditional export sector and import competing sector.[1]

---

[1] Gregory R.G., ibid, P76.

The fall in relative prices from P_1 to P_2 causes a decrease in traditional exports from q_1 to q_2 (B to A) and an increase in the quantity of imports demanded from q_1 to q_3 (B to C).

Gregory in his model shows clearly how the traditional export sector responds to an emergence of a new mineral sector through either an appreciation of the exchange rate (Australian Dollar) that causes the price of traded goods to fall, or through inflation in domestic prices (a rise in non traded goods).

I.   1-1-1-b. The core model: (Cordon and Neary 1982):

Cordon (1984) provided a new model, to explain the Dutch Disease, named "the core model". This model has been presented in details before that by Cordon and Neary (1982).[1]

In his model, Cordon assumed that there is a small open economy containing three sectors: the Booming sector (B), the Lagging sector (L) and the non-tradable sector (N). The core model shows the effect of a boom in sector B on the other two sectors through two different effects: spending effect and resource movement effect.

-1- The "Spending effect":

This effect appears if some part of the extra income in B (due to the boom in this sector) is spent[2], whether directly by factor owners or indirectly by the government after being collected in taxes and if the income elasticity of demand for N is positive. Consequently the relative price of N to the price of tradable should rises, thus, a real appreciation in the exchange rate which will draw resources out of B and L into N, then increasing the demand for N.

The figure below summarizes the core model of Cordon. The vertical axis P_n represents the price of N relative to that of L. Curves S and D are the supply and demand curves of the non-tradable sector N, respectively.

---

[1] Cordon M., « Booming sector and Dutch disease economics: survey and consolidation", Oxford economic paper, New series, Vol36, November 1984, P360.

[2] Cordon M., « Booming sector and Dutch disease economics : survey and consolidation », ibid, P360.

In this figure, the spending effect has shifted the demand curve from D_0 to D_1 and has raised P_n drawing resources out of L into N.

Figure2: the Core model.
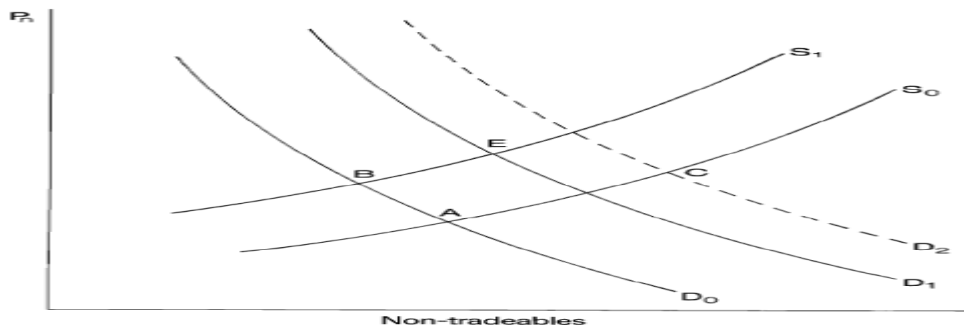
Source: Cordon M., « Booming sector and Dutch disease economics: survey and consolidation", Oxford economic paper, New series, Vol36, November 1984, P361.

-2- The resource movement effect:

This effect creates a movement of labor out of L and N into B, such movement is due to the boom in sector B which raises the marginal productivity of labor in this sector. According to Cordon, the movement effect has two parts:[1]

-2-1- The movement of labor out of L into B lowers output in L: this can be called direct de-industrialization because it does not include the market for N and does not require an appreciation of the real exchange rate.

-2-2- The second movement is shown in figure 2; the resource movements effect has shifted the supply curve from S_0 to S_1 and thus leads to excess demand for N in addition to that created by the spending effect (D_2), and so brings about additional real appreciation then it brings about an additional movement of labor out of L into N, reinforcing the de-industrialization resulting from the spending.

---

[1] Cordon M., ibid, P361.

When the two effects are combined, this leads to a movement of labor from L into N, creating the so-called "indirect de-industrialization" which completes the direct one resulted from the movement of labor from L to B.

I.   1-1-1-c. The monetary effect: S.Edwards(1985):

The first two models (Gregory 1976 and Cordon 1984) explained theoretically the effect of a boom in a commodity export sector on the non-resource sectors through a real appreciation in the exchange rate, which is known as a Dutch Disease literature.

Otherwise, S.Edwards (1985), S.Edwards and M.Aoki (1982) and S.Edwards(1986) have tackled in their studies a new effect and have shown that commodity export booms can also have important short run monetary effects which will spill over to the real exchange rate.

S.Edwards (1985)[1] argued that a resource based export boom will typically result in a balance of payments surplus and in the accumulation of international reserves. If this increase in reserves is not sterilized, an excess supply of money may develop which will result inflation.

In this context, S.Edwards developed a model for a small developing country with capital controls and no domestic financial markets. The model consists of three blocks: money market, inflation and exchange rate block[2]; the model can be summarized in two sides: monetary and real side.

The monetary side of the model describes the process of money creation:

$$\widehat{M}t = \alpha\widehat{Rt} + (1-\alpha)\widehat{DCR}t \quad \dots\dots\dots\dots\dots\dots\dots(1)$$

$\widehat{M}t$: the growth rate of nominal money;

$\widehat{Rt}$: international reserves expressed in domestic currency;

$\widehat{DCR}t$: the growth rate of domestic credit.

---

[1] Edwards S., « Commodity export boom and the real exchange rate : the money-inflation link », National Bureau of Economic Research, Cambridge, 1985, P3.
[2] Edwards S., « Commodity export boom and the real exchange rate : the money-inflation link ", ibid, P4.

Parameters α and (1-α) are base year shares.

Equation(1) shows that money supply depends positively on the international reserves and the domestic credit growth rate because most of developing countries go to domestic credits in order to finance their government deficits.

Regarding international reserves, equation (2) below indicates that changes in reserves respond to an excess flow demand or supply for money and to changes in the domestic price of the commodity export:

$$\widehat{Rt} = \gamma_0 \left[\widehat{M_t^d} - \widehat{M_{t-1}}\right] + \gamma_1 \widehat{P_t^c} \quad \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

P_t^c: the price of commodity export expressed in domestic currency

M^d: the nominal quantity of money demanded.

The monetary block of the model is closed by the following equation which assumes that the nominal demand for money depends only on real income[1]: $\widehat{M_t^d} = \widehat{P_t} + \widehat{Y_t} \quad \ldots\ldots\ldots (3)$

The real side of this model is defined by the equation of the real income Y_t:

$$\widehat{Y_t} = g + \rho(\widehat{P_t^{c*}} - \widehat{P_{Tt}^*}) \ldots\ldots\ldots\ldots\ldots(4)$$

g: the long term trend rate of output growth

P_t^{c*}: the world price of the commodity export

P_{Tt}^*: the price of the other tradable.

Equation (4) shows that changes in the real price of the commodity export generate deviations of the real income from its long run trend (g).

An increase in the world price of the commodity export will raise the real income as equation(4) shows, and the demand for non-tradables which, in turn, will affect the relative price of non-tradables through the following equation:[2]

$$\widehat{P_{nt}} = \phi\widehat{Y_t} + \pi(\widehat{M_t} - M_t^d) + \widehat{P_{Tt}} \ldots\ldots\ldots\ldots\ldots(5)$$

---

[1] Edwards S., ibid, P6.
[2] For more details about this equation refer to : S.Edwards, ibid, P7.

This process is generating by the spending effect and it concerns the real side of this model.

  Regarding the monetary side, according to Edwards, higher real income and prices of non-tradables will affect the demand and supply of money. Equation (3) indicates that higher demand for money will result from the increase in real income.

An important effect of this higher demand for money results, that is, if there is an excess demand for money, some deflationary effects can take place if the supply of money does not change after the boom, thus, monetary equilibrium can only be reestablished if P_t decreases or if $\widehat{Y}_t$ goes down.

  In his model, S.Edwards also showed that the excess demand for money is just one of the possible monetary consequences. Indeed, after the boom, international reserves will accumulate and the growth rate of money will be higher (equation (2) and (1) respectively), hence, an excess supply of money will result leading to an increase in the non-tradable price(equation(5)) which will appreciate the real exchange rate.[1]

I.   1-1-2. Procyclicality of fiscal policy:

Most of commodities are characterized with high volatility where the world markets prices for oil and natural gas are the most volatile. This volatility issue affects developing countries rather than industrialized ones, typically economies rich in such resources; that is, the cyclical variability pronounced in resource rich countries is due to the magnitude of swings in commodity prices particularly oil.

Kaminsky, Reinhart and Végh (2005)[2] defined the procyclical fiscal policy in terms of policy instruments (government spending and tax rates) and they argued that this situation involves higher (lower) government spending and lower (higher) tax rates in good (bad)

---

[1] According to S.Edwards(1985), real exchange rate is defined by the relative price of other tradables to non-tradables.

[2] Kaminsky G, Reinhart and Végh, « When it rains, it poors », National Bureau of Economic Research, april 2005, P17.

times; that is, fiscal policy is expansionary in good times and contractionary in bad times. According to them, the policy is procyclical because it tends to reinforce the business cycle.

In their studies, Kaminsky and associates (2005) measured the amplitude of the fiscal cycle by showing the difference between the change in real government spending when GDP growth is above the median and when it is below the median.[1] They found that the fiscal spending cycle for non-OECD countries is considerably large which suggests that fiscal policy is procyclical in those countries and markedly so in middle-high and middle-low income countries. Furthermore, the authors estimated the correlation between government spending and GDP, negative correlation indicates a countercyclical fiscal policy and vise versa for a positive correlation.

As the figure below displays, majority of advanced economies (black bars) show countercyclical spending while most developing countries show procyclical spending.

Figure3: cyclical correlation of government spending and GDP
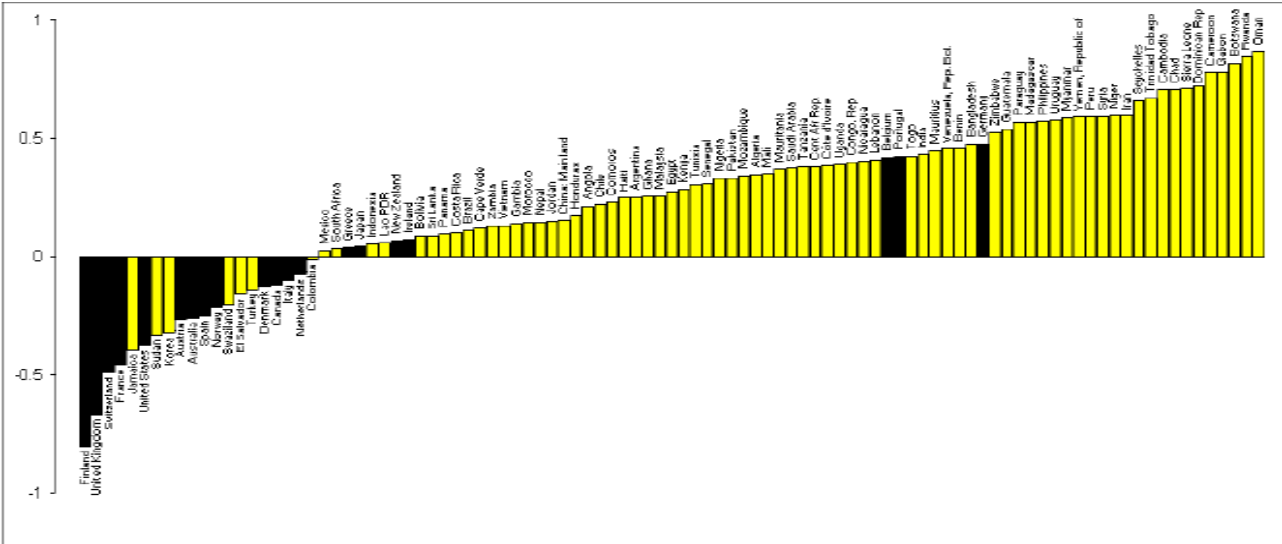
Source: Kaminsky Reinhart and Végh (2005).

---

[1] Kaminsky G, Reinhart and Végh, « When it rains, it poors », ibid, P35.

Three important characteristics of commodity exporting countries are likely to make government spending more pro-cyclical: [1] 1-government revenues derived from the exploitation of natural resources are more volatile than other sources of government revenues; 2- the size of the resource revenues is disproportionally large in commodity exporting countries and 3- those revenues are prone to rent seeking behavior. Moreover, Gelb and associates (1988) argued that governments in these countries often embark on large investment projects which take form of "white elephants"[2] projects, following commodity price booms.

I.   1-1-3. Volatility of commodity prices:

We have shown in the previous sub-section that commodity price volatility is the main cause of pro-cyclical fiscal policy in resource rich countries. Moreover, many authors treated this volatility as a new channel to explain the weak economic performance and growth volatility in those countries. This includes not only oil but even other commodities and the following figure displays volatility price indices of different commodities:

Figure4: Volatility of commodity and manufactured products indices
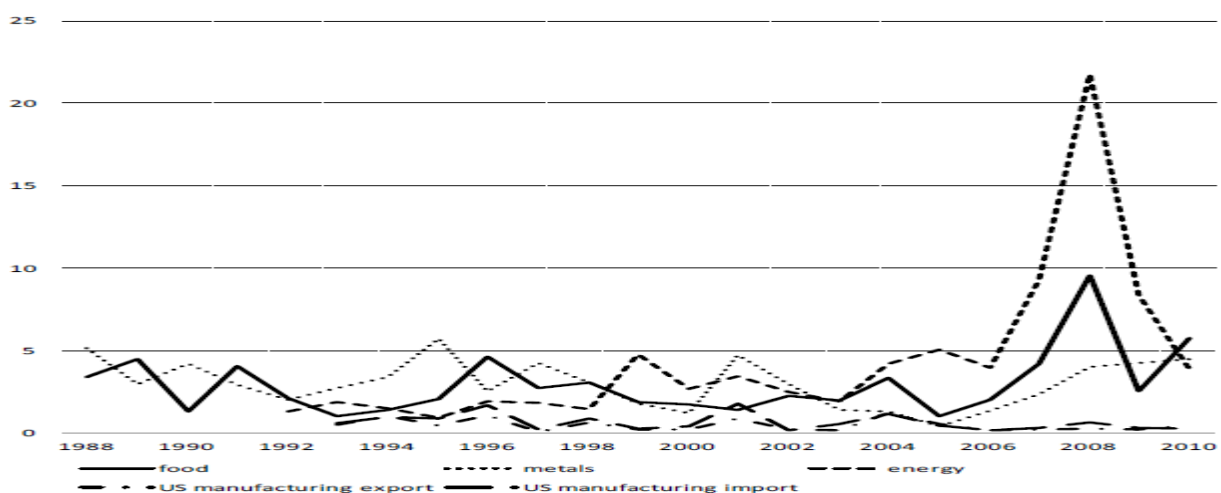
Source: Arezki R. and Gylfason T. (2011).

---

[1] Arezki R., « Fiscal policy in commodity exporting countries, stability and growth », November 2010, P2.
[2] White elephants : investment projects with negative social surplus.

This variability in the prices will lead to short-run and long-run challenges. In the short term, the concerned countries find difficulties to conduct their macroeconomic policies. Thus, they will experience lower rates of economic growth in the long run.

It has been recognized by many economists that the chocks and uncertainty existed in commodity prices really matter and they can create large swings in resource dependent economies namely macroeconomic volatility (fiscal policy and real exchange rates variability and inflationary pressures) through terms of trade volatility.

In their examination of the growth performance of 35 countries over the period 1870- 1939, Blatman Hwang and Williamson (2007) concluded that countries specialized in commodities with substantial price volatility have more volatility in their terms of trade, less foreign direct investment and experience lower growth rates than countries specialized in more stable prices and industrial leaders.[1]

I.   1-2 Political and institutional view:

Beyond the economic explanation of the natural resource curse, the question that matters : why governments in resource rich countries manage their revenues so poorly?.

This question gives role to politics and institutional quality. There exists large literature that supports this view building the political economy of the resource curse puzzle. It has been observed obviously that countries with good institutions and good politicians perform better.

I.1-2-1. Role of politics:

Governments and political systems represent a crucial channel through which the resource rents may affect economic growth either positively or negatively. Ross (1999)[2] gave large importance to the role of politics to explain the resource curse and he divided this explanation into three theories:

  a- Cognitive approach :

---

[1] Van der ploag F., Poelhekke S., "Volatility and natural resource curse", university of Oxford, 2008, P2.
[2] Ross M., " The political economy of the resource curse", World Politics, January 1999.

This approach suggests that natural resource rents can cause myopic sloth among policy makers. These rents lead to irrational abundance creating a "get-rich-quick mentality" among businessmen and a "boom-and-bust" psychology among policy makers which explains their failure to enhance growth and diversify their economies.

This explanation has already appeared in the history by John Bodin (go back to the introduction of the section).

b- Societal approach:

The societal theories suggest that booms in natural resources enhance the political leverage of non-state actors to impede the growth and development path. Otherwise, most of these theories argue that the curse of slow growth results from trade barriers which protect the winners of booms.

c- Statist approach (state-centered explanation):

The statist explanation seems to be hybrid and mixes the cognitive; societal and institutional arguments. It includes the rentier-state concept. This approach suggests that when governments of rentier states earn more revenues from resource exports, they are freed from the need to collect domestic taxes, so that, they fail to build strong economic policies and they become less accountable to the societies they govern.

I.1-2-2 Institutional quality:

The quality of institutions is a fundamental element that determines why some resource rich economies perform worse than others.

Acemoglu (2003)[1] has shown that good institutions encourage investment in machinery, human capital and better technologies which lead to achieve economic prosperity. In this context, according to Acemoglu, good institutions have three key characteristics:

---

[1] Acemoglu D., « a historical approach to assessing the role of institutions in economic development, root causes », International Monetary Fund, June 2003.

1- Enforcement of property rights so that a variety of individuals have incentives to invest and take part in economic life;

2- Constraints on the actions of politicians and other powerful groups so that they could not expropriate others' incomes and investments;

3- A degree of equal opportunity among individuals to participate in economic activities.

On the other hand, we can extend an important element from the second characteristic of good institutions, this element is the corruption.

- **Role of corruption:**

The transparency international organization defines the corruption as the abuse of entrusted power for private gain. It hurts everyone who depends on the integrity of people in a position of authority.

The relationship between corruption and economic growth is twofold. Firstly, some authors have suggested that corruption might raise economic growth, through two types of mechanisms: the "speed money" which would enable individuals to avoid bureaucratic delay; and government employees who are allowed to levy bribes would work harder. Secondly, other economists argue that the corruption tend to lower economic growth by reducing the investment rate.[1]

The corruption matter is quite related to the natural resource rich countries which exacerbates the curse paradox because of the rent seeking behavior. This can manifest itself in many ways. Public investments may be chosen not for any potential supply contribution, but to enrich contractors and politicians. Or there may be greater pressure for import protection to take advantage of the increasingly profitable home market. Incentives to maintain checks on

---

[1] Mauro P., "Growth and corruption", The quarterly journal of economics, Vol. 110, No 03, Aug.1995, P683-695.

the use of public funds by others may vanish entirely and be replaced by incentives to secure a share of the rent for oneself.[1]

That behavior of rent seeking is costly for economic growth, Murphy, Shleifer and Vishny (1993) explored two reasons for that:[2]

First: increasing returns from rent-seeking activities. That is, an increase in rent seeking activity can make rent activity more attractive relative to productive activity. This condition can lead to multiple equilibria in the economy, with bad equilibrium exhibiting very high levels of rent-seeking and low output.

Second: public rent-seeking by government officials, is likely to hurt innovative activities more than everyday production. Since innovation drives economic growth, public rent-seeking hampers growth more severely than production.

Leite and Weidman (1999) illustrated the interrelationship between natural resources, corruption and economic growth, they showed that resource abundance creates opportunities for rent-seeking behavior which is an important determinant for corruption and may affect economic growth. Their model focused on four major determinants of the extent of corruption: the corruption-dampening effects of improvements in monitoring technology and increases in penalties, and the corruption fostering of capital intensive production and concentration of bureaucratic power.

The table below shows the corruption ranking of the MENA (middle east and north africa) countries in 2012, these countries are ranked basing on their CPI (corruption perception index) score. This index was created by the transparency international organization, is calculated using different data sources from independent institutions that capture perceptions

---

[1] Gelb A., "Oil windfalls, blessing or curse", World Bank Research publication, 1988, P28.
[2] Murphy K., Shleifer A. and Vishny R., "Why is rent-seeking so costly", The American economic review, Vol. 83, N02, May1993, PP 409-414.

of corruption within the past two years. The CPI involves a scale of 0-100 where a 0 equals the highest level of perceived corruption and 100 equals the lowest level of perceived corruption. We notice from the table that most of the oil rich countries record bad CPI scores like Algeria, Iran, Iran and Libya. While we find that Qatar and UAE's CPI score are not bad because of their successful attempt to escape the oil curse.

Table2: Corruption ranking in the MENA countries in 2012.

Country Rank	Regional Rank	Country Territory	2012 CPI Score
27	1	Qatar	68
27	1	United Arab Emirates	68
53	4	Bahrain	51
58	5	Jordan	48
61	6	Oman	47
66	7	Kuwait	44
66	7	Saudi Arabia	44
75	9	Tunisia	41
88	10	Morocco	37
105	11	Algeria	34
118	12	Egypt	32
128	13	Lebanon	30
133	14	Iran	28
144	15	Syria	26
156	16	Yemen	23
160	17	Libya	21
169	18	Iraq	18

Source: transparency international organization.

I-2- Oil price volatility issue:

The behavior of oil prices has received special attention in the current economic studies especially after the two shocks of 1970s and 1980s. Since the mid 1980s, the price of oil remained very volatile as shown in the figure.

Figure5: Real crude oil prices, from January 1947 to December 2008
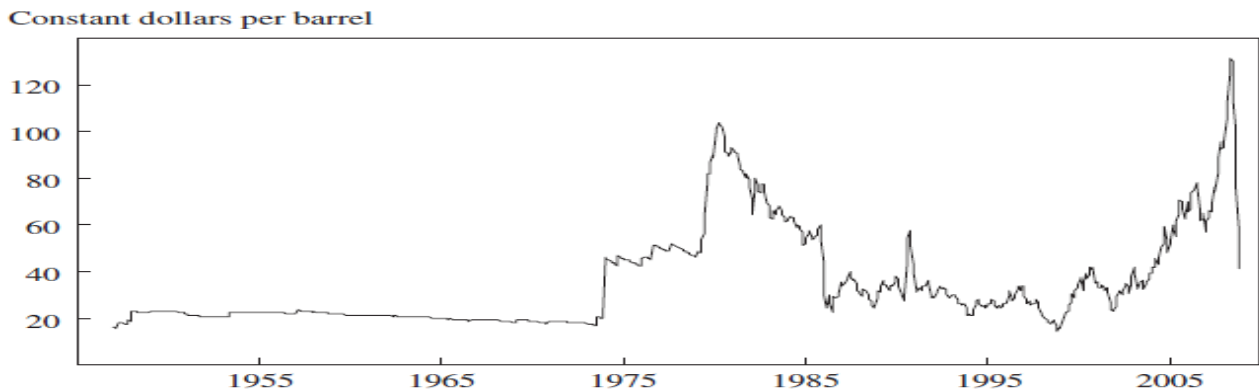
Sources: Energy Information Administration (EIA) data; Bureau of Labor Statistics data.
a. Monthly average price of West Texas Intermediate crude in dollars of November 2008.

Several reasons have caused this wide variability in oil markets: geopolitical, speculation and supply and demand shocks. This uncertainty in the price of oil, which is technically termed as volatility, represents a challenge for both importers and exporters of this commodity. Note that in our study we focus on the effect of volatility in oil exporters as one of the resource curse channels.

I-2-1- The causes and effects of oil volatility:

I-2-1-1- The causes:

a- Supply and demand for oil (market fundamentals):

a- 1 The demand side:

In the demand side for oil, the most important factor contributing in the price short-run changes is the income rather than the price elasticity (Hamilton 2009a).

Price elasticity:

The demand price elasticity measures the percentage change in quantity demanded divided by the percentage change in price[1]. The price elasticity of crude oil demand has always been small according to literature surveys estimations where Dahl(1993) and Cooper (2003) arrived at short run demand price elasticity below (-0.1). Such estimation confirms the existence of other factors behind the price that affects the oil demand.

Income elasticity:

The income elasticity means that if the GDP will go up, the oil consumption in a country will rise. In order to be convinced about the fact that the income has more contribution in the oil demand, the figure below displays the relationship between the real GDP and the oil consumption in U.S.A. over the period (1949-2009). The figure shows that the oil consumption follows the income growth remarkably steadily despite the price fluctuations.

Figure 6: real GDP and oil consumption in U.S.A.:
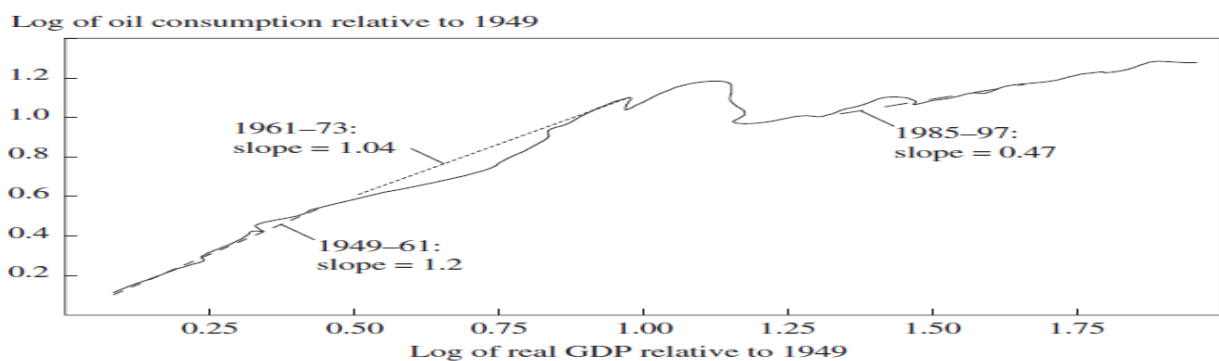
Source: Hamilton 2009a.

Moreover, a number of studies of income elasticity arrived at a value near unity. For instance, Gaterly and Huntington(2002)[2]estimated an average income elasticity over 1971-1997 of 0.55 for 25 OECD countries but 1.17 for 11 other countries characterized by rapid income growth over the period. The figure 7 shows the 1971-97 time path of per capita oil

---

[1] Hamilton J., "causes and consequences of oil shock of 2007-08", Brooking papers on economic activity, University of California, 2009, P2.

[2] Gaterly and Hunington, "The Asymmetric Effects of Changes in Price and Income on Energy and Oil Demand », 2001.

demand versus per capita income for five large Asian countries. We notice that their demand

increased as fast as income:

Figure7: Growth in income and demand for 5 Asian countries:
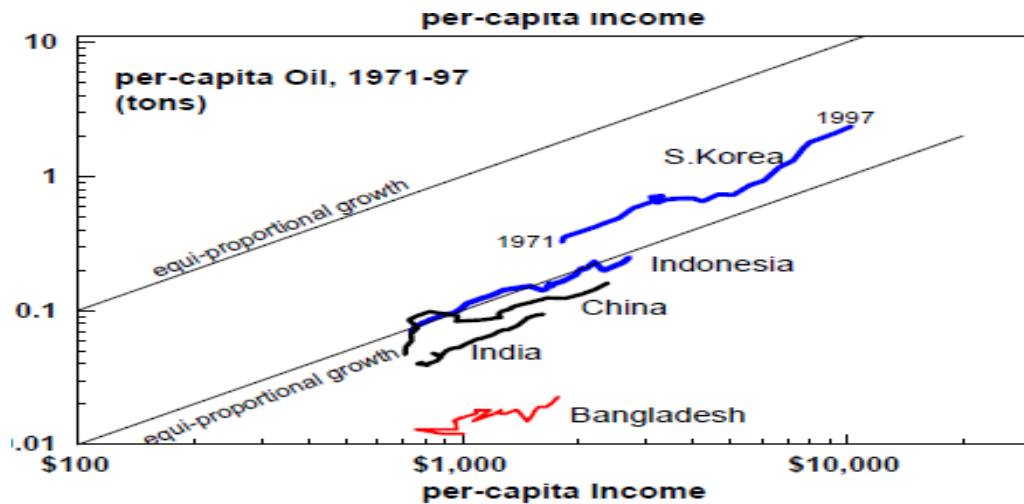
Source: Gaterly and Hunington, "The Asymmetric Effects of Changes in Price and Income

on Energy and Oil Demand », 2001.

a- 2 Supply side:

The role of OPEC:

The organization of petroleum exporting countries (OPEC) is a cartel which includes 12 of

the major oil producing countries. It produces about 40% of total liquid production of which

Saudi Arabia alone accounted for 25%.

OPEC is generally seeking to stabilize the price of oil but it faces a daunting task in the near

term because of exogenous uncertainties and poor quality of data.[1] OPEC's policies may

ensure oil price volatility instead of eliminating harmful fluctuations. Indeed, many experts,

Lynch(2003); Hamilton (2008) and Fattouh (2007) argued that the organization is powerless;

OPEC's quota decisions are now independent and respond to political interests of each

member.

---

[1] Lynch M., « causes of oil price volatility », Journal f energy and development, 2003, P2.

b- Behavioral changes:

b-1 Role of speculators:

A speculator from an economic point of view is anyone buying crude oil not for current consumption but for future use (Kilian and Murphy 2011). In fact, speculators are often accused of playing a role in oil price fluctuations. They attempt to profit and seek arbitrage opportunities in times of uncertainty.[1]

According to Kilian and Murphy, a speculator has two choices, one is to lock in the expected profit by buying an oil futures contract; the other is to buy oil, put into storage and sell that oil at a profit. Regarding the events of oil market, energy experts referred the oil hocks especially the unprecedented surge in the spot price during 2003-08 to the speculative behavior. There is evidence that after 2003, financial investors with no ties to the oil market entered the oil futures market in large numbers looking for higher returns.

b-2 Geopolitical events:

The past history of oil price shows that it has responded to geopolitical events since the first oil shock in 1973.

The Arab oil embargo of 1973, Iraq's invasion of Iran in September 1980, Iraq's invasion of Kuwait in 1990, September 11th attacks, U.S.A. invasion of Iraq in 2003, The Iranian sanctions to block oil exports through Hormuz strait and the recent so-called Arab spring; all these events have disrupted the oil supply which in turn has brought a big uncertainty in this market.

The following figure shows the reaction of the price of oil to each event and displays the variability of this price.

---

[1] Lynch M., ibid, P19.

Figure8: Price of crude oil per barrel 1970-2012:
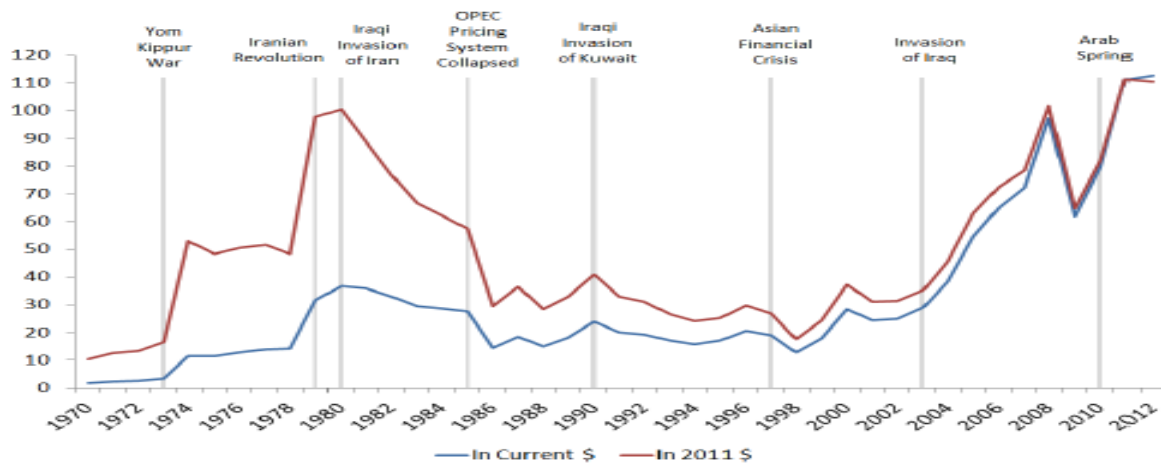
Source: Cashin P. et al (2013).

I-2-1-2 The effects of oil price volatility:

a- Macroeconomic volatility:

The variability of oil prices can put serious strains on oil exporters' macroeconomic variables: output growth; fiscal balance; exchange rates; inflation and external debt. Indeed, there is a transmission of volatility from the oil price to these variables through the terms of trade volatility because of the reliance of such countries on the oil exports.

Chuku, Effiong and Ndifreke (2010) discussed the transmission channels through which the oil price fluctuations may affect macroeconomic variables. The figure below summarizes these channels:

Figure9: Transmission channels of oil-price shocks:
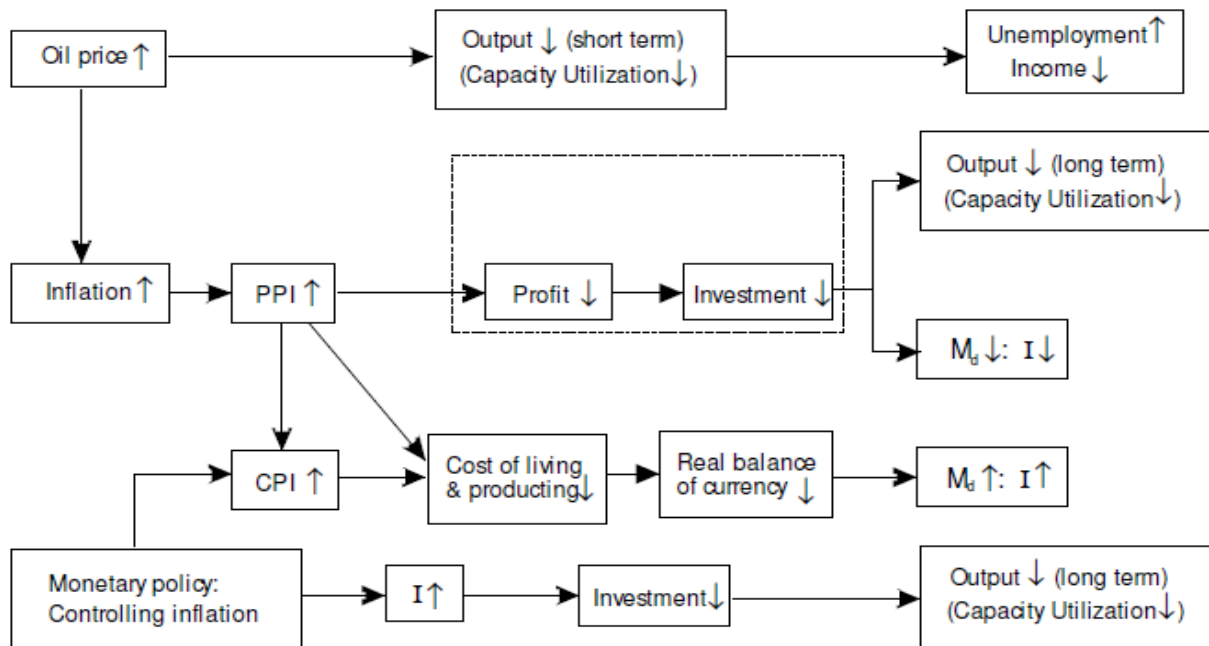
Source: Chuku, Effiong and Ndifreke (2010).

The figure shows the following channels:

- The supply side shock effect which focuses on the direct impact on output;

- The inflation channel where an oil shock can create an inflationary pressures in an economy which in turn could affect other variables like the quantity demanded for money through the PPI and CPI (production and consumer price indices).

- Other avenue is the monetary policy through which the monetary authorities increase the interest rates responding to the inflationary pressures which will impede investment.

b- Volatility and growth:

The volatility of output growth brought by the oil prices fluctuations has a negative impact on the economic growth. In this context, the pioneer work of Ramey and Ramey (1995) presented evidence by testing a sample of 92 countries, those economies with highly volatile

GDP grow at a lower rate. The figure shows clearly this negative relationship between volatility and growth:

Figure10: simple correlation between growth and volatility:
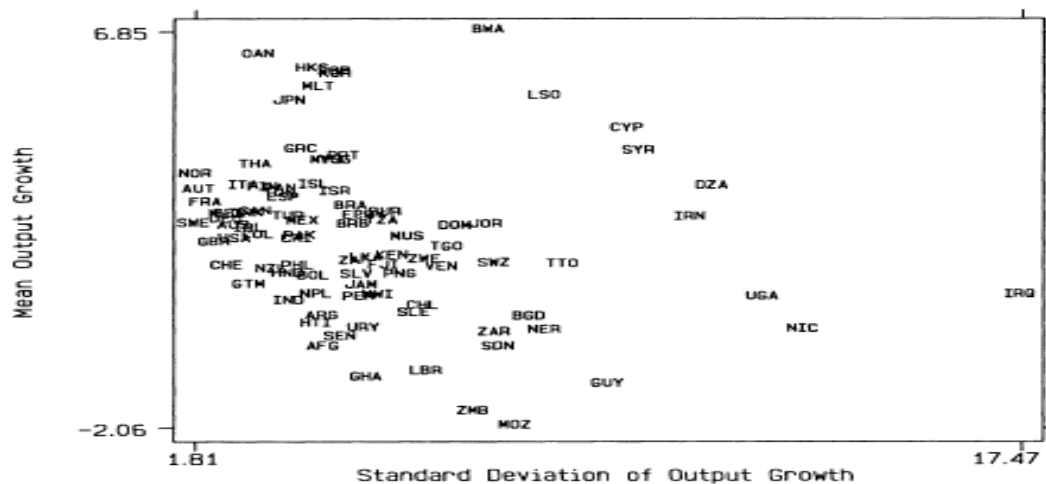
Source: Ramey and Ramey (1995).

From the figure we notice that across 92 countries, the higher the standard deviation (volatility) of output growth, the lower the mean (growth) of this output.

Furthermore, we observe that most of countries with high volatility in their GDP are oil rich countries like Algeria (DZA), Iran (IRN) and Iraq (IRQ), and countries recording high growth rates and low volatility are oil poor countries such as: Japan (JPN) and France (FRA).

This observation confirms the volatility explanation of the oil curse.

I-2-2- Means to reduce volatility effects:

The effects of the oil price volatility and uncertainty on the exporters' variables complicate the decisions of policy makers to manage the revenues in these countries. In this section we show the main elements to well manage and reduce such volatility.

I-2-2-1 Fiscal policy:

Fiscal policy is one of the strategies that should oil dependent country use in order to well manage its windfalls and avoid the negative effects of oil price volatility and resource curse

channels. The most appropriate policy is a prudent fiscal policy where the government should save during boom times and spending during bust times.

A rule of thumb is to use the special fiscal institutions (SFI) which have approved their success in many oil producing countries (OPC) in managing their revenues and making the fiscal policy away from the volatility problem then sustaining the GDP growth. These fiscal institutions include oil fund; fiscal rules and fiscal responsibility legislation (FRL); and budgetary oil prices.

a- Oil funds:

In the last 40 years, a number of countries have adopted the use of oil funds[1], in which a portion of government revenues from oil is earmarked for specific uses. These funds are best created after the discovery of the resource but before revenues from it have started to arise, however, many countries have created them during the period in which revenues are being received.

The basic objectives of the oil funds can be divided into: [2]

-First, the overarching policy objectives which include macroeconomic stabilization so that the government could smooth its expenditure in view of volatile and unpredictable oil revenue; financial saving for future generations in order to achieve intergenerational equity; and enhancing transparency and accountability in managing the oil revenues and fiscal policy.

-Second, oil funds have operational objectives that are expressed typically in terms of smoothing the net flow of oil revenue into the budget; depositing a share of revenue into the fund; and providing information about oil revenue inflows and changes in gross financial assets.

---

[1] Bacon R. and Tordo S., « Experiences with oil funds : institutional and financial aspect », World Bank report, June 2006, P1.
[2] International monetary fund, « The role of fiscal institutions in managing the oil revenue boom », IMF working paper, March 2007, P11.

From saving and stabilization objectives, we can distinguish 3 kinds of oil funds: stabilization funds; saving funds; and we find countries that make combination of saving/stabilization funds.

As discussed above, the oil saving funds are linked with the future generations wealth, that is, they are related to the concept of the permanent income while the stabilization funds are related to the revenue volatility concept.

The saving funds and permanent income principle aims to spend each period an amount of oil revenue of a magnitude such that the value of the wealth from oil remains constant allowing the same level of incremental total government expenditure to be continued indefinitely. The permanent income is the total wealth from oil multiplied by the expected real rate of return.[1] Thus, the saving fund depends on the government expenditure rather than the revenues. While the stabilization funds focus on the revenues and not the spending side. The size of these funds depends on the magnitude of expected oil revenues; their relative importance in the budget; and the possible volatility of the revenues.

Although the great role that the oil funds play in reducing the oil revenue volatility effect, these funds should be seen as complementary policy tools, not the main fiscal policy instrument. Moreover, the performance of funds is looked at mainly from an operational perspective focusing on their integration with the budget, asset and liability management and transparency.

---

[1] Bacon R. and Tordo S., « Experiences with oil funds : institutional and financial aspect »,ibid, P10.

Table3: oil funds, gross financial assets:

Country	Coverage of assets	2000 Billions U.S. dollars	2000 Percent of GDP	2005 Billions U.S. dollars	2005 Percent of GDP
Algeria 2/	Oil fund	--	--	9.9	11.8
Azerbaijan	Oil fund	0.3	5.2	1.4	11.1
Chad	Oil fund	--	--	0.02	0.4
Ecuador	Oil fund	0.0	0.0	0.4	1.2
Equatorial Guinea 3/	Gross public financial assets	0.1	12.3	2.9	43.5
Gabon	Oil fund	0.0	0.0	0.4	4.3
Iran, Islamic Rep.	Oil fund	5.9	6.2	11.7	7.2
Kazakhstan	Oil fund	--	--	8.0	14.4
Libya 3/	Gross public financial assets	13.3	40.7	26.0	68.7
Mexico	Oil fund	1.0	0.2	1.5	0.2
Norway	Oil fund	43.7	26.3	206.7	73.8
Russian Federation	Oil fund	--	--	53.0	7.0
Sudan	Oil fund	--	--	0.3	1.0
Timor-Leste	Oil fund	--	--	0.6	171.8
Venezuela, Rep. Bol.	Oil fund	4.6	4.0	0.7	0.6

Source: Fund staff estimates.

b- Fiscal rules and fiscal responsibility legislations:

Fiscal rules are defined as institutional mechanisms that are intended to permanently shape fiscal policy design and implementation.[1] These rules aim at correcting distorted incentives and containing pressures to overspend in good times so as to ensure fiscal responsibility and debt sustainability, thus, they aim to reduce the pro-cyclicality of fiscal policy.[2] The fiscal rules are often enshrined in constitutional or legal provisions like fiscal responsibility legislation (FRL).

Fiscal rules and FRL have a critical role as they are intended to constrain overall fiscal policy. However, to design an appropriate fiscal rule in oil producing country is a challenge, because of the exhaustible, volatile and uncertain nature of this commodity. These rules can be quantitative and provide numerical benchmarks for one or more key parameters of fiscal policy.

The fiscal rules differ across countries where the practices in oil producing countries are few. The first experience was in Alberta in 1990, then, Norway in 2001; Equador in 2002; Mexico in 2006; Nigeria in 2004 and Algeria 2000…among others. In these cases, the fiscal guideline

---

[1] International monetary fund, « The role of fiscal institutions in managing the oil revenue boom ", ibid, P17.
[2] Schaechter, Kinda, Bundima and Weber, « Fiscal rules in response to the crisis-toward the next generation rules, a new dataset », IMF, July 2012, P5.

targets have typically been set on the non-oil balance, the overall balance, expenditures or on several fiscal variables.[1]

The relatively successful experience of the FRL was the Norwegian one. Under the fiscal guideline that was introduced in 2001, the central government's structural non-oil deficit should not exceed 4% of the oil fund's total financial assets, equivalent to the expected long-run real rate of return of the fund's accumulated financial assets. However, Norway has maintained moderate spending growth which allows some degree of procyclicality.

The Nigerian government has been operating since 2004 an oil price based fiscal rule supported by a medium term fiscal strategy (MTFS) which includes targets for the non-oil revenues deficit. The main provision is that oil revenues above the budgeted level of oil prices and production are transferred to the excess crude oil account.[2]

c- Budgetary oil price:

Many oil exporting countries use very conservative oil price assumptions in the structure of their budgets. These prices could be regarded as unrealistically low. Such oil price assumptions are viewed as a prudent way to reduce the risk of a large deficit or fiscal adjustment in the event of unanticipated decline in oil revenue. The referential prices have tended to be adjusted upwards over recent years in view of the oil price boom. For instance, Algeria has adopted a budgetary oil price of 37 USD per barrel in 2008 while it was 19 USD in 2000.

The table below summarizes the practices of the three fiscal instruments to reduce volatility in four oil exporting countries namely: Algeria, Nigeria, Russia, and Saudi Arabia:

---

[1] International monetary fund, 2007, ibid, P18.

[2] Sturm M., Gurtner F. and Alegre J.G., « Fiscal policy challenges in oil exporting countries; a review of key issues", European Central Bank, occasional paper series, June 2009, P45.

Table4: overview of the key fiscal instruments in selected oil countries:

	Algeria	Nigeria	Russia	Saudi Arabia
Oil price assumption in the budget	USD 37 (2008) USD 37 (2009)	USD 59 (2008) USD 45 (2009)	USD 74 (2008) USD 41 (2009)	Not officially released. Private sector estimates: approx. USD 50 (2008) USD 45 (2009)
Oil stabilisation and savings fund	"Fonds de Régulation des Recettes" (since 2000) Primarily a stabilisation function (USD 50 billion)	"Excess Crude Oil account" (since 2004) Stabilisation function (USD 17.3 billion)	1) "Reserve Fund" Stabilisation function (USD 137 billion) 2) "Future Generations Fund" Savings function (USD 88 billion) (The fund established in 2004 was split in two in February 2008.)	"Saudi Arabian Investment Co." (since 2008) Savings function (USD 5.3 billion) The bulk of foreign assets that are not foreign exchange reserves in the narrow sense are managed by SAMA (USD 405 billion).
Fiscal rule	Oil revenues above the budgeted level are transferred to the oil fund.	Oil revenues above the budgeted level are transferred to the oil fund. Under the constitution, all tiers of government (federal, state, and local) share oil revenues. An MTFS includes targets for the non-oil primary deficit.	Oil revenues above the budgeted level are transferred to the oil fund.	None

Source: Sturm M., Gurtner F. and Alegre J.G.,(2009).

I-2-2-2 Role of financial development:

In their famous book about growth and volatility, Aghion and Banarjee (2005) argued that the macroeconomic volatility driven by terms of trade or commodity price shocks may slow innovations and depress growth in economies with poorly developed financial institutions.

To simply understand the argument of Aghion, we pursue the following demonstration:[1]

- The price level Pt is closed to the nominal exchange rate St :

$$Pt = StP_t^* \qquad\qquad P_t^* \sim 1$$

- The nominal wages Wt are pre-determined:

$$Wt = \emptyset\, At\, E[Pt] \;\blacktriangleright\; Wt = \emptyset\, At\, E[St] \quad : \quad \emptyset < 1 \text{ is a constant}$$

$$At \text{ is the productivity}$$

- $Yt = At\sqrt{lt}$: is the equation of output following the production function where (lt) indicates the employment.

---

[1] Van der ploag F., Poelhekke S., "Volatility and natural resource curse",ibid, P6.

- The profits are determined by: $\pi t \equiv At\, St\, \sqrt{lt} - \emptyset At\, E[St]\, lt$

- The next period's value of innovations: $V_{t+1} = VP_{t+1}\, A_{t+1}$ / $A_{t+1} = \gamma A_t$

The constant γ is superior to the unity if entrepreneurs have sufficient funds to innovate, otherwise: $A_{t+1} = A_t$. Note that, firms have sufficient funds (profits plus resource revenues Qt) to innovate if they have enough cash flow to deal with the adverse liquidity shocks which is interpreted by the equation:

$\mu\,(\pi t + StQt) > z\, Pt\, At$: μ is a measure of financial development

z is a random liquidity shock.

- The probability of innovation represented by the cumulative density function:

$$p_t = F\left(\frac{\mu(\pi t + StQt)}{St\,At}\right) \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(1)}$$

This implies that the higher the profits (πt) and the more developed financial system (μ), the higher the ability of firms to overcome liquidity shocks and thus the higher the probability of innovations.

The economic growth rate is given by: $gt = \dfrac{E[A_{t+1}] - At}{At}$

$$gt = (\gamma - 1)E[p_t] \quad \dots\dots\dots\dots\dots\dots\dots \text{(2)}$$

From equations (1) and (2), the economic growth increases with the expected probability of innovation. Consequently, the higher and stable resource revenues eases credit constraints with high developed financial system (μ) which improve the innovations and boost economic growth.

I-2-2-3- Role of economic diversification:

The economic experiences approved that the diversified economies perform better in the long term while countries that depend heavily in one commodity exports (oil or other natural resources) grow slower. This emphasizes the role of the economic diversification to sustain economic growth and development and reduce the macroeconomic volatility and shocks

brought by the oil price variability (Alan Gelb 2010). Indeed, export diversification is in general associated with lower terms of trade and output volatility as the figure shows:

Figure11: volatility and export diversification
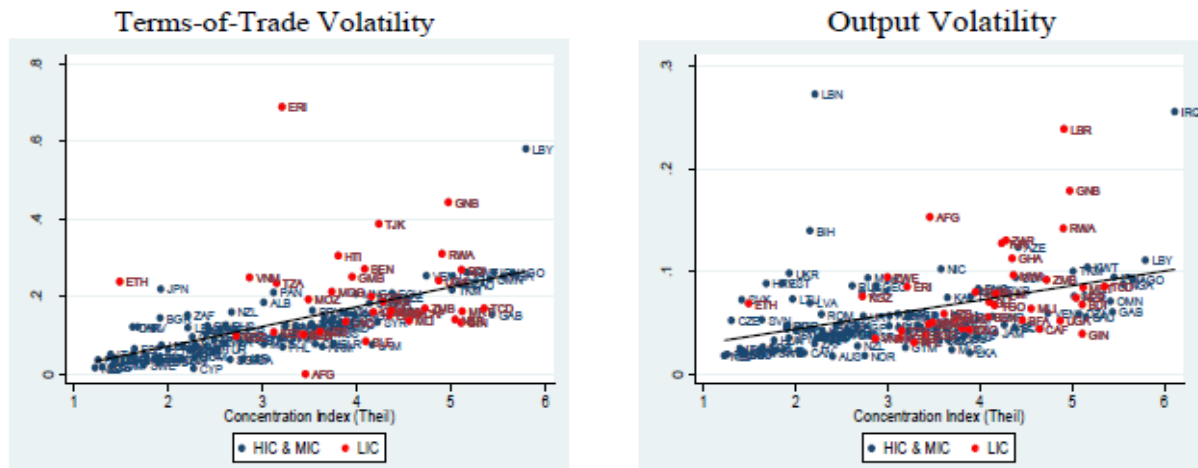
Source: Papageorgio and Spatafora (2012).

Showing the role of economic diversification, Gelb argued also that the volatility and uncertainty in oil prices represent a challenge against the diversification of oil rich economies. That is to say, it is difficult for those countries to build diversified economies from initial conditions of strong concentration in the mineral sectors (oil and gas for example). Basing on the few successful diversified oil rich economies, Gelb goes further and argues that oil rich countries should adopt macroeconomic policies in coordination with vertical policies (industrial policies). The key element of diversification policy is therefore prudent macroeconomic management over the resource cycle to stabilize the economic setting for the non-resource traded sectors.[1]

---

[1] Gelb A., « Economic diversification in resource rich countries », Arezki's book, 2012, P 75.

Chapter conclusion:

The two sections of the theoretical part came to the idea that the natural resource curse thesis is conditional and not a destiny. The Dutch Disease theory is the most important explanation of the curse puzzle where the boom in the resource sector leads to shrinkage in the other non-resource tradable sectors through a real appreciation in the exchange rate. The pro-cyclicality of the fiscal policy of the resource rich countries also explains the curse hypothesis economically; this pro-cyclicality is due to the large fluctuations of resource prices where the fiscal policy follows the business cycle which in turn hampers the economic growth. The quality of political and economic institutions represents other condition to explain the resource curse in which the countries with bad institutional quality are more likely to face the curse.

The second section of this chapter treated the oil price volatility issue as the most important commodity. This volatility which exists due to exogenous causes; leads to a volatility in macroeconomic variables of oil exporting countries and hampers their economic growth. Three solutions have been suggested by the economists in order to deal with this issue and well manage oil revenues: the sound fiscal policy; the developed financial system and the diversified economy. All these ideas were empirically approved by a set of studies which are provided in the second part.

Chapter introduction:

There exists a large literature which seeks to explain empirically the reasons beyond the failure of natural resource rich countries to enhance their economic growth and catch up with the developed countries. However, the studies have differed about the causes of this failure. Two variables are used differently; the natural resource abundance and the volatility. In this context, we divide this chapter into three sections; the first provides the group of studies arguing that the natural resource abundance affects economic growth, while the studies that tested the effect of volatility in resource prices and terms of trade on the economic growth and argued that the problem of the resource curse is rather the volatility than the resource abundance itself; are summarized in the second section; the third section outlines the issues raised by the first two sections.

II-1- Evidence on the traditional resource curse conundrum:

The evidence which supports the traditional resource curse hypothesis suggests that there is a negative relationship between resource abundance and economic growth in resource rich countries.

II-1-1- Sachs and Warner (1995)[1]:

Jeffrey Sachs and Andrew Warner were the first who tested empirically the association between resource abundance and economic growth. In their paper, they showed; using a cross country growth regression; that economies with a high ratio of natural resource exports to GDP in 1970 (the base year) tended to grow slowly during the subsequent 20 years period 1970-1990. Their finding remains significant after controlling for a large number of additional variables which include, initial GDP; openness policy; investment rates; human capital accumulation rates; changes in the external terms of trade; terms of trade volatility; inequality and the effectiveness of the bureaucracy. They also found that the effect appears when adding regional dummy variables and introducing alternative measures of resource abundance.

Seeking to assess the pathways behind the negative resource intensity-growth association, Sachs and Warner explored a simple empirical model based on four main hypotheses. One is that high natural resource abundance leads to increased rent-seeking and corruption which would show up in the measure of bureaucratic efficiency. The second is that high resource wealth encourages developing countries to pursue state-led development strategies as try to combat the Dutch Disease effects which lower the growth rates through low investment. The third hypothesis is that such countries would have higher overall demand and higher relative prices of non-traded goods which affects the relative prices if investment, and finally, the high

---

[1] Sachs J. and Warner A., "Natural resource abundance and economic growth", National Bureau of Economic Research, Cambridge 1995.

resource abundance leads to increase aggregate demand that shifts labor away from high learning by doing sectors and depresses growth in labor productivity.

The authors also built a dynamic Dutch Disease endogenous growth model to support their results and close the formal gap in the literature dividing the economy into three sectors (tradeable, non-tradeable and the resource sectors) where the tradeable manufacturing sector matters in the effects of endogenous growth.

II-1-2- The study of Gylfason and Zoega (2002)[1]:

Gylfason and Zoega (2002) demonstrated empirically and theoretically the role of the natural resource dependence to reduce economic growth by increasing inequality.

Using seemingly unrelated regression (SUR) estimates of a system of five equations for a sample of 87 countries over the period 1965-1998, the authors tried to reveal how natural capital intensity can affect growth directly and indirectly through various channels: investment, education and inequality.

The empirical results of Gylfason and Zoega can be summarized as follows:

• There is a negative direct effect of the natural capital share (resource dependence) on economic growth;

• A negative indirect effect is shown through investment and education, so that, an increase in natural capital share decreases investment rate and the secondary school enrolment rate with 0.20 and 0.03 respectively which affects in turn the economic growth (a positive correlation exists between investment and education and economic growth);

---

[1] Gylfason T. and Zoega G., « Inequality and economic growth : do natural resources matter ? », CESifo working paper N° 712, April 2002.

- Other negative indirect effect via the Gini index[1] (income distribution). An increase in natural capital share raises income inequality which will reduce economic growth with 0.04 point.

Thus, the authors concluded that natural capital intensity reduces growth directly as well as indirectly by reducing equality, secondary school enrolment rates and investment rates which leaves an important role for public policy to be used to encourage growth by enhancing equality.

II-1-3- The work of Papyrakis and Gerlah (2003)[2]

Elissaios Papyrakis and Reyer Gerlah examined empirically the direct and indirect effects of natural resource abundance on economic growth. They used an OLS estimation of a cross country growth regressions during the period 1975-1996 basing their equations on the conditional convergence hypothesis[3].

Their empirical analysis indicated the following results:

- The natural resource wealth, measured by the share of mineral resource in GDP, increases economic growth if negative indirect effects are excluded;

- The effect of natural resource abundance on economic growth is strongly negative when other dependent variables are included. These transmission channels are: corruption; investment measured by the ratio of real gross domestic investment to real GDP; openness index; terms of trade index and schooling index measuring the log of the average number of years of secondary schooling as proxy for educational quality;

---

[1] Gini index measures the extent to which income (or consumption) among individuals or households within an economy deviate from a perfectly equal distribution. A Gini index of 0 represents perfect equality while 100 reflects perfect inequality.

[2] Papyrakis E. and Gerlah R., « The resource curse hypothesis and its transmission channels", Journal of comparative economics, 32 (2004), PP 181-193.

[3] This hypothesis implies different growth rates between different countries are explained by various characteristics of these countries.

- Papyrakis and Gerlah further examined the magnitude and relative importance of the transmission channels indicated above for future policy implications. They estimated the effect of natural resources on those channels to capture their indirect effects on growth. They found that the investment is the most important channel with its relative contribution of 41% of indirect negative impact.

II-1-4- Alicia Rambaldi, Greg Hall and Richard Brown (2006)[1]

Rambaldi, Hall and Brown have re-tested the resource curse hypothesis using panel data for 47 countries covering the period 1983-2000 and improved measure of resource intensity. The authors regressed GDP growth on resource intensity using three alternative measures of resource intensity (capital stock (used before by Gylfason and Zoega GZ); Sachs and Warner's measure and they used their own measure of non-renewable resource rents per capita "PCRents") and several control variables which are the growth rates of: income terms of trade; domestic credit available to the private sector as a percentage of GDP; inflation; net accumulation of physical capital per capita; latitude; initial GDP and governance.

  Rambaldi, Hall and Brown arrived to the following results:

- The negative relationship between resource intensity still hold for the SW measure but it was not the case for the GZ measure because of the type of data used (Panel instead of cross country);

- No direct nor indirect evidence of the resource curse hypothesis when PCRents is used (appositive relationship);

- They concluded that testing the resource curse can be strongly dependent on the definition of resource intensity and measurement and modeling of economic growth.

---

[1] Alicia N. Rambaldi, Greg Hall, Richard P.C Brown, "Re-testing the Resource Curse Hypothesis Using Panel Data and an Improved Measure of Resource Intensity", University of Queensland, Australia, 2006.

II-1-5- Rabeh Arezki and Van der Ploeg (2007)[1]:

Seeking to show the role of trade policies and institutions, Arezki and Van der Ploeg provided new evidence for the impact of natural resource dependence on income per capita in a systemic empirical cross-country framework.

Using the ordinary least squares estimates of the original Sachs and Warner study, their results confirmed that natural resources negatively affect growth even after allowing for the positive growth effects of the investment-GDP ratio, institutional quality and openness. They also found that the natural resource curse is less severe in countries with less restrictive trade policies and appears in countries where institutional quality is worse than a critical value.

The authors re-estimated the precedent equations with IV estimates where they instrumented institutional quality and openness with bilateral trade shares, distance to the equator, settler mortality rates, legal origin and fraction of the population speaking English. They derived four main findings:

- Evidence of a negative direct effect of natural resource exports on income per capita even after controlling for geography, openness, and institutional quality;

- Trade policies directed toward more openness can make the resource curse less severe and may even turn it into a blessing:

- Evidence of natural resource curse is found even when the stock measure of natural resource abundance is used rather than a flow measure of resource dependence;

- The results are robust to the use of various indicators of institutional quality such as the risk of expropriation or the degree of corruption.

─────────────────────

[1] Arezki R. and Van der Ploeg F., "Can the natural resource curse turn into a blessing? Role of trade policies and institutions.", IMF working paper , August 2007.

II-1-6- Ali Alichi and Rabah Arezki (2009)[1]:

In their paper, Alichi and Arezki provided an alternative explanation for the resource curse based on the income effect resulting from high government current spending. They used a simple life cycle framework to show that private investment in the non-resource sector is negatively affected by current transfers financed through natural resource revenues which happens because expectation of transfers dampens saving within the economy, they further showed that higher degrees of openness and forward altruism[2] reduce this adverse effect.

To support their arguments, Alichi and Arezki estimated non-hydrocarbon sector growth regressions using panel data for 25 oil exporting countries over the period 1992-2005. They regressed the non-hydrocarbon GDP growth on the following explanatory variables: lagged GDP growth; government current spending as a percentage of non-hydrocarbon GDP which proxies transfers to private agents and is anticipated at the prior period; and a vector of other control variables which consists of institutional quality index, rate of change of REER that proxies the Dutch Disease channel. They also included two other control variables: restrictions on international goods and capital movements, and interactions of government spending with other variables.

Basing on two estimators (OLS and GMM), they derived the following results:

• A negative association between current expenditure and NHGDP growth (-0.18);

• Institutional quality index is positively associated with NHGDP growth (+0.016) which is consistent with the undermining institutions channel;

• A positive coefficient for REER but statistically insignificant which shows no evidence of the Dutch Disease in the authors' dataset;

---

[1] Alichi A. and Arezki R., "An alternative explanation for the resource curse: the income effect channel", IMF working paper, May 2009.
[2] Forward altruism is when the old individuals transfer part of their resources to the young.

- The absence of restrictions on goods and capital movements in a given country will lead to a positive impact of current spending on non-hydrocarbon sector development.

II-1-7-Kareem Ismail (2010)[1]

In his paper, Ismail (2010) derived a new version and structrul implications of the Dutch disease in oil exporting countries due to permanent oil price shocks from a Heckscher-Ohlin factor endowment model. He tested these implications in a highly-disaggregated manufacturing sector data across a wide group of countries including oil-exporters covering 1977–2004.

The author's results on oil-exporting countries were fourfold:

- First, oil booms have resulted in reducing manufacturing output even after several robustness tests;

- Second, evidence in the data shows that windfall shocks have a stronger impact on manufacturing sectors in countries with more open capital markets to foreign investment. This result is due to outflow of investment in manufacturing following a declining marginal return on capital, which is due to the expansion of labor-intensive non-tradables;

- Third, the relative factor price of labor to capital, and capital intensity appreciate due to windfall increases;

- Fourth, manufacturing sectors with higher capital intensity are less affected by windfall shocks, possibly due to a larger share of the effect being absorbed by the labor intensive tradable sectors.

The conclusion of the fourth result is that a diverse manufacturing sector may be more cushioned from the effect of oil shocks. This is due to capital-intensive sectors being less affected by the increased demand for labor by labor-intensive non-tradables during oil boom,

---

[1] Kareem Ismail, «The structural manifestation of the Dutch disease: the case of oil exporting countries », IMF working paper n° 10/103, 2010.

while labor-intensive sectors help cushion adjustment during oil busts by absorbing the labor shed by declining non-tradables.

II-1-8- Gylfason (2011):[1]

Tholvador Gylfason in 2011 presented a series of growth regression estimates for 164 countries during 1960-2000. His study regressed the rate of growth of per capita GDP on the share of natural capital in total wealth, and added other potential determinants of growth. This empirical study seems to be similar to the one co-authored with Zoega in 2002.

However, there is some differences and added points: Gylfason (2011) used the ordinary least squares estimates for 7 regression models and a SUR method for a benchmark model to show no difference between the two methods. The explanatory variables used by Gylfason in addition to investment rate and secondary school enrolment were democracy index and fertility.

The main findings of Gylfason were:

• Natural capital share (resource dependence) affects negatively economic growth via: investment, education, democracy and fertility;

• The results from OLS and SUR estimations are the same and no difference is found;

• Assessing the contribution of the five variables in economic growth, the author also found that none of these variables could be accounted away out and they are all important and make the difference in the economic growth.

---

[1] Gylfason T., « Natural resource endowment : a mixed blessing », CESifo papers, 2011.

II-1-9- Elbadawi and Soto (2012)[1]

In their paper about resource rents, political institutions and economic growth, Ibrahim Elbadawi and Raimundo Soto (2012) showed empirically the existence of the natural resource curse phenomenon but conditional on bad political institutions. Unlike the previous works, they used a flexible econometric model using a test for cross-dependency and common correlated effects mean group estimators developed by Pesaran (2006). Their data concerned 90 countries covering the period 1975-2009. Two variables have been included to show the effect of political institutions: first, the variable Polity2 which varies between (-10) if the country is non-democratic and (+10) if the country is highly democratic. Second, measure of political risk and checks and balances (political constraint index).

The main conclusions that have been derived from the empirical results of the authors were:

- Countries failing to achieve high enough standards of democracy and checks and balances will most likely fail in preventing the resource curse;

- Countries with above average democratic standards and in-place checks and balances can avoid the resource curse;

- Countries achieving high enough standards of checks and balances but are not democratic will likely be able to nullify the resource curse.

II-1-10- Kabbashi Suliman (December 2012)[2]:

Suliman (2012) examined the impact of the oil boom as a blessing or a curse, on Sudan's economy and analyzed the key features of the country's growth experience before and after the oil boom. The author argued that the Dutch Disease and fiscal linkages are the main

---

[1] Elbadawi I. and Soto R., « Resource rents, political institutions and economic growth", Economic research forum paper, 2012.
[2] Suliman K.M., « Understanding and avoiding the oil curse in Sudan », ERF working paper 735, December 2012.

mechanisms that transmitted the negative effects of the boom and that oil dependence has led to greater export concentration.

His paper assumed that oil boom in Sudan influenced by economic growth indirectly through its impact on the contribution of production factors and TFP, thus, the growth enhancing effect of oil is examined in terms of its contribution to technological innovations in the economy.

Suliman utilized a combination of growth accounting and time series analysis to identify the key features that distinguish growth records before and after oil boom and to test for possible channels of the oil curse in Sudan including the political economy issues. He concluded the following results:

- The misalignment of the RER have resulted in an overall loss of competitiveness approximated by the negative contribution to TFP growth (Dutch Disease channel);

- The allocation of oil revenues through the public sector has presented many fiscal challenges;

- The credibility of the government approximated by the credibility of the budget and the government announced commitment to maintain low inflation and a stable exchange rate, is very much reduced after the oil boom;

- Oil rent has significantly reshaped the incentives and constraints facing the political elites in Sudan.

The author finally argued that institutions building, political liberalization and pluralism and prudent fiscal, monetary and exchange rate policies for macroeconomic management are imperative for growth enhancing reform.

II-1-11-Akinwale Yusuf Opeyemi (2012)[1]

In an investigation for the factors driving the oil curse in Nigeria, Akinwale adopted multiple linear regression for the Nigerian economy, he used poor economic growth due to poor management of natural resources as a proxy for resource curse which the dependent variable, the independent variables included are: corruption or weak institutions; Dutch disease; poor level of technology and volatility of crude oil prices.

The regression analysis and the variance analysis (ANOVA) showed significance contribution of all independent variables except the oil price volatility coefficient which is insignificant.

The author further suggested some solutions for the oil curse in Nigeria: economic diversification; sound fiscal and monetary policies; establishment of various natural resource funds, direct distribution to the citizens, public involvement, good governance, domestic privatization, transparency and strong accountable institutions. Meanwhile, he concluded that weak institutions and poor technology are the greatest impediments to escaping the curse.

II-2- Evidence on the volatility channel of the curse:

Unlike the studies supporting traditional resource curse hypothesis, there was recent evidence which argued that it is not the problem of natural resource abundance itself that hampers economic growth, but it is the matter of the volatility existing in the prices of natural resources.

II-2-1- Van der Ploeg and Poelhekke (2008)[2]

Van der Ploeg and Poelhekke showed in their paper that the curse of natural resources is foremost a problem of volatility. They used panel autoregressive conditional

---

[1] Akinwale Y.O., "Empirical analysis of the resource curse in Nigeria", International Journal of Economics and Management Science, Vol.1 N6, 2012, PP 19-25.

[2] Van der ploag F., Poelhekke S., "Volatility and natural resource curse", university of Oxford, 2008.

heteroscedasticity in mean (ARCH-M) for the period 1970-2003 to test the importance of volatility for the paradox of plenty.

The authors found the following facts:

• First, volatile countries with a high standard deviation of yearly growth in GDP per capita have on average lower growth in GDP per capita;

• Second, developing countries suffer much more from volatility in output growth than developed countries. Whereas Western Europe and North America have a standard deviation of, respectively, 2.33 and 1.90 %‑points of yearly growth in GDP per capita;

• Third, countries with poorly developed financial systems are much more volatile;

• Fourth, countries that depend a lot on natural resources are much more volatile than countries without natural resources. Countries with a share of natural resource exports in GDP greater than 19% (have a staggeringly high standard deviation of output growth of 7.37 %‑point ;

• Fifth, landlocked countries suffer much more from volatility than countries with easy access to waterways.

They finally concluded that countries can turn the curse even into a blessing, because there is evidence for a positive direct effect of natural resource dependence on growth after controlling for volatility and the key to a turn-around for many resource-rich countries is financial development, ensuring openness and mitigating the effect of being landlocked, because the *indirect negative* effect of resource dependence on growth, via volatility, is much larger than any *direct positive* effect.

II-2-2- Paul Collier and Benedikt Goderis (2008)[1]

Unlike other studies, Collier and Goderis adopted panel cointegration methodology to explore longer term effects of commodity booms and they found strong evidence of the resource curse, indeed. They analyzed short run and long run effects of commodity export prices on GDP per capita building on error correction model which includes a vector other variables affecting GDP and a vector of regional time dummies.

The main authors' conclusions are:

• Commodity booms have positive short term effects but adverse long term effects;

• The resource curse is avoided by countries with sufficiently good institutions;

• Overvalued exchange rate, high public and private consumption, low or inefficient investment, lesser extent commodity price volatility and slow growth in the services sector explain a substantial part of the curse;

• Their findings support the large Dutch disease and the idea that commodity booms led countries away from productive activities and provide incentives for rent-seeking, lobbying and public sector employment; thus, the long term negative effects are due to commodity prices rather than resource abundance.

II-2-3- Michael Bleany and Havard Halland (2009)[2]

Bleany and Halland introduced the concept of fiscal policy volatility as a transmission mechanism for the resource curse. Using a sample of 75 countries over the period 1980-2004, they argued that countries with a higher share of natural exports tend to have both slower per capita growth and higher volatility of output and government consumption.

Their main findings were:

---

[1] Collier P. and Goderis B., "Commodity prices, growth and natural resource curse: reconciling a conundrum", Centre for the Studies of African Economies working papers (CSAE wps), August 2007.
[2] Bleany M. and Halland H., "The resource curse and fiscal policy volatility", CREDIT research paper No. 09/09, 2009.

- Both output volatility and fiscal policy volatility have negative effect on economic growth; but the effect of the output volatility becomes insignificant when the two variables are included together in the growth regression;

- When fiscal policy volatility is included in the growth regression with natural resource exports, the effect of this latter reduces by 25 percent which means that a quarter of natural resource curse operates via fiscal policy volatility;

- The resource curse also appears through other variables such as institutional factors which affect growth directly rather than indirectly through FPV.

II-2-4- Rabah Arezki and Thorvaldur Gylfason (2011)[1]

Arezki and Gylfason (2011) used a new dataset to examine the impact of commodity price volatility on economic growth in a panel of up to 158 countries, the data covered the period 1970-2007. To do so, they estimated a dynamic econometric model using generalized method of moments (GMM) system. The variables used were: non-resource GDP per capita as a dependent variable while the vector of explanatory variables consisted of the initial NRGDP, commodity price index, the volatility of the commodity price index measured by the annual standard deviation of the monthly changes of the index, democracy, saving and economic diversification index.

Their estimations arrived to the following findings:

- Increased commodity price volatility leads to a significant increase in non-resource GDP growth in democracies but no significant effect on growth in authocracies;

- An increase in commodity price index volatility leads to a large and statistically significant increase in net national saving in democracies while net national saving decreased significantly in authocracies, which means that changes in commodity prices encourage saving in democracies;

---

[1] Arezki R. and Gylfason T., « Commodity price volatility, democracy and economic growth", CESifo working paper n°3619, 2011.

- Using the indicators of economic institutions quality instead of political institutions, the authors found an important contribution in shaping the volatility channel of the resource curse.

II-2-5- Tiago, Cavalcanti, Mohaddes and Raissi (2011)[1]:

The authors' paper studied the impact of the level and volatility of commodity terms of trade on economic growth and argued that volatility rather than abundance per se, drives the resource curse paradox.

Raissi *et al* used in their empirical study for estimation the standard system GMM approach and a cross-sectional augmented version of the pooled mean group (CPMG) methodology of Pesaran (1999). They used both annual data for 1970-2007 and five year non-overlapping observations. The authors also tested the impact of volatility on economic growth through the three channels: physical capital accumulation, human capital stock and productivity.

They finally concluded the following results:

- The commodity terms of trade affected primary product exporters positively while there was a negative impact of CTOT volatility on output;

- The commodity price uncertainty mainly lowers the accumulation of physical capital and affects adversely human capital formation;

- Countries with more diversified export structure were better able to insure against price volatility than a sample of primary product exporters.

II-2-6- Samimi, Sadeghi and Sadeghi (2011)[2]

Samimi, Sadeghi and Sadeghi evaluated in their study the impact of the terms of trade volatility on economic growth in a sample of 20 oil exporting countries using the GMM

---

[1] Tiago, Cavalcanti, Mohaddes and Raissi, "Commodity prices volatility and the sources of growth", IMF working paper, 2011.
[2] Samimi J., Sadighi S. and Sadeghi S., "The impact of the terms of trade volatility on economic growth: evidence from oil exporting countries", International Journal of Economics and Management Engineering, N°1, Nov.2011, PP 50-53.

methodology during the period 1980-2005. The authors used the GDP as a dependent variable, capital formation, labor force, level of terms of trade and terms of trade volatility extracted from GARCH(1.1) model as explanatory variables.

Their regression results indicated the following:

• Growth depends positively on the current level of terms of trade;

• There is a negative effect of terms of trade instability, so that one percent increase of TOTV causes growth decrease by 0.31 percent;

• Volatility in TOT has much more important effect than the current level;

• Labor and capital formations have positive effects on growth.

They finally concluded that delinking public revenues from TOT volatility would be the appropriate strategy to reduce such volatility and avoid its deleterious effects on economic performance.

II-2-7- Weishu Leong and Kamiar Mohaddes (2012)[1]:

In their paper which tackled the institutions and the volatility, Leong and Mohaddes revisited the resource curse paradox and studied the impact of resource rents and their volatility on economic growth under varying institutional quality. The authors used five year non-overlapping observations between 1970 and 2005 for 112 countries.

Using the system GMM, they tested the relationship between real GDP per capita, resource rent measure based on the prices; cost of production and quantities for 13 commodities, rent volatility and other important determinants of growth: investment share of GDP, human capital, trade openness, government burden and lack of price stability.

The authors' findings confirmed the volatility effect and supported the volatility curse hypothesis rather than the resource abundance curse:

---

[1] Leong and Mohaddes, « Institutions and the volatility curse », University of Cambridge, 2012.

- Resource abundance proxied by real resource rent per capita growth has a positive impact on output growth;

- Strong negative growth effects of resource rent volatility;

- When institutional quality is high, volatility of resources rents is less output-reducing.

They explained the last result by the transparency, accountability, forward-looking to invest the rents appropriately and the control of rent-seeking motives which exist in countries with better economic institutions.

II-2-8- Rabah Arezki and Mustapha K.Nabli (2012)[1]

In an analytical study on the Middle East and North Africa (MENA) region, Arezki and Nabli assessed the economic performance of resource rich countries in this region over the past forty years. Their analysis discussed the inclusive growth and macroeconomic volatility and they documented that:

- Resource rich countries in MENA have performed poorly when assessing standard income level measures although they have maintained high levels of income per-capita;

- Resource rich MENA countries are characterized by high levels of macroeconomic volatility and low and non inclusive economic growth. The presence of volatility complicates the saving/investment decisions by the different economic agents which in turn affects long-term economic performance;

- The authors argued the role of institutions and diversification to avoid the curse of natural resources and they argued that resource rich MENA countries need to give priority to: better macroeconomic management to avoid pro-cyclical policies, larger quality investments in human and physical capital innovative policies to achieve diversification, and all this require major institutional and governance reforms.

---

[1] Arezki R. and Nabli M.K., « Natural resources, volatility and inclusive growth: perspective from the middle east and North Africa", IMF working paper, April 2012.

II-2-9- Ahmed S. Mahmud and Syed Abdul Basher (2013)[1]

Their paper developed a simple empirical model to investigate how exogenous movements in world prices of natural resources affect the existing political equilibrium in recourse-rich nations.

For point-source resources such as oil, the authors showed that:

- Resource booms lead to more procyclical transfers and regime instability;

- Increasing income inequality leads to greater pressure for democratization;

- Higher price volatility leads to an increase in semi-consolidated regimes.

Mahmud and Abdul Basher also studied in an extended theoretical model the political consequences of resource booms and busts under alternative types of resources. societies with diffused resources (which are labor-intensive) face more political instability when the world prices of commodities (e.g., coffee) are low rather than when prices are high. This is because when the export prices of diffused commodities are low, the poor majority has a low opportunity cost of mounting a revolution against the incumbent elite.

II-3- Issues raised by empirical evidence:

Most of the empirical studies have come to the conclusion that many natural resource rich countries are cursed instead of being blessed with such resources. This section provides and summarizes the differences and similarities of empirical evidence regarding the data, models used and their results, we then show the contribution of our study among the previous works.

- The majority of studies supporting the traditional resource curse hypothesis used resource abundance (ratio of resource export) or resource dependence (share of natural capital in GDP) to show its negative impact on the growth of GDP per capita (Sachs and Warner (1995), Gylfason and Zoega (2002), Arezki and Van der Ploeg (2007), Rambaldi; Hall and Brown (2006), Papyrakis and Gerlah (2003) and Gylfason (2011)). These studies introduced other variables and showed the role of institutional quality, human capital accumulation, inequality

---

[1] Mahmud A.S. and Abdul Basher S., "Price volatility and the political economy of resource rich nations", Qatar Central Bank, April 2013.

and openness to reduce the resource curse. Otherwise, Arezki and Alichi supported the resource curse result using the non-hydrocarbon sector growth for 25 oil exporting countries instead of GDP per capita of rich countries in many natural resources.

- The studies supporting the volatility curse have taken different path, they used the commodity price, resource rents and terms of trade volatility in lieu of resource abundance or dependence (Van der ploeg and Poelhekke (2008), Arezki and Gylfason (2011), Raissi *et al* (2011), Loeng and Mohaddes (2012)). Moreover, these studies have also included the variables contributing to reduce the growth effects of volatility, these variables are similar to those used in the traditional resource curse thesis.

- Different methods have been used for different sampling periods to test for the curse of natural resource abundance and they varied between ordinary least squares (OLS) and seemingly unrelated regression (SUR). However, the studies have come to the same conclusion that the natural resource abundance has negative direct and indirect effects on economic growth in resource rich countries.

- Most of the studies investigating for the volatility curse based their estimations on the generalized methods of moments (GMM); instead of the OLS estimator; to correct for the biases of endogeneity between explanatory variables. Meanwhile, some studies used other methods such the ARCH-M by Van der Ploeg and Poelhekke (2008). Using the GMM estimation, all these studies came to the same result that resource abundance is positively correlated with economic growth but it is the volatility of commodity prices which hampers growth.

- Both, the traditional resource curse and the volatility curse literature share the following points:

+ The diversified economies work better than the resource intensive countries and they could successfully escape to the resource curse and boost their economic growth;

+ Institutions and governance do matter in escaping or deepening the curse hypothesis, hence, resource rich countries with good institutions represent successful examples to achieve development;

+ As the human capital is a key determinant of economic growth, its absence allows for the occurrence of the resource curse, thus, countries endowed with natural resources should give importance on this factor;

+ Fiscal policy plays a crucial role so as resource rich countries must adopt sound fiscal policy to well manage their windfalls and enhance the economic growth;

+ Appropriate monetary policy is also required to deal with the natural resource price shock and their inflationary pressures which hamper the growth.

Although the large number of studies dealing with the natural resource curse either the curse abundance or the volatility curse, very few works have tested for the oil curse in the Algerian economy (Gelb(1988), Auty(2008), Chekkouri, Benbouziane and Chibi(2013)) since most of the empirical evidences used cross-country or panel data. Our study treats this point and tries to examine the recent channel of the oil curse namely the volatility curse in the Algerian economy. Following similar path to the evidence supporting the volatility curse, the study:

- Investigates the impact of the oil price volatility on the economic growth in Algeria;
- Uses time series data for the Algerian economy over the period of economic reforms. However, we use in our model the period 1995-2011 for the fitness of the results;
- Shows the role of economic diversification, fiscal policy and financial development either to exacerbate the volatility effect or to enhance economic growth;
- Finally it compares between the oil dependence curse and the volatility curse evidence in Algeria.

Chapter conclusion:

This part has divided the empirical works testing the natural resource curse into two groups; one supporting the idea that the natural resource abundance affects negatively economic growth; and the other groups including the studies that disagreed with the first and showed empirically that it is a matter of the volatility rather than the abundance. Most of the empirical studies have come to the conclusion that many natural resource rich countries are cursed instead of being blessed with such resources.

Although the difference in the variable used to test the natural resource curse, all the empirical evidence agreed about the conditions that exacerbate the growth negative effects of natural resources: bad institutional quality; unsound fiscal policy; underdeveloped financial system; lack of human capital formulation and economic diversification.

Chapter introduction:

Algeria is one of the oil rich countries that may be affected by the so-called natural resource curse. It is one of the most important producers and exporters of hydrocarbon products (oil and gas) in the world, its exports from this sector represent about 98% of its total exportation. Thus Algeria is facing the same challenge as the other oil rich countries. This chapter investigates empirically in the existence of the volatility curse in Algeria. It describes in a first section the oil economics in Algeria discussing how the Algerian government has managed the oil windfalls during the last decade (2000-2012) showing that Algeria has benefited from the recent increase in the international oil prices by creating the oil stabilization fund and applying the budgetary oil price. The econometric model examines the relationship between the oil price volatility and economic growth in Algeria using the ordinary least squares estimation (OLS). The model includes six linear equations which regress the oil price volatility on the economic growth as basic equation for the first four models. The empirical models further show the impact of fiscal policy, economic diversification and financial development on the oil price volatility effect. In order to compare this effect with the traditional oil curse hypothesis the study also tests the oil rent impact on the economic growth. The period taken for the econometric study is extended with five years for the goodness of the model results and it covers 1995-2011.

III-1- Oil economics in Algeria:

III-1-1- Evolution of the oil sector:

Algeria has been one of the most important oil and gas producers and exporters. The development of these two industries started in 1958 after the discovery of two giant oil and gas fields at Hassi Messaoud and Hassi R'mel in the northern Sahara region.

Algeria has applied a controlled and socialist economic system from the independence to the late of 1980s. Consequently, the national and state-owned oil company SANATRACH created in 1963 was responsible only for the transportation and marketing of hydrocarbon products. In 1971, after the nationalization of this sector, SONATRACH became a quasi-monopoly in oil production.

The hydrocarbon law of 1986 allowed the foreign companies to participate in the oil exploration where the maximum limit of the partner's share is 49% under the economic reforms starting in the 1980s. The main principles of this law were:

- The property of hydrocarbon reserves belongs to the nation;

- The exploration and exploitation activities are state's monopoly while their performance may be associated with foreign oil companies;

- Obligation for any foreign investor to enter into exploration contracts with SONATRACH and the partnership on the already discovered fields is not authorized.

The amendments of the law introduced in 1991 also expanded the possibilities for foreign participation while the law of 2005 and its amendments provided more open possibilities:[1]

- Establishing competition in free market;

- Separating the operations of the state from SONATRACH;

---

[1] Khelil Chakib, " Coping with challenges : an Algerian perspective", African oil and gas forum, Maryland, November 2006.

- Establishing two independent regulatory agencies (ALNAFT[1] and ARH[2]) in order to ensure regulation of the liberalized hydrocarbon sector;

- Establishing transparency in contracts awards.

Although these legal reforms, SONATRACH still dominates the hydrocarbon sector with its double role as both a producing company and a regulatory of the hydrocarbon sector and is ranked the 11th among world oil companies.

Regarding the production, the crude oil was at the centre of the expansion of hydrocarbon sector after the independence of the Algerian state. At the beginning of 1980s, oil production and exports declined remarkably because of OPEC's constraints to stabilize the world oil price. Indeed, between 1980 and 1982, the export share of crude oil decreased from 80% to 30%.

Recently, Algeria is taking steps towards maintaining and enhancing its oil production capacity by developing new oil fields to compensate the decline in older fields.[3] The oil production has increased sharply in the first five years of the last decade from almost 1.2 million barrel per day in 2000 to 1.7 million barrel per day in 2006 responding to the increase in the global demand as the figure shows:

---

[1] L'agence nationale pour la valorisation des ressources des hydrocarbures.
[2] L'agence nationale de control et de régulation des activités dans le domaine des hydrocarbures.
[3] Oil and gas Directory Middle East, « Research profile : Algeria », 2011.

Figure12: crude oil production in Algeria (million barrels per day)
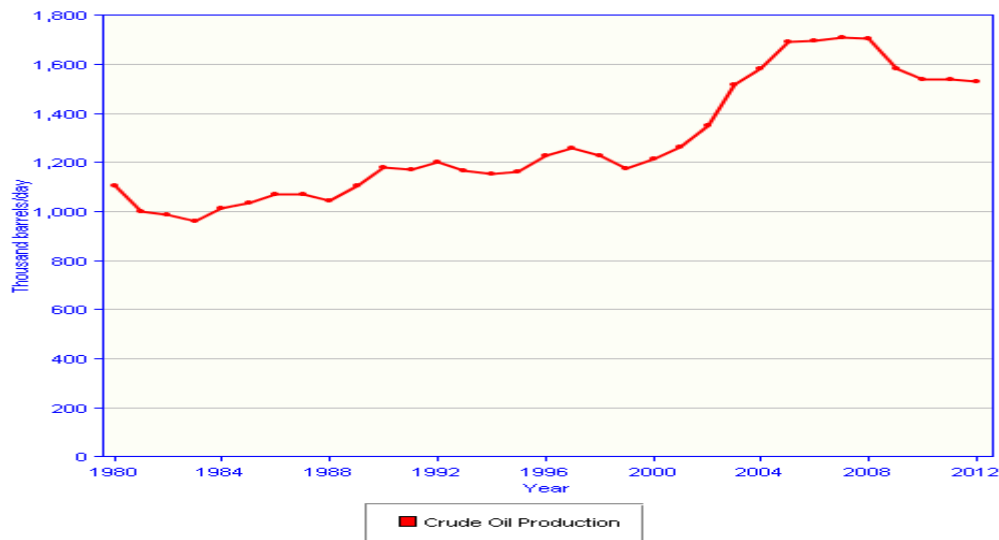
Source: Energy Information administration; www.eia.gov .

The oil sector has an important role in the Algerian economy through the large revenues from it. It contributed with 98% of total export in the last two decades and with about average of 30% of the total GDP, this contribution has changed over the period of independence with the highest ratio in the last decade as the figure below shows. Such large strategic windfalls need to be well managed by the implementation of specific economic policies.

Figure 13: the contribution of hydrocarbon sector in GDP
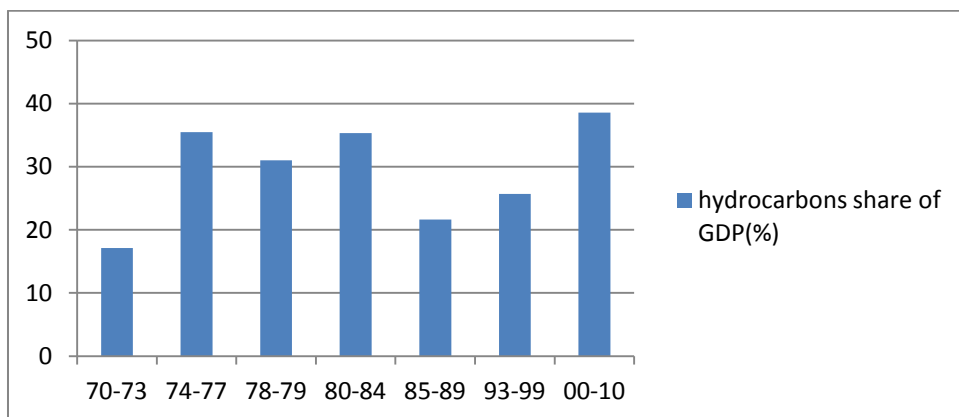
Source: student's construction using: IMF country reports and Chekkouri, Benbouziand and Chibi, "the Dutch Disease in Algeria", Economic Research Forum, 19ᵗʰ annual conference on economic development under the rise of islamist parties, Kuwait 2013.

III-1-2- Management of oil revenues:

After the independence and during the period 1963-1988, windfall revenues were largely wasted on large-scale, state-controlled heavy industry projects which were not well-integrated into the small domestic private sector or the international economy.[1] Algeria has further built up a huge external debt following the decline in world oil prices in 1986. In the 1990s, Algeria went through a severe situation; civil war in which 100000 people were killed, very bad financial position with large external debt from international institutions (International monetary fund and World Bank). From the year 2000, Algeria entered a new era, era of economic recovery after the black decade of the 1990s. Where the soaring oil prices have sent its economy on a boom, allowing it to pay off debt, build up major reserves and draw interest from foreign oil companies. But Algeria, worried about its failure to diversify its economy beyond the energy sector and is facing a big challenge.

In this section we are going to present the main Algerian economic policies adopted to manage its oil windfalls, reduce the effects of revenues fluctuations and enhance economic growth from 2000 till now, since it is the period of our empirical study.

a) Fiscal policy:

The dominance of the Algerian economy on the oil sector leads to an unstable fiscal policy stance that transmitted the volatility of international oil prices into the domestic non-hydrocarbon sector. The budget's dependence on volatile hydrocarbon revenues also created a significant deficit bias by ratcheting up fiscal expenditures. Favorable oil prices were regularly seen as permanent increases in revenue and were followed by expenditure increases,

---

[1] Mitchel J., Stevene P. and Cossinadri E., "Resource depletion, dependence and development: Algeria", Chatham house, working paper, November 2008, United Kingdom.

which were difficult to reverse when the oil revenue increases proved to be only temporary, so as the problem of fiscal pro-cyclicality appears. Indeed, following the continued increase in oil prices in 2000s, an expansion in the public expenditure (Figure) was registered due to the execution of the large economic programs (PSRE, PCSC and PIP)[1] responding to the social and development demands. Thus, a deficit in non-hydrocarbon budget was registered because of the increase in current expenditure following the raise of public sector wage bill, and capital expenditure due to the investment programs focusing on infrastructure.

Figure14: Budget expenditure in Algeria
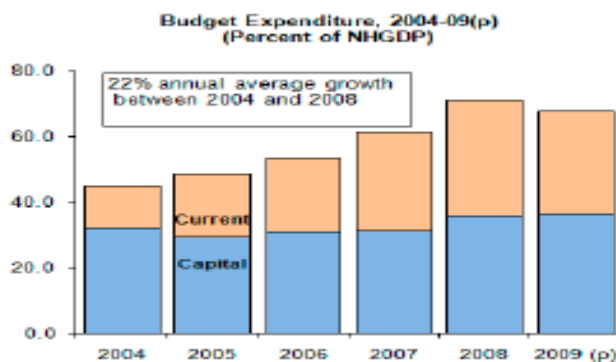
Source: International monetary fund: Country report n° 1057; Algeria, P 11.

However, Algeria has applied a prudent budget formulation, while managing its exceptional oil resources well.[2]

A referential oil price has been used in budget formulation which was 19US$/barrel from 2003 to 2005 and 22 US$ in 2006 then 37US$ since 2007.

The oil stabilization fund:

The excess oil revenues (the difference between actual and the referential oil price) are deposited into the oil stabilization fund (Fond de Régulation des Recettes)[1] which was created

---

[1] PSRE : Programme de soutien à la relance économique (2001-2004).
PCSC : Programme complémentaire de soutien à la croissance (2005-2009):140 billion US$.
PIP: Public investment program (2010-2014): 286 billion US$.
[2] World Bank report: « Assuring high quality public investment, Algeria », Public expenditure review, Volume I, 2007, P10.

in 2000, this fund records fast accumulation due to the considerable increase in oil price in international market from 2000 to 2007 (453, 2 billion DA in 2000, 623 billion DA in 2004 and more than 4200 billion DA in 2009) as shown in the figure, we notice that the ratio and accumulation of FRR stated to increase in 2003 following the increase in oil prices.

The oil fund has three main objectives: (i) reconstitute the cushion of external reserves that had been used in 1998-99 during a period of low hydrocarbon revenues; (ii) to service the stock of public debt in the context of strictly limited domestic bank and nonbank financing and (iii) to smooth the longer-term profile of expenditures. Henceforth, the oil fund of Algeria does not have intergenerational transfer purposes; it is rather stabilization than a saving fund.

Figure15: Algerian oil stabilization fund
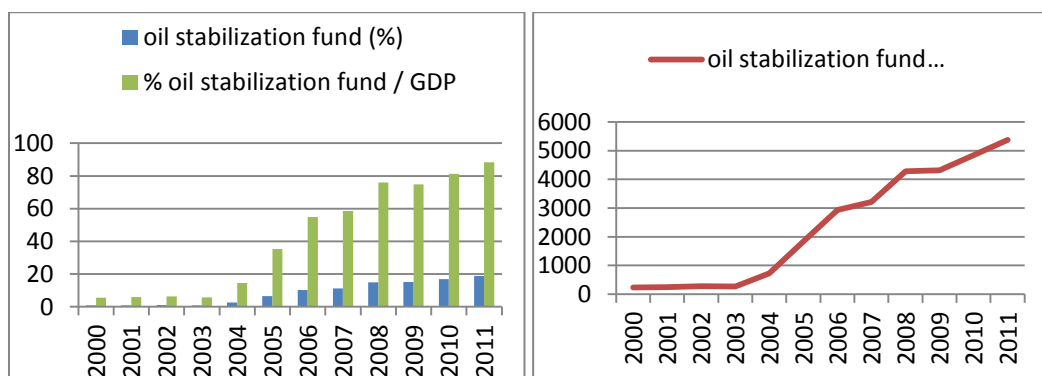
Source: author's calculation using IMF data.

b) **Monetary and exchange rate policies :**

The oil revenues and fiscal policy have boosted liquidity which should be sterilized to repulse the inflationary pressures[2]. The authorities have succeeded to absorb a large amount of liquidity and keeping inflation under control. The bank of Algeria used several measures to absorb the excess liquidity in the banking sector. In particular, it (i) raised the amount of deposit auctions; (ii) increased its policy interest rate several times; (iii) lengthened the

---

[1] By the 2004 budget law, the amounts accumulated in the FRR can be used to finance the budget deficit in case of lower than budgeted hydrocarbon revenues and reduce the outstanding national debt. For further details about FRR, refer to the World Bank report mentioned above, p19.
[2] International monetary fund: Country report n° 1057: Algeria , PP 15.

maturities of a large portion of the deposit auctions from one week to three months in July 2005; and (iv) set up on overnight deposit facility in September 2005.

 Nevertheless, the anticipated fiscal expansion due to the growth programs, the current strong growth of credit to the economy and the increase in imports prices would complicate the monetary management. Inflation increased to an unprecedented level of 11 percent in early 2012 and has become a real concern for the authorities.

Figure16: forecasted and actual inflation
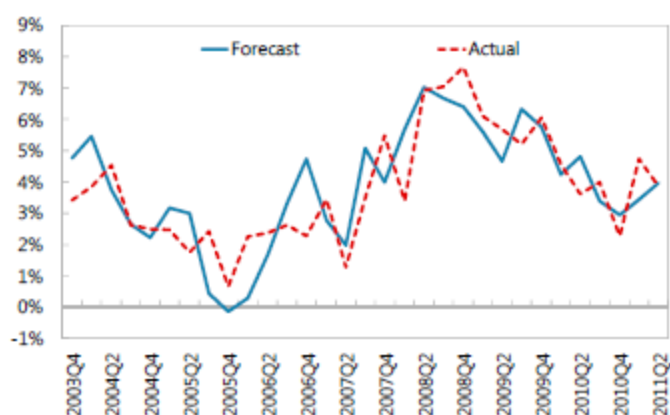
Source: IMF country report 1347, P12.

 + From 1974 the Algerian Dinar was pegged to a basket of currencies in which the Dollar has taken a large weight as it is the oil currency in the international market. The real exchange rate of the Dinar has fluctuated during the period 1974 -1994 responding to the movements of the US Dollar and to the oil price chocks.

+ During the last decade the Bank of Algeria intends to continue using the float managed exchange rate regime to keep the real exchange rate near its equilibrium levels in order to preserve the non hydrocarbon sector from the negative effect of the real appreciation. The BA intervenes largely in the currency market in order to maintain the real exchange rate in its equilibrium level taking account of the development of other economic fundamentals. The intervention in the currency market to determine the Algerian dinar keep the national currency

away from the Dutch Disease channel of the oil curse through the exchange rate real appreciation

Figure17: Real effective exchange rate and Equilibrium
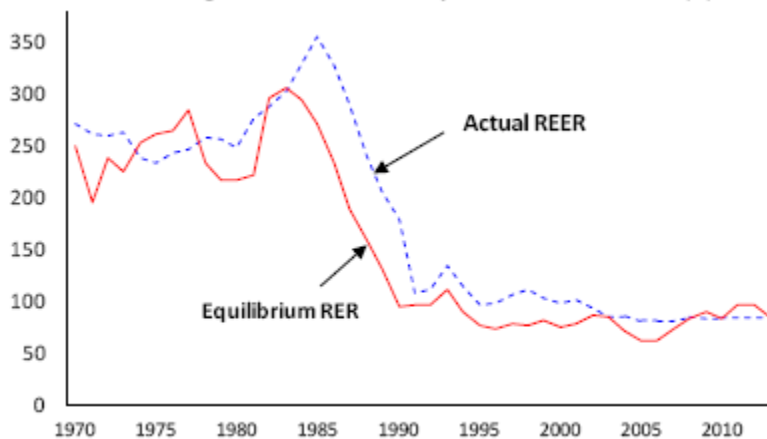
Source: IMF country report n°1220, PP26.

III-1-3- Economic growth and oil revenues:

Economic growth in Algeria is marked by different steps and variable rates. 1962-1984 was the period in which Algeria enjoyed high economic growth led by the growth in manufacturing sector due to the two oil important windfalls of 1973 and 1978. The period of 1986-1988 was the most difficult where the growth reached negative rates because of the deterioration of the Algerian economy following the oil price sharp decrease in 1986.

During 1995-1999, the economic growth started to improve slowly and reach positive rates due to the structural reforms supported by IMF and the World Bank and the privatization of the economic system.

The increasing oil revenues in the last decade have led to solid economic growth.[1] Macroeconomic prudent policies and development programs implemented since 2000 had

---

[1] International Monetary Fund, country report: Algeria, cr1220, 2012.

also a role in enhancing the overall growth in Algeria where the non-hydrocarbon growth has been the main driver. However, this performance was made by massive transfers of resources to the non-oil sector through public spending. Thus, Algeria's growth is still facing important challenges and needs to be more diversified in order to boost development path.

Figure18: Non-hydrocarbon output and oil revenues
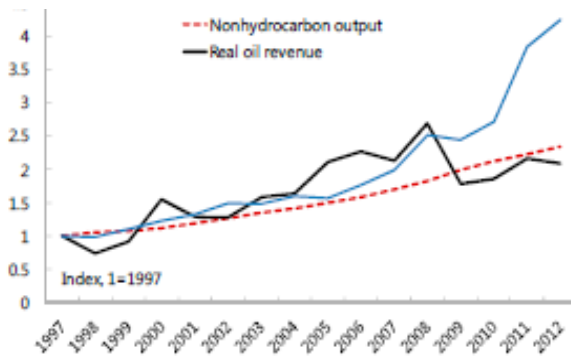
Source: IMF country report, 2013.

The non-hydrocarbon and overall growth follow the growth in real oil revenues. They recorded an improvement over the period 2002-2008 while a decrease in the overall GDP by 0.5% was marked following the decline of oil revenues due to the oil price decrease during the global financial crisis of 2008.

In a recent analysis of the IMF staff about the sources of growth in Algeria[1], it was found that the physical capital and total factor productivity is the main contributor in the hydrocarbon growth performance of the last two decades while the human capital accumulation was the major source for non-hydrocarbon growth in the 2000s as the figures show about the decomposition of the two sectors' growth. Nonetheless, Algerian growth is still under estimates and the average of the other oil exporting countries.

---

[1] International Monetary Fund, Algeria: selected issues paper, country report n°1348, 2013.

Figure19: hydrocarbon growth decomposition   **Figure20:non-hydrocarbon growth decomposition**
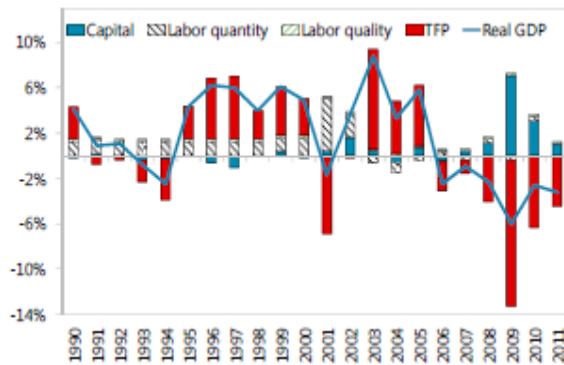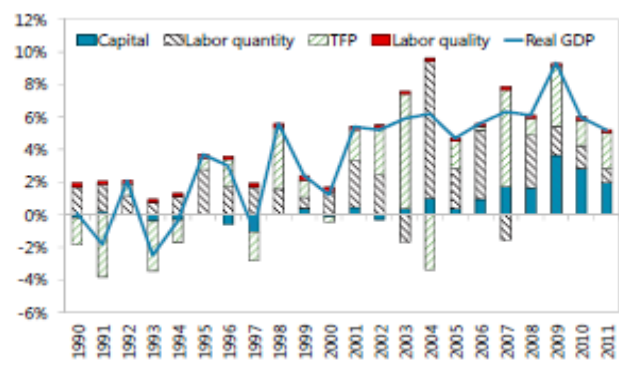
Source: IMF country report, 2013.

The contribution of the human capital in the non-hydrocarbon growth is due to the rapid employment over the recent years (labor quantity) and not to the labor quality which had a marginal contribution. This means that the Algerian government responded to social demands and it had not built strong economic policies based on real economy to boost and diversify the economic growth.

The growth decomposition shows that the problem of the Algerian economic growth is its reliance on oil revenues and the non-diversification of the national economy. Furthermore, the political and institutional channels of the natural resource curse may be a key constraint beyond this non-diversification.

III-1-4- The political and institutional environment:

The political and economic institutional quality is the main factor to lead an oil rich country either to enhance growth and diversify the economy or to keep it under the oil curse trap through the rent-seeking behavior.

In Algeria, the transition to the market economy followed by the civil war of the 1990s which impeded the development path and economic production. The Algerian presidency elections

of 1999 opened the society and the economy to a new era. The government is seeking to achieve the social peace between the fear of the return to the black decade and the conflict of the recent Arab spring; the situation is more stable. Algeria embarked in large and ambitious development programs thanks to the increasing oil windfalls in the last decade and could achieve strong financial and external situation. However, the economy is still dependent to the oil revenues.

As the literature suggested, corruption can hamper economic growth through the private investment. Hausmann (2010)[1] attributed the non-diversification to the business constraints on the private sector which include: corruption, anticompetitive « informal » practices, lack of access to finance, lack of access to land, electricity shortcoming and high taxes. These constraints reflect the institutional framework of the Algerian economy. Indeed, Algerian doing business was ranked 148 in the world in 2011 and 143 in 2012.

Although the legal framework to fight corruption, Algeria is ranked the 106th in the world according to the international transparency organization in which this factor represents the main factor to impede the investment as shown in the figure comparing to other constraints:

---

[1] *Hausmann R.,Klinger B. and Lopéz C. « Export diversification in Algeria »,The World Bank, 2010.*

Figure21: Top business constraints identified in the 2007 investment climate assessment in Algeria.
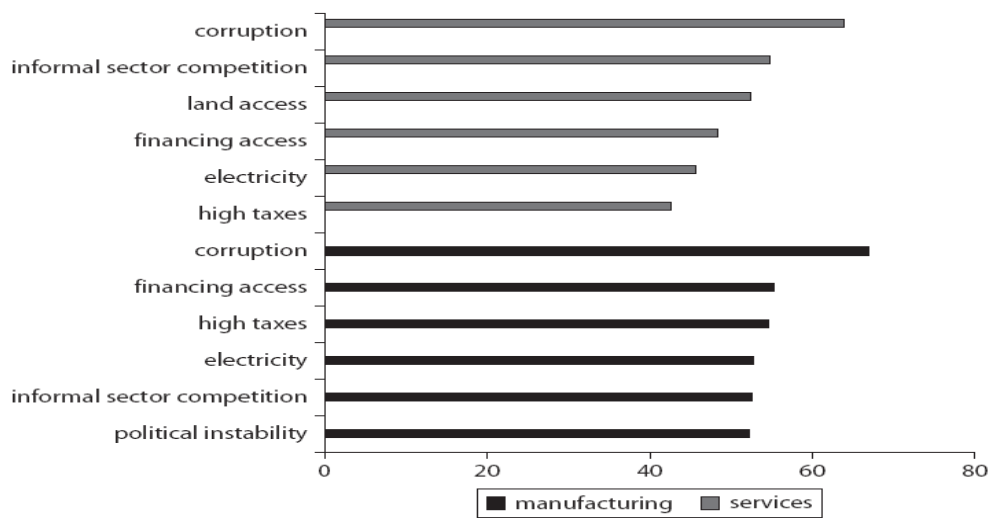
Source : José R. López-Cálix, Peter Walkenhorst, and Ndiamé Diop, « Trade Competitiveness of the Middle East and North Africa Policies for Export Diversification »,2010, p72.

Moreover, the figure below displays the evolution of the six governance measures which change between (-2.5) and (+2.5), the nearest the index to 2.5; the better the governance. Algerian governance indices remain negative over all the period (2000-2012) and no improvement is recorded except the political situation which has been more stable, however, the index is still negative.

Figure22: governance measures in Algeria
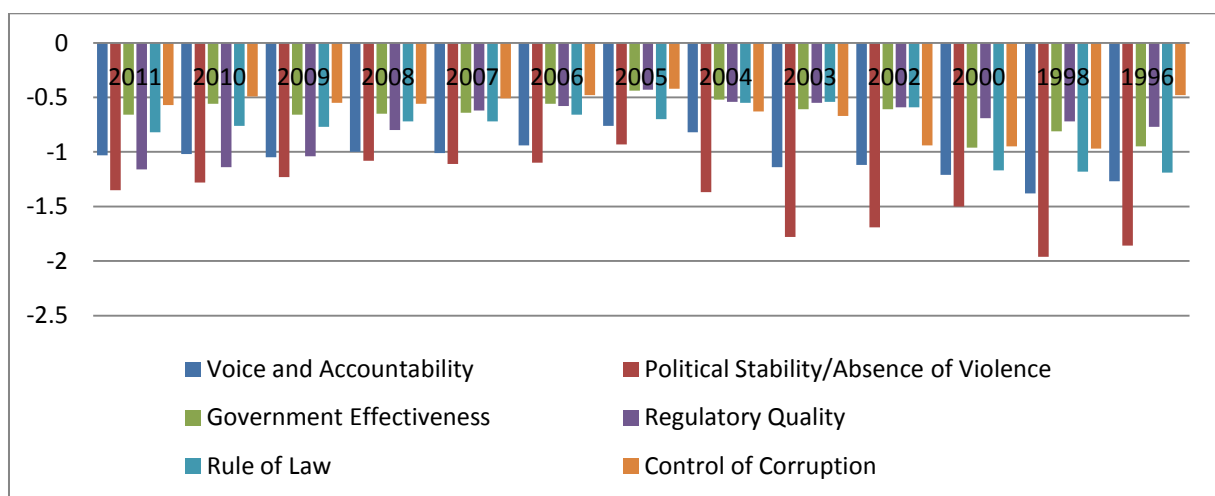
Source: world governance indicators database.

Khelif Amor (2013)[1] also confirmed that the institutional performance does matter in Algeria and it is the cause of the failure to achieve coherence among economic sectors. The oil economics expert found that the contribution of the oil sector in the total GDP and exports remains high and dangerous due to the oil policies adopted where this sector works for itself. Indeed, Algeria predicts 80 billion U.S. $ to be invested in the oil sector against 30 billion in the industrial and agricultural sectors; according to Pr.Amor.

All these indicators do not stimulate the private investment either national or foreign direct investment which in turn will impede economic growth and do not allow for a good management of oil revenues.

III-2- Data and Methodology:

III-2-1- Description of the data:

To empirically test the association between oil price volatility and economic growth in Algeria, annual data covering the period 1995-2011 are used for the following variables: real GDP per capita growth rate, oil price volatility, general government total expenditure share of GDP, domestic credit provided by banking sector in percent of GDP, Concentration index and the share of oil rents of GDP.

Oil price volatility (pricevolatility):

In order to estimate the volatility of oil prices we have two methods; either to estimate the conditional standard deviation using the generalized autoregressive conditional heteroscedasticity model GARCH (1, 1) or to calculate the annual standard deviation for monthly series. (For more details about the GARCH (1,1) estimation see Appendix 3).

---

[1] Khelif Amor, "La politique pétroliére est un scandale plus grand que l'affaire de Chakib Khelil », Article écrit par Bouziane Aissa, Magazine éléctronique « Le maghreb emergent », 02 Mars 2013, http://www.maghrebemergent.info/ .

In this study, we have used the second method of calculating the oil price volatility instead of estimating the conditional variance of the annual data using the model GARCH (1, 1) because of the non-significant results of this model and the absence of heteroscedasticity in the series which means its inadequacy.

The volatility is measured by the annual standard deviation of monthly changes (calculated by the logarithm) in international oil prices (Monthly data for the crude oil price are taken from the United Nations Conference on Trade and Development (UNCTAD) database.) using the following formulation (Cavalcanti et al. (2012),Arezki and Gylfason (2011)):

$$\sigma = \sqrt{\frac{1}{12}\sum_{1}^{12}(x_i - \mu)^2}$$

Whith:

σ: the annual standard deviation;

x_i: the logarithm of monthly oil price;

μ : the mean of twelve observations;

12 is the number of observations, in this case it reflects the number of months in a year.

General government total expenditure (govexp):

Total expenditure consists of total expense and the net acquisition of nonfinancial assets; and it is a measure to show the effect of fiscal policy. The data for this variable are expressed in percent of GDP and are taken from the World Economic Outlook database for the International Monetary Fund.

Domestic credit provided by banking sector (credit):

This variable is used to test the effect of financial development, it has been used before by Arezki and Gylfason(2011) and Vand der ploeg and Poalhekke (2008). The data are expressed as percent of GDP and are brought from the World Bank data base.

Concentration index (diversification):

This index measures the degree of market concentration and it is used to show the effect of economic diversification. It is also called the Herfindahl-Hirschman index; it varies between 0 and 1 values. The nearest the index to 1, the more concentrated the market and vise versa.

Herfindahl and Hirschman constructed this index from the following equation:

$$H_{ij} = \frac{\sqrt{\sum_{j=1}^{n}\left(\frac{x_{ij}}{X_i}\right)^2} - \sqrt{\frac{1}{n}}}{1 - \sqrt{\frac{1}{n}}}$$

x_{ij} : Exports value for country j and product i

$X_i = \sum_{j=1}^{n} x_{ij}$

n : Maximum number of countries.

The data for this index are taken from the UNCTAD database. The index has been used by many authors to show the role of economic diversification in economic growth (Hesse (2008); (Arezki and Gylfason(2011)…).

Oil rents:

The variable measures the dependence of Algerian economy on oil rents and is calculated by the share of oil rents in total GDP. The data are brought from the World Bank data base.

RGDP growth rate(y):

The variable is calculated by the annual growth rate of the real gross domestic product per capita at constant 2000 U.S. $. The data are taken from the World Bank database.

III-2-2- Methodology:

The model of the study examines the effect of oil price volatility on economic growth over the period 1995-2011 and shows the role of fiscal policy, economic diversification and financial development as suggested theoretically; it further tests the impact of oil dependence for comparing between the existence of volatility curse and dependence curse in the Algerian economy. To do so, 6 multiple linear regression models have been estimated using the Ordinary Least Squares method estimator.

a- An overview of the OLS estimation method:

The method of ordinary least squares is attributed to Carl Friedrich Gauss, a German mathematician. Under certain assumptions, the method of least squares has some very attractive statistical properties that have made it one of the most powerful and popular methods of regression analysis[1]:

$$Y_i = \hat{\beta}_1 + \hat{\beta}_2 X_{2i} + \hat{\beta}_3 X_{3i} + \dots \hat{\beta}_i X_i + \mu_i$$

The OLS procedure consists in so choosing the values of the unknown parameters that the residual sum of squares (RSS) $\sum_{i=1}^{n} \mu_i^2$ is as small as possible.

This method needs different assumptions and conditions in the regression equation to be estimated:[2]

Zero mean value of disturbance u_i. Given the value of X, the mean, or expected, value of the random disturbance term u_i is zero. Technically, the conditional mean value of u_i is zero;

Homoscedasticity or equal variance of u_i. Given the value of X, the variance of u_i is the same for all observations. That is, the conditional variances of u_i are identical;

---

[1] Gujarati N., « Basic econometrics », The fourth edition, 2004, P58.
[2] Gujarati N., « Basic econometrics », ibid.

No autocorrelation between the disturbances. Given any two X values, Xi and Xj, the correlation between any two ui and uj ($i \neq j$) is zero. Symbolically,

cov $(ui, uj \,|Xi, Xj) = E\{[ui - E(ui)] \,|\, Xi\,\}\{[uj - E(uj)] \,|\, Xj\,\}$

$= E(ui \,|Xi)(uj \,|\, Xj)$

$= 0$

The number of observations n must be greater than the number of parameters to be estimated;

There is no perfect multicollinearity. That is, there are *no perfect linear relationships among the explanatory variables;*

The regression model is correctly specified. Alternatively, there is no **specification bias or error** in the model used in empirical analysis;

Zero covariance between ui and Xi, or $E(uiXi) = 0$. Formally,

cov $(ui, Xi) = E[ui - E(ui)][Xi - E(Xi)]$

$= E[ui\,(Xi - E(Xi))]$ since $E(ui) = 0$

$= E(uiXi) - E(Xi)E(ui)$ since $E(Xi)$ is nonstochastic

$= E(uiXi)$ since $E(ui) = 0$

$= 0$

b- Methodology used in the study:

To get the objective of the econometric study, we have followed these different steps:

1/ Testing the stationarity of the series for the different variables used in the model using the Augmented Dikey-Fuller (ADF) and Phillippe-Perron (PP) unit roots tests:

If the t-statitics < critical value at 5% , we reject the null hypothesis and the series has not a unit root, it is stationary[1];

---

[1] Agung I.G.N., « Time series data analysis using Eviews », Statistics in Practice, Wiley and Sons edition, 2009, P447.

2/Estimating the 6 regression models using OLS method calculated in the software EVIEWS 6 program, taking into consideration all the method assumptions explained above. The equations estimated are:

Model 1: $y_t = \beta_1 + \beta_2 y_{t-1} + \beta_3 (pricevolatility)_t + \mu_t$

Model 2: $y_t = \beta_1 + \beta_2 y_{t-1} + \beta_3 (pricevolatility)_t + \beta_4 X_t + \mu_t$

Model 3: $y_t = \beta_1 + \beta_2 y_{t-1} + \beta_3 (pricevolatility)_t + \beta_4 (govexp)_t + \mu_t$

Model 4: $y_t = \beta_1 + \beta_2 y_{t-1} + \beta_3 (pricevolatility)_t + \beta_4 (diversification)_t + \beta_5 credit_t \mu_t$

Model 5: $y_t = \beta_1 + \beta_2 y_{t-1} + \beta_3 (oilrent)_t + \mu_t$

Model 6: $y_t = \beta_1 + \beta_2 y_{t-1} + \beta_3 (oilrent)_t + \beta_4 X_t + \mu_t$

$\beta_1, \beta_2, \beta_3, \beta_4$, and β_5 are the parameters to be estimated;

X_t: a vector of other explanatory variables including: diversification, credit and govexp;

y_{t-1}: is the lagged value of the real GDP per capita growth rate (*y*).

III-3- The empirical results:

The time series analysis for the six variables used indicated the non-stationarity of the series in the level under the ADF and PP unit roots tests, while the 1st differenced are stationary which allows us to use these series in the estimation. The results for these two tests are summarized in the Appendix 1 where the t-statistics and critical values show the sationarity of the 1st differenced series for all the variables at the 5% level.

The graph below displays the relationship between the oil price volatility and economic growth in Algeria and shows clearly that the growth is negatively associated with the oil price volatility during the period of the study (1995-2011):

Figure23: growth and volatility in Algeria 1995-2011
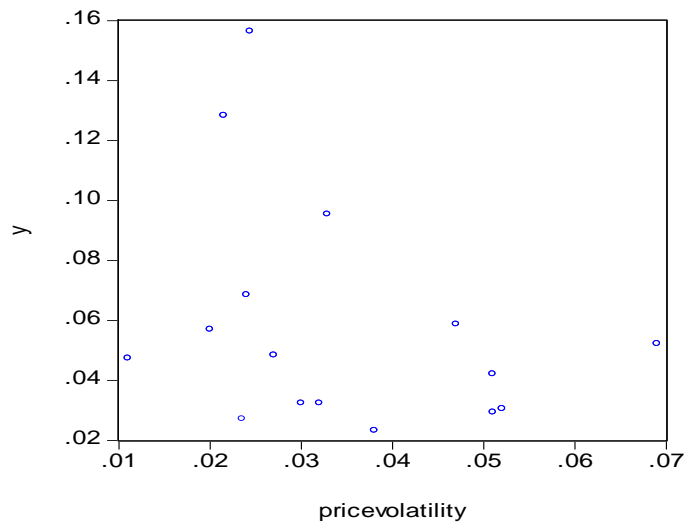
Source: student's construction using Eviews 6 program.

The serial correlation LM and the Breusch-Pogan-Godfrey tests show neither serial correlation nor heteroscedasticity in the residual terms of all the equations (Chi-squared probability > 0.05 (5%) ➔ we reject the null hypothesis), Appendix2. No perfect multicolinearity is shown among the explanatory variables, which means that the OLS method is appropriate in the estimation of our model.

The following table summarizes the estimation results for the 6 regression models mentioned above:

Table5 : Summary of growth regressions with OLS estimations (dependent variable: real GDP growth rate (y))

Independent variables (explanatory)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lagged(y) y_{t-1}	-0.39 (1.58)	-0.38 (-2.26)*	-0.37 (2.08)*	-0.43 (1.94)*	-0.49 (2.14)**	-0.37 (1.59)
Price volatility	-0.08 (0.89)	-0.17 (2.53)**	-0.19 (2.46)**	-0.09 (1.12)		
Govexp		0.32 (2.78)**	0.39 (3.23)***			0.17 (0.99)
Diversification		0.22 (1.62)		0.22 (1.25)		0.24 (1.32)
Credit		0.08 (1.69)		0.13 (2.26)**		0.08 (1.13)
Oil rent					-0.25 (1.88)**	-0.05 (0.23)
The constant	0.866 (0.17)	0.0002 (0.05)	0.001 (-0.50)	0.0039 (0.87)	0.002 (0.49)	0.001 (0.34)
R-squared	21%	75%	61%	52%	36%	56%
Adjusted R-squared	7%	60%	50%	31%	25%	30%
F-statistic	1.54	5.04**	5.4**	2.49	3.18*	2.11

*Values in parenthesis are the absolute values of the t-statistics. *, **, *** indicate significance at 10%, 5% and 1% respectively.*

Source: student's calculations using EVIEWS 6 program.

The results for the model 1 shows that the real GDP growth is negatively but non-significantly affected by its lagged value and oil price volatility which confirms the results of Arezki and Gylfason (2011) about the effect of commodity price volatility on economic growth of a set of authocratic resource rich countries. Model 2 shows statistical negative and significant impact of oil price volatility after controlling for government expenditure, concentration index and financial development(credit); the coefficient for the government spending indicates that economic growth responses positively and significantly with about 0.32 point to the changes in this variable over the period of the study; while the coefficients of economic diversification and credit are statistically positive but non-significant which indicates that the oil price volatility affected negatively and indirectly the economic growth through the fiscal policy measured by government expenditure and not because of the lack of

diversification or of the financial underdevelopment. The R-squared and adjusted R-squared are significantly high which means that this model is good and explains 60% of the relations.

In order to confirm the results of model 2, the models 3and 4 control separately for the effects of government expenditure, diversification and credit. Results for model 3 approve the negative indirect effect of oil price volatility via government expenditure where the t-statistics are significant and the net indirect effect of volatility through expenditure can be calculated: (-0.19)*(0.39) = (-0.0741). Model 4 confirms the previous result; the negative oil price volatility effect becomes insignificant after excluding the variable of government expenditure. A positive and significant impact of credit is shown where an increase with 1 point in credit leads to an increase with 0.13 in economic growth which means that over the period 1995-2011 the financial development enhanced economic growth but it has not contributed in reducing the oil price volatility effect. The coefficient of diversification is still positively insignificant. The non-significant F-statistic of model 4 also confirms the goodness of model 3 and its significant results. The first four models reflect the existence of the oil volatility curse but indirectly via the government expenditure.

For comparison with the traditional oil curse hypothesis, models 5 and 6 control for the share of oil rents in GDP instead of the oil price volatility. The results of model 5 shows obviously a positive and significant direct effect of oil rents on economic growth where an increase in oil rent with one point leads to a decrease with a quarter in economic growth. Meanwhile, the adjusted R-squared indicates that the variables used contribute with only 25% in the explication of the model, then the F-statistic is not highly significant (significant at 10%) which suggest the existence of other explanatory variables; not included in this model because of the non available and incomplete data for Algeria; that can explain the negative impact of oil rent on the Algerian economic growth such as: corruption, governance effectiveness…Model 6 includes the three variables used before in model2 and shows no

significance for the results. Oil rents and lagged economic growth affect negatively but non-significantly the economic growth. Government expenditure, diversification and credit have positive effects but statistically insignificant in this model; that shows no contribution of any variable among them in the negative association between oil rents and economic growth. The results for models 5 and 6 reflects the existence of a curse of oil dependence where the effect is direct while it can be indirect and explained by other excluded variables.

Chapter conclusion:

This part has tested empirically the impact of the oil price volatility on the economic growth in Algeria and examined the role of fiscal policy; economic diversification and financial development in reducing or explaining the effect of price volatility. The study also tested the impact of oil rents share in GDP on the economic growth. Six regressions have been estimated using OLS method over the period 1995-2011. The insignificant results of the GARCH(1,1) for the oil price series used in the study allowed us to calculate the volatility using the annual standard deviation

The results showed that the high volatility existing in the international oil market affects negatively the Algerian economic growth through the government spending which confirms the evidence of oil curse and fiscal policy pro-cyclicality via price volatility over the period 1995-2011. The financial sector has no longer contributed in reducing the oil price volatility negative effect. The Algerian economic growth is also affected negatively and directly but not highly significantly by the oil dependence measured by the share of oil rent in GDP; this shows the evidence of the traditional resource curse hypothesis in Algeria but no one of the explanatory variables used in our model contribute to this negative relationship.

This dissertation sought to determine the impact of oil price volatility on the economic growth in Algeria showing the evidence of the natural resource curse puzzle in the Algerian economy during the period 2000-2011 where the government has adopted new reforms to well manage its oil revenues and benefit from the recent international oil boom.

To achieve the objective above, the study based on both theoretical and empirical frameworks. The former focusing on the different explanations of the resource curse thesis which suggests a negative association between natural resource endowment and economic growth through the Dutch Disease; pro-cyclicality of fiscal policy and price volatility and institutional quality.

The empirical framework provided by a set of studies suggests that the natural resource curse does exist. Some of them argue a direct negative impact of resource abundance on growth while others find the resource curse thesis conditional with the existence of different factors that make the difference between successful and failed countries, these factors are: good institutions and governance; good human capital formation; sound fiscal management; opened and competitive markets.

In contrast to the previous arguments, many recent studies explain the natural resource curse by the high volatility of the different commodities instead of the abundance per se. Meanwhile, they are agreed with the works supporting the abundance curse about the conditional factors through which natural resources may hamper growth.

The Algerian economy as one of the most important producers of oil is not immune to the existence of oil curse. The policies and reforms adopted in Algeria since the year 2000 under the management of oil windfalls were not sufficient to escape the national economy from the oil dependence; and the institutional environment is the key constraint against the success.

Conclusion and recommendations

The empirical contribution of this work, using the OLS estimation method for 6 growth regressions, has reached the following results:

- The high volatility existing in the international oil market affects negatively the Algerian economic growth through the government spending which confirms the evidence of oil curse and fiscal policy pro-cyclicality via price volatility over the period 1995-2011. Consequently, the fiscal policy applied using the oil stabilization fund and the referential oil price have not been enough to escape the curse; this may be attributed first to the kind of the oil fund used which is stabilization rather than saving; and second to the quality of government expenditure which has focused in this period on current spending by the wage increases and capital non-productive spending by the development programs embarked following the oil boom;

- The financial sector has no longer contributed in reducing the oil price volatility negative effect; this is due to the quality of credits provided by the Algerian banking sector and also the use of these credits. Indeed, less contribution of the Algerian banks in financing the productive private investment;

- The Algerian economic growth is also affected negatively and directly but not highly significantly by the oil dependence measured by the share of oil rent in GDP; this shows the evidence of the traditional resource curse hypothesis in Algeria but no one of the explanatory variables used in our model contribute to this negative relationship.

Recommendations and research perspectives:

In the light of the above concluding remarks we extend the following recommendations:

- ✓ The oil stabilization fund has contributed to accumulate large amount of reserves and to build sound financial external position by paying all the external debts accumulated in the 1980s and 1990s. However, this fund will have no contribution for the future

generation development since it focuses on the stabilization principle rather than the permanent income and its accumulation does not go to any productive project;

✓ Algeria should apply sounder fiscal policy to reduce the negative impact of oil volatility on the economic growth by improving the quality of budget management;

✓ The low contribution of the credit provided by the banking sector can be attributed to the Islamic principles of the Algerian people that prohibit them to get traditional credits based on interest "Riba"; this point should be taken into consideration by the Algerian authorities so as they give more opportunities to the private sector to access to finance through Islamic principles;

✓ Algeria should improve the institutional environment to boost the investment and then escape the economy from the oil dependence and enhance economic growth. This could be achieved by more surveillance on the projects; more transparency and good governance.

━━━━━━━━━━ References ━━━━━━━━━━

1. *Acemoglu D. (2003) "A historical approach to assessing the role of institutions in economic development, root causes", International Monetary Fund.*

2. *Agung I.G.N. (2009) "Time series data analysis using Eviews", Statistics in Practice, Wiley and Sons edition.*

3. *Akinwale Y.O. (2012) "Empirical analysis of the resource curse in Nigeria", International Journal of Economics and Management Science, Vol.1 N6.*

4. *Alichi A. and Arezki R. (2009) "An alternative explanation for the resource curse: the income effect channel", IMF working paper.*

5. *Alicia N. Rambaldi, Greg Hall, Richard P.C Brown. (2006) "Re-testing the Resource Curse Hypothesis Using Panel Data and an Improved Measure of Resource Intensity", University of Queensland, Australia.*

6. *Arezki R. and Gylfason T. (2011) "Commodity price volatility, democracy and economic growth", CESifo working paper n°3619.*

7. *Arezki R. and Nabli M.K. (2012) " Natural resources, volatility and inclusive growth: perspective from the middle east and North Africa", IMF working paper.*

8. *Arezki R. and Van der Ploeg F. (2007) "Can the natural resource curse turn into a blessing? Role of trade policies and institutions.", IMF working paper.*

9. *Arezki R. (2012) "Fiscal policy in commodity exporting countries, stability and growth", Arezki R. and Gylfason T. "Beyond the curse", International Monetary Fund book, January 2012.*

10. *Auty R. (2008), " Rent, Ethnicity, Ideology and Political Incentives: Explaining Rent Cycling in Algeria, Nigeria and Indonesia", Paper prepared for the Centre for the Study of African Economies 2008 Conference on Economic Development in Africa, St Catherine's College Oxford, 16-18 March 2008.*

11. *Auty R. (1993) "Sustaining development in mineral economies: the natural resource curse thesis", Taylor and Francis group, New York.*

12. *Bacon R. and Tordo S. (2006) " Experiences with oil funds : institutional and financial aspect", World Bank report, June 2006.*

13. *Bleany M. and Halland H. (2009), "The resource curse and fiscal policy volatility", CREDIT research paper No. 09/09.*

14. *Bollerslev, Tim. (1987) "A Conditionally Heteroskedastic Time Series Model for Speculative Prices and Rates of Return", The Review of Economics and Statistics, Vol. 69, No. 3, Aug, 1987.*

References

15. *Cashin, Mohaddes, Raissi, and Mehdi Raissi. (2013) "The Differential Effects of Oil Demand and Supply Shocks on the Global Economy", IMF.*

16. *Chekkouri, Benbouziand and Chibi. (2013) "the Dutch Disease in Algeria", Economic Research Forum, 19th annual conference on economic development under the rise of islamist parties, Kuwait.*

17. *Chuku, Effiong and Ndifreke. (2010) "Oil price distortions and their short- and long-run impacts on the Nigerian economy, MPRA Paper No. 24434, August 2010.*

18. *Collier P. and Goderis B. (2007) "Commodity prices, growth and natural resource curse: reconciling a conundrum", Centre for the Studies of African Economies working papers (CSAE wps), August 2007.*

19. *Cordon M. (1984) "Booming sector and Dutch disease economics: survey and consolidation", Oxford economic paper, New series, Vol36, November 1984.*

20. *Edwards S. (1985) "Commodity export boom and the real exchange rate : the money-inflation link", National Bureau of Economic Research, Cambridge.*

21. *Elbadawi I. and Soto R. (2012) " Resource rents, political institutions and economic growth", Economic research forum paper.*

22. *Gaterly and Hunington. (2001) "The Asymmetric Effects of Changes in Price and Income on Energy and Oil Demand".*

23. *Gelb A.(1988) "Oil windfalls, blessing or curse", World Bank Research publication.*

24. *Gelb A.(2012) " Economic diversification in resource rich countries", Arezki R. and Gylfason T. "Beyond the curse", International Monetary Fund book, January 2012.*

25. *Gregory R.G.(1976) " Some implication of the growth mineral sector", The Australian journal of agricultural economics, Vol20, August 1976.*

26. *Gujarati N. (2004) "Basic econometrics", The fourth edition.*

27. *Gylfason T. and Zoega G.(2002) "Inequality and economic growth : do natural resources matter ?", CESifo working paper N° 712, April 2002.*

28. *Gylfason T.(2011) " Natural resource endowment : a mixed blessing", CESifo papers.*

29. *Hamilton J.(2009) "causes and consequences of oil shock of 2007-08", Brooking papers on economic activity, University of California.*

30. *Hausmann R.,Klinger B. and Lopéz C.(2010) " Export diversification in Algeria", José R. López-Cálix, Peter Walkenhorst, and Ndiamé Diop, "Trade Competitiveness of the Middle East and North Africa Policies for Export Diversification", Chapter 4, The World Bank.*

31. *International monetary fund. (2007) "The role of fiscal institutions in managing the oil revenue boom", IMF working paper, March 2007.*

References

32. *International Monetary Fund. (2012) Algeria selected issues, country report: Algeria, cr1220.*

33. *International Monetary Fund. (2013) Algeria: selected issues paper, country report n°1348.*

34. *International monetary fund. (2013) Algeria selected issues, country report N°1347, IMF.*

35. *International monetary fund. (2010) Algeria selected issues, Country report n° 1057, IMF.*

36. *Kaminsky G, Reinhart and Végh. (2005) " When it rains, it poors", National Bureau of Economic Research, april 2005.*

37. *Kareem Ismail. (2010) "The structural manifestation of the Dutch disease: the case of oil exporting countries", IMF working paper n° 10/103.*

38. *Khelif Amor. (2013) "La politique pétroliére est un scandale plus grand que l'affaire de Chakib Khelil », Article écrit par Bouziane Aissa, Magazine éléctronique « Le maghreb emergent », 02 Mars 2013, http://www.maghrebemergent.info/ .*

39. *Khelil Chakib. (2006) " Coping with challenges : an Algerian perspective", African oil and gas forum, Maryland, November 2006.*

40. *Leong and Mohaddes. (2012) "Institutions and the volatility curse", University of Cambridge.*

41. *Lynch M. (2003) "Causes of oil price volatility", Journal f energy and development.*

42. *Mahmud A.S. and Abdul Basher S. (2013) "Price volatility and the political economy of resource rich nations", Qatar Central Bank, April 2013.*

43. *Mauro P. (1995) "Growth and corruption", The quarterly journal of economics, Vol. 110, No 03, Aug.1995.*

44. *Mitchel J., Stevene P. and Cossinadri E. (2008) "Resource depletion, dependence and development: Algeria", Chatham house, working paper, November 2008, United Kingdom.*

45. *Murphy K., Shleifer A. and Vishny R. (1993) "Why is rent-seeking so costly", The American economic review, Vol. 83, N02, May 1993.*

46. *Papageorgio and Spatafora. (2012) "Economic Diversification in LICs: Stylized Facts and Macroeconomic Implications", International Monetary Fund.*

47. *Papyrakis E. and Gerlah R. (2004) "The resource curse hypothesis and its transmission channels", Journal of comparative economics, 32 (2004) 181–193.*

48. *Ramey and Ramey. (1995) " Cross-Country Evidence on the Link Between Volatility and Growth", The American Economic Review, Vol. 85, No. 5 (Dec., 1995).*

49. *Robert Engle. (2001) "GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics", Journal of Economic Perspectives—Volume 15, Number 4.*

50. *Robert F. Engle. (1983) "Estimates of the Variance of U. S. Inflation Based upon the ARCH Model", Journal of Money, Credit and Banking, Vol. 15, No. 3, Aug. 1983.*

References

51. Ross M., " The political economy of the resource curse", World Politics, January 1999.

52. Rudd David . (1996) "An empirical analysis of the Dutch Disease : developing and developed countries".

53. Sachs J. and Warner A.(1995)"Natural resource abundance and economic growth", National Bureau of Economic Research, Cambridge.

54. Samimi J., Sadighi S. and Sadeghi S. (2011) "The impact of the terms of trade volatility on economic growth: evidence from oil exporting countries", International Journal of Economics and Management Engineering, N°1, Nov.2011.

55. Schaechter, Kinda, Bundima and Weber. (2012) "Fiscal rules in response to the crisis-toward the next generation rules, a new dataset", IMF, July 2012.

56. SMITH A. (1776) " An inquiry into the nature and causes of the wealth of nations".

57. Sturm M., Gurtner F. and Alegre J.G. (2009) " Fiscal policy challenges in oil exporting countries; a review of key issues", European Central Bank, occasional paper series, June 2009.

58. Suliman K.M. (2012) "Understanding and avoiding the oil curse in Sudan", Economic Research Forum working paper 735, December 2012.

59. Tiago, Cavalcanti, Mohaddes and Raissi, (2011) "Commodity prices volatility and the sources of growth", IMF working paper.

60. Van der ploag F., Poelhekke S. (2008) "Volatility and natural resource curse", university of Oxford.

61. World Bank report. (2007) " Assuring high quality public investment, Algeria", Public expenditure review, Volume I.

62. www.imf.org

63. www.transparency.org

64. www.unctadstat.unctad.org

65. www.worldbank.org

Appendices

Appendix 1: Unit root tests

Augmented Dickey-Fuller test

	Level					
	Intercept		Trend and intercept		None	
	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%
RGDP growth rate (y)	-2.79 (0.0819)	-3.08	-2.71 (0.24)	-3.75	-1.65 (0.092)	-1.96
Price volatility	-3.07 (0.051)	-3.08	-2.93 (0.17)	-3.73	-1.40 (0.14)	-1.96
Government expenditure	-0.97 (0.73)	-3.06	-2.93 (0.17)	-3.73	0.75 (0.86)	-1.96
Diversification	-2.22 (0.20)	-3.08	-3.27 (0.11)	-3.82	0.02 (0.67)	-1.96
Credit	-0.67 (0.82)	-3.06	-1.82 (0.64)	-3.73	-1.70 (0.08)	-1.96
Oil rents	-1.26 (0.61)	-3.06	-1.82 (0.64)	-3.73	0.3 (0.76)	-1.96

	1st difference						
	Intercept		Trend and intercept		None		
	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%	Result
RGDP growth rate (y)	-5.61 (0.0006)	-3.09	-3.18 (0.13)	-3.93	-5.83 (0.00)	-1.96	I(1)
Price volatility	-4.54 (0.003)	-3.08	-4.45 (0.015)	-3.75	-4.71 (0.0001)	-1.96	I(1)
Government expenditure	-3.77 (0.01)	-3.08	-3.67 (0.057)	-3.75	-3.67 (0.0012)	-1.96	I(1)
Diversification	-4.82 (0.002)	-3.08	-2.96 (0.18)	-3.75	-4.87 (0.0001)	-1.96	I(1)
Credit	-3.70 (0.01)	-3.08	-3.56 (0.06)	-3.75	-3.36 (0.0024)	-1.96	I(1)
Oil rents	-3.76 (0.01)	-3.08	-3.61 (0.06)	-3.75	-3.77 (0.001)	-1.96	I(1)

Phillippe-Perron test

	Level						
	Intercept		Trend and intercept		None		
	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%	
RGDP growth rate (y)	-2.81 (0.08)	-3.08	-2.71 (0.24)	-3.75	-1.65 (0.09)	-1.96	
Price volatility	-3.21 (0.03)	-3.06	-2.75 (0.22)	-3.73	-1.29 (0.17)	-1.96	
Government expenditure	-0.97 (0.73)	-3.06	-1.95 (0.57)	-3.73	1.04 (0.91)	-1.96	
Diversification	-1.44 (0.53)	-3.06	-1.81 (0.65)	-3.73	0.02 (0.67)	-1.96	
Credit	-0.67 (0.82)	-3.06	-1.82 (0.64)	-3.73	-1.67 (0.08)	-1.96	
Oil rents	-1.23 (0.63)	-3.06	-1.82 (0.64)	-3.73	0.41 (0.79)	-1.96	
	1st difference						
	Intercept		Trend and intercept		None		
	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%	t-statistic	Critical value at 5%	Result
RGDP growth rate (y)	-5.53 (0.0007)	-3.09	-6.14 (0.0013)	-3.79	-5.75 (0.00)	-1.96	I(1)
Price volatility	-7.38 (0.00)	-3.08	-8.14 (0.0001)	-3.75	-7.84 (0.00)	-1.96	I(1)
Government expenditure	-3.77 (0.01)	-3.08	-3.73 (0.057)	-3.75	-3.67 (0.0012)	-1.96	I(1)
Diversification	-4.55 (0.003)	-3.08	-5.16 (0.004)	-3.75	-4.61 (0.002)	-1.96	I(1)
Credit	-3.70 (0.01)	-3.08	-3.56 (0.06)	-3.75	-3.36 (0.0024)	-1.96	I(1)
Oil rents	-3.76 (0.01)	-3.08	-3.61 (0.06)	-3.75	-3.77 (0.001)	-1.96	I(1)

Appendix 2: Residual tests

Serial correlation (LM test)

Model 1

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.458270	Prob. F(2,9)	0.1407
Obs*R-squared	4.946026	Prob. Chi-Square(2)	0.0843

Model 2

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.044796	Prob. F(2,6)	0.9565
Obs*R-squared	0.205971	Prob. Chi-Square(2)	0.9021

Model 3

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.354085	Prob. F(2,8)	0.7123
Obs*R-squared	1.138514	Prob. Chi-Square(2)	0.5659

Model 4

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.903234	Prob. F(2,7)	0.2188
Obs*R-squared	4.931358	Prob. Chi-Square(2)	0.0850

Model 5

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.819954	Prob. F(2,9)	0.4708
Obs*R-squared	2.157791	Prob. Chi-Square(2)	0.3400

Model 6

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.364794	Prob. F(2,6)	0.7087
Obs*R-squared	1.517809	Prob. Chi-Square(2)	0.4682

Heteroscedasticity (Breusch-Pagan-Godfrey test)

Model1:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.004242	Prob. F(2,11)	0.9958
Obs*R-squared	0.010790	Prob. Chi-Square(2)	0.9946
Scaled explained SS	0.005705	Prob. Chi-Square(2)	0.9972

Model2:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.219719	Prob. F(5,8)	0.1512
Obs*R-squared	8.135695	Prob. Chi-Square(5)	0.1489
Scaled explained SS	0.654820	Prob. Chi-Square(5)	0.9854

Model3:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	3.126430	Prob. F(3,10)	0.0746
Obs*R-squared	6.775793	Prob. Chi-Square(3)	0.0794
Scaled explained SS	2.069837	Prob. Chi-Square(3)	0.5580

Model4:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.245029	Prob. F(4,9)	0.3587
Obs*R-squared	4.987198	Prob. Chi-Square(4)	0.2886
Scaled explained SS	0.508068	Prob. Chi-Square(4)	0.9727

Model5:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.110879	Prob. F(2,11)	0.8960
Obs*R-squared	0.276659	Prob. Chi-Square(2)	0.8708
Scaled explained SS	0.170224	Prob. Chi-Square(2)	0.9184

Model 6:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.788644	Prob. F(5,8)	0.5860
Obs*R-squared	4.622293	Prob. Chi-Square(5)	0.4637
Scaled explained SS	0.717025	Prob. Chi-Square(5)	0.9820

Appendix 3: ARCH and GARCH models and volatility estimation:

Instead of concerning the phenomenon of heteroscedasticity as a problem to be corrected, Robert Engle (1982) suggested a model in which this problem is a variance to be modelled. The model suggested by Engle is: ARCH (Autoregressive conditional heteroscedasticity) model ,is used to model and forecast variance of the error terms.
An ARCH model is defined as follow (Engle 1982) :

$$Y_t / \Psi_{t-1} \sim N(x_t \beta, h_t)$$

$$h_t = h(\varepsilon_{t-1}, \varepsilon_{t-2}, \ldots, \varepsilon_{t-p}, \alpha)$$

$$\varepsilon_t = Y_t - x_t \beta$$

Whith :

Ψ_{t-1} *: a set of information available at (t-1)*

β *: a vector of unknown parameters*

h_t *:the conditional variance of the error term*

ε_t *: error term*

α *: an unknown parameters*

p: the order of the ARCH process.

In order to simplify, the model can be defined:

$$\sigma_t{}^2 = \alpha_0 + \sum_{1}^{p} \alpha_i \varepsilon^2{}_{t-i}$$

Where: ht = σ^2.

In 1986, Bollerslev developed a generalized ARCH (GARCH) model which can be defined in the equation below:

$$\sigma_t{}^2 = \alpha_0 + \sum_{1}^{p} \alpha_i \varepsilon^2{}_{t-i} + \sum_{1}^{q} \beta_j \sigma_{t-j}^2$$

This equation means that the conditional variance depends not only on the squared lagged error terms but also on the variance itself.

As GARCH is the model to estimate and forecast the volatility of financial assets, the series of volatility represents the conditional standard deviation which can be extracted from the simple GARCH (1, 1) using the equation:

$$\sigma_t{}^2 = \alpha_0 + \alpha_1 \varepsilon^2{}_{t-1} + \beta_1 \sigma_{t-1}^2$$

The volatility is calculated as the square root of the conditional variance $\sigma_t{}^2$.

Abstract (English)

One of the astonishing phenomena in the economic growth is that economies which have a large influx of revenues from natural resources perform worse than countries poor in such resources. The Algerian economy faces the same case with its oil windfalls. This dissertation seeks to examine the impact of oil price volatility on the Algerian economic growth under the so-called "natural resource curse" thesis. It explores the theoretical framework and the empirical observations dealing with the different resource curse explanations either economic or institutional. In particular, the research focuses on the oil price volatility as the most important issue which may affect growth in oil exporting economies. Furthermore, it provides some solutions regarding the fiscal policy; economic diversification and financial development that could mitigate this impact.

The dissertation shows econometrically using OLS regressions over the period 1995-2011 that the oil price volatility affects negatively the Algerian economic growth but indirectly through the government expenditure confirming the theory of pro-cyclical fiscal policy. It also shows the direct negative impact of oil abundance on economic growth. Thus, the study comes to the conclusion that the oil curse does exist in Algeria through both volatility and abundance. The results assert the failure of economic policies adopted by the Algerian government in the last decade to reduce the oil price volatility effect and diversify the economy then escaping the oil curse. The research finally suggests that although the fiscal reforms implemented, sounder fiscal policy is still needed to improve the situation of the Algerian economy.

Abstract (Arabic)

الملخص بالعربية

من بين الظواهر الغريبة في النمو الاقتصادي، أن الاقتصاديات التي لها تدفق كبير من مداخيل الموارد الطبيعية يكون أداء اقتصادها أضعف من تلك الاقتصاديات الفقيرة لهذه الموارد. يواجه الاقتصاد الجزائري نفس هذه الظاهرة مع مداخيله من البترول. وتبحث هذه الرسالة في اختبار اثر تطايرية أسعار البترول على النمو الاقتصادي الجزائري في ظل ما يعرف بنقمة الموارد الطبيعية. حيث تستطلع الدراسة الإطار النظري و الملاحظات التجريبية التي بحثت في مختلف تفسيرات نقمة الموارد، سواء الاقتصادية أو المؤسساتية. ويركز البحث على وجه الخصوص على تطايرية اسعار البترول كأهم مسالة بإمكانها أن تؤثر على النمو الاقتصادي للدول المصدرة للبترول. علاوة على ذلك، تعرض الدراسة بعض الحلول المتعلقة بالسياسة المالية، التنويع الاقتصادي و التطور المالي للتخفيف من هذا الاثر .

تبين هذه الرسالة قياسيا، و باستعمال طريقة المربعات الصغرى في تقدير مجموعة من الانحدارات في الفترة 1995-2011، أن التغيرات و تطايرية أسعار البترول تؤثر سلبيا على النمو الاقتصادي الجزائري، لكن بصفة غير مباشرة، من خلال الانفاق، وهذا ما يؤكد نظرية السياسة المالية الدورية. وتبين كذلك الاثر السلبي و المباشر لوفرة البترول على النمو الاقتصادي. وعليه فقد توصلت الدراسة إلى ان نقمة البترول موجودة في الجزائر من خلال كل من التطايرية و الوفرة. و تؤكد النتائج فشل السياسات الاقتصادية المنتهجة من طرف الحكومة الجزائرية، لتقليص اثر تطايرية سعر البترول و تنويع الاقتصاد، ثم الخروج من نقمة النفط.

وفي الاخير تم من خلال هذا البحث التوصل إلى أنه بالرغم من الاصلاحات المنجزة في السياسة المالية الجزائرية، إلا انه لا تزال هناك حاجة لسياسة مالية اكثر نجاعة، من أجل تحسين وضعية الاقتصاد الجزائري.

Abstract (French)

Résumé (Français)

L'un des phénomènes étonnants dans la croissance économique est que les économies qui ont un grand afflux des revenus provenant des ressources naturelles ont de moins bons résultats que les pays ne possèdant pas ces ressources. L'économie algérienne se trouve face au mème phénomène avec ses recettes pétrolières. Cette thèse vise à étudier l'impact de la volatilité des prix du pétrole sur la croissance économique algérienne dans le cadre de ce qu'on appelle «malédiction des ressources naturelles". Elle explore le cadre théorique et les observations empiriques portant sur les différentes explications de la malédiction des ressources, soit économiques ou institutionnelles. En particulier, la recherche se concentre sur la volatilité des prix du pétrole comme le problème le plus important qui peut affecter la croissance dans les économies exportatrices du pétrole. En outre, elle fournit des solutions relatives à la politique budgétaire, la diversification économique et le développement financier qui pourraient atténuer cet impact.

La thèse montre économétriquement, suivant la méthode des MCO pour un groupe des régressions multiples durant la période 1995-2011, que la volatilité des prix du pétrole affecte négativement la croissance économique algérienne, mais indirectement à travers les dépenses publiques confirmant la théorie de la politique budgétaire cyclique. Elle montre également l'impact négatif direct de l'abondance du pétrole sur la croissance économique. Ainsi, l'étude arrive à la conclusion que la malédiction du pétrole existe réellement en Algérie à travers la volatilité et l'abondance. Les résultats confirment l'échec des politiques économiques adoptées par le gouvernement algérien durant la dernière décennie pour réduire l'effet de la volatilité des prix du pétrole et diversifier l'économie et échapper à la malédiction du pétrole. Malgré les réformes fiscales mises en œuvre, la recherche suggère nécessairement une politique budgétaire plus solide afin d'améliorer la situation de l'économie algérienne.