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Oil Volatility, Economic Growth and Diversification
-Alternative Explanation of The Oil Curse In Algeria-

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

Presented by:

Mrs. Farah ELIAS ELHANNANI

Supervised by:

Pr. Mohamed BENBOUZIANE

Board of Examiners

President: Prof. Abderrezak Benhabib	University of Tlemcen
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Thanks to Allah for giving me the willingness and strength to fulfill this work (ALHAMDULILLAH)

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This work is dedicated to.....

My parents

My husband

My family in law

Sister and brothers

All my friends

Farah ELIAS ELHANNANI

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General Introduction

- Introduction

Many countries in the world are specialized in the production and exportation of specific commodities, thus, they experience substantial natural resource revenue windfalls. However, such countries are exposed to the challenge of how to manage these resources revenues under two main problems: the **volatility** existing in the commodities prices (oil in particular) and their dependency on these commodities (lack of **economic diversification**).

The fact is that some natural resource rich countries have succeeded to well manage their revenues and diversify their economies (Indonesia; Chile; Norway; Malaysia…) while others which represent the majority have failed to promote economic growth through their revenues; they suffer from the so-called **"natural resource curse"** phenomenon.

The causes beyond the negative impact of natural resource rents on the economic performance of resource rich countries has been the subject of large literature (Sachs and Warner 1995,1997; Gylfason 2004; Leiderman and Maloony 2007; Arezki and Van der Ploeg 2007and Elbadawi and Soto 2012…). It has been explained through different channels: economic and institutional. 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.

Oil rich countries represent an extreme within the range of resource dependent countries; about 35 countries are dependent on the hydrocarbons (Gelb 2010). The problem of oil price volatility has always worked as a buffer against the good performance of oil rich economies.

This problem is associated with economic diversification, indeed, countries whose exports and domestic sectors are more concentrated are more likely to experience volatility in their revenues and output; and countries with diversified economies could reduce the volatility and escape the oil curse.

The causal relationship between economic diversification and the volatility of oil revenues arises through the economic policies that should be adopted by an oil government. Besides, the question that can be extracted here is why some oil rich countries have done better in handling their oil rents than others. The broad answer suggested by the literature is often "**good governance**" and **institutional quality** (Gelb and Sina 2010).

From the brief introduction about the resource curse, oil volatility and economic diversification, our study searches in the Algerian case as one of the most important oil producers and exporters. It seeks to answer the following **basic question:**

What is the effect of oil price volatility on the economic diversification in Algeria?

Under this question, the following sub-questions can be extended:

1: What is the reality of the economic diversification in Algeria?

2: what is the relationship between economic development and economic diversification in Algeria?

3: what is the effect of foreign direct investment FDI on the economic diversification in Algeria?

4: What is the effect of domestic investment on economic diversification in Algeria?

5: what the role of institutions in the economic diversification in Algeria?

6: What is the effect of trade openness on the economic diversification in Algeria?

7: which effect has the real exchange rate REER on the economic diversification in Algeria?

- **Hypotheses the study:**
- **Hypothesis 1:** there is an effect of RGDP on the export concentration (HHI) (H_1)
- **Hypothesis 2:** there is an effect of oil price volatility on the export concentration (HHI) (H_1)
- **Hypothesis 3:** there is an effect of FDI on the export concentration (HHI) (H_1)
- **Hypothesis 4:** there is an effect of GCF on the export concentration (HHI) (H_1)
- **Hypothesis 5:** there is an effect of ICRG on the export concentration (HHI) (H_1)
- **Hypothesis 6:** there is an effect of openness on the export concentration (HHI) (H_1)
- **Hypothesis 7:** there is an effect of REER on the export concentration (HHI) (H_1)

- Objectives of the study:

The purpose of this research is to develop the guidelines for the Algerian state and non-state actors in managing the volatility of oil revenues then to diversify the economy. In particular, the study seeks to achieve the following objectives:

1- Providing an analytical framework for the economic diversification in Algeria and this what is lacked in the literature;

2- Using the portfolio theory and applying its equation on the national economy to measuring the degree of economic diversification in Algeria and this is one of the values added of this thesis;

3- Showing the effect of the oil price volatility on the economic diversification in Algeria and this is the second value added of this work since there has not a study (according to our knowledge) that dealt with this direct relationship using the oil volatility index;

4- Showing the relationship between the economic development and diversification;

5- Assessing the institutional framework of the Algerian economy and its role in the lack of economic diversification;

6- Empirically the study seeks to link between oil revenues volatility and economic diversification taking into consideration all the factors contributing in this relationship.

- Motivation of the study:

Many natural resource rich countries, oil exporters in particular, experience weak economic performance. That is they are cursed with oil instead of being blessed. Moreover, these countries are facing two challenges in managing their oil revenues: the volatility of international oil prices and the lack of diversification in their exports and domestic sectors.

- Methodology of the study:

In order to get the objectives of the study and answer the questions set above, the thesis follows descriptive, analytical and econometric approaches. Descriptive approach is used to provide the theoretical aspect of the oil curse, the management of oil rents volatility and the economic diversification; it is also used to provide and sum up the related literature review and empirical evidence on the role of economic diversification in the management of oil volatility assessing some experiences of oil rich countries that could handle the volatility issue and diversify their economies. The analytical and econometric approaches are used to analyze and examine the Algerian case through a specific econometric model.

- Data collection sources:

- Primary data:

The data of the time series used in the empirical analysis and in some sections of the theoretical chapters have been brought from national and international databases namely: the World development indicators database; the United Nations Conference on Trade and Development (UNCTAD); the international financial statistics database of the IMF; the national office of statistics (ONS); International Country Risk Guide governance indicators and the Energy Information Administration (EIA).

- Secondary data:

We mean by the secondary data the information used to build the theoretical framework of the thesis and varied sources have been used to accomplish this part: scientific papers talking about the same subject; books and original articles for building the conceptual framework; national and international reports and then books describing and analyzing the Algerian case.

- The structure of the study:

To fulfil this work, the thesis has been divided into the following chapters:

Chapter one focuses on the conceptual framework and it deals with the three concepts (volatility; resource curse and economic diversification). The chapter is then divided into three sections; the first dealing with the oil price volatility issue shedding light on its causes and effects on the oil exporters. Section two provides in details all the concepts relating to the natural resource curse phenomenon and its economic and political channels. Finally, section three deals with the economic diversification challenge explaining its patterns, determinants and the policies leading to a successful diversification in a resource rich country.

Taking into consideration the concepts providing in the first chapter.

Chapter two is divided into three sections: the first one displays the different works dealing with the resource curse using two different variables namely the resource abundance and the commodity price volatility; while the second section deals with the economic diversification as an objective and solution for the cursed countries. This section provides the different studies tackling empirically the issue of economic diversification and concludes a sub-section that sheds light on the countries experiences in diversifying their economies either successfully or no. Finally, the chapter summarizes the issues raised by all the studies presented in the previous sections and provides the contribution and the added value of the current thesis.

The third chapter analyzes the context of economic diversification for the Algerian economy showing the role of oil in the national economy in the first section; in section two, the chapter displays the different steps of the economic development programs as an economic framework for diversification. Finally, in section three, we take into consideration the institutional framework to diversify the national economy and the place of Algeria in the world regarding this framework.

Finally, chapter four analyzes and investigates empirically in the economic diversification in Algeria using different statistical tools. It analyzes the sectoral portfolio of the Algerian economy using the portfolio theory and then it investigates in the relationship between the oil price volatility and the export diversification index trying to show the effect of several economic and institutional factors on this index. To do this, we divided the chapter into three sections; firstly we described the methodology of the study presenting the different tools and the data used starting by the two stages least squares and simultaneous equations method to the equation of the portfolio theory. Secondly, we present the outputs of the sectoral portfolio equation and finally, we present the empirical results of the TSLS equation estimation then we test statistically the hypotheses of the study.

Chapter One

Theoretical and conceptual framework

Introduction:

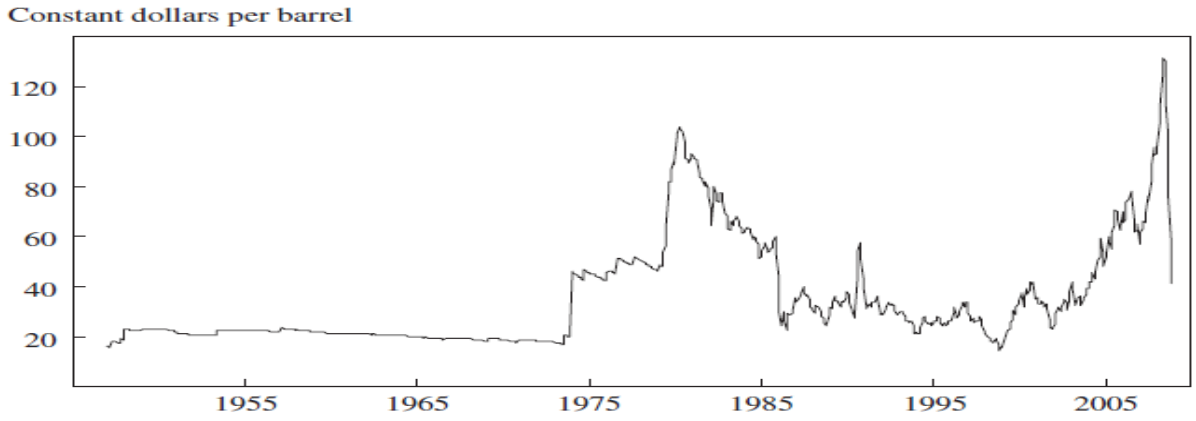
Many countries in the world are specialized in the production and exportation of specific commodities, thus, they experience substantial natural resource revenue windfalls. However, such countries are exposed to the challenge of how to manage these resources revenues under two main problems: the **volatility** existing in the commodities prices (oil in particular) and their dependency on these commodities (**lack of economic diversification**) and thus, facing the so-called **natural resource curse**.

Consequently, this chapter deals with the three concepts mentioned above (volatility; resource curse and economic diversification). The chapter is then divided into three sections; the first dealing with the oil price volatility issue shedding light on its causes and effects on the oil exporters. Section two provides in details all the concepts relating to the natural resource curse phenomenon and its economic and political channels. Finally, section three deals with the economic diversification challenge explaining its patterns, determinants and the policies leading to a successful diversification in a resource rich country.

I-1- 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.

Figure (1-1): 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-1-1- The causes of oil volatility:

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:

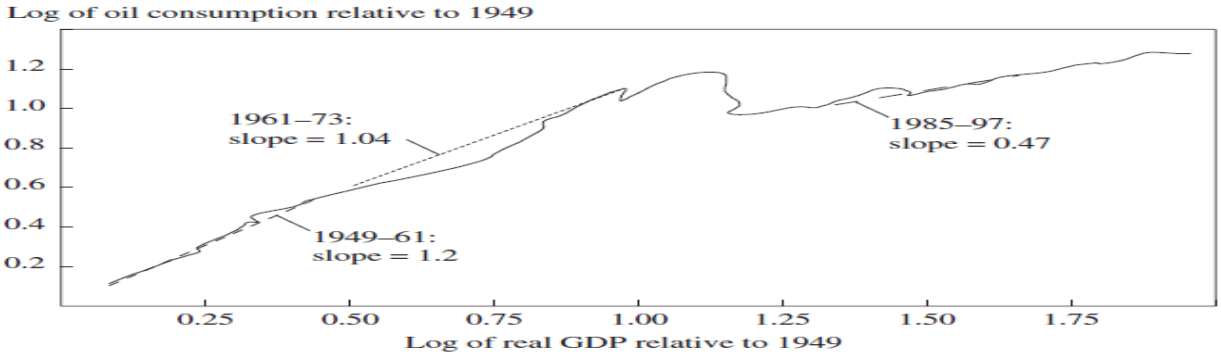
The demand price elasticity measures the percentage change in quantity demanded divided by the percentage change in price (Hamilton J., 2009, p2). The price elasticity of crude oil demand has always been small according to literature surveys estimations where Dahl(1993) and Cooper (2003) arrived at short 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.

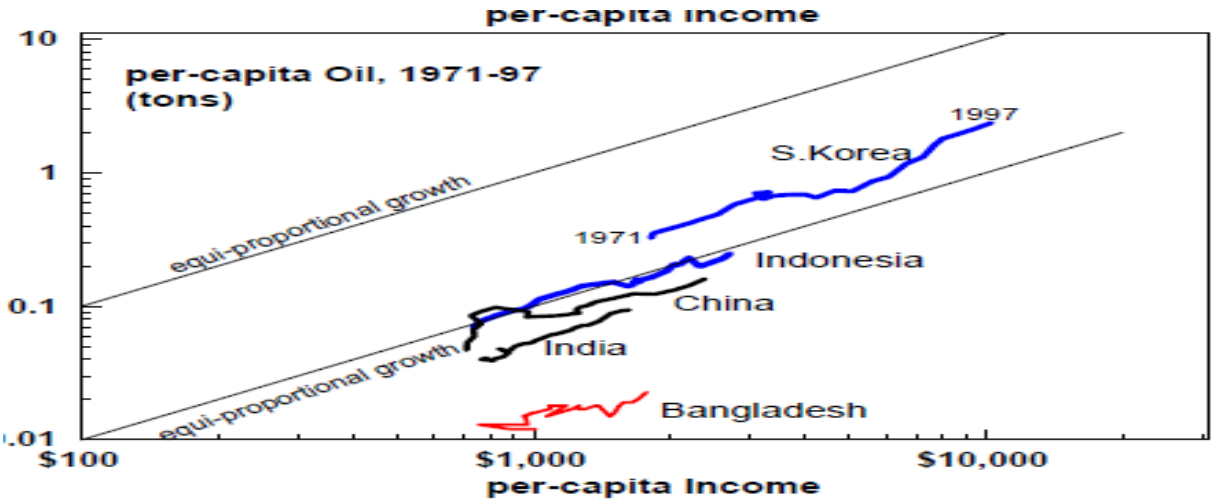
Figure (1-2): real GDP and oil consumption in U.S.A.:



Source: *Hamilton 2009a*.

Moreover, a number of studies of income elasticity arrived at a value near unity. For instance, (Gaterly and Huntington) 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 demand versus per capita income for five large Asian countries. We notice that their demand increased as fast as income:

Figure (1-3): 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 (Lynch M, 2003, p2) 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.

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(Lynch M, 2003, p19)

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.

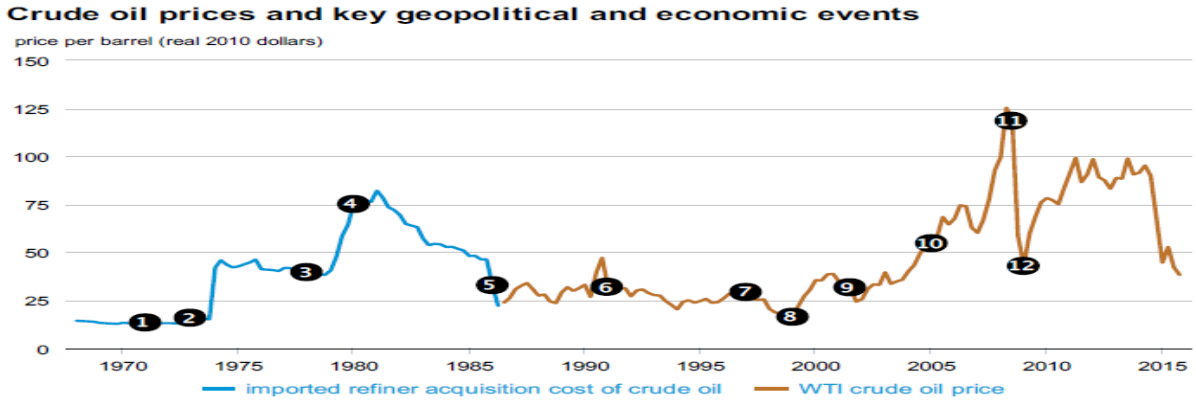
b-2- Geopolitical events:

Both crude oil and petroleum product prices can be affected by events that have the potential to disrupt the flow of oil and products to market, including geopolitical and weather-related developments. These types of events may lead to actual disruptions or create uncertainty about future supply or demand, which can lead to higher volatility in prices. The volatility of oil prices is inherently tied to the low responsiveness or "inelasticity" of both supply and demand to price changes in the short run. Both oil production capacity and the equipment that use petroleum products as their main source of energy are relatively fixed in the near-term. It takes years to develop new supply sources or vary production, and it is very hard for consumers to switch to other fuels or increase fuel efficiency in the near- term when prices rise. Under such conditions, a large price change can be necessary to re-balance physical supply and demand following a shock to the system. (Energy Information Administration 2015).

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.

Figure (1-4): Price of crude oil per barrel 1970-2015:



Source: *U.S. Energy Information Administration (December 2015).*

1: US spare capacity exhausted

2: Arab Oil Embargo

3: Iranian Revolution

4: Iran-Iraq War

5: Saudis abandon swing producer role

6: Iraq invades Kuwait

7: Asian financial crisis

8: OPEC cuts production targets 1.7 mmbpd

9: 9-11 attacks

10: Low spare capacity

11: Global financial collapse

12: OPEC cuts production targets 4.2 mmbpd

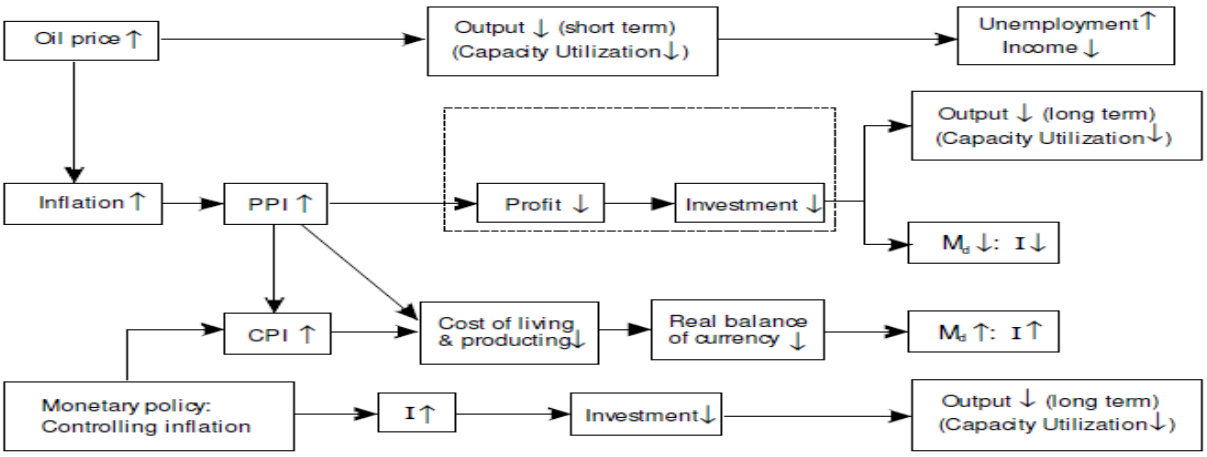
I-1-2- The effects of oil price volatility:

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:

Figure(1-5): Transmission channels of oil-price shocks:



Source: Chuku, Effiong and Ndifreke (2010).

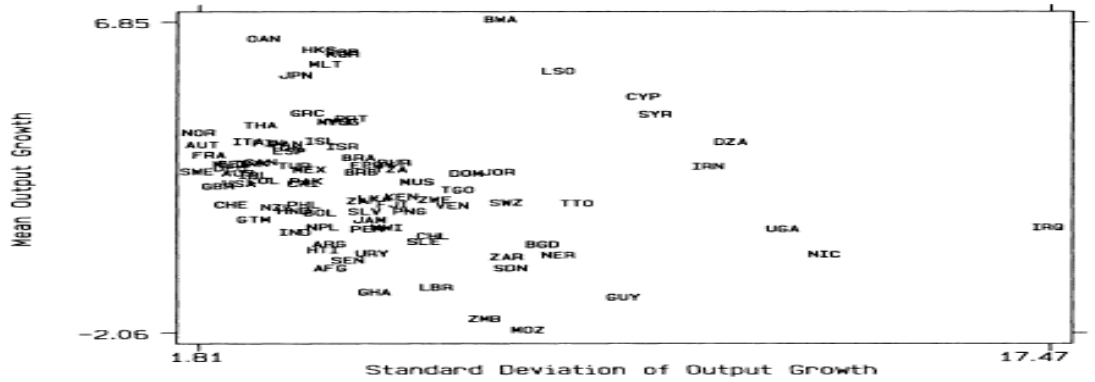
The figure shows the following channels:

- 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:

Figure (1-6): 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- 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.* » (Sachs and Warner 1995, P453)

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… »* (SMITH A, 1776, p4)

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-2-1- Economic explanation

a- 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 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 (1-1) :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).

a-1- Gregory model

Although that the term « Dutch Disease was first stated in 1977, one year before, (Gregory R.G, 1976, p71) 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 sector) will affect other export and import competing sectors (non resource

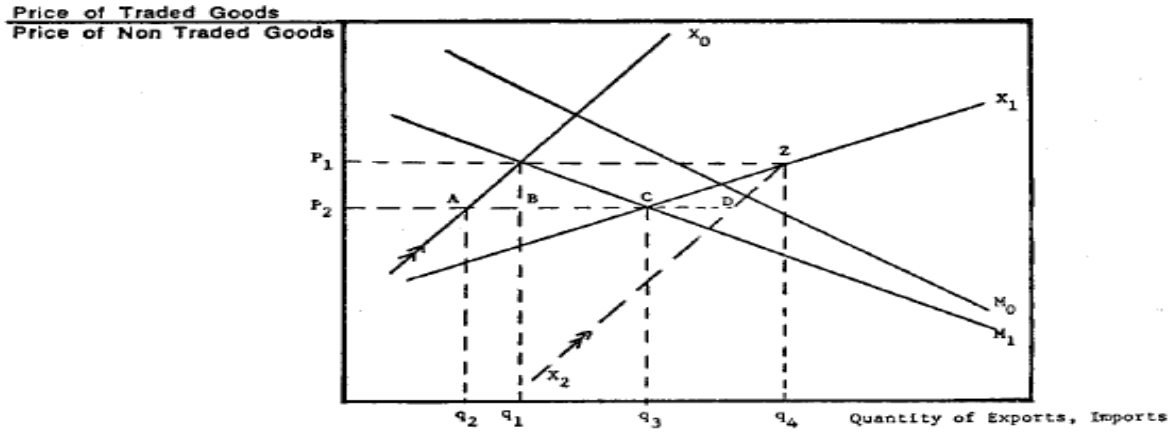
sectors) through the effect of the balance of payments and real exchange rates and relative rates of inflation. Gregory built his model starting with the following assumptions:

-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 (1-7): 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 (Gregory R.G, 1976,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).

a-2- 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) (Cordon M, 1984, p360).

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.

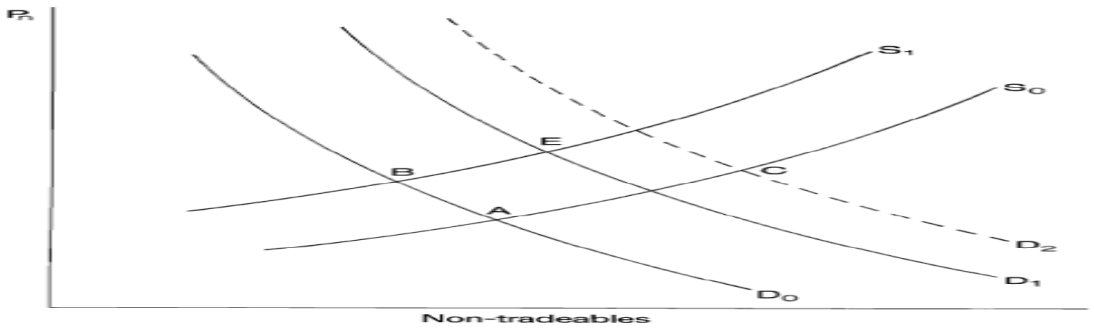
- The "Spending effect"

This effect appears if some part of the extra income in B (due to the boom in this sector) is spent (Cordon M, 1984, p360), 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.

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.

Figure (1-8): the Core model.



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

- 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 (Cordon M, 1984, p361):

-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.

- 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.

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.

a-3- 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, p3) 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 (S.Edwards, 1985, p4); the model can be summarized in two sides: monetary and real side.

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

$$\widehat{\boldsymbol{Mt}} = \alpha\widehat{Rt} + (1-\alpha)\widehat{DCRt} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$\widehat{\boldsymbol{Mt}}$**:** the growth rate of nominal money;

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

$\widehat{\boldsymbol{DCRt}}$**:** the growth rate of domestic credit.

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:

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

$\boldsymbol{P_t^c}$**:** the price of commodity export expressed in domestic currency

$\mathbf{M^d}$**:** 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 (S.Edwards, 1985, p6):

$$\widehat{M_t^d} = \widehat{P_t} + \widehat{Y_t} \quad \text{..... (3)}$$

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

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

$\boldsymbol{g}$**:** the long term trend rate of output growth

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

$\boldsymbol{P_{Tt}^*}$: 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 (S.Edwards, 1985, p7):

$$\widehat{\boldsymbol{P_{nt}}} = \phi\widehat{Y_t} + \pi\left(\widehat{M_t} - M_t^d\right) + \widehat{P_{Tt}} \text{ .....(5)}$$

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.

b- Procyclicality of fiscal policy

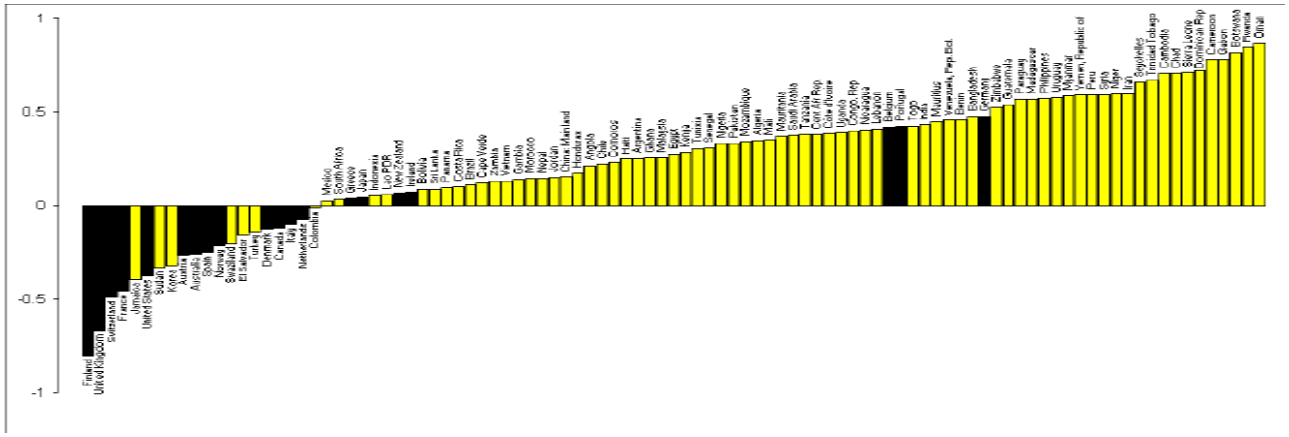
Most of commodities are characterized with high volatility where the world markets prices for oil and natural gas are the most volatile. This volatility issue affects developing countries rather than industrialized ones, typically economies rich in such resources; that is, the cyclical variability pronounced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

(Kaminsky, Reinhart and Végh, 2005, p17) 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) 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(Kaminsky, Reinhart and Végh, 2005, p35). 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.

Figure (1-9): cyclical correlation of government spending and GDP



***Source**: Kaminsky Reinhart and Végh (2005).*

Three important characteristics of commodity exporting countries are likely to make government spending more pro-cyclical (Arezki R,2010, p2):

1-government revenues derived from the exploitation of natural resources are more volatile than other sources of government revenues;

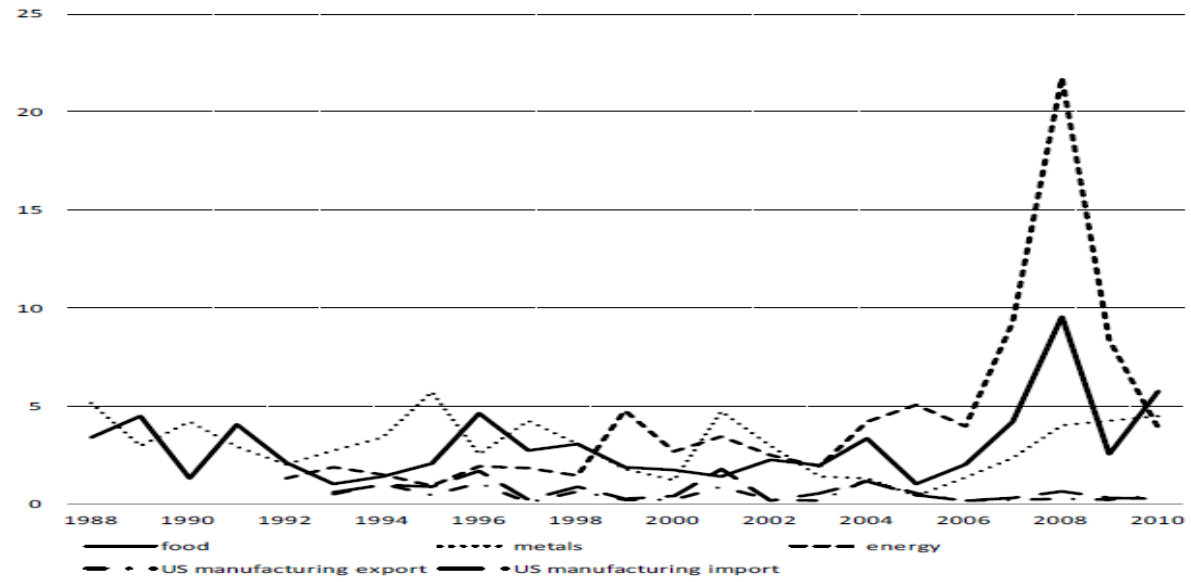
2- the size of the resource revenues is disproportionally large in commodity exporting countries;

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"* projects, following commodity price booms.

c- 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:

Figure (1-10): Volatility of commodity and manufactured products indices



***Source**: Arezki R. and Gylfason T. (2011).*

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 (Van der ploag F., Poelhekke S, 2008, p2).

I-2-2- 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.

a- 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, p33) gave large importance to the role of politics to explain the resource curse and he divided this explanation into three theories:

a-1- Cognitive approach

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).

a-2- 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.

a-3- 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.

b- Institutional quality

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

Acemoglu, 2003, p14) 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- 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.

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 (Mauro P, 1995, p685).

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 the use of public funds by others may vanish entirely and be replaced by incentives to secure a share of the rent for oneself (Gelb A, 1988, p28).

That behavior of rent seeking is costly for economic growth, (Murphy K., ShleiferA. and Vishny R,1993, p409) explored two reasons for that:

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 **(1-2)** 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 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.

Table (1-2): Corruption ranking in the MENA countries in 2012.

Country Rank	Regional Rank	Country / Territory	CPI 2012 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-3- Theoretical foundations of economic diversification

Economic diversification is vital for economic growth and development. The economic history approved that the diversified economies perform better in the long term than economies that heavily depend on income originated from one sector (agriculture, mining or hydrocarbon…).

I-3-1- Definitions and determinants

a- definition and patterns of economic diversification

Diversification is defined as a variety of ways according to the field of application. In the economy, diversification is generally taken as the process in which a growing range economic output is produced; it can also refer to the diversification of markets for exports or the diversification of income sources away from domestic economic activities. (Zhang 2003)

In this context, we can distinguish between two patterns of economic diversification: economic (product) diversification and export diversification.

Economic diversification is the process in which the economy becomes more diverse in terms of goods and services it produces. This type can also be called as **domestic diversification. Export or trade diversification** refers to deliberate policies intended to change the shares of commodities in the export portfolio, or break into new geographical markets. (Akram Esanov 2011)

The economic diversification falls also in two patterns referring to the policies in one hand and to the nature of diversification itself from other hand; **horizontal** and **vertical.**

Regarding the policies: "horizontal" policies being those that work in a neutral way across a wide range of sectors. For example, improving education or cutting red tape and business regulation in general. There is no special sector focus in these measures. "Vertical" policies will be targeted and focused towards particular sectors or value chains. Say, heavy industry, which can be encouraged by selective credit or trade policy. Referring to the nature of diversification itself; vertical diversification could refer to policies that diversify in a particular sectoral dimension, in particular forward and backward along the resource value chain. Horizontal diversification could mean more across-the-board diversification, into agriculture, manufacturing or tourism.

b- Determinants of economic diversification

In the economic theory, there is no a clear framework that determines exactly the factors affecting the economic diversification or specialization in any country. However, the empirical literature tried to detect the key determinants of economic diversification which were geographic, economic, demographic and institutional. (Murphy, Shleifer and Vishny) proposed three channels through which rent seeking can affect diversification. The first one is political: when the incumbent elites are not interested in innovation and innovators are not part of this elite, innovations are not likely to be introduced. Second, rent-seeking adds extra fixed cost to launching a new product. Third, as innovations are long-term projects, they are likely to involve more steps and therefore more rent-seeking.

- The income (level of development)

Regarding the role that the economic diversification plays in the development, several studies included the gross domestic product (GDP) per capita as a measure of economic development to determine empirically the economic diversification. (Imbs and Wacziarg 2003, p12) found that per capita income and sectoral concentration follow a U-shaped pattern: countries first diversify, in the sense that economic activity is spread more equally across sectors; however, there exists in a development process a point at which they start specializing again.

- Institutions and governance

Good governance and strong institutions are a pre-requisite in building an enabling environment for economic diversification (Maré J.H.E, 2011, p7). Thus, poor institutions could be considered as a fixed production cost and a barrier for firms to operate on the market. (Di-Giovani and Levchenko 2010).

Democracy, economic freedom, rules of law, corruption, access to finance among other institutional variables were used to show the effect of institutions on economic diversification. Obviously, the institutions impact on diversification reflects the role of the government to succeed in well diversifying its economy. Acemoglu and Robinson (2000) and Dunning (2005) were the pioneers to model that effect. (this model will be detailed in the next sub-sections).

- Human capital

The investment in the three kinds of capital: natural- social and human- is so important to diversify an economy. Hence, the recent studies stressed the role of the human capital as one of the factors that drive economic diversification. (Gylfason, 2005,p 33) argued that a poorly educated populace is easier to oppress over long periods than is a well educated population that knows full well what is lacking. In this argument, Gylfason points the role of education as a measure of human capital and shows its link with the political determinant of economic diversification.

- Private sector

The private sector also play a vital role in boosting diversification either through national investors or foreigners usually via the foreign direct investment (FDI). This sector contributes with the innovations that put in the different economic activities. Moreover, FDI can also promote export diversification by spillover effects on the export intensity of domestic firms in the non-traditional export sector (Alaya M, 2012, p9) (by lowering the fixed cost of introducing the products of this sector in the international market and when the indigenous firms learn from the export behavior of foreign affiliates and become more reactive to international markets). Therefore, Crespo and Fontoura (2007) showed the link between local and foreign firms and explained how the formers may learn about overseas markets by observing and imitating the foreign affiliates.

I-3-2- Measuring economic diversification

Several economic theories tend to result in different measures of economic diversification regarding the different concepts of diversification.

a- The entropy measure (Shanon Entropy Index "SEI")

This index compares the existing employment among industries in a region to an equi-proportional distribution. Thus, the measure of economic diversification should depend only on the number of economic sectors and the relative share of each sector (Hackbart and Anderson, 1974, P4).

Let $D(p_1, p_2, \ldots\ldots, p_n)$ denote the measure of economic diversification where: $p_1, p_2, \ldots\ldots, p_n$ are the relative share of each sector and "n" is the number of sectors. The construction of this index requires the following assumptions:

1- D is a symmetric function of p's depending only on their relative magnitudes and not their order;

2- D is continuous in each variable so that small changes in the economic structure produce small changes in the measure;

3- One sector is divided into two components with relative share q_1 and q_2.

These three conditions are sufficient to determine the function D*:

$$\boldsymbol{ESI} = D(\mathrm{p1}, \mathrm{p2}, \ldots\ldots, \mathrm{pn}) = -\sum_{1}^{n} \mathrm{p_i} \ln \mathrm{p_i}$$

Higher entropy index values indicate greater relative diversification, while lower values indicate relatively more specialization.

b- Herfindahl-Hirschman index

The second and the most famous index for economic diversification is the Herfindahl-Hirschman index (HHI). This index is a statistical measure of market concentration; that is; the degree of concentration of the output of firms in banking or industrial markets (A.Rhoades 1993).

The HHI indicates the extent to which a particular regional economy is dominated by a few firms and it is calculated by squaring the market shares of all firms in a market and then summing the squares:

$$\boldsymbol{HHI} = \sum_{i=1}^{n} (MS_i)^2$$

Where: MS_i represents the market share of firm *i*.

This index is normalized and used to measure the sector concentration (Noqvi and Morimone 2005; Haouas and Heshmatic 2014…). It is defined by:

$$\boldsymbol{HHI} = NH = \frac{\sqrt{\sum_1^n p_i^2} - \sqrt{1/N}}{1 - \sqrt{1/N}}$$

$$\boldsymbol{P} = \frac{x_i}{X}$$

x_i is the value of exports of commodity *i*

$\boldsymbol{X} = \sum_1^N x_i$, N is the number of products.

This relative measure of diversification ranges from 0 to1; a higher value indicates a greater concentration, thus, low economic diversification and a lower value indicates smaller concentration, thus, high economic diversification.

c- Portfolio theory

The portfolio theory (PT) was originally developed and applied to financial investments. First founded by Markowitz (1958), the PT determines the efficient portfolios using the mean-variance measures as proxies to the expected return and the risk of the financial assets and portfolios.

This portfolio principle has been proposed in an approach developed by Conroy(1975) to analyze economic diversification. Since then, several studies have used the PT for the analysis of economic diversification (Sigel et al (1993;1994), Wagner (1993;2000)…).

Conroy (1975) viewed economic policies planned to promote economic growth and diversification as a set of financial assets selected to create an efficient portfolio. Thus, the policy makers are selecting a community's industrial portfolio (Wagner 2000). The Conroy's argument focuses on the individual industry's net return, the stability of these net returns, and the covariance of these net returns between industries. In this context, the portfolio theory captures the characteristics of individual industries and inter-industry relationships on regional growth and stability.

The portfolio measure and following the Markowitz principle, can be expressed as (State of Hawaii, 2011,p11):

$$\boldsymbol{\sigma_p^2} = \sum_{i=1}^{N} S_i^2 \sigma_i^2\,(X) + \sum_{i=1}^{N} \sum_{i=1}^{} \sum_{j=1} S_i S_j \sigma_{ij}(X_i, X_j)$$

$S_i \ and \ S_j$ are the shares of economic activity (employment, income or output X) in the ith and jth sectors.

σ_i^2 is the variance of economic activity for the ith sector.

σ_{ij} is the covariance of economic activities for the ith and the jth sectors.

According to the equation above, the economic diversification is measured by the variance (economic instability) of the industrial portfolio. Thus, the lower the variance the more diversified the economy and vice versa.

I-3-3- Ways to diversify

"Sowing the oil" to diversify the non-oil economy has been an objective for many oil exporters (Gelb and Sina 2010). Some countries have been quicker to achieve this objective than others due to the policies they executed and the political and institutional environment they work in. According to Gelb and Sina (2010), the economic diversification requires the combination of three policies: a reasonably open trade policy and the active use of resource rents to increase the productivity of other exportable sectors and reduce their production costs.

a- Fiscal policy considerations

Fiscal policy refers to the part of government policy concerning the raising of revenue through taxation and other means and deciding on the level and pattern of expenditure for the purpose of influencing economic activities or attaining some desirable macroeconomic goals (Anyanwu 1997; p249). Fiscal policy has a particular significant impact on economic performance in oil exporting countries. Such impact makes the fiscal policy as a key to well manage the oil revenue and to diversify the oil economies. However, fiscal policy in these countries is facing specific challenges both in the long run (fiscal sustainability) and the short run (macroeconomic stabilization) (Sturm, Gutner and Alegre 2009; p4).

The fiscal policy framework in most of the resource rich countries indicates the failure of fiscal institutions to achieve economic diversification; whereas, few other countries have succeeded to well diversify their economies through these institutions and this is due to the way they use such policy.

a-1 Resource funds

Among the special fiscal institutions that the resource rich countries should be equipped with; we find the natural resource funds. The natural resource fund is a special-purpose investment fund owned by a government whose principle source of financing is revenue derived from oil, gas or minerals sales and that invests at least in part in foreign financial assets. (Revenue Watch Institute Report; 2014; P08).

The most famous natural resource funds are the ones whose origin is oil revenues, namely the oil funds.

The figure below displays all the identified natural resource funds in the world, it is clear from this table that the oil represents the main source of the majority of NR funds, while we find the minerals and natural gas in the second place:

Table (1-3): list of all identifies natural resource funds (December 2013)

Government	Fund name	Year established	Value of assets (2013, latest available or estimate)[11]	Financing resource
Abu Dhabi (UAE)	Abu Dhabi Investment Authority*	1976	$627 billion	Petroleum
	International Petroleum Investment Authority	1984	$65.2 billion	Petroleum
	Mubadala Development Company	2002	$55.5 billion	Petroleum
Alabama (USA)	Alabama Trust Fund*†	1985	$2.94 billion	Petroleum
Alaska (USA)	Alaska Permanent Fund*†	1976	$48.6 billion	Petroleum
Alberta (Canada)	Alberta Heritage Savings Trust Fund*†	1976	$15.7 billion	Petroleum
Algeria	Revenue Regulation Fund	2000	$77.2 billion	Petroleum
Angola	Angola Sovereign Fund	2012	$5 billion	Petroleum
Azerbaijan	State Oil Fund*†	1999	$35.8 billion	Petroleum
Bahrain	Future Generations Reserve Fund	2006	$0.2 billion	Petroleum
Botswana	Pula Fund*†	1994	$4.6 billion	Minerals
Brunei	Brunei Investment Agency	1983	$40 billion	Petroleum
Chile	Pension Reserve Fund*†	2006	$7.3 billion	Minerals
	Social and Economic Stabilization Fund*†	2007	$15.6 billion	Minerals
Colombia	Savings and Stabilization Fund	2011	Not yet operational	Petroleum
Equatorial Guinea	Fund for Future Generations	2002	$0.2 billion	Petroleum
Dubai (UAE)	Investment Corporation of Dubai	2006	$70 billion	Petroleum
Gabon	Gabon Sovereign Wealth Fund	1998	$0.4 billion	Petroleum
Ghana	Ghana Heritage Fund*†	2011	$0.1 billion	Petroleum
	Ghana Stabilization Fund*†	2011	$0.2 billion	Petroleum
Iran	National Development Fund of Iran*	2011	$54 billion	Petroleum
	Oil Stabilization Fund*	2000	No information available	Petroleum
Kazakhstan	Kazakhstan National Fund*†	2000	$68.7 billion	Petroleum
Kiribati	Revenue Equalization Reserve Fund	1956	$0.6 billion	Minerals
Kuwait	Kuwait Investment Authority*	1953	$386 billion	Petroleum
Libya	Libyan Investment Authority	2006	$65 billion	Petroleum
Louisiana (USA)	Louisiana Education Quality Trust Fund†	1986	$1.2 billion	Petroleum
Malaysia	National Trust Fund	1988	$1.7 billion	Petroleum
Mauritania	National Fund for Hydrocarbon Reserves†	2006	$0.3 billion	Petroleum
Mexico	Oil Revenues Stabilization Fund	2000	$6 billion	Petroleum
Mongolia	Fiscal Stability Fund†	2011	$0.3 billion	Minerals
Montana (USA)	Montana Permanent Coal Trust Fund†	1978	$0.6 billion	Minerals
Nauru	Phosphate Royalties Stabilization Fund	1968	No information available	Minerals

Government	Fund name	Year established	Value of assets (2013, latest available or estimate)[11]	Financing resource
New Mexico (USA)	Land Grant Permanent Fund†	1898	$0.9 billion	Minerals and land
	Severance Tax Permanent Fund†	1973	$0.3 billion	Petroleum and minerals
Nigeria	Nigerian Sovereign Investment Authority	2011	$1 billion	Petroleum
North Dakota (USA)	North Dakota Legacy Fund*†	2011	$1.2 billion	Petroleum
Norway	Government Pension Fund Global*†	1990	$767 billion	Petroleum
Northwest Territories (Canada)	Northwest Territories Heritage Fund	2012	$0.001 billion	Minerals
Oman	State General Reserve Fund	1980	$8.2 billion	Petroleum
Papua New Guinea	Papua New Guinea Sovereign Wealth Fund	2011	Not yet operational	Gas
Qatar	Qatar Investment Authority	2005	$115 billion	Petroleum
Ras Al Khaimah (UAE)	RAK Investment Authority	2005	$1.2 billion	Petroleum
Russia	National Welfare Fund*†	2004	$88.1 billion	Petroleum
	Reserve Fund*†	2004	$86.9 billion	Petroleum
Sao Tome and Principe	National Oil Account	2004	No information available	Petroleum
Saudi Arabia	SAMA Foreign Holdings	1952	$675.9 billion	Petroleum
	Public Investment Fund	1971	$5.3 billion	Petroleum
Texas (USA)	Texas Permanent University Fund*†	1876	$14.4 billion	Petroleum and land
Timor-Leste	Timor-Leste Petroleum Fund*†	2005	$14.6 billion	Petroleum
Trinidad and Tobago	Heritage and Stabilization Fund*†	2000	$4.8 billion	Petroleum
Wyoming (USA)	Permanent Wyoming Mineral Trust Fund*†	1974	$6.1 billion	Minerals
Venezuela	Macroeconomic Stabilization Fund	1998	$0.8 billion	Petroleum
	National Development Fund†	2005	$18 billion	Petroleum

Source: revenue watch institute, 2014.

The basic objectives of the oil funds can be divided into (International monetary fund, 2007, p11):

-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.

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 (Bacon R. and Tordo S) . 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.

In addition to the main roles that play the oil funds, they can also provide the following objectives (Mehrara et al. 2012, P338):

- Dampening the real exchange rate appreciation in period of rising oil revenues by investing the fund resources abroad;
- The saving funds are used as an instrument of prevention against the excess injection of revenues into the stream of government spending;
- They may contribute to transparency and good fiscal policy by setting benchmarks against which governments may be assessed; as they also contribute to economic development to the extent that fiscal policy and expenditure strategy are well determined.

b- Industrial policy

Engaging in manufacturing enables dynamic learning-by-doing gains that raise productivity and income (Gelb, 2010; 5). This argument of Gelb shows the important role of industrial policy in creating added value which raises the income then leads to the creation of new products. (Rodrik 2007; p99) justified the industrial policy that promotes the diversification of the production portfolio. In his book, Rodrik defined this policy as a process of economic self-discovery in the broader sense. Thus, Diversification of the productive structure requires "discovery" of an economy's cost structure—i.e., discovery of which new activities can be produced at low enough cost to be profitable. The analysis of industrial policy needs to focus

not on the policy *outcomes* – which are inherently unknowable ex ante – but on getting the policy *process* right; and the right model for such policy is of strategic collaboration between the private sector and the government with the aim of uncovering where the most significant obstacles to restructuring lie and what type of interventions are most likely to remove them. In this context, Rodrik discussed ten design principles for industrial policy:

1. **Incentives should be provided only to "new" activities**. The main purpose of industrial policy is to **diversify the economy** and generate new areas of comparative advantage.

It follows that incentives ought to focus on economic activities that are new to the domestic economy. "New" refers to both products that are new to the local economy and to new technologies for producing an existing product. Many countries provide tax incentives for new investments without sufficiently discriminating between investments that expand the range of capabilities of the home economy and those that do not. Note also that this focus differs substantially from the tendency that many incentive programs have to subsidize small and medium sized enterprises (SMEs). SME support policies are based on the criterion of size—not on whether the activity in question has the potential to spawn new areas of specialization. It is the latter that produces economic growth.

2. **There should be clear benchmarks/criteria for success and failure**. Industrial policy is a necessarily experimental process. In the absence of a clear idea of what constitutes success and observable criteria for monitoring it, failures can get entrenched.

3. **There must be a built-in sunset clause**. One way to ensure that resources (both financial and human) do not remain tied up for a long time in activities that are not paying off is to phase out support by default. Hence, every publicly supported project needs to have not only a clear statement ex ante of what constitutes success and failure, but also an automatic sunset clause for withdrawing support after an appropriate amount of time has elapsed. .

4. **Public support must target activities, not sectors**. The targets of public support should be viewed not as sectors but as activities. This facilitates structuring the support as a corrective to specific market failures instead of generic support for this or that sector.

5. Activities that are subsidized must have the clear potential of providing spillovers and demonstration effects. There is no reason to provide public support to an activity unless that activity has the potential to crowd in other, complementary investments or generate informational or technological spillovers. Public support must be contingent on an analysis of this sort. Moreover, activities that are supported should be structured in such a way to maximize the spillovers to subsequent entrants and rivals.

6. **The authority for carrying out industrial policies must be vested in agencies with demonstrated competence**. The location of competence may predetermine the tools used. But this is a necessary compromise: when administrative and human resources are scare, it is better to employ second-best instrument effectively than to use first-best instruments badly.

7. **The implementing agencies must be monitored closely by a principal with a clear stake in the outcomes and who has political authority at the highest level**.

8. **The agencies carrying out promotion must maintain channels of communication with the private sector**.

9. **Optimally, mistakes that result in "picking the losers" will occur**. The objective should be not to minimize the chances that mistakes will occur, which would result in no self-discovery at all, but to minimize the costs of the mistakes when they do occur. If governments make no mistakes, it only means that they are not trying hard enough.

10. **Promotion activities need to have the capacity to renew themselves, so that the cycle of discovery becomes an ongoing one.** Over time, some of the key tasks of industrial policy will have to be phased out while new ones are taken on.

Moreover, Rodrik (2007) argued that the successful industrial policy requires a good institutional framework; effective human capital and education. This will be discussed in the next sections in our thesis.

Moreover, (Hirschman, 1981, p34) proposed three major types of linkages from the commodities to the industrial sector; namely: fiscal; consumption and production linkages. These linkages show the way to use the commodities' rents to promote industrial diversification.

- **Fiscal linkages:** the resource rents which the government is able to harvest from the commodities sectors in the form of corporate taxes, royalties and taxes on the incomes of employees. These rents can be used to promote industrial development in sectors unrelated to commodities.

- **Consumption linkages**: means that the demand for the output of other sectors arising from the incomes earned in the commodities sector (UNIDO report 2010, p19). The demand generated by employees in the commodities sector had the potential to provide a major spur to industrial production as workers and capitalists spent their incomes earned in the resources sector.

- **Production linkages:** Hirschman believed that the most viable link between the commodities and the industrial sector was via production linkages; particularly backward linkages. He saw production linkages as providing great potential for industrial development

in previously enclave commodity dependent economies and believed that two factors influence the degree of these linkages. The first is scale, reflecting the size of demand from the commodities sector in relation to the minimum effective scale of production in backward linkages supplier firms and of output for forward linkage user firms. The second is "technological strangeness", that is, how similar the technology and processes are between the core resources sector and those in supplier and user firms.

c- Building human capital

c-1- The concept of human capital

Human capital is defined in the *Oxford Busiess English Dictionary* as "the skills, knowledge and experience to an organization or a country." It encompasses the notion that there are investments in people (e.g., education, training, health) and that these investments increase an individual's productivity.

The concept of human capital goes back to the « Wealth of Nations » of the Philosopher Adam Smith. In his definition of capital: "The acquisition of … talents during … education, study, or apprenticeship, costs a real expense, which is capital in [a] person. Those talents [are] part of his fortune [and] likewise that of society"

c-2- Measuring human capital

Human capital measurement is an important source in terms of suggesting and implementing policies regarding human resources.

- Output-Based Approach: Some economists attempted to measure the stock of human capital utilizing "school enrollment rates" as a proxy of human capital (Barro, 1991; Barro & Lee, 1993)

- Cost-Based Approach: Cost-based approach is based on measuring the stock of human capital through summing costs invested for one's human capital. To calculate the invested const, Kendric (1976) utilized an individual's investment costs considering depreciation, and Jorgenson & Fraumeni (1989) presented discounted income in the future. But this approach is based on indirectly measuring stock of human capital. So it is difficult to precisely classify boundary between investment and consumption in the perspective of costs.

- Income-Based Approach: This approach is based on the returns which an individual obtains from a labor market throughout education investment. Mulligan & Sala-i-Martin (1995) defines that aggregate human capital is the sum of quality adjustment of each individual's labor force, and presents the stock of human capital utilizing an individual's income. But human-unrelated factors can more influence an individual's income. In this sense, this approach rarely presents a complete measurement for human capital.

c-3- Human capital and economic diversification

(Gylfason, 2005, p21) argued that economic diversification encourages growth by directing economic activity away from excessive reliance on primary production in agriculture or a few natural-resource-based industries, thus helping lead labor away from low paying jobs in low-skill-intensive farming or mining to more **lucrative** jobs in more **high-skill-intensive occupations;** this latter means to build an intensive human capital. Bravo-(Ortega and De Gregorio, 2007, p65) showed empirically that the relationship between a country's rate of economic growth and the relative abundance of its natural resources depends on each country's level of human capital.

Gylfason (2005) said that most of the things that are good for growth also encourage economic diversification and he discussed six determinants of growth that lead to economic diversification in which he emphasized the role of training and education as essential elements. Moreover; in other study; Gylfason (2000) explained the linkage between education (human capital) and economic growth and he argued that more and better education is a prerequisite for rapid economic development; it stimulates economic growth through different channels namely: increasing the efficiency of the labor force; fostering democracy (Barro 1997) and creating better conditions for good governance (this will be discussed later); improving health and enhancing equality. Gylfason in his paper shows empirically that economic growth is positively related to education; whereas, the three measures of education inputs; outcomes and participation (expenditure on education; years of schooling for females and secondary school enrollment) have a negative relationship with natural resource abundance which means that the poor human capital deters economic growth, consequently impedes the diversification path.

d- Institutions

(North, 1991, p98) defined institutions as "the humanly devised constraints that structure political, economic and social interaction". They can be either formal or informal rules, and are distinct from actors that follow them.

The work in the economic field has focused mostly on the importance of economic or political institutions for the performance of economic systems. However, the rules governing other aspects of social life, such as the educational system or innovation systems, can also have important implications for the diversification process of a country, and therefore we will consider a broader set of institutions that goes beyond the purely economic and political field.(Boschma and capone; 2014; p7)

d-1- Economic institutions

Economic institutions refer to the rules that directly affect the economic system. Although this definition can be very inclusive, the current literature has focused mostly on two variables: property right institutions that protect common citizens against expropriation by the government and by other powerful citizens, and contracting institutions, that allow and favor the enforcement of contracts. Although generally are considered separately, we can include within the set of economic institutions also the rules governing international trade, and determining the degree of trade openness of a country. All these institutions share a strong and direct impact on the emergence of markets, either domestic or international. There is now a broad consensus on the role that economic institutions play in the process of economic growth, with a specific preeminence of property rights and rule of law over contract rules (Acemoglu and Johnson, 2005, p950) and trade integration (Rodrik et al., 2004). Moreover, it is also quite clear to understand that in presence of good economic institutions individuals and organizations have strong incentives to innovate in order to gain profits from their activities. However, here we claim that in presence of these institutions the diversification process will be less constrained by the existing productive structure. There are at least two rationales for this proposition: first, an economy with good economic institutions favors the entry and the investments by foreign firms that may possess capabilities that are far from the current set available in a country. Second, the search for new capabilities is costly, and the more so the farther the capabilities are from what is currently known: good economic institutions provide a strong incentive to incur these costs, since they also guarantee secure profits in case of success.

d-2- Political Institutions

Political institutions are the rules that shape and constraint actors in the political sphere. The most important element of political institutions is the form of government (democracy versus autocracy), but there are several important aspects to consider, such as the constraints on the executive action, the level of corruption, or the presence of general freedoms, such as the freedom of press and association. There is no conclusive evidence of a link between political institutions and economic outcomes: democracy could even have a negative direct effect on economic growth (Barro, 1996), but transition to less democratic form of government can also impact negatively income. There is more consensus on the indirect effects of political institutions via economic institutions: democratic forms of government and ample freedoms for citizens provide ample guarantees on the persistence of good economic institutions (Acemoglu and Robinson, 2012).

The link with diversification is also weaker than in the case of economic institutions. However, there is recent evidence that political rights have a selective positive effect on the growth of sectors that are close to the technological frontier (Aghion et al., 2007, p132). This effect is due to the lower barriers to entry associated with democracy because of a weaker protection of vested interests: therefore, it should also lead to the discovery of new products that are far from the current productive structure of a country.

d-3- Coordination Institutions

If it is true that economic institutions supporting property rights and contract enforcement are positive for growth, it must also be recognized that these objectives can be pursued through different institutional arrangements that are equally effective (Rodrik, 2008, p102). The basic discrimination element is given by the rules governing the firms coordination problems in with their working force, with the investors, and with the other firms. Although these coordination problems arise in different realms, the solutions adopted by firms tend to be similar because of institutional complementarities, and determine two types of political economies: in liberal market economies (LME) firms coordinate their activities through hierarchies and market arrangements, while in coordinated market economies (CME) firms rely on non-market relations and strategic interactions. The main prediction of this theory is that coordinated market economies are better at supporting incremental innovation: workers are more secure of their job and can reach higher levels of industry-specific technical skills; the coordinated system of corporate governance reduces the importance of getting immediate profits from breakthrough innovations to avoid hostile takeovers.

d-4- Educational Institutions

An institutional domain that can be relevant for the development of new products is the educational system of a country: the presence of people with strong skills and advanced competences (as signaled by the completion of higher education) is important, as well as the existence of a majority of the population that has at least a basic formal education. There is now a quite supportive evidence that the quality of education is more important for growth than the simple number of years spent at school (Barro, 2013); however, even an imperfect measure of education as the level of education attainment shows important results.

Higher levels of education should have a positive impact on diversification, especially in knowledge-demanding fields: some form of knowledge is necessary to move towards both related fields and unrelated fields. However, since secondary education is often concerned with practical knowledge, it is possible that countries with a relatively high share of secondary

education will have stronger propensity to related diversification, while countries with a higher share of tertiary education will diversify also in less related products.

d-5- Technology and Innovation Institutions

The literature on markets for technologies (Arora et al., 2001) and more generally on markets for inventions (Conti et al., 2013, p720) has pointed out the importance of allowing the innovation process to take place also outside the organizational boundary of a firm. In presence of well-developed markets for technologies specialization and division of labor are enhanced, supporting the diversification process of a country. However, the development of markets for technologies is the outcome of the interaction of formal and informal institutions, including effective intellectual property rights, appropriate contracts, and social norms.

Countries with well developed markets for technologies should be less constrained in their diversification process: firms might pursue innovative projects without needing downstream capabilities for the commercialization. Moreover, the presence of markets for technologies determines an easier access to knowledge favoring the recombination of existing skills to produce novelty.

d-6- Culture

In the economic literature about institutions and growth, culture is typically considered as an unconvincing explanation for the observed patterns. The culture variable is often operationalized through very specific variables, such as common language, religion, or juridical system (Acemoglu et al., 2001). However, if include in the concept of institutions also informal rules and social norms, then we cannot exclude the idea of culture as "the collective programming of the mind distinguishing the members of one group or category of people from another". The research stream developed by Geert Hofstede has shown that it is possible to identify cultural traits at the national level that affect the values and the behavior of the majority of the population. Over time, Hofstede et al. (2010) identified 4 dimensions of national culture.

First, the Uncertainty Avoidance dimension reflects the preference and the tolerance of a society for uncertainty and ambiguity. A quite direct link might be suggested: since engaging in the development of products that are not so related to the current activities is a very uncertain process, we can expect that countries avoiding uncertainties might be more strongly constrained by the current productive structure in the process of industrial diversification.

Second, the Individualism dimension reflects the expectation of a society that an individual is able to look after himself and is not strongly integrated in his origin group. Here considerations similar to what were developed in the case of coordinated and liberal market economies can be applied: more collectivistic countries should be more constrained in their innovation activities. There is suggestive evidence that these two dimensions are correlated with more radical and creative innovations (Acemoglu et al., 2014).

Third, the Masculinity dimension reflects the importance in society played by competition and assertiveness: people can therefore pursue their projects without caring about consensus and expecting to be rewarded for their achievements.

Finally, the Long-Term Orientation dimension reflects the propensity of people to save and invest for the future, and to be persistent in their endeavors, characteristics that can be very important when trying to develop ideas and products that are not very related with the current activities. On the contrary, short term oriented cultures have a weaker propensity to abandon traditions and to open to diversity.

Conclusion:

This chapter provided the conceptual framework of the thesis with its sections and dealing with the different sides of the three concepts: oil price volatility; resource curse and economic diversification came to several ideas:

- The large fluctuations in international oil prices represents a challenge for the oil exporters working as a channel to the resource curse by hampering the economic growth and development of such countries;
- The natural resource curse thesis is conditional and not a destiny;
- The resource curse phenomenon can appear through different economic and political channels in which the Dutch disease, fiscal pro-cyclicality, volatility and weak institutions are the main ones;
- Economic diversification is a challenging objective of the resource rich countries;
- A diversified resource rich economy needs a set of strategies and policies to be implemented; namely: sound fiscal and industrial policies with a strong basis of human capital and good business environment.

Chapter Two

The Empirical Literature

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 and to diversify their economies out of the resource sectors. In this context and taking into consideration the concepts providing in the first chapter, this chapter is divided into three sections: the first one displays the different works dealing with the resource curse using two different variables namely the resource abundance and the commodity price volatility; while the second section deals with the economic diversification as an objective and solution for the cursed countries. This section provides the different studies tackling empirically the issue of economic diversification and concludes a sub-section that sheds light on the countries experiences in diversifying their economies either successfully or no. Finally, the chapter summarizes the issues raised by all the studies presented in the previous sections and provides the contribution and the added value of the current thesis.

II-1- Evidence on the natural resource curse

II-1-1- evidence on the traditional resource curse

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.

- Sachs and Warner (1995):

(Jefrrey Sachs and Andrew Warner, 1995) 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 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 (tradable, non-tradable and the resource sectors) where the tradable manufacturing sector matters in the effects of endogenous growth.

- Gylfason and Zoega (2002):

(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);
- Other negative indirect effect via the Gini index* (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.

- Papyrakis and Gerlah (2003):

(Elissaios Papyrakis and Reyer Gerlah, 2003) 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*.

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;

* 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.

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

- 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;
- 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.

- **Alicia Rambaldi, Greg Hall and Richard Brown (2006):**

(Rambaldi, Hall and Brown, 2006) 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 (a ppositive 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.

- **Rabeh Arezki and Van der Ploeg (2007):**

(Rabeh Arezki and Van der Ploeg, 2007) 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.

- **Ali Alichi and Rabah Arezki (2009):**

In their paper, (Alichi and Arezki, 2009) 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 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;
- 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.

- **Kareem Ismail (2010):**

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

- **Tholvador Gylfason (2011):**

(Gylfason, 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.

- **Elbadawi and Soto (2012)**:

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.

- **Kabbashi Suliman (December 2012):**

(Kabbashi, 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 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.

- **Akinwale Yusuf Opeyemi (2012):**

In an investigation for the factors driving the oil curse in Nigeria, (Akinwale, 2012) 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-1-2 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.

- **Van der Ploeg and Poelhekke (2008):**

(Van der Ploeg and Poelhekke, 2008) showed in their paper that the curse of natural resources is foremost a problem of volatility. They used panel autoregressive conditional 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.

- **Paul Collier and Benedikt Goderis (2008):**

Unlike other studies, (Collier and Goderis, 2008) 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.

- **Michael Bleany and Havard Halland (2009):**

(Bleany and Halland, 2009) 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:

- 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.

- **Rabah Arezki and Thorvaldur Gylfason (2011):**

(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;
- 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.

- **Tiago, Cavalcanti, Mohaddes and Raissi (2011):**

The authors' paper (Tiago, Cavalcanti, Mohaddes and Raissi, 2011) 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.

- **Samimi, Sadeghi and Sadeghi (2011):**

(Samimi, Sadeghi and Sadeghi, 2011) 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 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.

- **Weishu Leong and Kamiar Mohaddes (2012):**

In their paper which tackled the institutions and the volatility, (Leong and Mohaddes, 2012) 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:

- 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.

- **Rabah Arezki and Mustapha K.Nabli (2012):**

In an analytical study on the Middle East and North Africa (MENA) region, (Arezki and Nabli, 2012) 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.

- **Ahmed S. Mahmud and Syed Abdul Basher (2013):**

(Ahmed S. Mahmud and Syed Abdul Basher, 2013) in 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-2- Evidence on economic diversification

III-2-1- Empirical evidence

In the recent years and after approving the evidence of the resource curse; many studies started to show the role of economic diversification in escaping the curse.

- Gylfason T. (2005):

In his paper, (Gylfason, 2005) illustrated the relationship between political and economic diversification and economic growth. He used multiple cross-country regressions to show the effect of both economic and political diversification on economic growth. Gylfason came to the result that rapid growth requires the accumulation of high-quality capital of several different kinds, and these different kinds of capital tend to complement one another in the growth process except the natural capital that competes with or crowds out the others. Thus, both economic and political diversifications are good for growth.

- Rodrik D. (2005):

Using the GINI index to measure economic diversification, (Rodrik, 2005) tried to describe the phenomenon of diversification in a set of countries and then he suggested ten principles for economic diversification policies in each country which are:

- Provide incentives and subsidies only for "new" activities.
- Establish clear benchmarks and criteria for success and failure of subsidized projects.
- Build in automatic sunset clause for subsidies.
- Target economic activities (technology transfer or adoption, training, and so on), not industrial sectors.
- Subsidize only activities that have clear potential to provide spillovers and demonstration effects.
- Vest the authority for carrying out industrial policies in agencies with demonstrated competence.
- Make sure agencies are monitored closely by a "principal" who has a clear stake in the outcomes and has political authority at the highest level.
- Make sure implementing agencies maintain channels of communication with the private sector.
- Understand that even under "optimal" industrial policies "picking losers" will sometimes occur.
- Endow promotion activities with the capacity to renew themselves, so that the cycle of discovery can become an ongoing one.

- Herzed D. and NOWAK-LEHMANN D. (2005):

(Herzed and Lehmann, 2005) tested the diversification-led growth hypothesis by estimating an augmented Cobb-Douglas production function on the basis of time series data from Chile covering the period 1962-2001. Using co-integration method, the authors attempted to examine the hypothesis that export diversification is linked to economic growth via externalities of learning-by-doing and learning-by-exporting fostered by competition in world markets. An interesting finding is that orienting further sectors towards exporting is more important for growth than increasing the share of industrial exports in total exports.

- Hesse H. (2008):

(Hesse, 2008) in his paper suggested that developing countries should diversify their exports since this can help them to overcome export instability or the negative impact of terms of trade in primary products. The author showed empirically using panel regression, that export diversification plays a vital role in the process of economic development where this latter is typically a process of structural transformation where countries move from producing "poor-country goods" to "rich-country goods."

- Al-kawaz A. (2008):

Regarding the case studies, (Al-kawaz, 2008) in his paper addressed the issue of economic diversification as a necessary but not sufficient condition to enhance the economic development process of the state of Kuwait. Referring to other oil producing countries and using pooled econometric model, the author recommended that macroeconomic and sectoral policies should work in parallel. Public policy in full cooperation with private sector should be oriented and re-oriented towards goods and services fails in the high quality category; institutional framework; developmental role of the state and high qualified human capital are essential.

- Alaya M. (2012):

(Alaya M. 2012) Studying the driver forces of export diversification in the Middle East and North Africa countries over the period 1984-2009; Alaya found an inverted-U shape relationship between economic development and diversification. His estimation results showed that endowments of natural resources explain the export concentration in this region. By contrast, openness and accumulation of physical capital (foreign and domestic) lead to more export diversification. The author used the Two Stages General Least Square Estimation with Panel data of twelve countries.

- Olumide S.A. and Akongwale S. (2013):

(Olumide S.A. and Akongwale S, 2013) Taking the Nigerian case, the authors showed, using both qualitative and quantitative analysis, that the solid mineral sector in Nigeria has the potential to contribute immensely to the economy of Nigeria. Specifically, they revealed that the development of the solid mineral sector could help to combat poverty in Nigeria via job creation; especially, given its forward linkage with other sectors of the economy. Most importantly, it could help alleviate some of the problems associated with "enclave" nature of the Nigerian economy that has for too long being vulnerable to fluctuations in global oil prices.

- NDJAMBOU P. (2013):

(NDJAMBOU P. 2013) In a Phd thesis, Ndjambou analyzed how territorial economic diversification can be the strategy to implement in Gabon in order to reduce its dependence on oil revenues. The method of Ordinary Least Squares (OLS) has been used to find out factors of the Gabonese economic diversification from 1980 to 2010. His model contained eight independent variables (level of development, public investment, foreign direct investment, inflation, exchange rate, trade openness, and entrepreneurship) and one dependent variable (Hirschman-Herfindalh-Standardized Index). It appeared from the statistical inference and the descriptive analysis that Gabonese economic diversification was affected by trade openness, the exchange rate and inflation.

Moreover, Ndjambou defined a diversification strategy that can boost territorial development of the country in the long term. This strategy of territorial economic diversification consists of five pillars that are: « Green Gabon », « Gabon energy », « Mining Gabon », « Blue Gabon » and « Gray Gabon ».

- Alodadi A.A.S. (2016):

(Alodadi A.A.S, 2016) here applied three models to examine the most important determinants of oil and non-oil sector economic growth in two of the largest economies in the Gulf Cooperation Council (GCC), namely Saudi Arabia and the UAE. Given the governments' determination to reduce dependence on oil income, Alodali's thesis focused on the role of non-oil sectors. Explanatory variables in the models included exports, government spending, investment (private and public), tourism (religious and international), labour and capital, while GDP is used as the dependent variable. Through isolating the non-oil sector from the oil sector, the study highlighted the potential role of tourism as a future crucial factor in determining economic growth in oil rich countries, especially in the GCC.

II-2-2 Countries' experiences

a- Case of Indonesia:

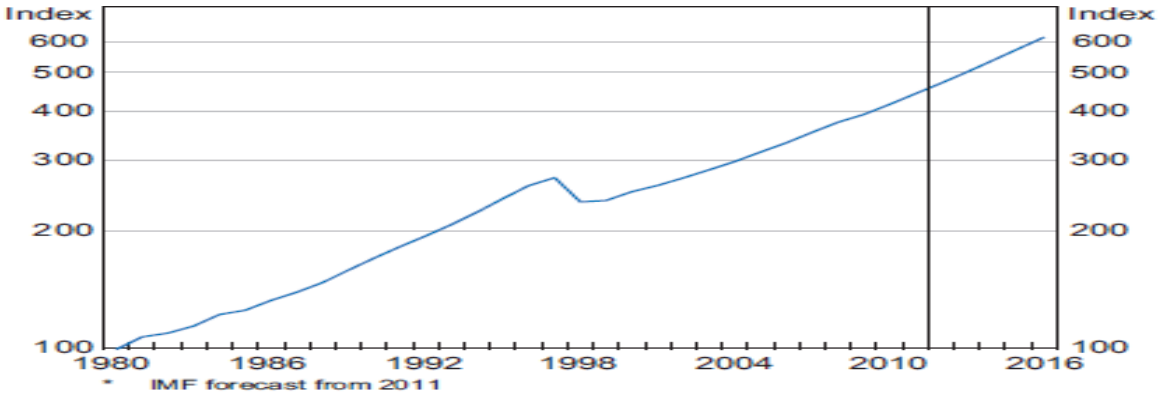
a-1. Overview on Indonesian economic performance

Indonesia is a vast maritime archipelago situated at the Equator, slightly above Australia. It consists of 17,000 islands has potential to be a source of several natural resources, i.e., geothermal reserves, liquid natural gas (LNG) reserves and minerals (bauxite, coal, copper, and gold).(Zen F. 2012).

Indonesia's oil industry is one of the worlds' oldest. The quest for oil began in 1871, only twelve years after the earliest drillings in Pennsylvania.(Gelb 1989). However, the sectoral composition of Indonesia's economy has gone through a series of changes in the past decades and it was not until 1980s when oil prices plummeted that Indonesia started to embrace an export-oriented policy. Indonesia's initial economic development depended on the extractive sector during the 1970s, and the country's industrialization started when the government adopted an import substitution policy. Windfall profits from the oil boom led the government to overlook the role of foreign investment; hence it focused on inward-looking policies.

Indonesia recorded impressive economic growth from the mid 1970s to 1997. It was one of the top performers in Asia, as the table below shows. When the 1997 Asian financial crisis occurred, Indonesia was the country hardest hit most severely and the effects lingered for years afterward (Zen, 2012); the average growth rates decreased from 7.9 in 1970s to 4.4% in 1990s. Nevertheless; Indonesia became an increasingly important part of the global economy in the recent years. It is now the fourth largest economy in east Asia1 – after China, Japan and South Korea – and the 15th largest economy in the world on purchasing power parity (PPP) basis (Elias S. and Noone C, 2011). Its real GDP is knowing an upward trend since the end of the Asian crisis and it is still increasing (Figure **2-1**).

Figure (2-1): Real GDP in Indonesia; 1980=100 Log scale



Source: *Elias S. and Noone C. (2011); P33*.

Table (2-1) : Selected Asian countries average growth (%)

Country	1970-1979	1980-1989	1990-1999	2000-2008	1970-2008
China	7.5	9.4	10.5	10.2	9.3
India	3.3	5.6	5.5	7.5	5.3
Indonesia	7.9	6.4	4.4	5.2	6.1
Malaysia	7.7	6.0	7.2	5.1	6.6
Philippines	5.7	1.8	3.1	4.8	3.9
Thailand	7.3	7.9	4.6	4.8	6.2

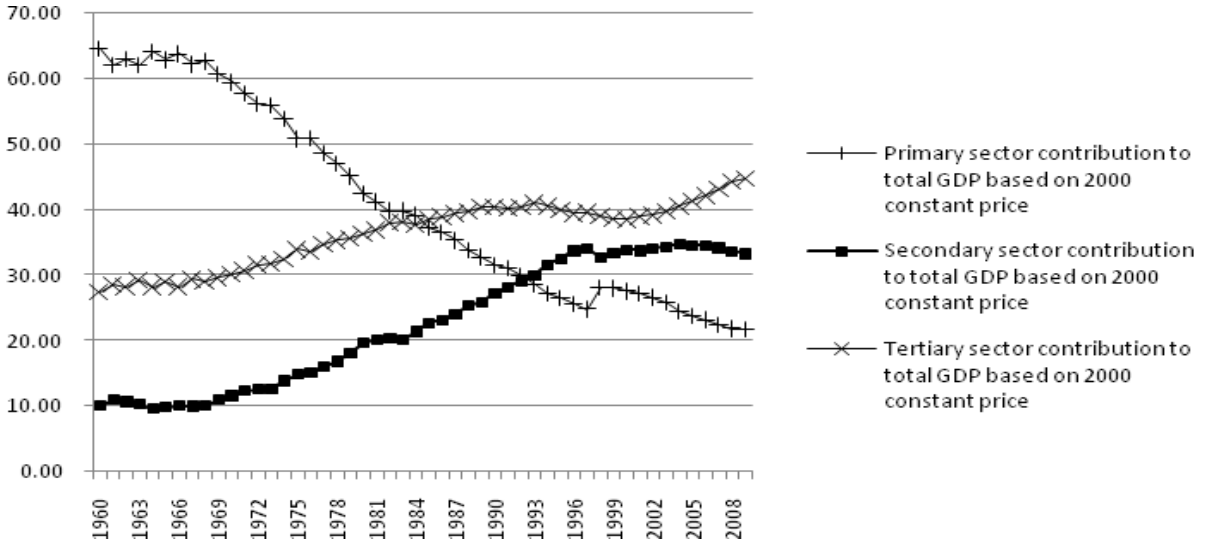
***Source**: Zen F. (2012); P3.*

Before displaying the other economic indicators and analyzing the sectoral composition of Indonesia, we provide the main features of the Indonesian economic policy which have been the main reason beyond its success to avoid the oil curse effects despite its abundance of oil. Gelb 1989 distinguished three of these features:

- The government accepted the need for a flexible exchange rate policy in large part because the idea that Indonesia's comparative advantage would be in oil for some time was never widely accepted.
- Macroeconomic management was prudent and adaptive. The government was prepared to use key macro instruments to spread the absorption of windfalls over time and limit the impact of the oil booms on the non-oil tradable sectors. It was also prepared to undertake major structural reforms to help adjust to the oil glut.
- The government was committed to a broad development strategy that emphasized raising rural incomes. It devised programs to achieve this and succeeded in enlisting the participation of millions of small farmers.

From the time of Indonesia's early economic development until industrialization started to occur in 1980s, the main source of Indonesia's output was the primary sector, while secondary and tertiary sectors significantly increased from the 1980s to 1996 as the figure presents. Despite industrializing over the past half century, agriculture remains an important part of the Indonesian economy accounting for 16 per cent of output in 2009 (a relatively high share compared with other economies in East Asia) (*Elias S. and Noone C. 2011).*

Figure (2-2) : Contributions of Sectoral Groups to Indonesia's Economy, 1960-2009



Source: *Zen F. (2012), ibid, P4.*

Note: *Primary sector= agriculture, mining and quarrying; secondary sector= manufacturing, utility and construction; and tertiary sector = all services.*

After the oil boom of 1973, Indonesia raised its expenditure largely from 412.0 Billion Rupiah in 1972 to 1282.1 Billion Rupiah in 1974 (Chekkouri S.M. (2012); P66). The Indonesian government has issued many laws during that period on both foreign direct and domestic investments. The government provided a closed list for FDI. It also gave tax incentives including up to five years of tax holidays for business profits, and an additional five-years of tax holidays for reinvesting net profits and dividends, as well as free import duty and excise for capital goods.52 More importantly, the government agreed to respect foreign investors' ownership rights by promising not to seize the foreign companies—a process often called "nationalization." Moreover, national private companies got generous tax incentives. Yet, these important laws in investment said nothing about export incentives. Government policies were indeed still inward-oriented, and production was directed to fulfill the domestic market (Zen F. (2012); P5).

In 1979, when oil prices plummeted and finally hit bottom in 1982; it forced Indonesia to undertake significant deregulation and liberalization policies. From 1985 to 1987, a series of regulations to support investment were issued. Some of the more significant ones were deregulation packages for the following industries: automotive, machinery and electrical equipment (issued in January 1987); and mining, agriculture, and health (issued in June 1987). The government also discounted import duties for selected commodities, including textiles and steel. To accelerate exports, it created Bonded Zone through Government Regulation No. 22 in 1986. Companies operating within such a zone got various tax and duty

incentives to support their exporting activities. This showed that Indonesia was changing its import-substitution policy for an export-oriented one. The openness to international capital accompanied by macroeconomic stabilization had attracted both foreign capital as well as domestic investment and eventually diversified the outputs. On the other hand, it decreased the portion of the extractive sector. Note that the extractive sector was not in the restricted investment list; therefore there were several foreign companies operating in this sector. The extractive sector's role in Indonesia's economy has declined over time and was significantly decreasing during the period of industrialization.

Table (2-2) : The Role of Extractive Sector in Indonesian Economy

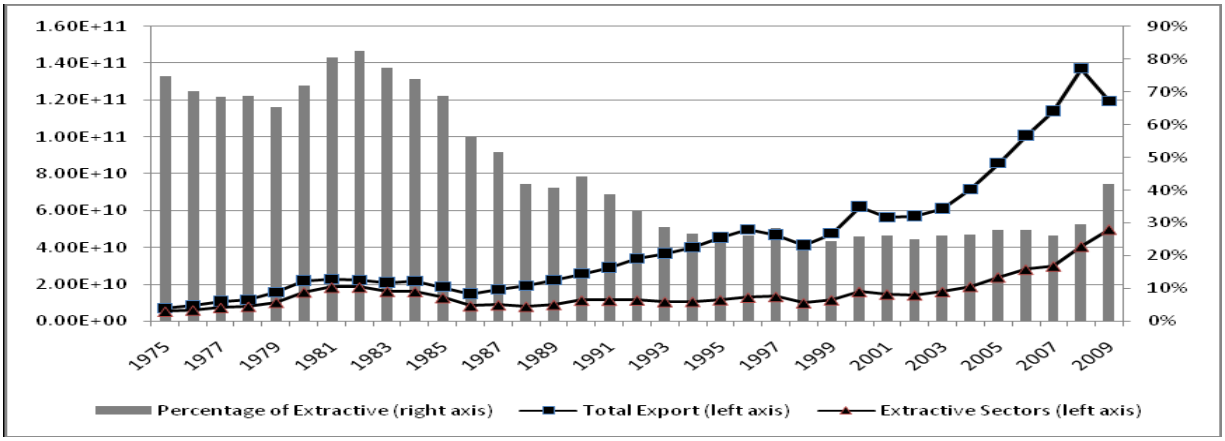
Year	Period of	Extractive Sector	
		Average Ratio to GDP	Growth (%)
1960-1967	Closed Economy	14.97	1.01
1968-1978	Open up to FDI	25.24	37.58
1979-1997	Industrialization	15.19	-55.00
1998-2009	Post-crisis	10.29	-32.75

***Source**: Zen F. (2012); P15.*

a-2. Diversification trends and reality in Indonesia

After stabilizing the political situation during the period 1965-1975 with the presidency of Suhartou; Indonesia started to build the economy in a few basic sectors: infrastructure, basic industries, agriculture and education where it remarkably improved its human development index and welfare of people. In the name of nationalism, the government adopted an import-substitution policy to decrease Indonesia's dependency on imported goods using the oil profits coming from the 1973's oil boom. In 1983 and after the sharp decrease in oil prices, Indonesia faced an economic crisis; the government had to respond by devaluating the currency, searching for foreign aid, reopening the door to foreign capital, and lifting protections on domestic industries. Since then, when the government relaxed the restrictions and promoted export-oriented policies, FDI increased. It contributed to higher diversification in manufacturing industries in Indonesia. Hence, export performance was undersized before 1985 and was dominated by the extractive sector. The export value of the non-extractive sector had been increasing since then as the figure below shows, but tends to be stagnant since the 1997 crisis. Meanwhile, the extractive sector (primary commodity) continues to play a significant role in Indonesia's economic growth.

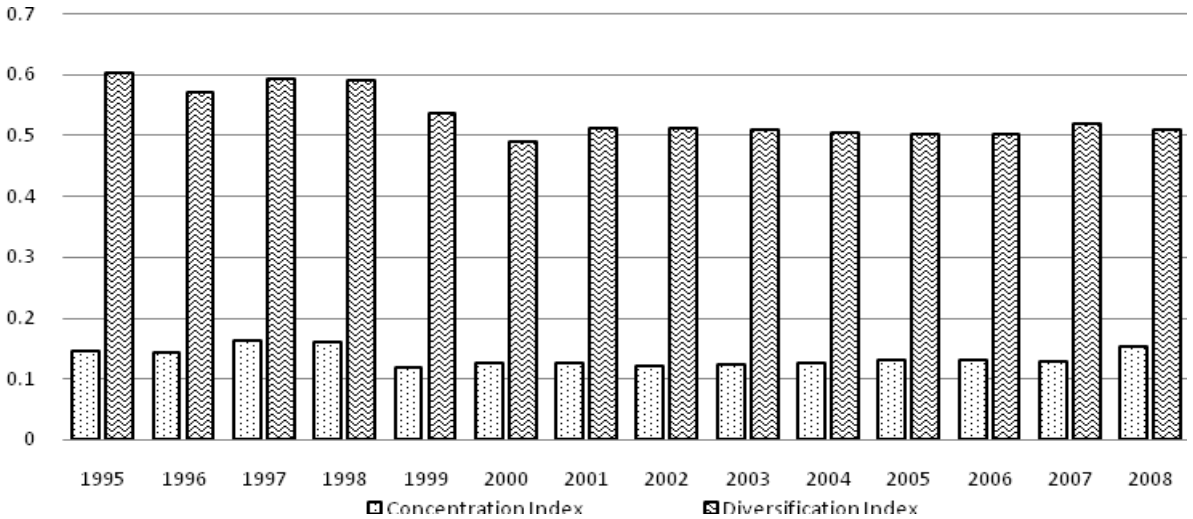
Figure (2-3) : Export Value (US$) of Indonesia to the World



Source: *Zen F. (2012); P9.*

The shifting of industrial policies from inward- to outward-looking was accomplished by introducing incentives for export-oriented industries in the 1980s, accompanied by growing numbers of export processing zones (EPZ) established in several locations. The EPZs were created to provide jobs, increase exports and gain technology transfers. Imported and exported goods to and from EPZs are exempted from tax and duty. (*Zen F. (2012))*

Figure (2-4) : Concentration Index and Diversification Index of Indonesia's Exports



Source: *Zen F. (2012); P10.*

The figure above shows clearly that Indonesia is achieving high diversification indexes comparing to its concentration index which reflects the success of its economic strategies to avoid its dependency on oil exports.

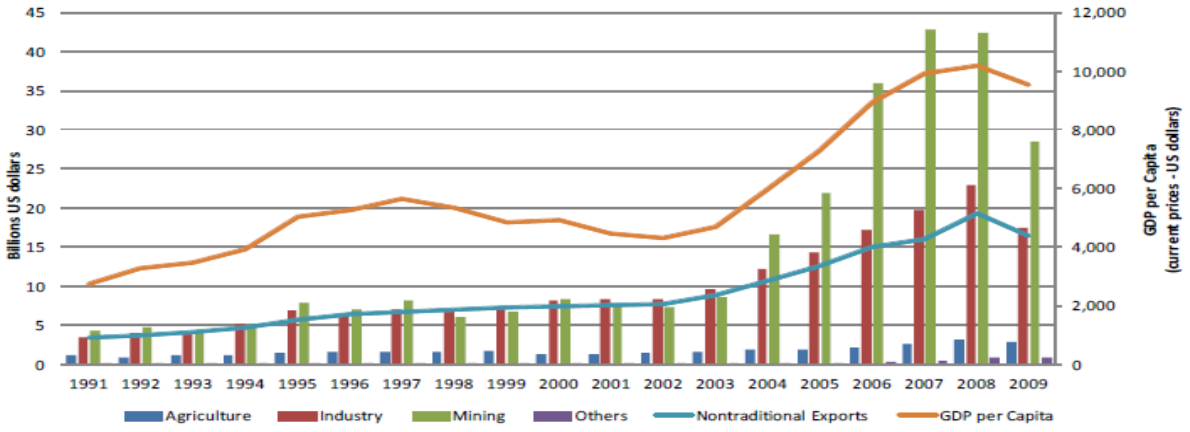
b. Case of Chile:

b-1. Role of resource revenues in Chile's economy

Chile has 38 percent of the world's copper reserves and is the largest copper producer, having produced 33.6 percent of the world's copper in 2009. It's also a leading supplier of molybdenum, rhenium, silver, gold, iron, natural nitrates and others. Revenues from the mining industry constitute an important share of income, and key social programs in areas such as health, pensions, disability and innovation are funded in part by revenues from this industry. The biggest source of income comes from the two state-owned companies, the Chilean National Copper Corp. (CODELCO) and the much smaller National Mining Co. (ENAMI). (Varas M.E, 2012, P3)

Copper in Chile has two important features that characterize this activity. First, copper has been produced mainly by large firms (producing more than 50,000 tons per year). In the last fifty years, more than 85% of Chilean copper production has been related to large firms. Second, since the 1970s (after the "Nationalization" process of 1971), state and private firms have coexisted in copper mining. Regarding the exports, the participation of copper as a percentage of the Chilean export basket has diminished considerably over the last 50 years. Until the seventies, copper played an important role in the export basket, with participation as much as 70%, but this had dropped to 35% by 2002 (of total exports). Then, due to the recent boom in copper prices, the share in the export basket increased to a peak of 57% in 2006, not because of increased production but chiefly as a result of the price effects. This drop in copper's participation in total exports is considered to be an indicator of the success in the diversification of the economy. That is, the Chilean economy depends less on copper now than it did in the 1970s. (Miller A. and Simpasa A. 2011)

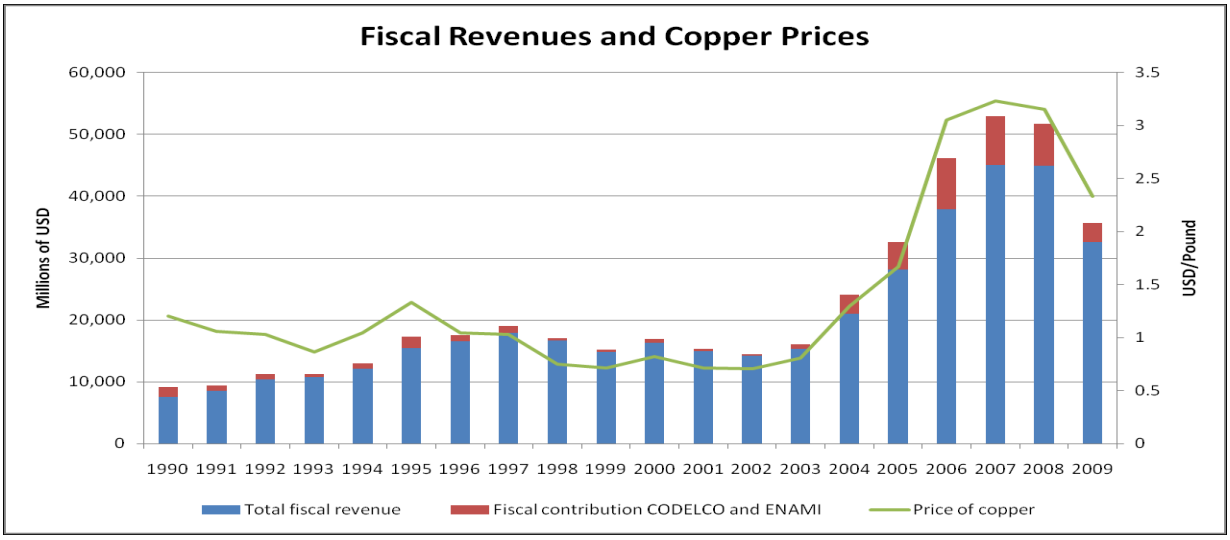
Figure (2-5) : Total Exports by Sector and GDP per Capita (FOB prices 1991-2009)



***Source**: (Varas M.E. (2012); P17.*

After the increase of the copper prices in 2004, policymakers started discussing a set of reforms in the first half of the 2000s that would allow the state to manage cyclical changes in the price of copper. In 2006 a new royalty on mining activities took effect that allowed the state to take part in the cyclical windfall, particularly of copper and, more recently, molybdenum prices. Along with the instatement of other laws, the increase in state revenues allowed the creation of three funds that would make a big impact on Chile's public policy: the Economic and Social Stability Fund (ESSF), the Pension Reserve Fund (PRF) and the Innovation for Competitiveness Fund (ICF). Fiscal revenues increased considerably since 2004 in which the higher contributions are made by the state-owned companies than by the private sector under the royalty law. On average, contributions from CODELCO and ENAMI to total fiscal revenues between 2004 and 2009 amounted to 15.72 percent, having reached a high of 22 percent in 2006. The chart below shows the evolution of fiscal revenues and the share coming from CODELCO and ENAMI in relation to copper prices.

Figure (2-6) : State-Owned Copper Companies and Total Fiscal Revenues

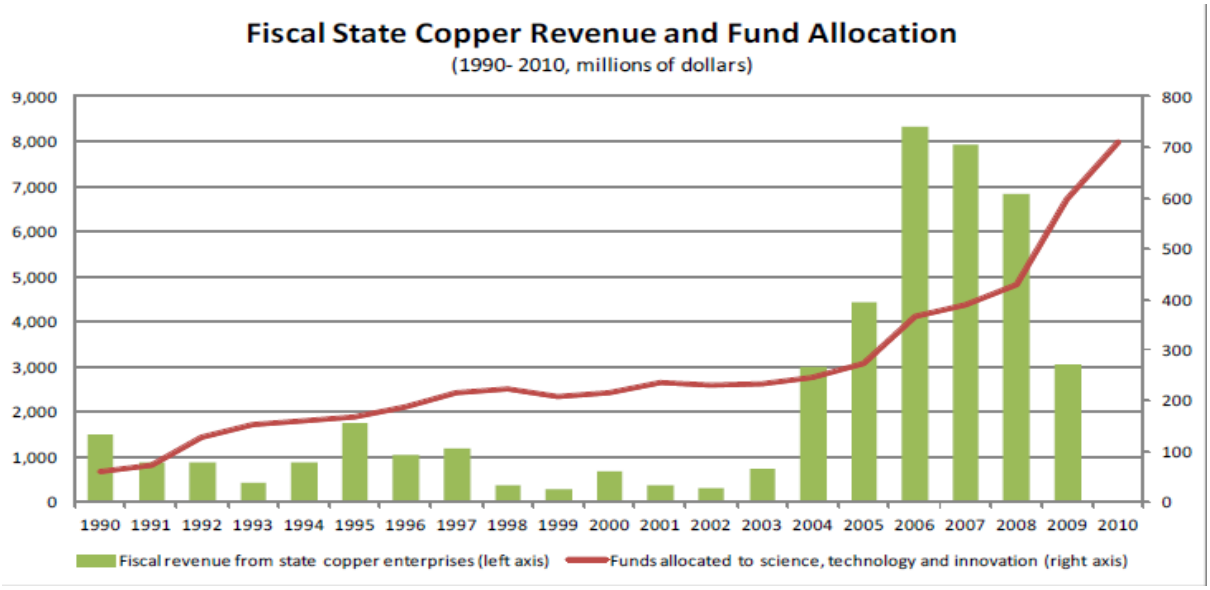


Source: *Varas M.E. (2012); 12.*

In the context of funds creation, the ESSF was created in 2007 with the objective of financing possible fiscal deficits and/or to amortize public debt, therefore avoiding the effects of any economic or financial downturns stemming from the world economy or the volatility of state income from copper or other sources. Its initial asset was $2.58 billion. The PRF was created in 2006 with an initial asset of $604.5 million. It is designed to finance programs introduced by pension reform targeting the increasing expenses of the aging population and covering basic old age and disability solidarity pensions. The ICF stems from the creation of the NCIC in 2005, a public-private advisory board for the president of Chile that does not have enforcement powers. Its main goal was to create a National Strategy of Innovation for

Competitiveness (NSIC) for the next 15 years providing a vision of the role that Chile's productive sector should have in the world economy. The figure below presents the development of fiscal revenues and the fund allocation of ICF and it is obvious that the Chilean government has relied on this fund due to its important objectives to achieve economic diversification.

Figure (2-7): Fiscal Revenues from State Copper Companies and Fund Allocation to ICF and Programs on Science and Technology



Source: *Varas M.E. (2012); 12.*

b-2. The government strategies and diversification reality

In addition to the funds created after the copper price boom; a set of policies was implemented to stabilize the macroeconomic environment, supervise capital markets, regulate monopolies and control volatility. In terms of a growth strategy, the government focused on increasing productivity through export growth. This strategy consisted firstly of programs supporting the creation of small and medium-sized enterprises (SMEs) and facilitating their access to financing. Secondly, the government initiated an aggressive strategy to fully integrate into the world economy by negotiating free trade agreements, lowering tariffs and therefore facilitating access to untapped and bigger markets for the new and more diversified types of exports. However, it's important to note that the policies implemented in this period were mainly composed of horizontal ones—with only a later addition of vertical policies after the recommendations of NCIC; in a way this continued the previous period's notion of state neutrality toward the productive sector. *(Varas M.E, 2012)*

Table (2-3) : Main State Agencies and Instruments

Main Mission		Instruments
BancoEstado	Provides financing to SMEs	As a government commercial bank, it provides credit to SMEs otherwise considered too risky to be given credit in commercial banks. It does so through the FOGAPE program, which serves as a guarantor in the credit process.
National Commission for Scientific and Technological Investigation (CONICYT)	Improve human capital and strengthen the scientific and technological base	Founded in 1967 as part of the Ministry of Education, it operates through 11 programs aimed at improving Chile's knowledge-based human capital through research and development (R&D). It is a key player, managing an average of 42 percent of the total funds allocated to the National Strategy for Innovation and Competitiveness.
CORFO	Supports entrepreneurs, provides funding, and promotes innovation	It provides horizontal support to all sectors through an array of programs, some of which are programs working with small providers (Supplier Development Program-PDP). It fosters strategic alliances between SMEs (PROFO) improves management quality and productivity (FAT). It also supports technical assistance to encourage SMEs to get certified with international standards (FOCAL).
CORFO-GIF	Provides financing to SMEs	It provides access to financing for SMEs or people who do not qualify for loans from commercial banks. It does so by issuing debt instruments and placing them in the market. The funds do not target specific sectors or clusters.
CORFO-INNOVA	Supports innovation	With the creation of the CNIC, this agency supports innovation programs with a high technological component through seed capital, connecting with angel investors, providing technical assistance, and other types of subsidies.
CORFO-InvestChile	Attracts foreign investment in high technology	This was created in 2000 to encourage FDI focusing on assisting technology-intensive companies that relocate to Chile. It offers economic incentives and assistance throughout all stages of development and start-up. Some companies established through the implementation of this program are Delta's call center, Yahoo, JP Morgan and McAfee.
Foreign Investment Committee	Attracts FDI and positions Chile as an investment platform	This administers the contracts through which FDI is materialized and promotes Chile as a stable, modern, open economy for investments.13 It also promotes Chile's trade network through which investors can operate to reach other markets.
DIRECON	Negotiates and administers Chile's trade agreements	Specialized teams negotiate and administer free trade agreements and other economic or association agreements.
ProChile	Supports exporting efforts of SMEs	This promotes Chilean products and services through a network of 56 offices. It co-finances participation in trade shows, identifies business opportunities, and provides technical assistance to exporters.

Ministry of Agriculture – FIA	Supports innovation in agri-business	The agency provides support through financing and technical assistance to projects and businesses incorporating higher technology into their productive process.
Ministry of Agriculture – INDAP	Support small agricultural family- based businesses	Created in 1962, it provides micro-credits to rural, small family-owned businesses in order to achieve sustainability and increase competitiveness in the national and international market.

Source: *Varas M.E. (2012) ; P9.*

Despite all the efforts done to achieve diversification, Chile's exports have been affected by the copper prices via the appreciation of the real exchange rate. To evaluate the level of exports and their diversification, (Varas, 2012) used the Herfindahl-Hirschman Index HHI. Including all sectors of the economy, Chile shows a trend of diversification (other than a slight increase in 1995 to 1997) up to 2004 when the trend reverses. The gap from 1995 to 1997 and the trend observed since 2004 could be explained by the increase in the price of copper (more than $1 a pound in the 1990s and later between $1 and more than $3 from 2004 to 2008). To show the role of copper, (Varas,2012) isolated copper exports and as we notice from the table below a slight decrease in the index showing that the country is slowly moving toward a more diversified economy.

Table (2-4) : HHI for Chile

Years	HHI without copper	HHI with all sectors
1990	0.28	0.30
1991	0.27	0.26
1992	0.28	0.26
1993	0.25	0.24
1994	0.24	0.24
1995	0.26	0.26
1996	0.25	0.25
1997	0.23	0.25
1998	0.23	0.23
1999	0.23	0.24
2000	0.21	0.24
2001	0.21	0.23
2002	0.22	0.23
2003	0.22	0.22
2004	0.22	0.25
2005	0.21	0.26
2006	0.20	0.29
2007	0.20	0.30
2008	0.20	0.27
2009	0.22	0.27

Source*: Varas (2012) calculations based on data from UN Comtrade according to the Standard International Trade Classification, rev.3.*

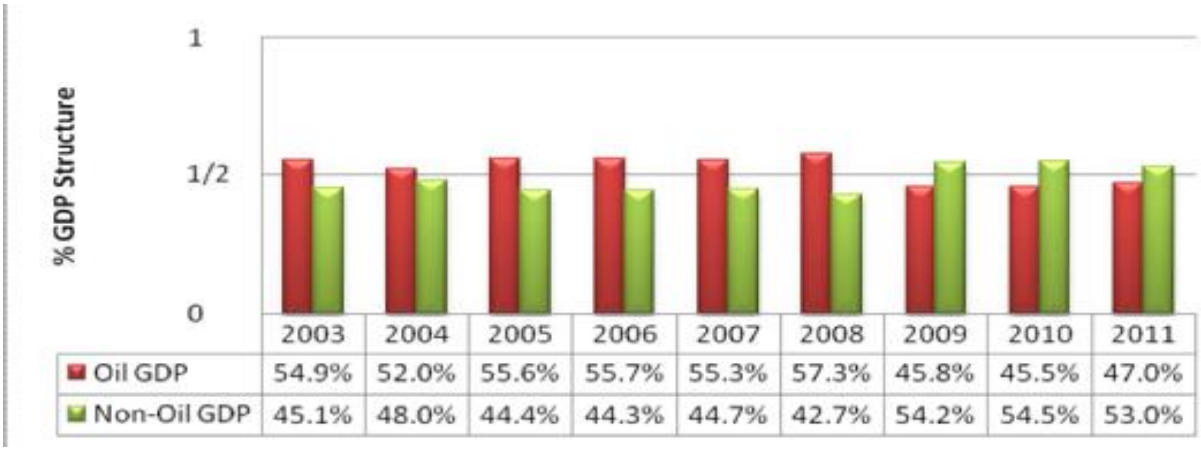
c. *Case of Angola*:

c-1. Oil economy in Angola

After becoming independent from Portugal in 1975, Angola faced an intense civil war that destroyed most of the economic infra-structure which led to the paralysation of most economic activities (agriculture and the industry) except the production of oil and diamond that were used mainly to finance the war. In 2002 the war ceased and eventually the country gained peace. With the peace Angola increased the production of oil and diamonds and started to invest in agriculture and industry and other sectors of the economy such as services (Paulo F.M. 2013; p 10).

Angolan oil sector (the second largest in the Sub-Saharan region after Nigeria) represents around half of GDP, 95% of exports and 75% of government revenues. On the back of continued exploration and a favourable regulatory environment; oil production reached 1.75 m bpd in 2012. In the longer term, if the newly discovered pre-salt reserves prove similar to those found in Brazil, Angola could become Africa's largest oil producer (Chatterjee C.S. 2013; Deutsch Ban Research)

Figure (2-8) : structure of GDP in Angola

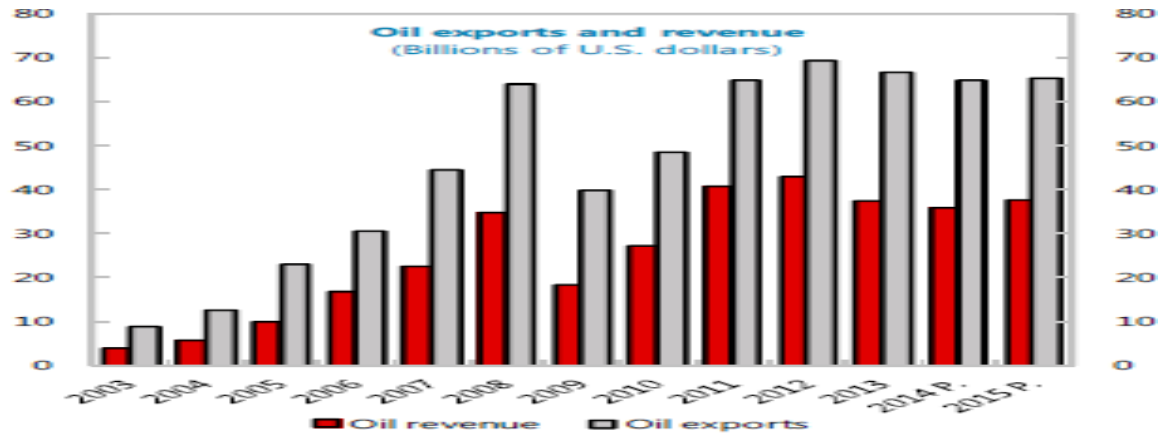


	2003	2004	2005	2006	2007	2008	2009	2010	2011
Oil GDP	54.9%	52.0%	55.6%	55.7%	55.3%	57.3%	45.8%	45.5%	47.0%
Non-Oil GDP	45.1%	48.0%	44.4%	44.3%	44.7%	42.7%	54.2%	54.5%	53.0%

Source: *Paulo F.M. (2013) "Diversification of the Angolan Exports – Challenges and Benefits"; p15.*

The figure above shows clearly the concentration of the Angolan economy on the crude oil production. Moreover, the fiscal policy is also dependant on the oil windfalls and their volatility as the figure and the table below display. However, Angola is trying to improve the expenditure management to reduce the effect of oil price volatility with the introduction of new control procedures for contracts above USD 1.5 million, and accumulated arrears (USD 2.3 billion in 2012) were eliminated (Muzima J.D. and Mandy F. 2015; African Economic Outlook Report; P5)

Figure (2-9) : oil revenues and exports



Source: International monetary fund (2014); Country report N°14/274; P20.

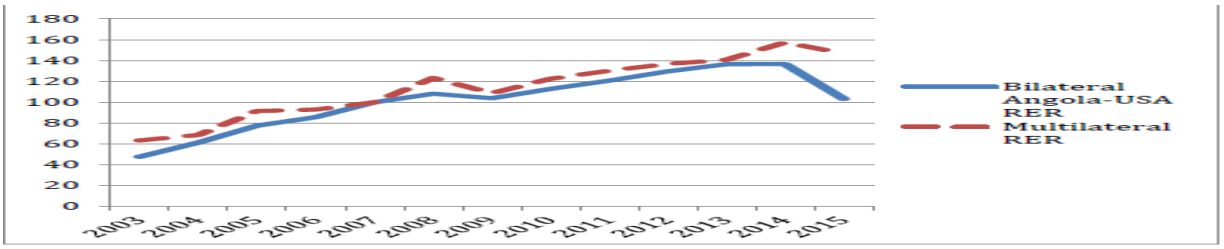
Table (2-5): Central government indicators

	2009	2010	2011	2012	2013 Prel.	2014 Proj.	2015 Proj.
Central government (percent of GDP)							
Total revenue	34.5	43.5	48.8	45.9	41.0	37.5	37.0
Of which: Oil-related	24.2	33.0	39.0	37.3	30.0	27.2	26.5
Of which: Non-oil tax	9.0	7.8	7.3	6.6	8.1	8.2	8.6
Total expenditure	41.9	40.0	40.2	41.3	40.7	41.6	41.2
Current expenditure	29.5	28.6	30.0	29.0	28.7	29.6	29.3
Capital expenditure	12.4	11.4	10.2	12.3	12.0	12.0	11.9
Overall fiscal balance	-7.4	3.4	8.7	4.6	0.3	-4.1	-4.2
Non-oil primary fiscal balance	-29.8	-26.2	-26.9	-29.2	-27.5	-28.9	-27.9
Non-oil primary fiscal balance (Percent of non-oil GDP)	-53.7	-47.4	-51.1	-53.7	-46.2	-46.0	-42.8

Source: *International monetary fund (2014); Country report N°14/274; P26.*

In addition to volatility of oil revenues, reliance on oil exposes Angola to "Dutch disease" whereby oil revenues lead to currency appreciation that crowds out other tradable goods sectors and, worse, the "resource curse" effects on corruption and rent-seeking. Regarding the exchange rate, the oil prices had an effect on the appreciation of the real exchange rate of Kwanza (see the figure below) which reflects that Angola could not avoid the Dutch Disease effect and the oil curse and this will be confirmed by analyzing the diversification of the economy in the next sub-section.

Figure (2-10) : Angola Bilateral Vis a Vis USA and Multilateral Real Exchange Rates (RER) 2007 = 100

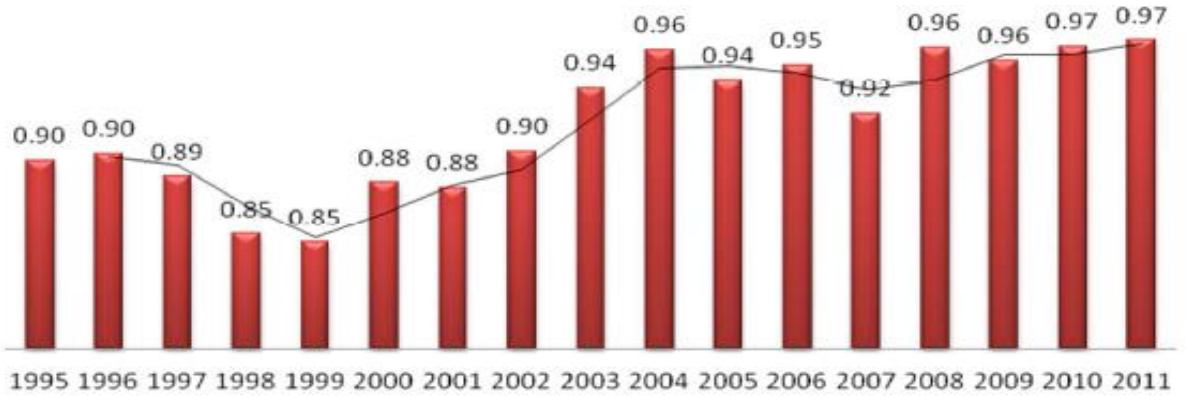


Source: *Golub S. and Prasad V. (2016); "Promoting Economic Diversification and International Competitiveness in Angola"; P7.*

c-2. Economic diversification in Angola

The economic diversification has not been addressed in Angola until the late of 2000s. As we have seen in the previous sub-section, the main macroeconomic indicators show that the Angolan economy is so concentrated on only one industry (oil). For more analysis on the export concentration, the figure presents the development of the Herfindahl Hirschmann Index.

Figure (2-11): Angola's Herfindahl Index



Source: *Paulo F.M. (2013); P26.*

From the figure, the Herfindahl index is above 0.9 very close to 1 the upper limit of concentration. It is noteworthy that from 1997 to 2001 the concentration index is lower than 0.9 and within this period in 1998 and 1999 was recorded the lowest concentration index being this 0.85. One of the reasons that might explain this fact is the higher diamond production and exports that occurred in this period and the lower crude oil production due to the intensity of the war in these years, helped decrease the exports concentration index. With the end of the civil war in April of 2002 the concentration index started to increase again reaching the value of 0.97 in 2011. During the period of peace from 2002 to 2011, only in 2007 was recorded a lower index (0.92) throughout all this period.

In 2014, manufacturing and agriculture accounted for only about 5%-7% of GDP each, despite the fact that some 70% of the population is employed in agriculture. Recently, rapid growth of some service industries, notably banking and telecommunications, have slightly reduced the oil-diamonds share of GDP and there are some glimmers of hope for the revival of commercial agriculture (*Golub S. and Prasad V. (2016);P 2).*

All the indicators above show that diversification is still a challenge for Angola and this is because of many reasons like the business climate and the poor institutional framework which will be assessed in the countries experiences comparison sub-section.

d- Countries experiences comparison

The three of the countries analyzed before are natural resource abundant countries. However, each one has applied different strategy to avoid the negative effect of this natural resource on its economy i.e.: diversifying its economy.

The experience of Angola with diversification is more recent than of Chile and Indonesia because of the civil war and the political instability that it faced before 2002. Indonesia has achieved good economic performances and could benefit from the oil booms to re-orient its economic structure from an oil dependent to a diversified economy from the growth in the agricultural and industrial sectors in addition to other tradable commodities which avoided the Dutsch Disease and oil price volatility effects. Whereas, Chile is a special case in managing natural resources; it has applied sound fiscal policies to avoid the effect of copper price volatility but the diversification; and although it is (Chile) a successful experience; is still moving very slowly and this is due to the place of Chile as the most important producer of copper in the world.

From the experiences above and the characteristics of each economy, we can extend the following differences:

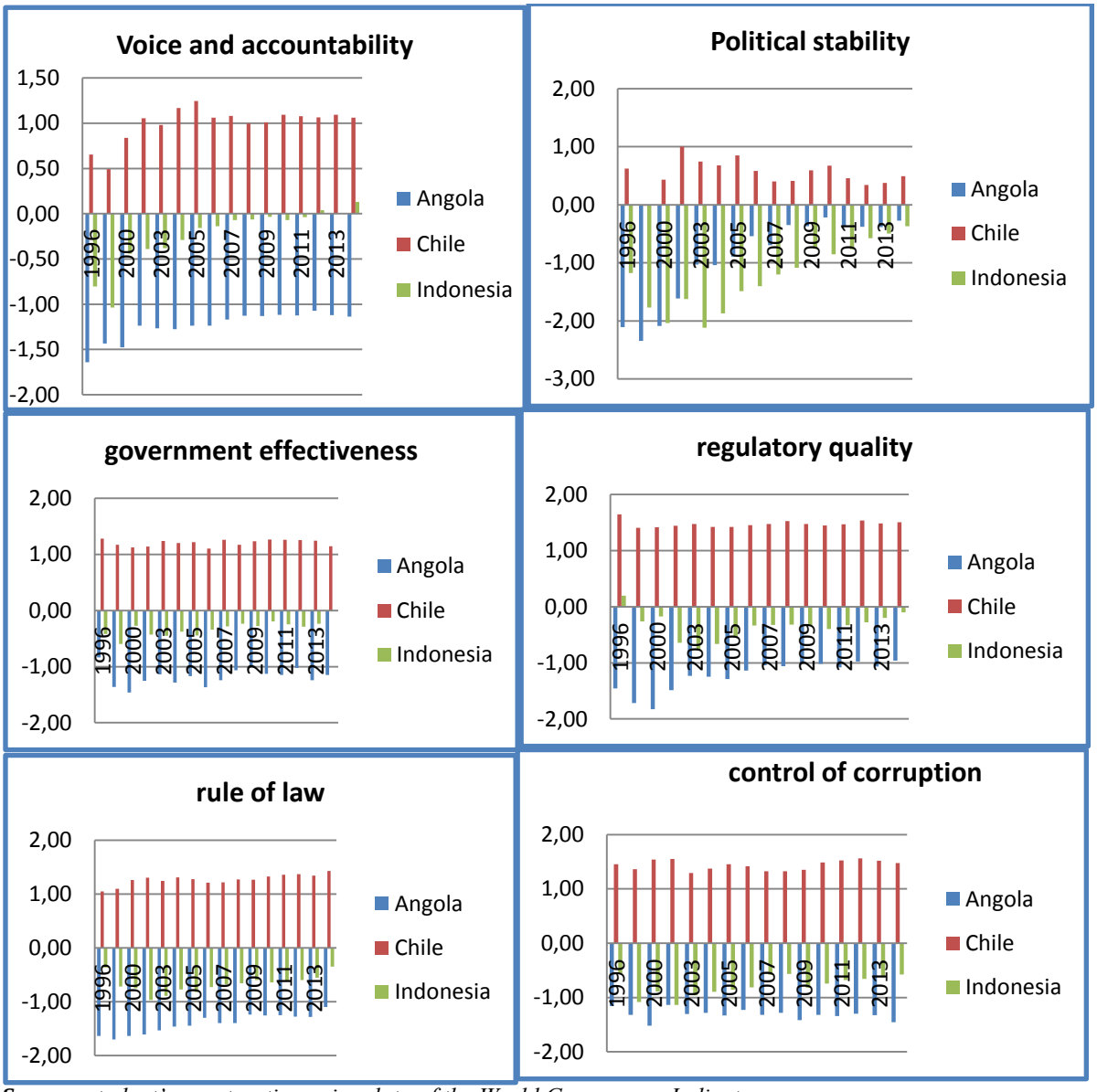
- The political situation and governance

Since 1973, Indonesia and Chile faced a stable political and economic situation due to the Suhartu's government in Indonesia and the nationalization of copper industry in Chile; this has had a good effect on the economic performances of both countries: effective economic policies suitable with the economic variations and strong economic objectives.

While Angola has faced very bad political situations; it has not been independent until 1975 and this was followed with a strong civil war ending till 2002. All this has impeded the economic recovery in Angola.

For the governance, it is clear that the three countries have not achieved yet the most developed economies' level due to the quality of their political and economic institutions as to other social indicators. However, the governance reality differs among the three of them. The figure below displays the six governance indicators for Angola, Indonesia and Chile and we can clearly notice that Chile records the highest and positive levels followed by Indonesia which records negative rather than positive indicators due to its large population and the poverty which still a challenge in many areas in Indonesia; while Angola seems to be the worst one; negative levels for all indicators.

Figure (2-12) : Governance indicators (Angola, Chile and Indonesia 1996-2014)

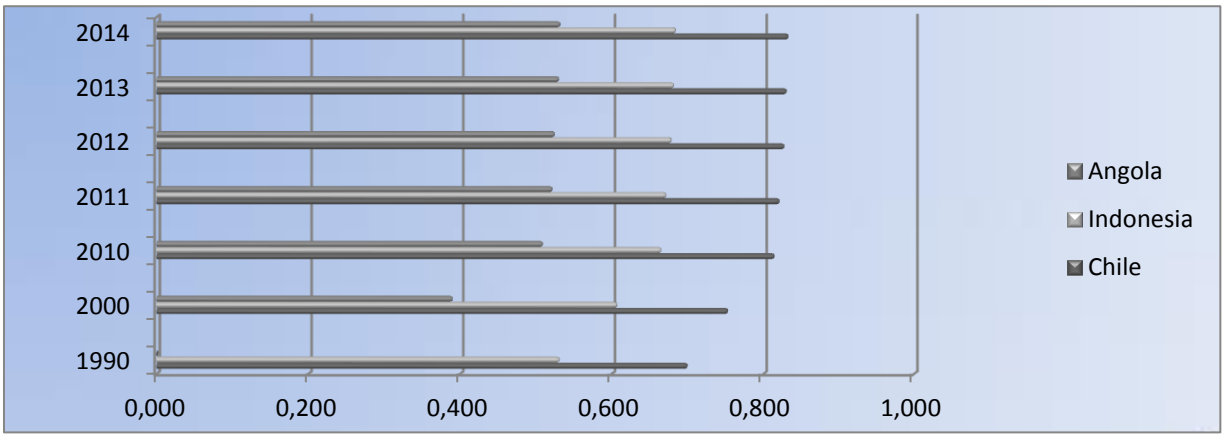


Source: *student's construction using data of the World Governance Indicators.*

- Human development

Human capital represents a key element in the economic diversification path as we have seen in chapter II. The strategies applied by the Indonesian and Angolan governments to diversify their economies focused largely on the sector of education and human capital, this has led to higher human development indexes. Chile ranks 42 in the world among the very highest human development indexes due to the strong focus of the government on higher human development by creating the National Council on Innovation and Competitiveness (NCIC), while Indonesia ranks 110 in the world among the medium indexes. Angola ranks 149 in the world among the lowest countries. The figure below shows the trend of the human development index from 1990 to 2014 for the three countries.

Figure (2-13): the Human Development Index (1990-2014)



Source: *Student's construction using data from the United Nations Development Programs.*

- Dealing with the economic policies

Chile has focused in the early stage of diversification on industrial policy and developing the import substitutions industries. However, the Chilean strategy since 1975 was horizontal dealing most with fiscal and exchange rate policies and human capital with some vertical policies focusing on the industrial sector; while Indonesia applied in addition to the human development focus; vertical policies focusing on non-mining industry and much more on agriculture. The Indonesian government policies had an effective role to support the rural areas and agriculture's development and regulation. For Angola, the civil war had an important impact on the development path and economic policies; the government has not focused on any specific sector, the weak governance is impeding this path. Angola tried recently to apply horizontal policies to reduce the oil volatility effect by creating a stabilization fund, however, this fund seems to be ineffective because of its dependency on oil prices which keeps the accumulations stagnant.

II-3 Issues raised by empirical evidence and contribution of the study

II-3-1 Issues raised by empirical evidence

The empirical literature provided in this thesis has been divided into two dependent sections; one focusing on the so-called natural resource curse dealing with its two channels: resource abundance and volatility; the other section focused on the role of economic diversification in avoiding such curse and thus enhancing economic growth.

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 and openness to reduce the resource curse. Nevertheless, these studies differed in the control variables and methodologies they used; Sachs and Warner (1995) 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 (tradable, non-tradable and the resource sectors) where the tradable manufacturing sector matters in the effects of endogenous growth; Gylfason and Zoega (2002) focused on the role of education and inequality as channel through which the negative impact of resource abundance on economic growth appears; Papyrais and Gerlah (2003) gave the importance to the investment and their results showed that it is the most importance channel leading to the resource curse; Rambaldi et al (2006) and in addition to the measure of natural abundance, they used their own measure of non-renewable resource rents per capita in which they didn't find any evidence of the resource curse. Focusing on the role of trade openness and institutional quality, Arezki and Van der ploeg showed the indirect negative effect of the natural resource abundance through those channels. 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; they also estimated the Dutch disease effect using the REER in addition to other control variables including restrictions on international goods and capital movements, and interactions of government spending with other variables; whereas, such effect (the Dutch Disease) has been estimated by Kabbashi (2012) using the impact of the misalignment of the RER on competitiveness approximated by the contribution to TFP growth.

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.

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. Obviously, the dominant feature in this set of studies is that most of them used the GMM method to test the volatility effect except the

work of Vander Ploeg and Poelhekk (2008) using the ARCH-M and Collier and Goderis (2008) using co-integration methodology. However, the same studies differed in the index of the volatility they used; some of them used the volatility of output measured by the yearly standard deviation of monthly growth rates (Vander Ploeg and Poelhekk 2008 and Bleany and Halland 2009); others used the commodity terms of trade (CTOT) volatility to show the same effect measured either by the yearly standard deviation(Cavalcanti, Mohades and Raissi 2011) or extracted from the GARCH (1,1) model (Samimi, Sadegui and Sadegui 2011) while others used the price volatility measured either by the yearly standard deviation (Arezki and Gylfason 2011) or using the effect of the commodity booms (Collier and Goderis 2008 and Mahmud and Abdul Basher 2013). Differently, Bleany and Halland (2009) estimated the effect of fiscal policy volatility in addition to output volatility instead of commodity price volatility as the fiscal policy is the main channel to the natural resource curse.

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.

Regarding the studies dealing with the economic diversification issue, most of them have used simple models such as: co-integration; OLS; Two stages least squares and GMM. All of the studies came to the result that economic diversification is important and has a crucial role in economic growth; however, such diversification should be promoted by some other economic and political variables considered as determinants. These determinants are obviously related to the economic growth which reflects the interrelationship between economic diversification, its determinants and economic growth. In addition to their common result showing the importance of economic diversification and its determinants, most of the studies used the Herfindahl-Hirschman index to measure economic diversification except Rodrik (2005) who used the Gini index and Gylfason (2005) using the effect of political diversification.

The works dealing with the economic diversification issue can be divided into two sets; one dealing with the impact of the diversification on the economic growth and development (Gylfason 2005; Herzed and Lehmann 2005; Hesse 2008; Al-Kawaz 2008 and Alodali 2016); the second set is the one analysing the determinants of economic diversification (Rodrik 2005; Alaya 2012 and Ndjambou 2013).

From the remarks above, we can distinguish the following results that are common in the majority of the empirical literature:

- 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 via export and economic diversification;
- As the human capital is a key determinant of both economic growth and diversification, its absence allows for the occurrence of the resource curse, thus, countries endowed with natural resources should give importance to this factor;
- Investment with its two patterns domestic and foreign is a vital element in the economic development path so that it represents the best tool to diversify an economy;
- 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.

Consequently; our scientific interest from this chapter was as follows:

- Building the theoretical framework of the study from the concepts provided by the previous studies dealing with natural resource curse and economic diversification;
- Building the problematic of the study and its objectives and importance;
- Building the empirical framework and the model of the research from the models and the variables used which helped to build a model supporting the Algerian case;
- The empirical literature's results had a contribution in building the analytical framework and the explanation of the recent results.

II-3-2 The contribution of the study

Although this thesis has benefited a lot from the previous studies in both conceptual and empirical framework and it shares several points with them; it has specific issues which can be considered as a contribution in the scientific research. The thesis is different from the other previous studies in three points:

- This study investigates in the direct effect of the oil price volatility on the economic diversification in Algeria which has not been taken into consideration in the previous empirical works dealing with the diversification issue;
- Differently to the other studies that focused on the panel data in showing the determinants of economic diversification, the current research uses time series data for the Algerian economy

which represents a challenge in doing such kind of studies because of the lack of data facing the researcher;

- The empirical side of the thesis includes two steps; the first one is to analyse the economic diversification in Algeria seeking in its determinants and showing the inter-relationship between oil price volatility, economic growth and economic diversification. To do that, we use the two stages least squares method. In the second step, the thesis tries to measure the economic diversification using the portfolio theory; this measure is characterized by its ability to show the link between the diversification and the instability of an economy; thus, it measures the link between diversification and volatility in one index.

The table below summarizes the different points between the current study and the previous researches:

Table (2-6) : the differences between the current and the previous studies

	The previous studies	**The current study**
The sample	Covered the period from 1970 to 2010	Covered the period 1985 - 2015
The type of data	Cross-section and Panel data	Time series data
The variables used	**Economic diversification**: HHI and Gini index **Volatility**: Yearly standard deviation of economic growth; yearly standard deviation and conditional standard deviation of TOT and the yearly standard deviation of the commodity price index **Economic growth**: real GDP per capita; Non-resource GDP per capita	**Economic diversification**: HHI and Portfolio index **Volatility**: the yearly standard deviation of the monthly oil prices **Economic growth**: real GDP per capita
The econometric method	Co-integration; Ordinary least squares; Generalized method of moments and ARCH in mean.	Two stages least squares and trend analysis of the portfolio index.
The study approach	Descriptive and analytical approaches.	Descriptive; comparative and analytical approaches.
The countries' experience	A set of world countries	The Algerian economy

Conclusion:

This chapter tried to analyze the different studies dealing empirically with the resource curse, volatility and economic diversification. To find the works tackling those variables in one model has been a challenge for the student, for that reason, the chapter has been divided into three section; one showing the effects of the resource abundance and volatility differently; the other providing the impact of the economic diversification by summarizing a set of empirical works and synthesizing the experiences of three countries namely: Chile-Indonesia and Angola. The third section showed the contribution of the current study which links between the oil volatility and economic diversification and analyzing the Algerian experience as an oil rich country facing the volatility-diversification challenges and using different methodology and index (portfolio index) which will be discussed in details in the next two chapters.

Chapter Three

Oil and Economic Diversification in Algeria

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. Algeria is trying to diversify its economy by implementing several programs under different national and international circumstances. This chapter analyzes this context for the Algerian economy showing the role of oil in the national economy in the first section; in section two, the chapter displays the different steps of the economic development programs as an economic framework for diversification. Finally, in section three, we take into consideration the institutional framework to diversify the national economy and the place of Algeria in the world regarding this framework.

III-1- Oil economies 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 HassiMessaoud and HassiR'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 SONATRACH 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 was 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.

Four types of partnership were possible under the law of 1986 which would include granting Sonatrach the privilege of holding a minimum participation of 51% (http://www.sonatrach.com/en/elements-histoire.html):

Partnership under a "Production Sharing Contract" (PSC)

- Partnership under a "contract of service"
- Joint venture without legal personality in which the foreign partner is a trading company incorporated under Algerian law with its headquarters in Algeria
- Partnership in the form of a stock trading company, incorporated under Algerian law, having its head quarters in Algeria.

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 (Khalil C., 2006, P5):

- Establishing competition in free market;
- Separating the operations of the state from SONATRACH;

- 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.

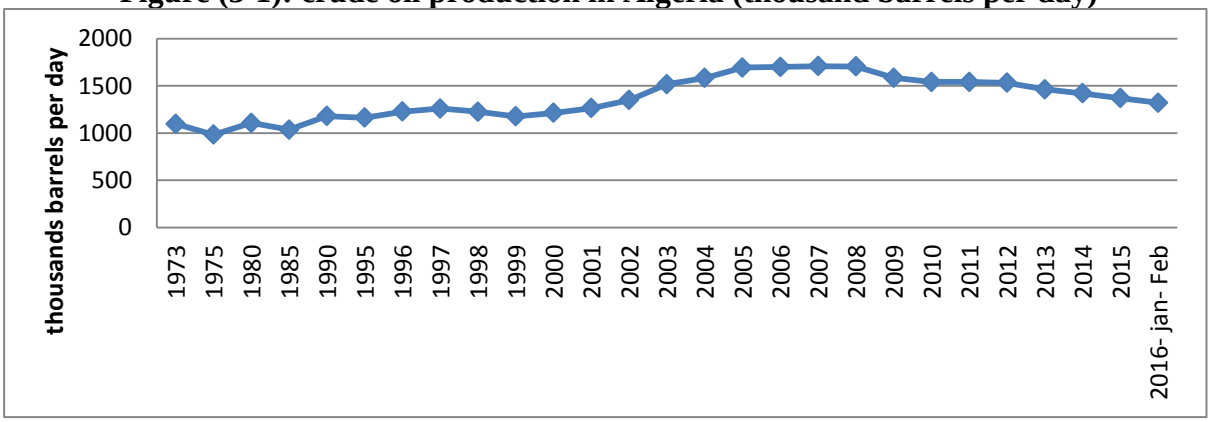
From 2000 until today Sonatrach has made considerable efforts in: the exploration, development and exploitation of fields, hydrocarbons transportation infrastructures (gas pipelines and compression stations), natural gas liquefaction plants and methane tankers. Since the year 2000, several projects have been launched in the development process of competencies, internationalization, petro-chemistry development and diversification of Sonatrach activities, also, the primary production target set for the period 1999-2007was largely exceeded.

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 Algeria. 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. 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 **(3-1)** shows. However, this production has known a decrease after 2012.

Figure (3-1): crude oil production in Algeria (thousand barrels per day)

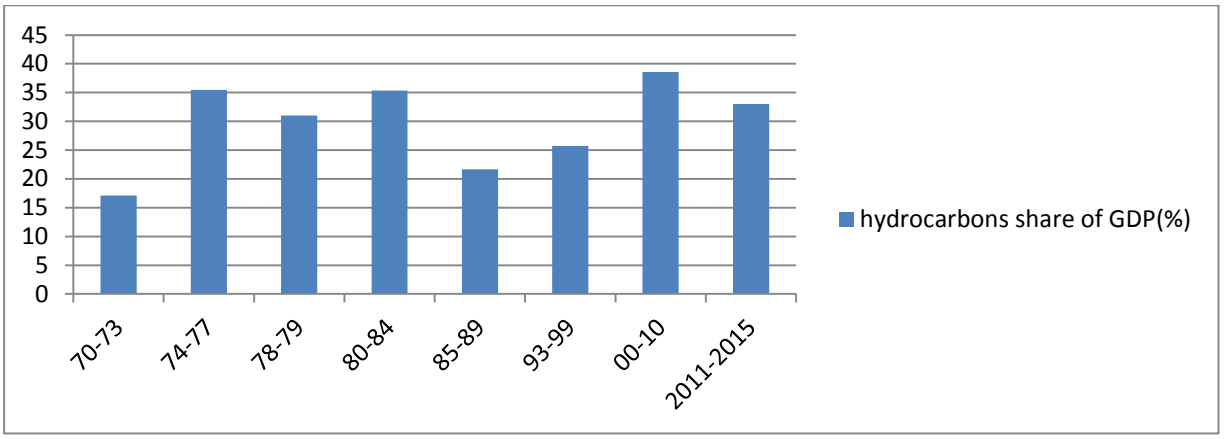


***Source**: Energy Information administration; www.eia.gov .*

[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.

The hydrocarbons 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 decade 2000-2010 as the figure below shows. During the recent years, the hydrocarbons share of GDP has decreased with about 5% due to the fluctuations in the international oil prices and to the policies implemented regarding the other economic sectors in the context of economic diversification. However, such large strategic windfalls need to be well managed by the implementation of specific economic policies.

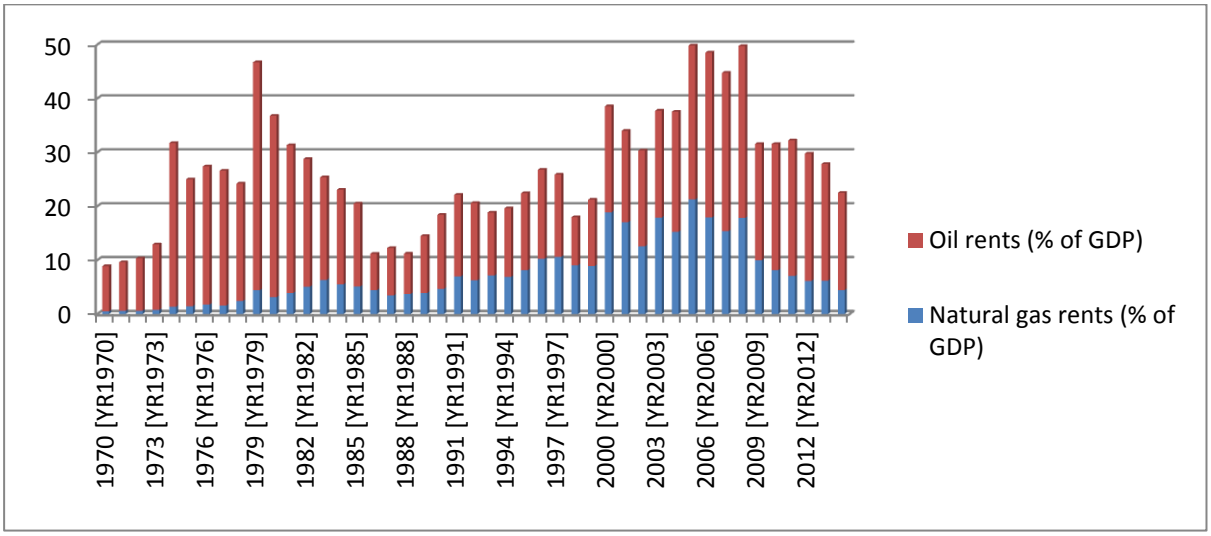
Figure (3-2): the contribution of hydrocarbon sector in GDP



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

As mentioned above, the Algerian hydrocarbons sector includes crude oil and natural gas, but the revenues earned from oil are much larger than the others got from natural gas production and exportation as the figure below displays, despite the Algerian status in the world production of natural gas. Due to the important contribution of oil in the gross domestic product of Algeria and due to the prices of this commodity characterized by the volatility, we are going to focus in our next sections, the empirical in particular, on the oil rather than natural gas.

Figure (3-3): share of oil and natural gas rents of GDP (1970-2014)



***Source**: student's construction using World Development Indicators database.*

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 (Mitchel J., Stevene P. and Cossinadri E., 2008, P8) 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.

a) Fiscal policy:

The government refers to the following data when preparing the budget project:

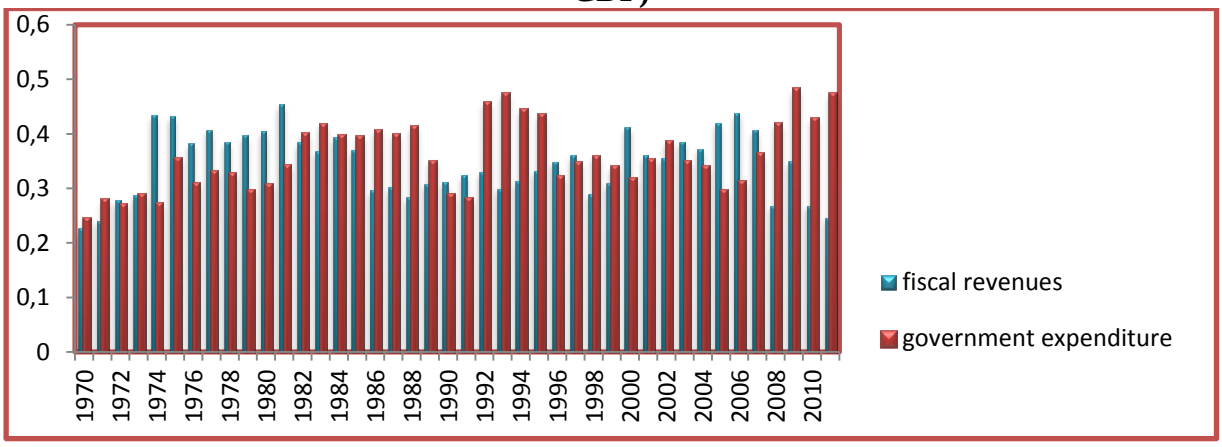
Table (3-1): references of the government budget project

The global economic situation	The macroeconomic and financial factors for the financial law of the year N relative to the year N-1
- The global economic situation in the year N-1; - The situation of the global oil market.	- The referential oil price; - The exchange rate of the Algerian dinar against the U.S. Dollar; - Imports; - Exports of hydrocarbons; - Inflation rate; - The growth rate of GDP; - The estimated revenues comparing to the year N-1; - The estimated expenditures comparing to the year N-1; - The expected budget deficit and - The reserves of the oil fund (RRF).

***Source**: Note of presentation for the budget law proposal of 2014 (French); P08.*

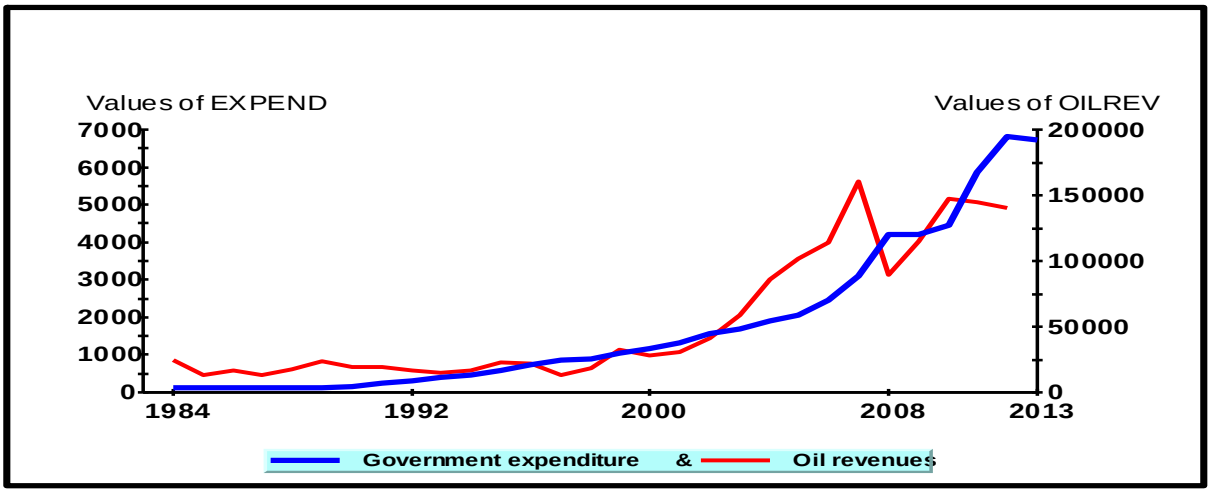
It is clear from the table above that the fiscal policy is so dependent on the hydrocarbon sector. Thus, it focuses largely on the government expenditure due to the large revenues from the oil tax. The dominance of the oil sector in the Algerian economy leads to an unstable fiscal policy stance that 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, which were difficult to reverse when the oil revenue increases proved to be only temporary, so as the problem of fiscal pro-cyclicality appears.

Figure (3-4): development of the fiscal revenues and public spending in Algeria (as% of GDP)



***Source**: authors' construction using data from the national office of statistics (ONS).*

Figure (3-5): Co-movement of Algeria government expenditure and oil revenues(1984-2013)



***Source**: student's construction using world bank data.*

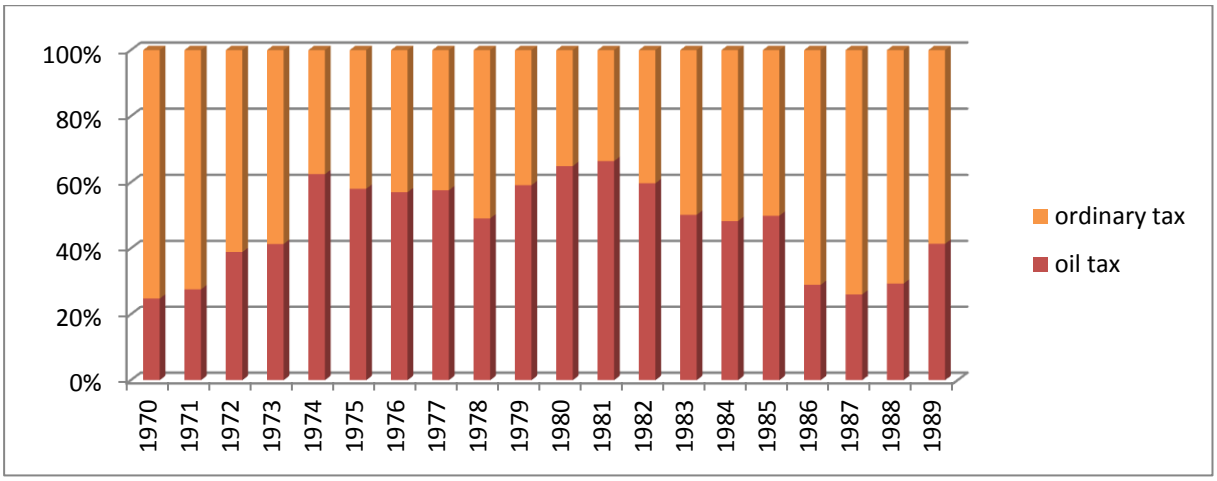
a-1- Evolution of fiscal policy in Algeria:

- 1971-1989: the planned economy era:

This period was characterized by the nationalization of the hydrocarbon sector in 1971 and the planned economic system.

It can be easily witnessed from the Algerian budget (figure below) that the public revenues were based on the oil tax with the ratio of 27.5% in 1971 against 24% in 1970 of the total fiscal revenues. This rate has registered an increase following the increase in the international oil prices. It (the ratio of the oil tax) surged to 38.9% in 1973 and 62.19% in 1975. After the sharp decrease of the oil price in 1980s, the oil tax revenue went down with about 25%. This had a strong effect on the total revenues which were 30% of GDP in 1986 against 45% in 1981.

Figure (3-6): construction of the national taxes in Algeria (1970-1989)



***Source**: student's construction using data from ONS.*

- 1990-1999 the transitory period:

The collapse in the international oil market has shown the weakness of the Algerian economy and threatened social stability in the late 1980s. Indeed, the lack of public confidence in the Algeria's political leadership, the high rate of unemployment among youth and the measures of austerity announced by the government were the main reasons for the anti-government riots in October 1988. A social strife known as the black decade and economic disequilibrium were the main characteristics of this phase.

For this reason, Algeria has embarked in different structural programs and reforms under the aim of transition from the planned to a market economy. A macroeconomic stabilization programme from April 1994 to March 1995 and a structural adjustment programme from April 1995 to March 1998 aimed to correct fiscal and external deficits, promote economic growth and push Algeria's transition process from social to market oriented economy. To achieve macroeconomic stabilisation, these programmes relied on strong fiscal adjustment supported by tight fiscal policy and decreases in government investment expenditures. Thus, government expenditure was increasingly reoriented towards current expenditure and government capital expenditure declined to about 6 percent of GDP by 1991. The oil tax revenue increased during the years 1990; 1991 and 1992 from 51% to about 66% of GDP due to the increase of the oil price resulting of the Gulf War. Simultaneously, the ordinary tax registered remarkable changes due to the fiscal reforms; it changed from 48% of total revenues in 1990 to 33% in 1991 followed by an increase with about 5% to 40% in 1993.

Furthermore, during the period 1990-1998, Algeria's **external borrowing declined** markedly, because some official export credit agencies limited the amounts of new export guarantees available for Algeria. External borrowing, which had exceeded US$ 6 billion annually in the late 1980s dropped to an annual average of US$ 1.8 billion in 1996-1998 (IMF,2000) . In this context , a number of empirical studies such as Micheal , Hutchison , Ilan Noy and Lidan Wang(2010) , Chamon , Manasse and Prati (2006) Show that "**Sudden Stops "** of international capital inflows initiated in Algeria in 1990 and during 1995-2004 . As a result, all these factors included the sudden stop of capital inflows and the IMF policy recommendation called for fiscal tightening, forced the Algerian government to undertake a contractionary fiscal policy during that period after the expansionary fiscal policy of 1970s.

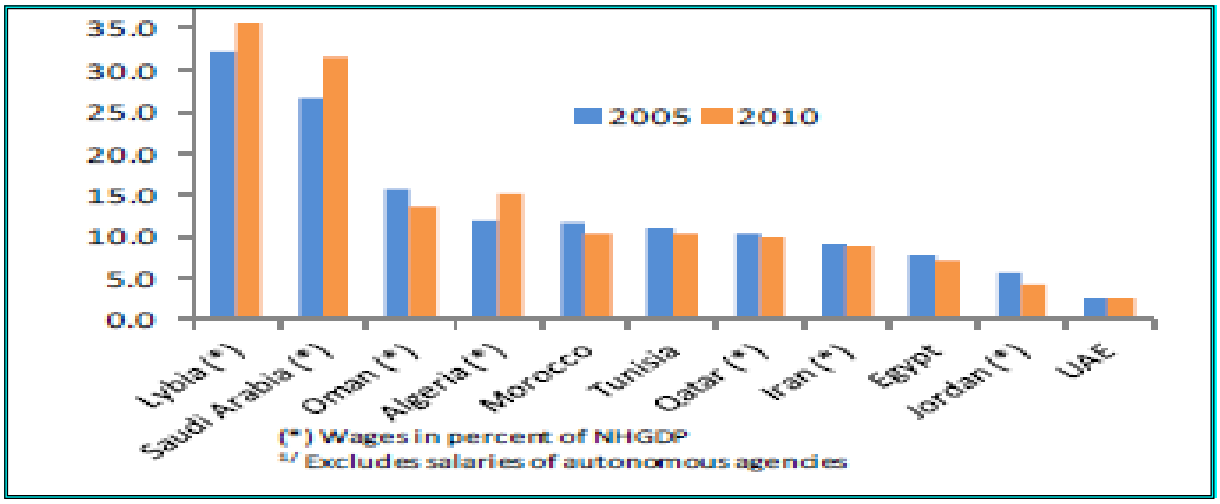
- The period of economic recovery:

Algeria's public spending has increased sharply during recent years, this is due partly to the importance rise of oil revenues and the massive public investment programs initiated in the 2000s, and partly to an expansion of subsidies.

As a result of the oil windfall, the Algerian government has pursued a very expansionary fiscal policy, through the implementation of a series of substantial public investment programs (2001-2004, 2005-2009, and 2010-2014) . Between 2001 and 2004, the government implemented the first public investment program (Economic Recovery Program) , worth about DA 525 million (US$7 billion), followed by a second program known as Complementary Plan for Growth Support (Programme Complémentaire de Soutien à la Croissance) for 2005-2009 , with initial allocation of DA 4,203 billion (roughly US$55 billion) , which has increased to about DA 8,705 billion (approximately US$114 billion) in the late June 2006 (World Bank 2007) . On the mid 2010 the Algerian government has announced the third public investment program for 2010-2014 with an investment amounting to 21,214 billion Algerian dinars (around US$286 billion) .

In addition to raising wages in a great many sectors and raising the minimum wage and pensions (Algeria increased the minimum wage in 2010 as well, by 30%, raising it from 12,000 to 15,000 dinars, before granting the current increase of 30,000 dinars), in 2010, the authorities increased salaries by 34 percent, making Algeria one of the MENA countries with the highest public salary burden.

Figure (3-7): Wages and salaries, Percent of GDP and NHGDP



***Source**: International Monetary Fund , Algeria: 2011 Article IV Consultation—Staff Report; Public Information Notice , Country Report No. 12/20 , January 2012 .*

Furthermore, the international oil market is facing a decline and a strong volatility in the oil prices (since the end of 2014) which obliged the Algerian government to announce about some austerity procedures to deal with the current situation.

However, Algeria has applied a prudent budget formulation, while managing its exceptional oil resources well. (World Bank report, 2007, P7)

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 tax has known an increase over the first seven years of the period from 66% of total tax revenues in 2002 to 77% in 2007. In 2008 with the global financial crisis and the sharp decrease in the oil prices, the Algerian oil tax decreased to 62% in 2009 and 53% in 2011 because of the decrease in oil revenues, while the non-oil tax registered an increase in the year 2013 with 8.7% (Presentation note of the budget law proposal for 2014 (French); P10). For the year 2014, the budget law has been elaborated under the following financial and budget data:

- A referential oil price for the budget calculation of 37$ and a price of about 90$ per barrel for the calculation of the total oil revenues and the value added of the hydrocarbon sector, as a prudential price.
- 4218.2 billion DA as budget revenues predicted for 2014 with about 37% as oil tax, 55% as ordinary tax and 6% as exceptional tax.
- 7656.2 billion DA as government expenditure where 4514.7 billion DA as current expenditure and 2941.7 billion DA for equipment with the increase of 11.3% comparing to 2013.

The last increase in the public spending is basically due to the current expenditure resulting from the remunerations and subsidies for the public service staff.

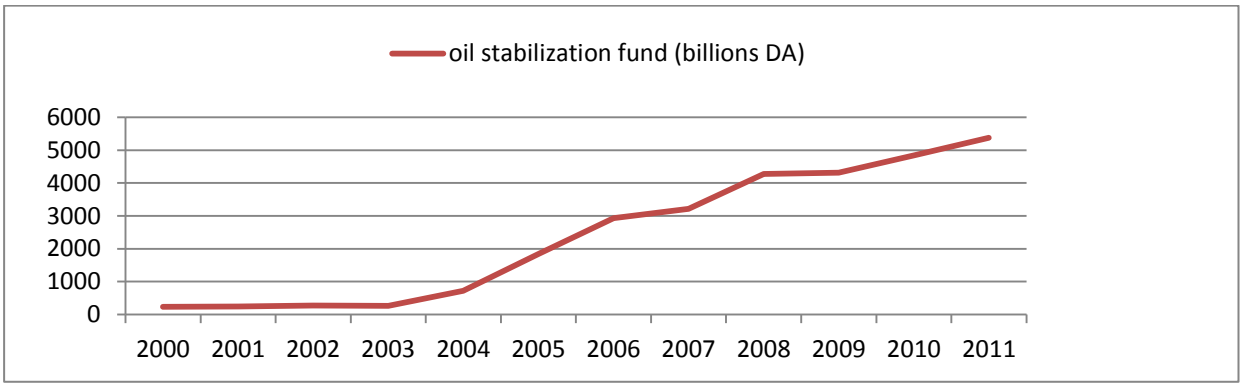
a-2- The oil stabilization fund:

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

[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.

Figure (3-8): Algerian oil stabilization fund



***Source**: authors' construction using the World bank data.*

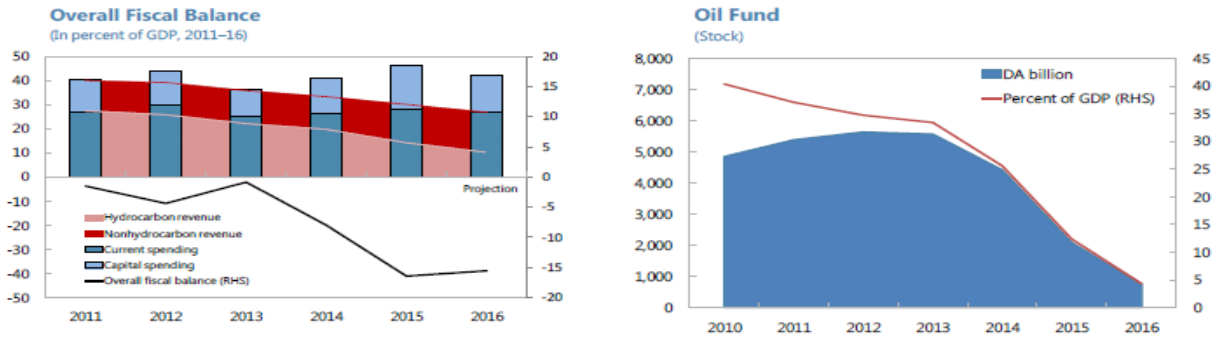
Table (3-2): Oil Stabilization Fund Evolutions (2000- to 2014 previsions):

Millions DA	**Accumulations 2000-2012**	**2013 close**	**Budget law 2014**
Resources			
Remaining at the end of n-1	18821076	5633751	7005169
Budgeted oil tax	15155800	1615900	1577726
Recovered oil tax	30580276	4125846	3601482
Added value of the oil tax	15424476	2509946	2023757
Availabilities before deductions	**21058227**	**7349224**	**9028926**
Uses			
Principal taken public debt	2600172	0	0
Reimbursement advances of the bank of Algeria	607956	0	0
Treasury deficit financing	6582597	1138527	1802562
Remaining after deductions	**5633751**	**7005169**	**7226364**

***Source**: Note of presentation for the budget law proposal of 2014 (French); P10.*

Despite the creation of the oil fund, Algerian fiscal stance has been heavily influenced by hydrocarbon prices. Public spending is disconnected from the saving rule since the FRR can be freely drawn upon for budget support. The non-hydrocarbon primary deficit (NHPD) and spending have been highly correlated with oil prices for the past 15 years, widening during good times and contracting in bad times. (IMF country report 16/128, 2016, P7)

Figure (3-9): Overall fiscal balance and oil fund in Algeria



***Source:** IMF country report 16/128, 2016.*

b) Exchange rate and monetary policies:

b-1- Monetary policy:

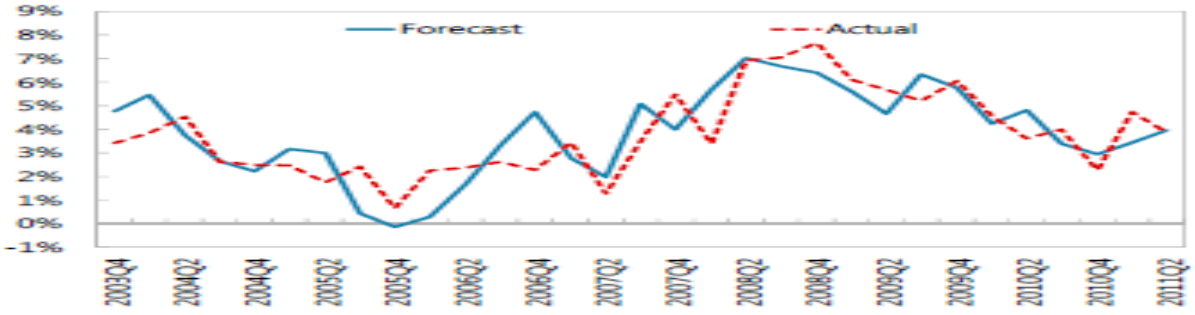
The monetary policy during the period of planned economy has been characterized by the dependence of the central bank to the government and has had nearly no role in achieving the monetary objectives or managing the revenues from the hydrocarbons sector. In 1990, Algeria implemented the credit and money law 90-10 which declared the independence of the Bank of Algeria. However, the current monetary policy framework was set in 2003, and adjusted over time to reflect the developments of the economic environment.

The oil revenues and fiscal policy have boosted liquidity which should be sterilized to repulse the inflationary pressures (IMF country report n°1052, Algeria 2010, p15). 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 maturities of a large portion of the deposit auctions from one week to three months in July 2005; and (iv) setup on overnight deposit facility in September 2005.

The BA has since 2010 explicitly targeted price stability, in addition to external stability of the currency. There is an explicit annual inflation target of 4 percent. The monetary policy framework has adjusted over time to reflect the developments of the economic environment caused by **oil price fluctuations**. Since 2003, base money has been the main intermediate instrument of monetary policy, and liquidity management tools have dominated the monetary policy toolkit.

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.

Figure(3-10): forecasted and actual inflation



***Source**: IMF country report 1347, P12.*

b-2- Exchange rate policy:

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 substantial appreciation of the U.S. dollar during the first half of the 1980s led to a strong rise in the real value of the Algerian dinar (of about 50 percent during 1980–85), thus undermining the competitiveness of the non-hydrocarbon sector and stimulating imports.

In 1986, the government responded to the dramatic erosion of export revenue; caused by the reverse oil chock; by borrowing abroad and intensifying import restrictions. In parallel, the Bank of Algeria let the Algerian dinar depreciate against the basket by 31 percent between 1986 and 1988. Restrictions imposed on the allocation of foreign exchange increased demand for foreign exchange in the informal market, driving the parallel market premium to about 400 percent. This rigid system was replaced in 1988 by a system of foreign exchange allocation to the five public commercial banks within a framework of credit ceilings, which were consistent with balance of payments targets. The public banks in turn would allocate foreign exchange to their client public enterprises.

Table (3-3): official and parallel exchange rate of the Algerian dinar against the French Franc

Years	1970	1974	1977	1980	1987
Official market	1,0	1,0	1,3	0,62	0,80
Parallel market	1,0	1,1	1,5	2,0	4,0

Source: *Henni A. (1991), "essay on the parallel economy, the Algerian case", Enag Edition.*

Between 1989 and 1991, the Algerian dinar was again allowed to depreciate (more than 200 percent in nominal terms) to counteract the terms of trade losses during this period. (Koranchelian, 2005, P4)

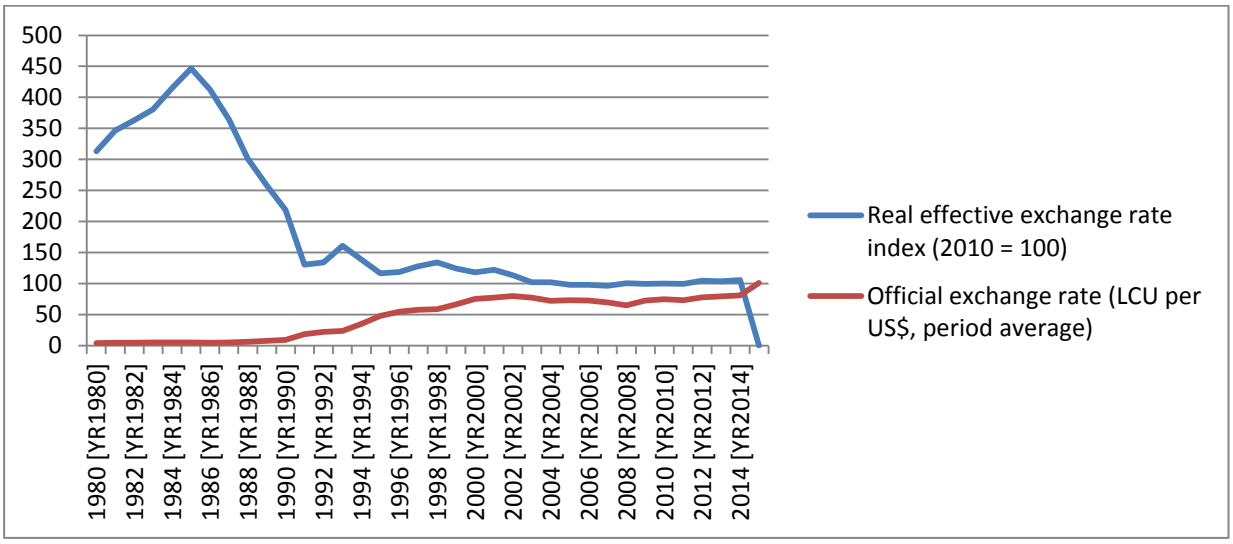
During 1991–94, the rate of nominal depreciation averaged 4 percent annually, bringing the value of the Algerian dinar to about DA 24 per U.S. dollar on the official market. This relative stability of the nominal rate did not correspond to economic fundamentals: adverse terms of trade shocks and expansionary fiscal and monetary policies resulted in inflation being persistently higher than in Algeria's trading partners. The Algerian dinar, therefore, appreciated by 50 percent in real terms between October 1991 and end-1993.

In 1994, the authorities put in place an adjustment program. One of the immediate objectives of the program was to correct the previous real appreciation of the Algerian dinar. From 1995 to 2001, Algeria's exchange rate policy has aimed at maintaining a stable real exchange rate against a basket of currencies weighted according to the country's main trading partners and

competitors. In 1995, the managed float regime was implemented through fixing sessions between the Bank of Algeria and commercial banks. An interbank foreign exchange market was established in 1996. Between 1995 and 1998, the REER appreciated by more than 20 percent, followed by a depreciation of 13 percent between 1998 and 2001. Following 16 months of real depreciation since early 2002, due to the appreciation of the euro against the U.S. dollar, the authorities intervened in the foreign exchange market in the second half of 2003 to realign the REER to its end-2002 level instead of its end-1995 level. Between June and December 2003, the Algerian dinar appreciated against the U.S. dollar by 11½ percent and the REER appreciated by 7½ percent.

Since 2001, 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 policy response to the sharp oil price decline since 2014 initially focused on allowing nominal exchange rate depreciation**.** To moderate import demand and reduce pressure on reserves, the Bank of Algeria (BA) allowed the currency to depreciate by 25 percent against the US dollar and by 6.7 percent against the euro in 2015.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

Figure (3-11): real effective and nominal exchange rate of Algerian Dinar



Source: *student's construction using World bank data.*

III-2 The economic environment of diversification in Algeria

The Algerian economic structure has known different steps regarding the circumstances and the development strategy undertaken by the Algerian government. This section displays these different steps trying to show the path that Algeria has taken to diversify and develop its economy.

III-2-1 Algerian economic structure before the independence

This period was characterized by the French control of all the Algerian economic elements.

a. Dominance of the agriculture

Soil and agricultural wealth of Algeria attracted the French colonialism. Thus, it followed the scorched earth policy which means the expropriations of land from the Algerians. The French colonialism tried to build an economy specialized in agriculture and created a sector (agriculture) owned by the strangers from France and Europe known as colonists where 25000 of them owned about 2.7 Million Hectares of the best lands in Algeria while 622000 of the Algerians had 5.6 Million Hectares of the worst and mountainous lands. (Bahloul M.B.H. (1999), Tome 1; P23)

Agricultural production presented an important contribution in the gross domestic product with about 58%; while it presented 60% of the total exports in which 55% of them were of wine. (Bahloul (1999); ibid; P24)

Two products have dominated the agricultural sector in this period. The first is grains and wheat in particular in which they occupied 3 Million Hectares of soil; and grapevines especially between 1920 and 1934 where the viticulture in Algeria surpassed the French one. The production of vines contributed with about 46 % of the total agricultural production while the grains contributed with 33%. (Ouatbane A. (1992); P26-27)

b. Reality of the industrial sector:

During it colonization, France tried to build an own-sector economy depended on agriculture and refused any tendency to the development of the industry to keep Algeria as a market of its industrial products. Industry has not known any development until 1956 after the discovery of two giant oil and gas fields at HassiMessaoud and HassiR'mel in the northern Sahara region. (Chekkouri S.M. (2012); P85)

The heavy industry has developed very slowly because of the high technology needed and the unstable security situation in Algeria due to the revolution. Whereas, the French president Charles De Gaulle in 1959 declared for the program of Constantine in which the ostensible objectives were (Benachenhou A. (1978); P303):

1. The development of agriculture and raising it productivity with 25% to increase the rural households revenues;
2. Building an Algerian industrial sector and creating 400 thousand jobs to absorb the unemployment and decrease the migration to the cities;
3. Building a heavy industry and enhancing the public works activities; in addition to improve living standard for Algerians.

However, the real economic objective behind Constantine's program was to deepen the dominance of foreign capital in Algeria to strangle the revolution and keep it under the imperialism; this was through encouraging the foreign companies and the French ones in particular to invest in the oil and gas fields. In 1960, from about 4650 million Franc of investments, the sources of finance were allocated as follows (Bahloul (1999); ibid; P30):

- Investment of the private French companies: 2380 million French Franc;
- French government investments with about 2020 million FF;
- The investments of non-French foreign companies with 250 million FF.

The industrial capitalists from France and other European countries proceeded their dominance via the industrial unions such as The Union Bank of Paris- Mirabou- that owned 78% of the iron mines in Ounza and the cork company; and the mines union which owns 80% of the capital of Phosphate company in Constantine. (Bahloul (1999); ibid; P25)

The industrial sector in Algeria was characterized by extractive industry and this was only from the discovery of oil and gas in 1956. The contribution of hydrocarbons in the Algerian economy started to increase since 1959 which was the watershed from the dependence to agriculture to the dependence to hydrocarbons. As the table below shows, hydrocarbons sector contributed with about 48% in GDP while this contribution was only 14% in 1958; the contribution in exports has also increased to 59%:

Table (3-4): contribution of hydrocarbons in total exports and GDP (1958-1962)

Years	Contribution in Exports	Years	Contribution in GDP
1959	**58%**	**1958**	**14%**
1960	**54%**	**1960**	**34%**
1961	**54%**	**1962**	**48%**
1962	**59%**		

***Source**: Banachenhou A. "the Algerian experience in development and planning 1962-1980"; OUP; P 6-7.*

III-2-2 The planned economic development era 1962-1988

In this stage Algeria has witnessed the real concept of development trying to getting out of the dependence on the French economy and to diversifying its economy from per sector. The planning strategy for diversification started in 1967; before this date Algeria had social objectives rather than economic because of the social problems resulting from the colonization. During 1962- 1967, Algeria has taken important decisions regarding the nationalization of many activities namely: colonists' lands in 1963; mines in 1966 and banks in 1966 and 1967 (Bahloul (1999); ibid; P70)

a. The evolution of economic programs

- The triennial plan (1967-1969)

The triennial plan was the first plan for the independent Algerian state. This plan was oriented to the quick development of the device production and the industrial device in particular.

The targeted investment size of this plan was 9.06 Billion Algerian Dinars, while the costs estimated were 19.58 Billion AD. The Algerian government has focused on the industrial sector and heavy industries (hydrocarbons in particular) due the strategic role of this sector. However, Algeria hasn't allocated important budget for the basic investments which represent the infrastructure despite their importance to move the productive investments. This plan was experimental for the Algerian strategy of development. Thus, it tried to liberalize its economy under the circumstances that it lived in this period. (Appendix 3-1)

- The first four-year plan (1970-1973)

This plan has been applied focusing on three bases: the first is to support the socialist economy and reinforce the economic independence of the country; second is to make industrialization in the first place in the development strategy's elements; third is to make the equilibrium between rural and urban areas.

In this plan, Algeria has increased the size of investments allocated due to its ambitions to fight the underdevelopment, poverty and achieve high levels of economic and social development.

The four year plan was a medium term program while the previous one was short term, for that reason, the investments allocated for this program were greater three times than for the triennial program. The industry is always the priority in the development program (more than 54% from the total investments) due to its importance in developing the productive forces and diversifying the products portfolio. (See Appendix 3-2)

- The second four-year plan (1974-1977)

The total investment allocated to this plan was about 110 Billion AD. The increase of this amount was due to two reasons: the first is the increase of the international oil price; the second is the wide and various tasks of the program and this is through its general trends summarized in:

- Consolidating the social changes;
- The development of the society's material base;
- The decentralization to achieve regional equilibrium;
- The development of the economic relationships between the third world countries.

In this program, the government has focused on the industrial sector (43% of the total investments) due to its role as the driver of the society's global development and the basic industries based on the transformation of natural resources into factors of production were the main sector. (Appendix 3-3)

- The first five-year plan (1980-1984)

As the period of the program has been expanded, the investments size of the first five-year plan increased also and achieved 400.6 Billion AD which was the financial allocation of this program. It was clear that the productive sector including industry, and agriculture and the semi-productive sector including services and infrastructure were the priorities of the Algerian government while implementing this program. (for the details about the investments of each sector see Appendix (3-4)).

- The second five-year plan 1985-1989:

This program came after four development programs implemented by the Algerian government and it was featuring two characteristic; it was complementary to the first five-year plan regarding the attention given to governance and it (the second program) gave special priority to the development of agriculture and hydraulic.

The priorities of the second five-year program can be summarized in three points:

1. Organizing the national economy;
2. Developing agriculture and hydraulic sectors;
3. Diminishing the reliance on the external world.

These priorities were obvious from the costs of investments in the productive sector with the amount of 367.02 Billion AD and the basic economic and social infrastructures sector with 362.13 Billion AD from total costs with 828.38 Billion AD (Bahloul, 1999, Tome II, P139) (For the details about investments refer to the Appendix (3-5))

b. Assessment of the Algerian development plans:

During the planned economy period, the investments' financing structure has been based on three sources namely: the budget (oil tax and institutional contributions); external borrowing and monetary financing (Temmar H., 2015, Tome I, P44)

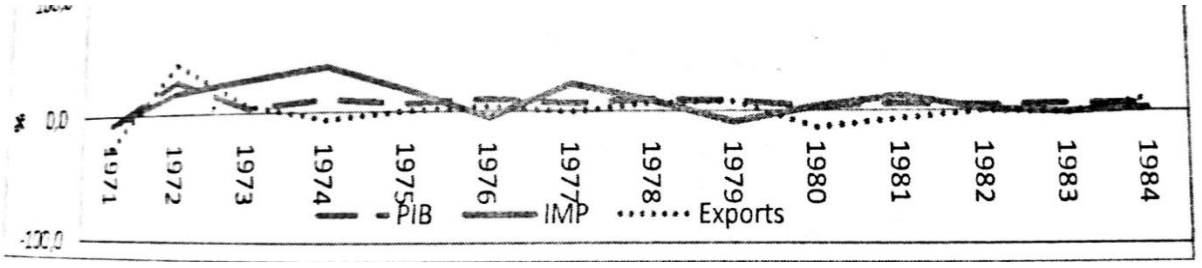
Table (3-5): the structure of the planned investments financing

	1970	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Share of investments / GDP	17%	20	21	22	20	27	31	36	39	31	23	19	18	16	13
Non-monetary finance (%of total financing)		40	58	72	108	75	59	64	59	82	87	110	44	27	54
External finance		15	13	5	6	33	34	29	35	36	29	18	18	14	19
Monetary financing (%of total financing)		60	42	28	-8			36	41	18	13	-10	56	73	46

***Source**: Temmar H., 2015, Tome I, P45.*

The important resources gained from the oil tax due to the first oil shock have contributed in financing a massive investment as machines and services imported by the enterprises. However, the choice of intensive investment and heavy industrialization has led to a deficit in the trade balance (an increase of total imports from 25.8 to 36.6% of GDP). This situation has constituted a risk of insolvency and indebtedness which has been exacerbated because of the exports concentration on hydrocarbons (95%).

Figure (3-12): Growth rates of exports and imports



***Source**: Temmar H., 2015, Tome I, P47.*

Regarding the gross domestic product, Algeria has witnessed a positive economic growth and large increase in the value added of the industrial sector (table 3-6), but this improvement was due to the high accumulation of capital rather than an improvement in the productivity as the table (3-8) shows the high ratio of investment and capitalization coefficient.

Table (3-6): growth rates of the value added per sector (%)

	1969-1974	1974-1979	1979-1982	1974-1982
1.Agriculture	5.3	8.6	4.3	6.2
2.Manufactured industry	6.9	13.5	8.2	10.6
3.(1+2)	6.2	11.4	6.7	8.8
4.Hydrocarbons	4.3	3.2	-1.3	0.7
5.Construdtions and services	9.6	16.3	5.7	8.3
6.GDP (1+2+4+5)	6.6	8.5	3.8	5.1

***Source**: Temmar H., 2015, Tome I, P48.*

The table below also shows the important development of the industrial sector and confirms the diversification of the production function out of the hydrocarbons.

Table (3-7): growth rates of the value added per industry (%)

	1967-70	1970-74	1974-78	1977-78
Hydrocarbon industry	8.5	2.5	5.5	9
Basic industries	25	5.5	17	19
Consumption industries	9.5	10.5	4	3

***Source**: Temmar H., 2015, Tome I, P48.*

Table (3-8): evolution of the marginal coefficient of capital (%)

	1975	76	77	78	79	80	81	82	83	84	85
GFCF*	45	43	47	52	43	39	37	37	38	35	35
ICOR**	4	3	5	4	5	6	7	7	8	6	6
GDP/capita***	1.9	5.1	2	5.7	4.6	-2.1	0.1	3.2	1.9	2.2	2.3

***Source**: Temmar H., 2015, Tome I, P49.*

(: Gross fixed capital formation; **: incremental capital-output ratio; *** growth rate of GDP)*

The weak productivity was due to many causes like the low qualification of workers, their insufficient social preparation to the industrial life and a low level of management.

III-2-3 The post-planned era

a. Evolution of the programs

a.1 The transitory period (1990-1999)

The oil shock of 1986 has entered Algeria in a phase of structural adjustment. The sharp decrease of export revenues and the increase of the debt services led to a serious economic and social crisis. Facing this situation, Algeria was obliged to go towards an adjustment stabilization agreement with the international monetary fund (IMF) and accept all the conditions imposed by this institution. This step constituted a set of economic and social objectives including:

- Transition to the market economy;
- Industrial restructuring;
- Diversification of the national economy's financing sources out of the hydrocarbons exports;
- Rational exploitation and consumption of wealth;
- Ensure a just distribution of the national wealth.

Under the extended fund facility in 1994, the IMF approved a credit for Algeria totaling 1795 million $, this credit was to support a medium-term adjustment and structural reform program. This program aimed at ensuring high and sustained level of economic growth, establishing low level of inflation and restoring balance of payments viability by 1998. On the structural front, the centerpiece of the medium-term program was a deepening of the liberalization of the trade and payments systems. A large number of public enterprises were given full management autonomy while others were dissolved; a legal framework for privatization of public enterprises was put in place and a privatization program was implemented, commercial banks were recapitalized and performance contracts were signed with the state to ensure their efficient management.

a.2 Period of economic recovery

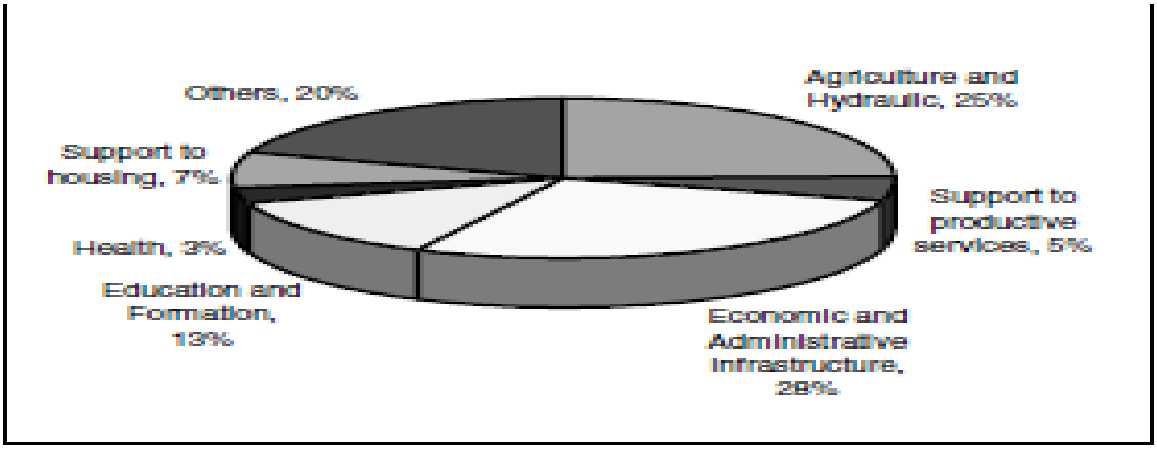
After the civil conflict and the financial instability of 1990s, Algeria has faced since 2000 big challenges: the reduction of unemployment, enhancing the non-hydrocarbon growth and sustainable development were the main goals to be achieved. To realize these objectives, Algerian authorities relied on an expansionary fiscal stance thanks to the high oil revenues. Four ambitious programs have been executed: 1- Economic recovery support program (2001-2004), 2-complementary program to sustain growth (2005-2009), 3- program of public investment (2010-2014) and the new five-year program 2015-2019.

- **Economic recovery support program 2001-2004**

The Economic Recovery Support Program known as « PSRE »[1] is spread over the period 2001-2004. With an amount of DA 525 billion (US$ 7 billion) to be disbursed, the program had three key objectives (World bank report 2007, P4): 1-poverty reduction, 2- employment creation and 3-regional equilibrium preservation and rural spaces reinvigoration.

Operationally, the PSRE based on the following points to be achieved: to stimulate the demand, support activities that create the added-value and new jobs by a promotion of agricultural farming and productive enterprises particularly small and medium enterprises, and re-establishment of infrastructure in particular which push the economic activity.

Figure (3-13): The PSRE sectoral distribution



Source: *World Bank report, « Assuring high quality public investment, Algeria », Public expenditure review, Volume I, 2007,P6.*

The figure above shows the budget share of each sector in the program, it's clear from the figure that the government have concentrated on the productive activities, Agriculture and hydraulic with 25% (almost 70 billion DA), and infrastructure with 29% (210,5 billion DA).

Despite the objectives of the PSRE to recover economy and sustain growth and development, it remains modest comparing with the other programs and its results.

In a midcourse evaluation of the PSRE done by the World Bank, the following remarks have been concluded (World Bank report 2007, P4):

- PSRE will have a modest impact on growth (1 percent annual increase on average).
- Employment creation under PSRE projects will be temporary—850,000 as direct effect (170,000 on average) and 664,000 as indirect employment generation.
- Imports (especially related to transport and public works projects) will grow faster than exports, reducing the current account surplus by 1 percent of GDP during 2001-05.

[1] Programme de Soutien à la Relance Economique.

- Projects had little reference to strategic sectoral objectives, their quality was weak and the technical preparation of staff implementing them was uneven in general.
- Poor implementation also originated from the urgency that accompanied project preparation, the myriad of specific demands it was supposed to respond, and the multiplicity of actors (25 ministerial and 48 wilaya commissions).
- Cost-benefit analysis shows that selected PSRE projects were extremely expensive.

- **The Complementary Program to Sustain Growth:**

Under the continuous increase of oil revenues and the development demands, Algeria started to embark on other development plan known as « PCSC »[1] : the complementary program to sustain growth over the period 2005-2009. The program initial allocation was 4203 DA billion (55 US$ billion), this amount has been doubled to 8705 DA billion (1&4 US$ billion).

With incorporation of the previous PSRE, the PCSC included new programs for the South and Haut Plateau regions. The table below provides the PCSC budget payment credits in 2004-2009 :

Table (3-9): PCSC authorization and initial budget credits 2004-09 (Billion DA)

	PSRE	Initial PCSC	South Plan	*Haut Plateaux*	*Dotations* to Special Accounts	Total PCSC	Initial Budget Payment Credits
2004	1,071					1,071	
2005		1,273			227	1,500	862
2006		3,341	250	277	304	4,172	1,979
2007		260	182	391	244	1,077	2,238
2008		260			205	465	2,299
2009		260			160	420	1,327
Total	**1,071**	**5,394**	**432**	**668**	**1,140**	**8,705**	**8,705**

***Source**: World Bank Report, ibid, P2.*

From this program the government had high expectations and objectives; it wanted to address the country's most pressing needs, to deal with basic infrastructure rehabilitation, to improve population's standard of living and develop human resources and enhance growth.

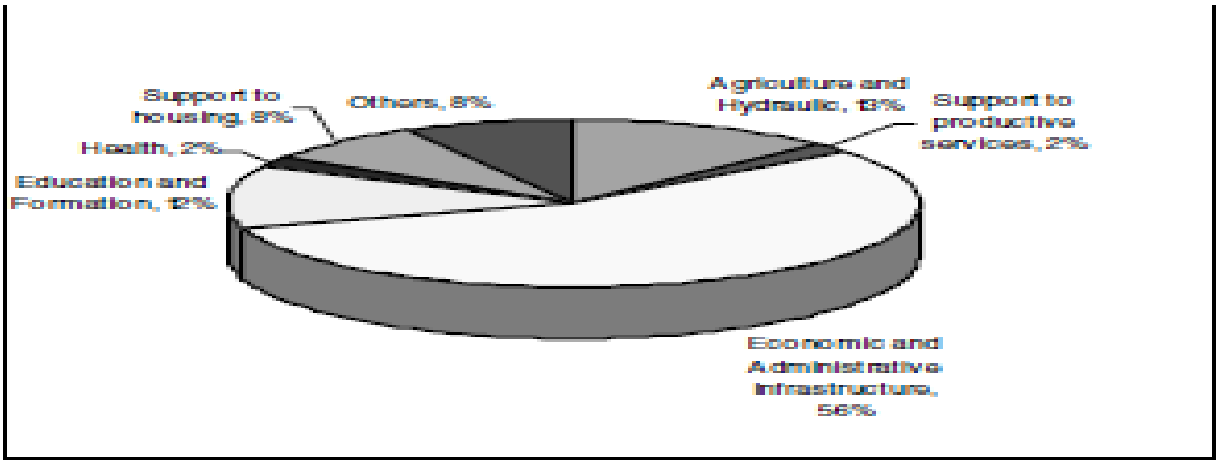
The authorities have been aware that such ambitious plan needs a sustainable fiscal management and will provide consequently many challenges. According to a World Bank

[1]Programme Complémentaire de Soutien à la Croissance.

analysis, this program raises the challenges in how to design sound sectoral strategies; how to program future trends in capital versus recurrent expenditure; how to implement adequate project management and budget execution; and how to improve the efficiency and cost-benefit of projects in general.

The figure below introduces the sectoral composition of the PCSC where we notice that the infrastructure represents the highest contribution in the full budget of the program.

Figure (3-14): sectoral composition of the PCSC:



Source: World Bank report, ibid, P6.

By comparing figure 2 with figure 1 the following points can be observed:

- Economic and Administrative infrastructure is the most beneficiary sector from the PCSC, its authorization doubled from 29% in PSRE to 56% (more than a half).
- Agricultutre and hydraulic are the most losers from the program, their share decreases from 25% in PSRE to 13% of total resources of PCSC.

The conclusions above show clearly the focus of the Algerian government on the infrastructure as the key factor to push the growth.

The Public Investment Program (2010-2014) :

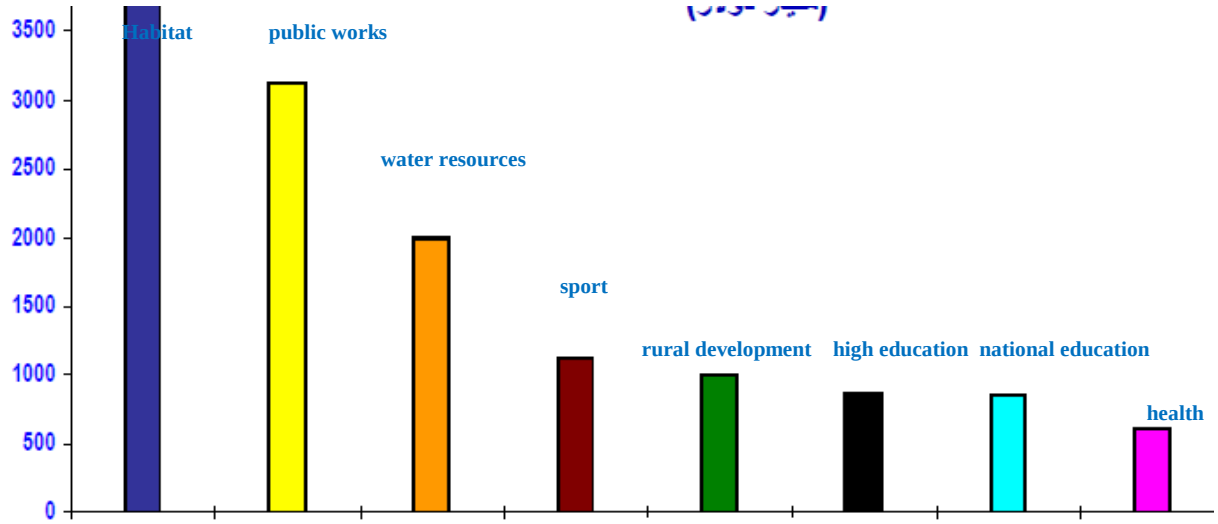
Public investment program known as « PIP » is the most massive development plan, the PIP should be applicable over the period 2010-2014. Its financial authorization is 286 US$ billion. The program includes a launch of new projects with an amount of 156 US$ billion (21214 DA billion) and an update of previous projects with 130 US$ billion (9700 DA billion). (The statement of Algerian Ministerial Council, P3)

The main objectives of the PIP are [1]: 1-enhance human resources development ; 2-continue to develop the infrastructure and improve the public services ; 3-sustain the economic development ; 4-develop the knowledge economics and create new jobs.

[1] Public Investment Program(2010-2014), ANDI. www.andi.dz .

The budget allocation of each sector in the PIP is as shown in the figure below.

Figure (3-15): budget allocation distribution by sector (Billion DA)



***Source**: Public Investment Program(2010-2014), ANDI. www.andi.dz*

- **The new five-year program 2015-2019:**

With a financial authorization of 262 billion US dollars[1], the new five year-year program for investment and development has the objective to improve the economic situation by completing the previous launched projects and realizing new projects. This new program gives importance to the infrastructure, agriculture and private investment by giving to this sector more opportunities to contribute in creating an added value and improving the local economic development.

b. Assessment of the post-planned era

Despite the notable macroeconomic results registered by the implementation of the stability and adjustment program, by 1999, the national economy has not shown any independence to the hydrocarbon sector, contrariwise, this sector has been reinforced in the GDP (39% in 1999 against 24% in 1985), the fiscal revenues (64% in 1997 against 22% in 1987) and exports (97% by the end of the program). Consequently, the structural adjustment program and the reforms implemented over the 1990s did not give any new structural bases for a diversified economic growth and openness and the macro-financial stability was due to the timely recovery of international oil market. The failure of the economic reforms in this period could be referred to the social strife and the political instability lived by the Algerian society.

[1] http://www.dknews-dz.com/ "Bouteflika lance le Plan quinquennal 2015-2020 : Les grands défis économiques de l'Algérie », Publié par Boualem Branki le 29-08-2014, 17h56.

Since the year 2000, the Algerian economy started to recover regarding the main macroeconomic indicators (table 3-10). However, and despite the development in infrastructure and human resources due to the investment and economic recovery programs, the national economy remains less diversified. The contribution of non-hydrocarbon industry is still very weak and only 10% of the enterprises are in the industrial sector; thus, the hydrocarbons remain the major sector to finance the economy and the energy enterprises constitute the major part of the productive investments (table 3-11).

Table (3-10): the main macroeconomic indicators in Algeria (2005-2012)

	2005	06	07	08	09	10	11	12
Total GDP growth (%)	5.1	2.0	3.0	2.4	2.4	3.3	2.4	3.3
Non-hydrocarbon exports (%of total exports)	1.6	2.1	1.6	1.8	1.7	1.9	2.1	1.6
Unemployment rate	15.3	13.5	12.4	11.3	10.2	10.0	10.0	10.0
Balance of trade (Billion US$)	21.2	29.0	1.6	1.8	1.7	1.9	2.1	1.6
External debt/GDP	16.7	4.8	4.2	3.3	3.8	3.5	2.2	2.1
Domestic debt (%of GDP)	13.8	21.8	11.8	6.7	7.9	9.1	8.4	8.3

***Source**: Temmar H., 2015, Tome I, P286.*

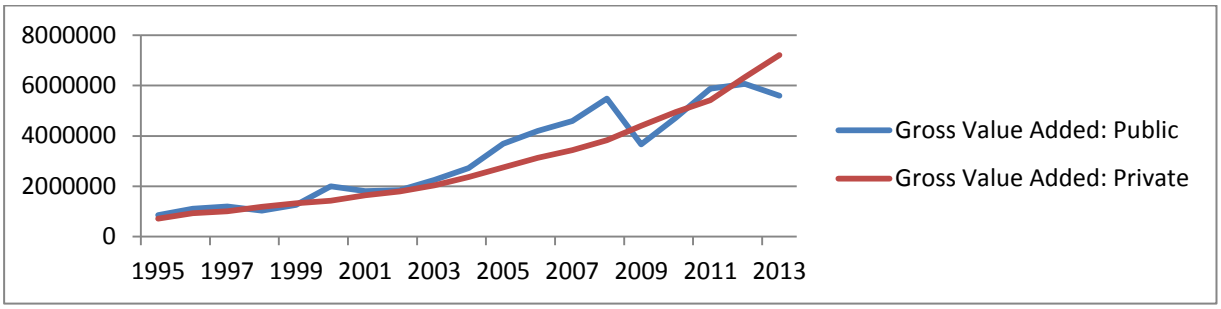
Table (3-11): contribution of institutional sectors in total investments (%)

	1989-94	1995-99	2000-12
Total investment	41.5	43.8	35.2
Energy investment	16	29	26.2
Non-energy investment	26	15	9
Household and individual investments	21	20	13.2
Public administration investment	37	36	51.6
Financial institutions investment	0.3	0.2	0.2

***Source**: Temmar H., 2015, Tome I, P296.*

From the figure below, we notice very clearly that the public sector is the main one affected by the oil price volatility. The value added from both public and private sectors; the public value added exceeded the private during all the first eight years of the development programs but it started to decrease with the decline of the oil price in 2008 as in 2013 while we find the private value added with a rising trend despite the changes in the oil prices.

Figure (3-16): Public and private gross value added (Million DZD)

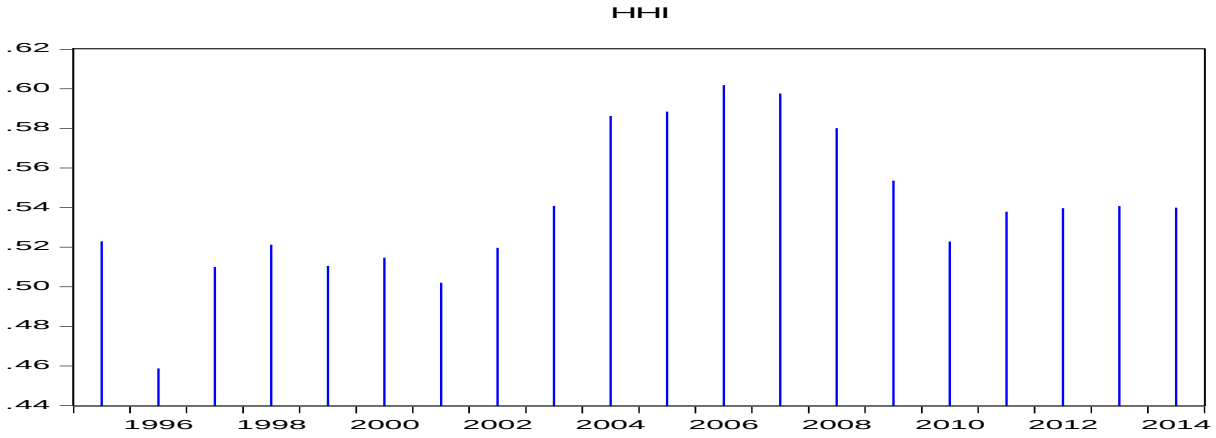


***Source**: authors' construction using data from national office of statistics*

Regarding the external trade, we provide an index for the export concentration. 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.

The graph below presents the yearly variation of the Algerian concentration index over the period 1995-2014. It is clear that the export structure in Algeria is so concentrated; the index is about 0.50 as an average of all the period. Between 2004 and 2008, the index has reached 0.60. This strong export concentration is unfavorable for the development while the concentrated economies perform worse than the diversified ones.

Figure (3-17): the export concentration index in Algeria 1995-2014



Source: student's construction using data from UNCTAD.

III-3 Institutional environment of economic diversification

As argued in the literature, the institutions have an important role in achieving economic diversification. Thus, 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. This section provides the institutional framework of the Algerian economy since the nationalization of the hydrocarbon sector.

III-3-1 Evolution of the institutional framework in Algeria

As the economic plans and programs implemented by the Algerian government to diversify the economy have taken different steps, the institutional framework of these programs have also changed according to the political and economic circumstances in Algeria. The following tables summarize the different changes and steps that the institutional framework has known since 1970.

Table (3-12): The economic system

Institutional organization	1970-1986	1986-1999	2000-2008	2009-2010
Market freedom	Strictly regulated by the state	Progressive openness under the IMF programs	Rationalization and transparency	Openness and regulation of some product and services
Markets regulation	Controlled market	Almost inexistent regulation	Very weak regulation and without efficiency	Reaffirmed regulation but inefficiency of the institutions of control
Business area	Strictly regulated by the state	Weak supervision	Measures of freedom and flexibility	Strengthened supervision
Enterprise freedom	Limited and largely regulated	Limited and largely regulated	Enhancement of the enterprise freedom	Promotion of the enterprise freedom
External trade	Strictly controlled by the state	Progressive then sudden openness	Freedom and joining to free exchange zones	Limitation of imports and regulation of the adhesion in the free exchange zones
Banking system nationalization	Banks; financial funds charged by: - distribution of planned investments; financing the operations of national societies (S.N.)	Organized Public commercial banks	Enhanced public banks and attempts of bank privatization Foreign bank facility	Putting the privatization projects away and tightening the foreign bank facility authorization
Financial market	Inexistent	Inexistent Creation of Algiers stock market and introduction of four public enterprises' securities	Bonds operations Withdrawal of the stock market securities Attempts to create a financial market in the external bank of Algeria BEA	Creation of national fund of investment (FNI) Promotion of the decentralized public investment funds

Source: Temmar H. (2015), "The Algerian economy: 1970-2014", Tome IV "The public economic governance", University Publications office, Algeria, P104.

From the table above, we can distinguish two institutional and governance models: the first one is a **centralized planned management** of a state's **closed economy** and the second is a hybrid model of market, of free enterprise and of openness to world markets but this has not excluded the role of state in the economy. (Temmar H.2015, Tome IV, P95)

It appears from the table that 1986 is the year to abandon the centralized planned model. The first step covering the period of 1970-1986 marked by the implementation of a state development strategy under a centralized planned management, institutional framework of a unique party, active voluntarism and administrative management of the national economy.

In this period, the Algerian state had an optimistic ambition to rapid economic development characterized by a purely political vision due to the release of the colonial live. The industrialization and agricultural revolution involved the nationalization of mineral and hydrocarbon wealth, banks and insurance companies and external trade; these sectors were strictly controlled by the state and seen as strategic sectors related to the sovereignty. The financial market was inexistent as it is one of the capitalism elements and this was contradictory with the economic and political principles and objectives of this period.

The period of 1986-1999 was marked by the implementation of an institutional framework of multiparty and an economic model of free enterprise and openness. However, these economic and institutional reforms have not constituted a strong framework to develop and diversify the national economy; the social and political strife and the inefficient economic management impeded the development path.

The third phase 2000-2008 lifted the confusions and brought a clarification in the political framework (Temmar H.2015, Tome IV, P98), the period was characterized by a reconciliation between the community and the political authority synchronized with a global economic strategy marked by social stabilization, economic recovery and integration of the national economy in the international and regional markets.

The fourth step 2008-2014 (tables 3-12 and 3-14) is marked by the return of the state to the economy under the necessity of keeping an independent threatened Algeria. Assuring the free enterprise, the governance knows an inflection toward the state intervention.

Algeria is being in an ambivalent and confused institutional framework (Temmar H.2015, Tome IV, P101). Assured and enhanced free enterprise in one hand, and in other hand, the market is still the institution of value formation. Thus, the institutional framework of free enterprise and market is the same but the economy is largely led by the state.

Table (3-13): The production recovery

	1970-1986	1986-1999	2000-2008	2009-2010
Investments	Centralized under the public spending plans	Centralization then freedom for enterprises to mobilize investments Policies to attract FDI	Enhancing the freedom of investment and introduction of rationalization and supervision measures	Return to the direct investment by the creation of public investments fund (FNI)
FDI (foreign direct investment)	Non-hydrocarbon FDI inexistent Controlled by the plans' objectives	Attractive investments code Installation of enterprises in the hydrocarbons sector	Active policies to attract FDI Installation of medium and international enterprises	Framing the foreign direct investment
Public enterprise	Economy (production and services) organized in the vertical enterprises (S.N.)	Empowerment of the public enterprises in the participation funds and holdings framework Consolidation of public enterprises: bank-Enterprise device	Enhancing the autonomy of enterprises: SGP (société de gestion de participation) Implementation of an extensive program of privatization	Stopping the privatization and enhancement of public enterprise
Private enterprise	Repressed	Promotion of the private enterprise	Active promotion of the private sector Establishment and measures to enhance the small and medium enterprise (SME)	Measures to promote investment in favor of the private enterprise

Source: *Temmar H. (2015), "The Algerian economy: 1970-2014", Tome IV "The public economic governance", University Publications office, Algeria, P105.*

Table (3-14): Institutional framework for 2000-2014

Institutional organization	2000-2008	2009-2014
Market freedom	Freedom Transparency	Freedom Regulation of some consumer products
Enterprise freedom	Enhancement of the enterprise freedom Privatization	Promotion of the enterprise freedom: fiscal and financial measures Suspension of privatizations
Business area	Measures of rationalization Attempts to enhance efficiency of agencies	Enhanced administrative framing
Market regulation	Very weak and inefficient regulation	Assured but inefficient regulation of institutions
External trade	Freedom and adhesion to the free exchange zones Readjustment of customs tariffs	Relative limitation of imports Reassessment of the adhesions to the free exchange zones
Banking system nationalization	Enhanced public banks Attempt of the bank privatization Freedom of foreign bank facility	Putting away the privatization projects Tightening the authorization of foreign bank facility Enhancing the public banks
Financial market	Bonds operations Withdrawal of bank securities Creation of business bank branch at the external bank of Algeria	Creation of FNI Promotion of regional public investment funds
Investments	Enhancement of investment freedom	Promotion of national investment
Foreign direct investment	Rationalization of FDI attractiveness device Introduction of rationalization and supervision of FDI measures	Framing the foreign direct investment

Source: *Temmar H. (2015), "The Algerian economy: 1970-2014", Tome IV "The public economic governance", University Publications office, Algeria, P105.*

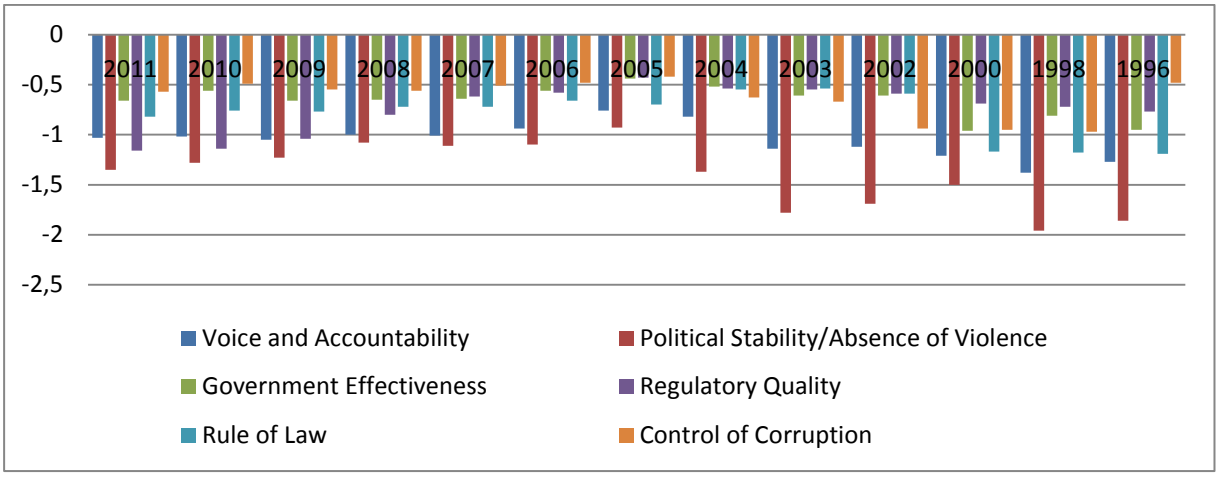
III-3-2 Assessment of the governance indicators in Algeria

During the recent years, many institutions are trying to measure the quality of governance in the world. Regarding Algeria, we choose two sets of governance indicators; the first is the Worldwide Governance Indicators (WGI) provided by experts of the World Bank including six indicators (voice and accountability; political stability; government effectiveness; regulatory quality; rule of law and control of corruption), the second is the economic freedom indicators provided by Heritage Foundation (business freedom, freedom of corruption, fiscal

freedom, trade freedom, labor freedom, government spending, property right, monetary freedom, investment freedom and financial freedom).

For Algeria, 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 (1995-2012) and no improvement is recorded except the political situation which has been more stable, however, the index is still negative.

Figure (3-18): governance measures in Algeria



Source: world governance indicators database.

The ten economic freedom indicators are graded on a scale of 0 to 100. The nearest the index to 100, the freest is the country's economic environment. The table (3-15) shows the evolution of these indicators in Algeria from 1995 to 2016.

Table (3-15): economic freedom indicators in Algeria.

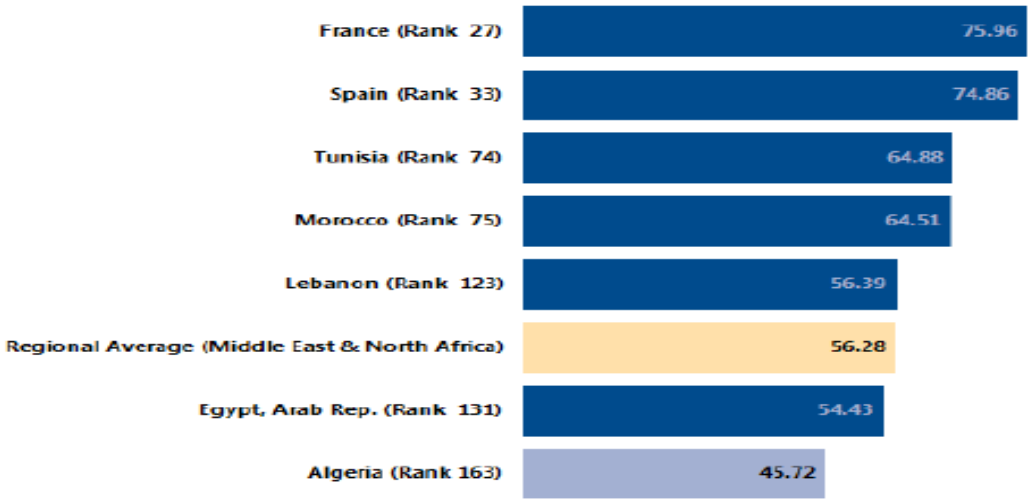
index year	overall score	property rights	freedom from corruptio	fiscal freedom	governme nt	business freedom	labor freedom	monetary freedom	trade freedom	investmen t freedom	financial freedom
2016	50.1	25	36	81	59.4	62.1	48.2	68.1	60.8	30	30
2015	48.9	30	36	80	38.7	66.6	50.5	71.2	60.8	25	30
2014	50.8	30	28.7	80.5	51	66.3	48.3	67.8	60.8	45	30
2013	49.6	30	29	80.4	44.1	65.2	52.6	76.6	67.8	20	30
2012	51	30	29	82.9	47.9	66.3	54.4	76.3	72.8	20	30
2011	52.4	30	28	83.5	62.4	69.4	52.9	75.4	72.8	20	30
2010	56.9	30	32	83.5	73.4	71.2	56.4	77.2	70.7	45	30
2009	56.6	30	30	77.2	74.1	72.5	55.5	78.6	68.6	50	30
2008	56.2	30	31	77	74.6	73.6	57	80.2	68.8	40	30
2007	55.4	30	28	73.8	74.2	73.7	57.6	80.7	66	50	20
2006	55.7	30	27	73.9	74.4	74.8	57.4	78.8	61	50	30

2005	53.2	30	26	73.9	61.8	70	55.9	80.1	54.4	50	30
2004	58.1	30	50	74.1	62.4	70	N/A	81.1	55	70	30
2003	57.7	30	50	65.2	74.9	70	N/A	78.9	50.4	70	30
2002	61	30	50	65	71.2	70	N/A	82.8	60	70	50
2001	57.3	30	50	64.6	63.3	70	N/A	78.2	59.6	50	50
2000	56.8	50	50	64.7	63.3	70	N/A	74	39.6	50	50
1999	57.2	50	50	48.7	72.8	70	N/A	69	54.2	50	50
1998	55.8	50	50	48.6	69.3	70	N/A	60.1	54.2	50	50
1997	54.9	50	50	48.8	65.5	70	N/A	56	54.2	50	50
1996	54.5	50	50	48.8	60.7	70	N/A	57	54.2	50	50
1995	55.7	50	50	48.8	69.5	70	N/A	59.2	54.2	50	50

Source: *http://www.heritage.org/*

As the table above shows, most of the freedom indicators recorded rates above 50 except the financial freedom and freedom of corruption indicators that have known a decrease since 2005 registering rates below 30 which indicates that Algeria is still suffering of corruption. This latter impedes the development path despite the Algerian efforts to diversify it economy. Hausmann (2010) 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 and 163 in 2016 and it is ranked the least among its comparator (Figure 3-19).

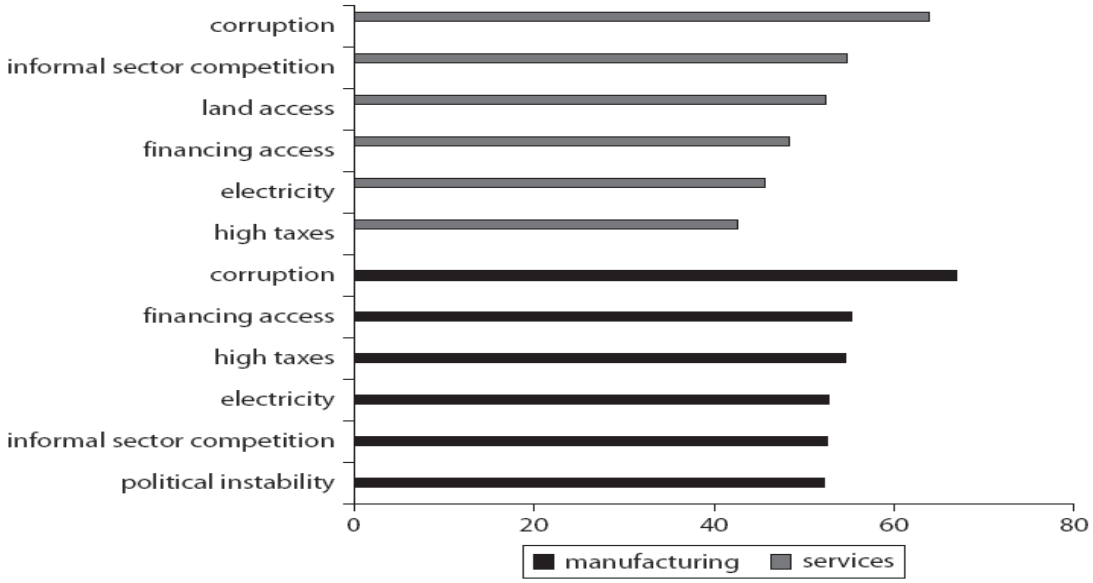
Figure (3-19): how Algeria and comparator economies rank on the ease of doing business



Source: *Doing business 2016, "economy profile Algeria 2016", world bank report, P 8.*

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:

Figure (3-20): 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.*

Conclusion:

This chapter analyzed the context of the Algerian economic diversification showing the role of oil in the national economy in the first section; in section two, the chapter displayed the different steps of the economic development programs as an economic framework for diversification. Finally, in section three, we assessed the institutional framework to diversify the national economy and the place of Algeria in the world regarding this framework.

The hydrocarbons 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 decade 2000-2010. During the recent years, the hydrocarbons share of GDP has decreased with about 5% due to the fluctuations in the international oil prices and to the policies and economic programs implemented regarding the other economic sectors in the context of economic diversification. Although the efforts done by the Algerian government to diversify the economy and the institutional framework undertaken to succeed these programs, Algerian governance indicators are still very weak according to many international institutions. Algeria ranked the 106th in the world according to the international transparency organization in which this factor represents the main factor to impede the investment**.**

Chapter Four

The Empirical Study of The Relationship Between Economic Diversification And Oil Volatility In Algeria

Introduction:

The hydrocarbons sector has an important role in the Algerian economy through the large revenues from it. Algeria is trying to diversify its economy by implementing several programs under different national and international circumstances such as the oil prices fluctuations.

This chapter analyzes andinvestigates empirically in the economic diversification in Algeria using different statistical tools. It analyzes the sectoral portfolio of the Algerian economy using the portfolio theory and then it investigates in the relationship between the oil price volatility and the export diversification index trying to show the effect of several economic and institutional factors on this index. To do this, we divided the chapter into three sections; firstly we described the methodology of the study presenting the different tools and the data used starting by the two stages least squares and simultaneous equations method to the equation of the portfolio theory. Secondly, we present the outputs of the sectoral portfolio equation and finally, we present the empirical results of the TSLS equation estimation then we test statistically the hypotheses of the study.

IV-1- Methodology of the study

IV-1-1- Statistical tools description

a- Overview on the simultaneous equations models (SEM)

The simultaneous equation model is a structural model formulated from the economic theory, where explanatory variables from one equation can be dependent variables in other equations. (Vogelvang B. 2005). And unlike the single-equation models, in the simultaneousequation models one may not estimate the parameters of asingle equation without taking into account information provided by otherequations in the system. It is known that one of the crucial assumptions of the method of ordinary least squares OLS is that theexplanatory *X* variables are either non-stochastic or, if stochastic (random),are distributed independently of the stochastic disturbance term. If neitherof these conditions is met, then, as shown later, the least-squares estimatorsare not only biased but also inconsistent; that is, as the sample size increasesindefinitely, the estimators do not converge to their true (population)values (Gujarati D. 2004). Therefore, one of the other more consistent methods to estimate such kind of structural models is the two stages least squares. Thus, in the following hypothetical system of equations:

$Y1i = \beta 10 + \beta 12Y2i + \gamma 11X1i + u1i$ ……..*(1)*

$Y2i = \beta 20 + \beta 21Y1i + \gamma 21X1i + u2i$ ……..*(2)*

where *Y*1 and *Y*2 are mutually dependent, or endogenous, variables and *X*1 isan exogenous variable and where *u*1 and *u*2 are the stochastic disturbanceterms, the variables *Y*1 and *Y*2 are both stochastic. Therefore, unless it can beshown that the stochastic explanatory variable *Y*2 in (1) is distributedindependently of *u*1 and the stochastic explanatory variable *Y*1 in (2) isdistributed independently of *u*2, application of the classical OLS to theseequations individually will lead to inconsistent estimates.

The choice of the estimation methods is based on the identification criterion in a system of simultaneous equations.The so-called **order and rank conditions ofidentification** lighten this problem of identification by providing a systematic routine.To understand the order and rank conditions, we introduce the followingnotations (Gujarati, 2004, P748):

M = number of endogenous variables in the model

m = number of endogenous variables in a given equation

K = number of predetermined variables in the model including theintercept

k = number of predetermined variables in a given equation

In a model of *M* simultaneous equations in order for an equation to be identified, it must exclude *at least M* − 1 variables (endogenous as well as predetermined) appearing in the model. If it excludes exactly *M* − 1 variables, the equation is just identified. If it excludes more than *M* − 1 variables, it is over-identified.

In a model of *M* simultaneous equations, in order for an equation to be identified, the number of predetermined variables excluded from the equation must not be less than the number of endogenous variables included in that equation less 1, that is,

$K - k \geq m - 1$

If $K - k = m - 1$, the equation is just identified, but if $K - k > m - 1$, it is over-identified.

The order condition discussed previously is *a necessary but not sufficient*condition for identification; that is, even if it is satisfied, it may happen thatan equation is not identified (Gujarati, 2004, P 747). To apply the rank condition one may proceed as follows:

1. Write down the system in a tabular form,

2. Strike out the coefficients of the row in which the equation underconsideration appears.

3. Also strike out the columns corresponding to those coefficients which are nonzero.

4. The entries left in the table will then give only the coefficients of thevariables included in the system but not in the equation under consideration.

From these entries form all possible matrices, like **A**, of order $M-1$and obtain the corresponding determinants. If at least one non-vanishing ornonzero determinant can be found, the equation in question is (just or over)identified. The rank of the matrix, say, **A**, in this case is exactly equal to$M-1$. If all the possible $(M-1)(M-1)$ determinants are zero, the rank ofthe matrix **A** is less than $M-1$ and the equation under investigation is notidentified.

1. If $K-k > m-1$ and the rank of the **A** matrix is $M-1$, the equation is over-identified and we can use the two stage least squares (2SLS).

2. If $K-k = m-1$ and the rank of the matrix **A** is $M-1$, the equation is exactly identified and we can use whether the indirect least squares (ILS) or the two stage least squares (2SLS);

3. If $K-k \geq m-1$ and the rank of the matrix **A** is less than $M-1$, the equation is under-identified and the estimation is impossible;

4. If $K-k < m-1$, the structural equation is unidentified. The rank of the **A** matrix in thiscase is bound to be less than $M-1$.

The sufficient rank condition of identification discussed above is so difficult in practice if no impossible (Bourbonais R. 2009, P 210), consequently, we summarize the identification conditions as follows:

$M-1 > M-m + K-k \longrightarrow$ The equation is under-identified, the estimation is impossible;

$M-1 = M-m+ K-k \longrightarrow$ The equation is just-identified, we can use whether the indirect least squares (ILS) or the two stage least squares (2SLS);

$M-1 < M-m+ K-k \longrightarrow$ The equation is over-identified, we can use the two stage least squares (2SLS).

b- The two stages least squares method

The method of the two stages least squares is the most used in practice for the just and over-identified structural models. This method, as its name indicates, is based on the application of two stages of the ordinary least squares (OLS) (Bourbonais R. 2009, P 212). Moreover, the TSLS can be applied using a direct derivation of the estimator using specific programs.

The method of 2SLS is especially designed for over-identified equations,although it can also be applied to exactly identified equations. The basic idea behind TSLS is to replace the (stochastic) endogenous explanatory variable by alinear combination of the predetermined variables in the model and usethis combination as the explanatory variable in lieu of the original endogenous variable. The TSLS method thus resembles the **instrumental variablemethod** of estimation in that the linear combination of the predeterminedvariables serves as an instrument, or proxy, for the endogenousregressor. (Gujarati, 2004, P785)

Some features of 2SLS (Gujarati, 2004, P774):

1. It can be applied to an individual equation in the system without directlytaking into account any other equation(s) in the system. Hence, forsolving econometric models involving a large number of equations, 2SLSoffers an economical method. For this reason the method has been used extensivelyin practice.

2. 2SLS provides only one estimate per parameter.

3. It is easy to apply because all one needs to know is the total numberof exogenous or predetermined variables in the system without knowingany other variables in the system.

4. Although specially designed to handle over-identified equations, themethod can also be applied to exactly identified equations.

5.A noteworthy feature of 2SLS is that the estimates obtainedare consistent, that is, as the sample size increases indefinitely, theestimates converge to their true population values. The estimates may notsatisfy small-sample properties, such as unbiasedness and minimum variance.Therefore, the results obtained by applying this method to smallsamples and the inferences drawn from them should be interpreted withdue caution.

c- The portfolio index of economic diversification

As we showed in the theoretical part of this thesis, the portfolio theory (PT), developed and applied to financial investments,has been proposed in an approach developed by Conroy (1975) to analyze economic diversification. Conroy (1975) viewed economic policies planned to promote economic growth and diversification as a set of financial assets selected to create an efficient portfolio. In this context, the portfolio theory captures the characteristics of individual industries and inter-industry relationships on regional growth and stability.

IV-1-2- Model and data presentation

The empirical model of this thesis is based on estimating the effect of oil price volatility on the economic diversification in Algeria over the time period 1985-2015 basing on the two stages least squares method from one hand. From other hand, we apply the portfolio theory to estimate the economic diversification in Algeria taking into consideration the economic instability (volatility).

a- Presentation of the portfolio index equation

The portfolio measure and following the Markowitz principle, can be expressed as (State of Hawaii, 2011,p11):

$$\boldsymbol{\sigma_p^2} = \sum_{i=1}^{N} S_i^2 \sigma_i^2\,(X) + \sum_{i=1}^{N} \sum_{i=1\ j=1} S_i S_j\, \sigma_{ij}\,(X_i, X_j)$$

$S_i \ and \ S_j$ are the shares of economic activity (employment, income or output X) in the ith and jth sectors.

σ_i^2 is the variance of economic activity for the ith sector.

σ_{ij} is the covariance of economic activities for the ith and the jth sectors.

According to the equation above, the economic diversification is measured by the variance (economic instability) of the industrial portfolio. Thus, the lower the variance the more diversified the economy and vice versa.

For the Algerian case, the value added of 20 economic activities and the data have been brought from the National Office of Statistics over the period 1981-2011.

b- Presentation of the TSLS equation

To estimate the effect of oil price volatility on the economic diversification, we estimate the following equation taking into account the other determinants of diversification:

$$HHI_t = \alpha_0 + \alpha_1 RGDP_t + \alpha_2 oilvolatility_t + \alpha_3 FDI_t + \alpha_4 GCF_t + \alpha_5 ICRG_t + \alpha_6 Openness_t + \alpha_5 REER_t + \varepsilon_t$$

- The dependent variable: is represented by HHI and is used to measure the degree of market concentration, 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 (for more details refer to chapter 1):

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

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 and the World Bank.

- The independent variables

RGDP is the real gross domestic product per capita calculated in logarithmic terms and the data are taken from the World Development indicators database;

Oil price volatility (oilvolatility):

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. 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 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)):

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

With:

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.

- FDI is foreign direct investment inflows as percentage of GDP, data are brought from UNCTAD database.

- GCF is the gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. The data are brought from the World Bank indicators.

- ICRG is the institutional quality variable measured by political risk index[1];

- Openness is the rate of trade openness; it is calculated by the sum of exports and imports of goods and services measured as a share of gross domestic product.

- REER is the real effective exchange rate based on the year 2010 and it is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. The data are brought from the World Bank indicators.

[1]This index is taken from the dataset constructed by Political Risk Services (International Country Risk Guide governance indicators, 2013) .According to ICRG's definition" *the aim of political risk index is to provide a means of assessing the political stability of the countries*". The political risk rating comprises 12 variables covering both political and social attributes (Government stability , Socioeconomic conditions , Investment profile , Internal conflict , External conflict , Corruption , Military in politics , Religious tensions , Law and order , Ethnic tensions , Democratic accountability , Bureaucracy quality) .The ICRG political risk score ranges from 0.00% to 100% , with higher values indicating low risk , and lower score means higher risk .

- List of instruments:

To apply the method of two stage least squares, we use a set of instrumental variables in which some of them are the explanatory variables used in the structural equation (FDI; GCF; ICRG; Openness; oil volatility and REER); we used also the lagged endogenous variable (RGDP(-1)). Other economic variables are used namely: the inflation rate measured by the consumer price index (CPI) to control for the monetary policy; the total government expenditure (Govexp) as percentage of GDP to control for the fiscal policy and the domestic credit provided to private sector (Private) to control for the development of the financial system.

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

1. Before estimating the equation and using the TSLS, we verify the identification of the model.

Number of endogenous variables in the model is 2; 7 exogenous variables in the equation; 11 predetermined variables in the model.

2-1=1 < 2-1+11-7=5 => the model is over-identified so we can use the two stage least squares method.

2. Time series analysis focusing on descriptive statistics of the variables used and 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 (Agung I.G.N; 2009; P447).

3. We estimate the equation below:

$$HHI_t = \alpha_0 + \alpha_1 RGDP_t + \alpha_2 oilvolatility_t + \alpha_3 FDI_t + \alpha_4 GCF_t + \alpha_5 ICRG_t + \alpha_6 Openness_t + \alpha_7 REER_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (4\text{-}1)$$

4. Testing the validity of the model: Autocorrelation; Heteroscedasticity; Normality of the error terms and multicolinearity.

5. Hypotheses testing: using the test of student, we test the significance of the estimated parameters basing on the following hypotheses:

Hypothesis 1: there is an effect of RGDP on the export concentration (HHI) (H_1)

Hypothesis 2: there is an effect of oil price volatility on the export concentration (HHI) (H_1)

Hypothesis 3: there is an effect of FDI on the export concentration (HHI) (H_1)

Hypothesis 4: there is an effect of GCF on the export concentration (HHI) (H_1)

Hypothesis 5: there is an effect of ICRG on the export concentration (HHI) (H_1)

Hypothesis 6: there is an effect of openness on the export concentration (HHI) (H_1)

Hypothesis 7: there is an effect of REER on the export concentration (HHI) (H_1)

IV-2- Empirical results of the diversification portfolio index

After estimating the effect of the oil price volatility and the other determinants of economic diversification, this section analyzes the diversification in a different way taking indirectly the effect of instability basing on the portfolio theory.

IV-2-1- The analysis of the portfolio equation

The portfolio measure and following the Markowitz principle, is estimated by the following equation:

$$\boldsymbol{\sigma_p^2} = \sum_{i=1}^{N} S_i^2 \sigma_i^2 (X) + \sum_{i=1}^{N} \sum_{i=1}^{} \sum_{j=1} S_i S_j \sigma_{ij} (X_i, X_j)$$

$S_i \ and \ S_j$ are the shares of economic activity (value added X) in the ith and jth sectors.

σ_i^2 is the variance of economic activity for the ith sector.

σ_{ij} is the covariance of economic activities for the ith and the jth sectors.

For the Algerian case 19 economic activities have been used namely: hydrocarbons; energy and water; agriculture; services and petroleum works; mines; Steelmaking-Metallurgical-Mechanical-Electrical and Electronic industries; construction materials; public works; chemistry and plastic; food industries; textile industries; leather and footwear industries; wood and paper industries; various industries; transport and communication; trade; hotels-coffee and restaurants; services for enterprises and services for households. The data covered the period 1981-2011, this period has been chosen for two reasons: first, it covers the different main development programs implemented by the Algerian government which allow us to analyze them easily. The second is the non-availability of the data of these sectors for the years after 2012 which leads us to stop in 2011.

The calculation of the index using the above equation has taken different steps:

1. We calculated the shares of the sectors' income (value added) in the total value added;

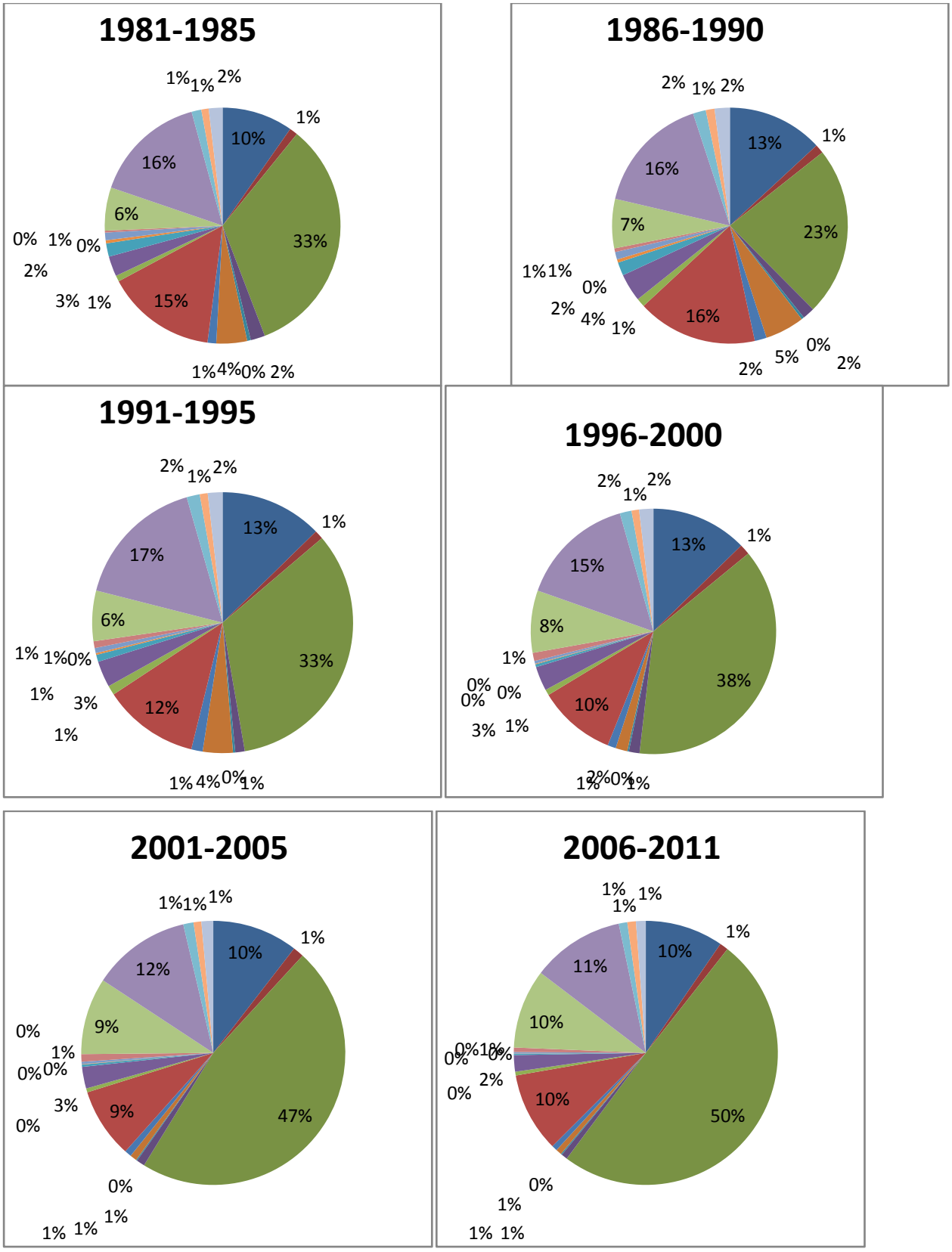
2. We calculated the five years mean of the shares ratios of each sector instead of using the yearly data and this allowed us to estimate the portfolio index of each program;

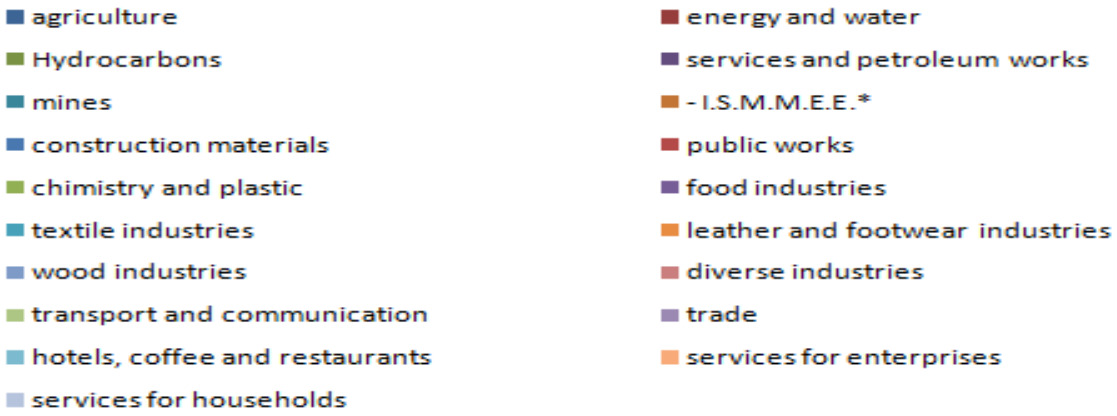
3. We measured the variances of each sector;

4. We estimated the covariance matrices for each five years;

5. Finally we estimated the portfolio index of diversification for each program (five-years).

Figure (4-1): sectoral contribution in the total value added (1981-2011)



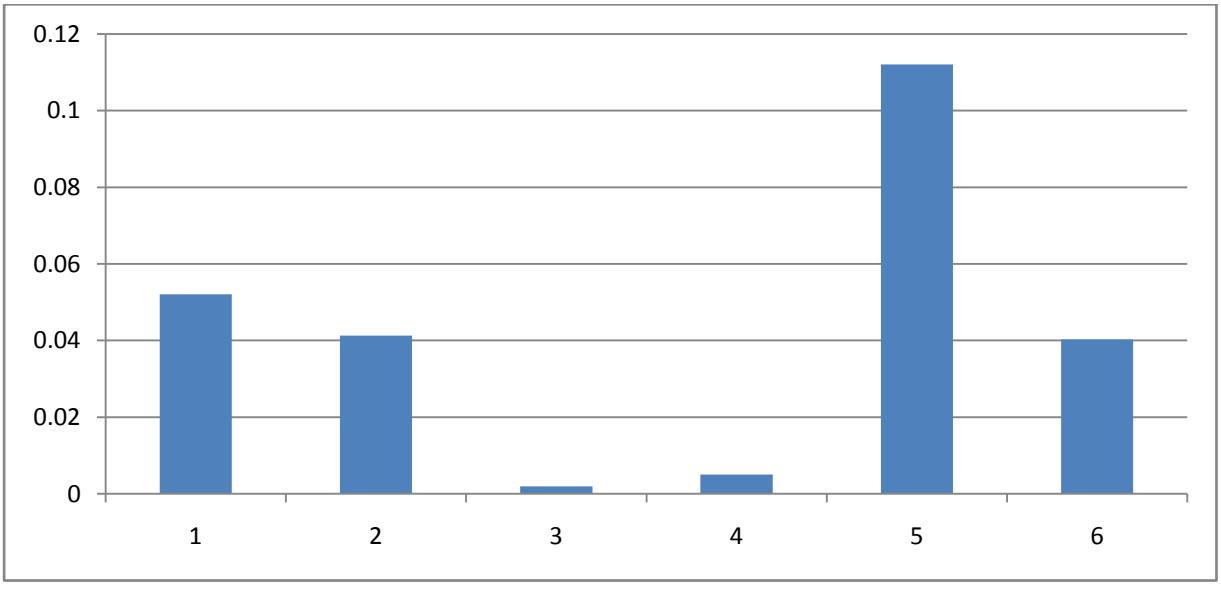


***Source**: student's construction and calculations using data from national office of statistics*

The figure above displays the shares of value added by economic activity for each five years from 1981 to 2011. The diagram shows clearly the dominance of the hydrocarbon sector which has known an increase from 33% over 1981-2000 to 50% over the 2000s. The sectors that had an importance after the hydrocarbons and played the second role in the total value added are the public works and trade. We can also notice obviously from the figure that the sectors of services with all its categories are nearly neglected and do not played an important role in the total value added of Algeria.

IV-2-2- The outputs of the diversification portfolio index

Figure(4-2): evolution of the sectoral diversification portfolio index



***Source**: student's construction and calculations using data from national office of statistics*

After measuring the variances and co-variances matrices of the sectoral contributions, we achieved the total variance of the sectoral portfolio which reflects the diversification portfolio index. As shown in the literature, the lower the variance the more diversified the economy

and vice versa. The calculated index is displayed in the figure above, we notice that the variance changed from each program to other ranging from 0.01 to 0.11. During the period 1981-1990 covering the first and second five-year programs, the portfolio variance was 0.05 and 0.04, these values are superior to those in the period of 1990s and less than the index values during the new economic development and recovery programs (2000-2011). Since the portfolio index relates the economic diversification by the instability, the values achieved confirm that the economic development programs implemented by the Algerian government were attached by the hydrocarbon sector especially during the 1980s where it contributed with about 33% and 2000s with about 49%. However, this index was very low during the 1990s, the period of social instability and economic transition to the opened market, this was due to the efforts of government to solve the people from the social strife in one hand and to open the economy from other hand but such efforts were like a trap because the national economy returned to the dependence to the oil sector very quickly in 2000 where the oil prices started to increase.

IV-3- The empirical results of the economic diversification's determinants

IV-3-1- Time series analysis

This sub-section analyses the time series of the variables used in the model of the study using the descriptive statistics and the stationarity test.

Table (4-1): Descriptive statistics of the variables

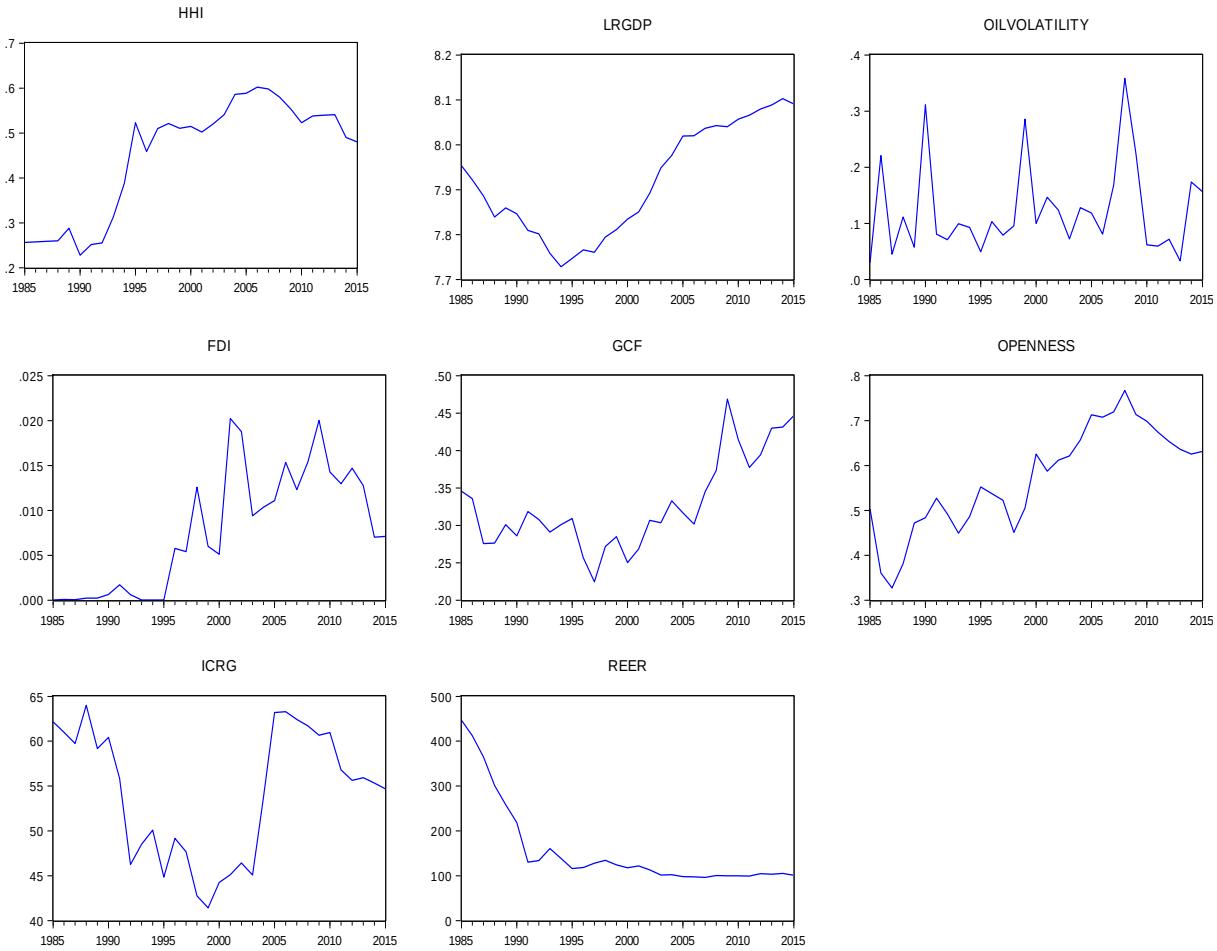
	HHI	LRGDP	OILVOLATILITY	FDI	GCF	ICRG	OPENNESS	REER
Mean	0.45082	7.91698	0.1228	0.00774	0.3272	54.134	0.5705	156.41
Median	0.51058	7.89197	0.0993	0.00701	0.3076	55.625	0.5871	117.95
Maximum	0.60184	8.10272	0.3581	0.02023	0.4688	64.000	0.7668	446.64
Minimum	0.22766	7.72817	0.0296	1.96E-08	0.2245	41.417	0.3268	96.399
Std. Dev.	0.12945	0.12251	0.0817	0.00678	0.0619	7.2548	0.1145	96.659
Skewness	-0.65929	0.08059	1.3894	0.2791	0.7291	-0.2538	-0.2931	1.9495
Kurtosis	1.78889	1.55128	4.2605	1.77914	2.6616	1.6072	2.2371	5.5167
Jarque-Bera	4.14034	2.7444	12.026	2.3277	2.8946	2.8386	1.1955	27.818
Probability	0.12616	0.25353	0.0024	0.31227	0.2352	0.2418	0.5500	0.0000
Sum	13.97549	245.4265	3.80695	0.240058	10.1439	1678.16	17.6884	4848.75
SumSq.Dev.	0.502734	0.450246	0.20041	0.001381	0.11507	1578.96	0.39361	280287.3
Observations	31	31	31	31	31	31	31	31

Source: *student's construction using Eviews' Outputs.*

The table above displays the descriptive statistics of the variables used in the TSLS equation. Basing on 31 observations, the Jarque-Bera statistic shows that all the variables follow normal distribution except the series of oil price volatility and the real effective exchange rate which

are highly leptokurtic to the normal (Kurtosis superior to 3). The means and medians of all the series are positive which indicates the positive trend of these series. Moreover, the figure (4-1) displays the graphs of each variable and we can notice very clearly the instability of the oil prices from the different spikes showed in the volatility diagram.

Figure (4-3): graphical presentation of the variables' series



Source: *student's construction using Eviews' Outputs.*

After controlling for the identification problem and showing that the equation is over-identified; the unit root test for the variables used indicated the non-stationarity of the series in the level under the ADF unit roots test while the 1st differenced are stationary except the series of the oil price volatility which is stationary in the level and the consumer price index which is integrated in order II, which allows us to use these series in the estimation. The results for these tests are summarized in the table (4-2).

Table (4-2): results of the Augmented Dickey-Fuller unit root test for stationarity

Variables		None	Intercept	Trend and intercept	
HHI	Level	0.5697	-1.5239	-0.63874	I(1)
	1st difference	-5.0002***	-5.086***	-5.4165***	
LRGDP	Level	0.74403	-0.8774	-4.0263**	I(1)
	1st difference	-3.0202***	-3.0854***	-3.19**	
CPI	Level	1.269	-0.31568	-2.7976	I(2)
	1st difference	-1.0871	-2.4346	-2.3911	
	2nd difference	-5.5408***	-5.4630***	-5.3623***	
GCF	Level	0.36672	-0.90815	-2.45556	I(1)
	1st difference	-5.401***	-5.5968***	-5.8487***	
GOVEXP	Level	0.08435	-2.4198	-2.2208	I(1)
	1st difference	-4.058***	-3.9745***	-4.0708**	
FDI	Level	-1.074	-2.0362	-2.5951	I(1)
	1st difference	-6.5523***	-6.5234***	-6.6341***	
Openness	Level	0.1956	-1.2403	-2.4958	I(1)
	1st difference	-5.4152***	-5.49045***	-5.5289***	
Oilvolatility	Level	-2.11256***	-5.3697***	-5.2807***	I(0)
	1st difference	///	///	///	
ICRG	Level	-0.5677	-1.6839	-1.7093	I(1)
	1st difference	-4.8355***	-4.7618***	-4.7399***	
REER	Level	-1.2807	-5.784***	-4.8958***	I(1)
	1st difference	-3.404***	-3.62**	-3.92**	
PRIVATE	Level	-2.405**	-2.166	-1.117	I(1)
	1st difference	-3.879***	-3.941***	-4.490***	

, ** and * mean the significance at 10, 5 and 1% levels respectively.*

The calculated t-statistics in the table above indicate that all the variables except the oil price volatility and the consumer price index are integrated of order 1. Thus, and for avoiding fallacious results we use the stationary series (differenced series) in the regression.

IV-3-2- The validity of the model

The correlation analysis showed no strong multicolinearity between the independent variables of the equation under study; which allows us to continue our estimation. (Table 4-3)

Table (4-3): Correlation analysis matrix

Correlation Probability							
	D(LRGDP)	**OILVOLATILITY**	**D(FDI)**	**D(GCF)**	**D(ICRG)**	**D(OPEN-NESS)**	**D(REER)**
D(LRGDP)	1.0000						
OILVOLATILITY	-0.0600 0.7525	1.000 -----					
D(FDI)	-0.09697 0.6102	0.0653 0.7315	1.0000 -----				
D(GCF)	0.149337 0.4309	0.2952 0.1132	0.2085 0.2687	1.00000 -----			
D(ICRG)	0.116524 0.5397	0.1445 0.4461	0.0857 0.6522	-0.1364 0.4720	1.000000 -----		
D(OPEN-NESS)	0.243600 0.1946	-0.019 0.9204	-0.232 0.2153	0.018765 0.9216	0.226655 0.2284	1.000000 -----	
D(REER)	0.441161 0.0147	0.0323 0.8654	0.0793 0.6770	-0.0073 0.9695	0.125751 0.5079	-0.2645 0.1578	1.000 -----

Source : constructed by the student using EVIEWS' output

Table (4-4) summarizes the different tests to show the validity of the model specified:

Table (4-4): tests for model's validity

J-Statistic **Prob. J-stat.**	1.35 0.71
Jarque- Bera normality	1.25 P= "0.53"
Breusch- Godfrey auto-correlation	1.092 P= "0.58"
Heteroscedasticity Breusch-Pagan-Godfrey	9.649 P= "0.20"

Source : constructed by the student using EVIEWS' output

The serial correlation Breusch-Godfrey and the heteroscedasticity Breusch-Pogan-Godfrey tests show neither serial correlation nor heteroscedasticity in the residual terms the equation (Chi-squared probability > 0.05 (5%) ➔ we reject the null hypothesis). The Jarque-Bera statistic indicates that the error terms are normally distributed. The J-statistic developed by Hansen reflects the validity of the instruments and the model used (the null hypothesis of the

validity of the model is accepted at the significance level of 5%: Prob.J-stat.> 0.05). All the tests done indicated the well specification of the model and variables.

IV-3-3- Estimation results and hypotheses testing

The table below summarizes the parameters estimated of the equation (4-1) which measures the effect of the oil price volatility on the economic diversification showing the effect of other control variables as determinants of diversification.

Table (4-5): summary of the estimation results
Dependent variable: D(HHI)

Variables	D(LRGDP)	Oilvolatility	D(FDI)	D(GCF)	D(ICRG)	D(OPENNESS)	D(REER)	Constant
	-0.564 (-1.954)*	-0.3248 (-3.855)***	0.185 -0.126	0.3938 (1.966)*	-0.0018 (-1.06)	0.5562 (3.062)***	0.000711 (2.042)**	0.0512 (3.93)***

R-Squared 51%	**F-statistic** 3.22**
Adjusted R-Squared 35%	**Durbin- Watson** 1.7096

, **, * mean significance at 10, 5 and 1% respectively. The values between parentheses are the calculated t-statistics.*

***Source**: constructed by the student using EVIEWS' output*

- Hypotheses testing:

As shown in the previous section, we have seven hypotheses to be tested as the number of parameters and variables' effect estimated.

From the results above, the *t* calculated is greater than the t-student tabulated at 10% only,thus, we accept the hypothesis 1 indicating the existence of the **effect of RGDP on the export concentration (HHI)**, this effect is negativewhich means that the level of income measured by the real GDP has negative and weakly significant relationship with export concentration in Algeria forming the U-shaped curve as argued in the theory. This hypothesis is rejected at the level of 5%.

The *t* calculated of the parameter $\alpha_2$is greater than the t-student tabulated at 5%, thus, we accept the hypothesis 2 indicating the existence of the **effect of oil price volatility on the export concentration (HHI)**, this effect is negative which means that the volatility in oil prices measured by the standard deviation has negative and significant effect on export concentration in Algeria.

The *t* calculated of the parameter $\alpha_3$is less than the t-student tabulated at 5%, thus, we reject the hypothesis 3 indicating the existence of the **effect of foreign direct investment on the**

export concentration (HHI), which means that the level of foreign investment had no effect on export concentration and no role in economic diversification in Algeria.

The *t* calculated of the parameter $\alpha_4$is greater than the t-student tabulated at 10% only, thus, we accept the hypothesis 4 indicating the existence of the **effect of GCF on the export concentration (HHI)**, this effect is positive which means that the domestic investment measured by the gross capital formation has negative and weakly significant relationship with export diversification in Algeria showing the weakness of investment policy. This hypothesis is rejected at the level of 5%.

The *t* calculated of the parameter α_5 is less than the t-student tabulated at 5%, thus, we reject the hypothesis 5 indicating the existence of the **effect of ICRG on the export concentration (HHI)**, which means that the institutional quality and governance have not played any role on export diversification in Algeria.

The *t* calculated of the parameter α_6 is greater than the t-student tabulated at 5%, thus, we accept the hypothesis 6 indicating the existence of the **effect of openness on the export concentration (HHI)**, this effect is positive which means that the trade openness has negative and significant relationship with export diversification in Algeria and this is referred to the specialization of the Algerian export in the hydrocarbon sector.

The *t* calculated of the parameter α_7 is greater than the t-student tabulated at 5%, thus, we accept the hypothesis 7 indicating the existence of the **effect of REER on the export concentration (HHI)**, this effect is positive which means that the real exchange rate has led to more export concentration in Algeria showing the Dutch Disease effect. However, this effect is very small estimated by 0.0007 only.

The calculated F-statistic of the model is significant at 5% (F calculated is greater than F tabulated) which confirms the goodness and well specification of the model and variables.

Conclusion:

This chapter used different empirical tools to analyze the economic diversification reality and its relationship with the oil volatility and other economic and institutional variables namely the portfolio theory and the two stages least squares. Consequently, the chapter came to the following results:

- The calculated portfolio index, changed from each program to other ranging from 0.01 to 0.11;
- The real GDP has negative and weakly significant relationship with export concentration measured by the HHI in Algeria forming the U-shaped curve as argued in the theory;
- The volatility in oil prices measured by the standard deviation has negative and significant effect on export concentration in Algeria;
- The level of foreign investment had no effect on export concentration and no role in economic diversification in Algeria;
- The domestic investment measured by the gross capital formation has negative and weakly significant relationship with export diversification in Algeria showing the weakness of investment policy;
- The institutional quality and governance have not played any role on export diversification in Algeria;
- The trade openness has negative and significant relationship with export diversification in Algeria and this is referred to the specialization of the Algerian export in the hydrocarbon sector;
- The real exchange rate has led to more export concentration in Algeria showing the Dutch Disease effect.

Conclusion and Recommendations

- Conclusion:

This thesis sought to develop the guidelines for the Algerian state and non-state actors in managing the volatility of oil revenues then to diversify the economy and avoid the so called "oil curse". For that reason, the study dealt with this issue theoretically and empirically.

Accordingly, the theoretical framework and dealing with the three concepts in the first chapter "oil volatility; natural resource curse and economic diversification" argued that the large fluctuations in international oil prices represent a challenge for the oil exporters working as a channel to the resource curse by hampering the economic growth and development of such countries; the natural resource curse thesis is conditional and not a destiny which can appear through different economic and political channels in which the Dutch disease, fiscal pro-cyclicality, volatility and weak institutions are the main ones; economic diversification is a challenging objective of the resource rich countries where a diversified resource rich economy needs a set of strategies and policies to be implemented; namely: sound fiscal and industrial policies with a strong basis of human capital and good business environment.

Before analyzing the Algerian case, the study tried to analyze the different studies dealing empirically with the resource curse, volatility and economic diversification. To find the works tackling those variables in one model has been a challenge for the student, for that reason, the thesis through the second chapter showed the effects of the resource abundance and volatility differently; then it provided the impact of the economic diversification by summarizing a set of empirical works and synthesizing the experiences of three countries namely: Chile-Indonesia and Angola.

Regarding the Algerian economy which is the case study of this thesis, chapter three described and analyzed the economic diversification in Algeria and it found that the hydrocarbons 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 decade 2000-2010. During the recent years, the hydrocarbons share of GDP has decreased with about 5% due to the fluctuations in the international oil prices and to the policies and economic programs implemented regarding the other economic sectors in the context of economic diversification. Although the efforts done by the Algerian government to diversify the economy and the institutional framework undertaken to succeed these programs, Algerian governance indicators are still very weak

according to many international institutions. Algeria ranked the 106th in the world according to the international transparency organization in which this factor represents the main factor to impede the investment.

Moving to the empirical chapter, used different empirical tools to analyze the economic diversification reality and its relationship with the oil volatility and other economic and institutional variables namely the portfolio theory and the two stages least squares.

After measuring the variances and co-variances matrices of the sectoral contributions, we achieved the total variance of the sectoral portfolio which reflects the diversification portfolio index. As shown in the literature, the lower the variance the more diversified the economy and vice versa. The calculated index is displayed in the figure above, we notice that the variance changed from each program to other ranging from 0.01 to 0.11. The values achieved confirm that the economic development programs implemented by the Algerian government were attached by the hydrocarbon sector especially during the 1980s where it contributed with about 33% and 2000s with about 49%. However, this index was very low during the 1990s, the period of social instability and economic transition to the opened market, this was due to the efforts of government to solve the people from the social strife in one hand and to open the economy from other hand but such efforts were like a trap because the national economy returned to the dependence to the oil sector very quickly in 2000 where the oil prices started to increase.

Regarding the econometric model showing the effect of the oil price volatility and other factors on the export concentration HH index, we found that: the real GDP has negative and weakly significant relationship with export concentration measured by the HHI in Algeria forming the U-shaped curve as argued in the theory;

The volatility in oil prices measured by the standard deviation has negative and significant effect on export concentration in Algeria; this negative sign can be explained by the prudent policies implemented by the Algerian government to reduce the dependence on the oil market. Thus, during the periods of high price volatility, we noticed that the export concentration index registered low levels, which means that this volatility led to more diversification rather than concentration and this is due to government interaction regarding this issue through different economic decisions under the economic development programs and macroeconomic policies since the nationalization of the hydrocarbon sector. The fiscal policy has been one of the main policies used by the Algerian government to face the challenge of the oil price

volatility through the government spending which has been re-oriented to the non-hydrocarbon sectors in one hand and through the creation of the oil fund in other hand.

However, the positive relationship found in this side does not reflect the strength of the Algerian economic structure; the solutions and the decisions taken during the times of high volatility are temporary because of the weak base and environment of this diversification and this is confirmed by the effect of the other economic and institutional determinants of economic diversification.

The level of foreign investment had no effect on export concentration and no role in economic diversification in Algeria; which is explained by the very low FDI inflows rates (about 0.02% in average) and the Algerian external policy regarding the investment that is not attractive at all for the foreigners(the base of 49-51%).

The domestic investment measured by the gross capital formation has negative and weakly significant relationship with export diversification in Algeria showing the weakness of investment policy; despite the efforts from the Algerian government to improve the level of domestic investment, this latter has not played a role in diversification and this was because of the mismanagement of the national projects and their sectoral orientation where we find very low contribution of the national private sector in the productive sectors.

The institutional quality and governance have not played any role on export diversification in Algeria; and this is an important impediment for the economic diversification and development.

The trade openness has negative and significant relationship with export diversification in Algeria and this is referred to the specialization of the Algerian export in the hydrocarbon sector (95%); the Algerian imports are still focusing on the strategic commodities, thus, the openness of the Algerian external trade has been in export of hydrocarbons and imports of the basic commodities in addition to the imports of the Chinese products with low prices and quality which has been one of the main products competing the domestic ones and impeding the development of national production.

The real exchange rate has led to more export concentration in Algeria showing the Dutch Disease effect, an appreciation in the real exchange rate has led to the shrinkage of the non-hydrocarbon sectors which has been really noticed during the period of 1980s, but this effect is not really touched during the recent years due to the devaluation of the nominal exchange rate of the Algerian dinar.

- Recommendations and research perspectives:

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

Algeria should give more attention to the services sectors (tourism in particular) which have very low contribution if we do not say no contribution in the total value added (0.01%). This sector plays an important role in diversifying the economy and enhancing the macroeconomic variables, since Algeria has all the conditions to be a highly touristic country.

Algeria should review in the domestic investment policy executed through the development programs implemented, in this context we can recommend that the best way to improve the role of the domestic investment is the partnership between the private and the public sectors in which this latter plays the role of a supervisor while it keeps the innovation for the private sector.

The external trade policy should be related with the domestic investment one in order to increase the non-hydrocarbon exports.

Algeria should apply sounder fiscal policy to achieve strong economic diversification and performance by improving the quality of budget management. 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. So, we recommend for the Algerian government to use this fund as one of the tools to enhance the domestic investment through its contribution in productive projects rather than basing only on financing the budget deficit.

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Appendices

Appendix (3-1) : the triennial plan investments with current prices

Sectors	**Financial provision (Billion AD)**	**Real investments (Billion AD)**
- Agriculture	1.26	1.39
- Fishing	0.01	-
- Hydraulic	0.35	0.49
Total of agriculture and hydraulic	***1.62***	***1.88***
- Hydrocarbons	2.27	2.52
- Basic industries	2.18	1.58
- Other transformation industries	0.49	0.37
- Energy and mines	0.46	0.44
Total of industry	***5.40***	***4.91***
- Tourism	0.34	0.18
- Transportation	-	0.07
- Wire and wireless communications	0.12	0.11
- Storage and distributing	-	-
Total of semi-product sector	***0.46***	***0.36***
- Transport network	0.34	0.28
- Habitat	0.34	0.24
- Education and formation	0.81	0.84
- Other investments	0.09	0.65
Total of basic investments	***1.58***	***2.01***
Total of investments	**9.06**	**9.16**

Source: Behloul (1999); P190.

Appendix (3-2) : the first four year plan investments with current prices

Sectors	Programs' costs (Billion AD)	Financial provisions (Billion AD)	Real investments (Billion AD)
1- Productive sector	46.83	17.34	25.79
Industry	37.35	12.40	21.44
Agriculture	9.49	4.94	4.35
2-Semi product sector	4.43	1.87	2.60
Trade, transport and wire communication	4.43	1.87	2.60
3- Non productive sector	17.29	8.54	7.92
Economic infrastructure	2.05	1.14	1.21
Social infrastructure	15.24	7.40	6.71
Total investments	*68.56*	*27.75*	36.31

Source: Behloul (1999); P198.

Appendix (3-3) : the second four-year plan investments with current prices

Sectors	**Financial provision (Billion AD)**	**Real investments (Billion AD)**
- Agriculture	12.00	5.85
- Fishing	0.12	0.09
- Hydraulic	4.60	2.97
Total of agriculture and hydraulic	***16.72***	***8.91***
- Hydrocarbons	19.50	36.00
- Basic industries	21.86	28.46
- Other transformation industries	4.01	5.07
- Energy and mines	2.63	4.62
Total of industry	***48.00***	***74.15***
Building and public works institutions	***2.73***	***3.45***
- Tourism	1.50	1.24
- Transportation	6.49	5.27
- Wire and wireless communications	1.51	2.32
- Storage and distributing	1.00	1.39
Total of semi-product sector	***10.50***	***10.22***
- Transport network	3.09	2.66
- Industrial areas	0.70	0.57
- Habitat	8.30	8.55
- Education and formation	9.95	5.95
- Other investments	10.23	9.77
Total of basic investments	***32.27***	***24.50***
Total of investments	**110.22**	**121.23**

Source: Behloul (1999); P341.

Appendix (3-4) : the first five-year plan investments with current prices

Sectors	**Cost of programs (Billion AD)**	**Financial allocation (Billion AD)**
- Agriculture	23.90	20.00
- Forests	4.00	3.20
- Fishing	1.5	0.9
- Hydraulic	30.00	23.00
Total of agriculture and hydraulic	***59.4***	***47.1***
- Hydrocarbons	78.00	63.00
- Basic industries	56.5	32.00
- Other transformation industries	56.54	43.46
- Energy and mines	22.17	17.00
Total of industry	***213.21***	***155.46***
Building and public works institutions	***25.00***	***20.00***
- Tourism	4.6	3.4
- Transportation	15.8	13.00
- Wire and wireless communications	8.00	6.00
- Storage and distributing	17.8	13.00
Total of semi-product sector	***46.20***	***35.4***
- Transport network	28.2	17.5
- Industrial areas	2.1	1.4
- Habitat	92.5	60.00
- Education and formation	65.7	42.2
- Other investments	28.19	21.54
Total of basic investments	***216.69***	***143.64***
Total of investments	**400.6**	**550.5**

Source: Behloul (1999); Tome 2; P97.

Appendix (3-5): the second five-year plan investments with current prices

Sectors	**Cost of programs (Billion AD)**	**Financial allocation (Billion AD)**	**Real investments (Billion AD)**
- Agriculture	44.00	30.00	
- Forests	9.60	7.00	{13.564
- Fishing	1.10	1.00	
- Hydraulic	60.72	41.00	28.737
Total of agriculture and hydraulic	***115.42***	***79.00***	***42.301***
- Hydrocarbons	41.5	39.8	28.822
- Basic industries	91.3	44.6	{31.791
- Transformation industries	79.6	58.5	
- Energy and mines	39.2	31.3	24.899
Total of industry	***251.6***	***174.2***	***85.518***
Building and public works institutions	***33.2***	***19.00***	***15.255***
- Tourism	5.5	1.80	1.663
- Transportation	21.52	15.00	6.849
- Wire and wireless communications	14.00	8.00	7.011
- Storage and distributing	25.01	15.85	8.939
Total of semi-product sector	***66.03***	***40.65***	***24.462***
- Transport network	60.46	43.60	34.355
- Industrial areas	2.5	1.90	0.562
- Habitat	124.92	86.45	52.312
- Education and formation	64.8	45.00	31.722
- Other investments	109.45	60.20	84.019
Total of basic investments	***362.13***	***237.15***	***202.970***
Total of investments	**828.38**	**550.0**	**370.5**

Source: Behloul (1999); Tome 2; P223.

APPENDIX N(4-1): the shares of the sectors' income (value added) in the total value added

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
- Agriculture. Sylviculture. Pêche et Forêts	0,10548368	0,09736958	0,09014273	0,08795327	0,10493594	0,11616641	0,13537764	0,14784403	0,1593396	0,14610894
- Eau et Energie	0,01004656	0,01179406	0,01125671	0,01013116	0,01315354	0,01397275	0,01468876	0,01320237	0,01199154	0,01051488
- Hydrocarbures	0,38396808	0,35493824	0,33727645	0,30480866	0,28558239	0,17264005	0,19393591	0,20089518	0,22925334	0,291619
- Services et Travaux pétroliers	0,01762366	0,01951309	0,01970291	0,02344138	0,01875411	0,02246701	0,01912946	0,0122738	0,01425265	0,01077018
- Mines et Carrières	0,00501744	0,00507066	0,00481174	0,00459834	0,0051775	0,00450065	0,00421881	0,00490357	0,00357666	0,002822
- I.S.M.M.E.E. *	0,02993979	0,03205372	0,04176258	0,05449809	0,05203118	0,06536488	0,05884447	0,05390805	0,03842368	0,0425508
- Matériaux de Construction &Verre	0,01038469	0,00971997	0,01177073	0,0133006	0,01475868	0,01825635	0,01649068	0,01663609	0,01286241	0,01455956
- Bâtiments et Travaux Publics	0,13038137	0,14736042	0,15483397	0,16202256	0,16131024	0,19590587	0,18142598	0,15898533	0,15477202	0,13320415

- Chimie. Caoutchouc & Plastiques	0,00694627	0,00717437	0,00756201	0,00879749	0,01060683	0,0124631	0,0092779	0,00991578	0,00920829	0,01158988
- Industries Agroalimentaires	0,02752679	0,02932797	0,02744024	0,02768671	0,02620294	0,03574395	0,03937303	0,03885693	0,03575614	0,0405478
- Industries Textiles	0,01651257	0,01672749	0,01566246	0,02146084	0,02090475	0,02096532	0,01891609	0,01788905	0,01981824	0,01560496
- Industries des Cuirs et Chaussures	0,00423344	0,00453204	0,00411319	0,0041905	0,00424988	0,00481717	0,00472987	0,00408898	0,00405468	0,00409918
- Industries du Bois et Papiers.	0,00897506	0,01092235	0,01089577	0,01080689	0,01038942	0,01152814	0,01088561	0,01701956	0,00986777	0,00907954
- Industries diverses	0,00202813	0,00197434	0,00224277	0,00364029	0,00358935	0,00565753	0,00512126	0,00480561	0,00413801	0,00451543
- Transports et Communications	0,05376337	0,05368805	0,06058619	0,06439839	0,06354951	0,07181194	0,07012701	0,06997427	0,06573562	0,06342171
- Commerce	0,14716068	0,15696856	0,15670493	0,15529122	0,15996347	0,17695857	0,16350689	0,16961431	0,17222083	0,14869171
- Hôtels. Cafés & Restaurants	0,01297486	0,0130182	0,01330897	0,0126393	0,01503187	0,017393	0,01921208	0,01986168	0,01735993	0,01785627
- Services fournis aux Entreprises	0,00869663	0,00915173	0,00977655	0,01162402	0,01103949	0,01194456	0,01216667	0,0148571	0,0132568	0,01210303
- Services fournis aux Ménages	0,01833692	0,01869518	0,02014908	0,0187103	0,01876892	0,02144275	0,02257188	0,02446831	0,02411177	0,02034098

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1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0,12843188	0,15312742	0,14260581	0,1260029	0,12529387	0,1356859	0,10956383	0,14649551	0,13838857	0,10089939	0,11938716	0,11443646
0,00957028	0,01289303	0,01219615	0,01183115	0,01230205	0,01222863	0,01386382	0,01620667	0,01540511	0,01377758	0,01514955	0,01521194
0,34752571	0,2985874	0,26910677	0,28325912	0,32226334	0,36646994	0,37874446	0,28781836	0,34280816	0,33849111	0,41829244	0,40512054
0,00945804	0,0119677	0,01444572	0,01528801	0,01400419	0,01368604	0,0148594	0,01599647	0,01401251	0,01250556	0,01112064	0,01097078
0,00297973	0,00308338	0,00279062	0,0027756	0,0026931	0,00254736	0,00203018	0,00233232	0,0018125	0,00146366	0,00177754	0,00150322
0,04530016	0,04497332	0,03910788	0,03544907	0,02928019	0,01922004	0,01246862	0,01362257	0,01254165	0,00968565	0,0098343	0,00940953
0,01372125	0,01649285	0,01544688	0,01433833	0,01452102	0,01276915	0,01141047	0,01300384	0,0097214	0,00779313	0,00940822	0,0098975
0,03600806	0,03683535	0,03388038	0,03723128	0,02883284	0,02942019	0,03144043	0,0393851	0,03697973	0,03049136	0,03154682	0,03157356
0,01242482	0,0084182	0,00692971	0,00671444	0,0050569	0,00392829	0,00320548	0,00398355	0,00384397	0,00295766	0,00348176	0,0033435
0,00292457	0,00233347	0,00215885	0,00214859	0,00135417	0,00100826	0,00098827	0,00116143	0,00083953	0,00069933	0,00065852	0,0007139
0,00718308	0,00610548	0,00833214	0,00641019	0,00558017	0,00379409	0,00390628	0,00442302	0,0038951	0,00298686	0,00325777	0,00365725
0,00326968	0,00957676	0,01170894	0,01101645	0,01348481	0,01180103	0,01309629	0,01311049	0,01140443	0,00823989	0,0108143	0,01109388
0,06140523	0,0679022	0,07068953	0,06472158	0,06362059	0,0727093	0,08219869	0,09311174	0,0919046	0,08042587	0,08797716	0,09352485
0,15111704	0,15205817	0,18165865	0,19214369	0,18073292	0,15655498	0,15725506	0,17153171	0,15872943	0,12716708	0,1379532	0,1396868
0,01538764	0,01706939	0,01786396	0,01788829	0,01708198	0,0155728	0,01634908	0,01749558	0,01620012	0,01320192	0,01427816	0,01467139
0,00929446	0,00939003	0,01009821	0,01071636	0,01042155	0,00950458	0,00981163	0,01039151	0,00983891	0,00907636	0,01010224	0,01070254
0,01544045	0,01646102	0,01900968	0,01876408	0,02112752	0,01928387	0,02047548	0,02164793	0,01970587	0,01574388	0,01672175	0,01683489

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2003	2004	2005	2006	2007	2008	2009	2010	2011
0,11991746	0,11383193	0,09036725	0,0873035	0,08811813	0,07781138	0,1150695	0,10466999	0,103841793
0,01437632	0,01329276	0,01162323	0,01125293	0,01091303	0,01002372	0,01126922	0,01016763	0,00978521
0,43493198	0,45489657	0,52094593	0,52852018	0,50890584	0,53458839	0,38413108	0,43098172	0,463783328
0,0102863	0,00966611	0,00916578	0,00874899	0,0114951	0,00927638	0,01170861	0,00652727	0,006255135
0,0013075	0,00110452	0,00098149	0,00115652	0,00130741	0,0018095	0,00235511	0,00187693	0,001828495
0,00883758	0,00810368	0,00676923	0,0061759	0,00665851	0,00689221	0,01027094	0,00862144	0,007957963
0,00775702	0,00817921	0,00714259	0,00692529	0,007278	0,00646124	0,00826124	0,00727073	0,006721316
0,09332493	0,08994185	0,0785291	0,08305409	0,09118555	0,09306268	0,12355819	0,12310934	0,111702852
0,00549317	0,00512939	0,0042493	0,00479075	0,00464217	0,00450143	0,00558662	0,0049133	0,00445696
0,027551	0,02496415	0,02150219	0,01987929	0,01942423	0,01756022	0,02328734	0,0220764	0,020512391
0,00305776	0,00264364	0,00220284	0,00185181	0,00162278	0,00137736	0,0018027	0,00142715	0,00119241
0,00057662	0,00052723	0,00042277	0,00034966	0,0002934	0,00027031	0,00031498	0,00026736	0,000230339
0,00320828	0,00301912	0,00241867	0,00225444	0,00199883	0,00178503	0,00208456	0,00177271	0,001560068
0,01053736	0,00915755	0,0076793	0,0065567	0,00557361	0,00489043	0,0060611	0,00518599	0,00443532
0,09088991	0,10051035	0,10021991	0,10122346	0,10234677	0,09239777	0,1125938	0,10221294	0,092876895
0,12850449	0,11903756	0,10380919	0,09915866	0,10742309	0,10731224	0,14228472	0,13191025	0,127811021
0,01361895	0,01229422	0,01081832	0,01023797	0,01005016	0,00975304	0,01302868	0,01179302	0,010743194
0,01020864	0,00956687	0,0090096	0,00874603	0,00892461	0,00898976	0,01217966	0,01265533	0,012173269
0,01561477	0,0141333	0,01214331	0,01181384	0,01183879	0,01123689	0,01415194	0,0125605	0,012132032

Appendix (4-2): the variances series of the value added by sector

	1981-85	86-90	91-95	96-2000	2001-2005	2006-11
- Agriculture. Sylviculture. Pêche et Forêts	1.5001E-07	0.00044828	4.9235E-06	0.00060505	0.00042108	0.00013676
- Eau et Energie	4.8267E-06	5.9784E-06	3.7313E-06	1.1996E-06	6.2174E-06	1.0771E-06
- Hydrocarbures	0.00483987	0.007078	0.00031909	0.00039141	0.00526887	0.00209543
- Services et Travaux pétroliers	6.3895E-07	6.8408E-05	1.0334E-05	6.9676E-07	1.9107E-06	3.1096E-06
- Mines et Carrières	1.2809E-08	1.4089E-06	4.108E-08	5.8721E-07	3.1685E-07	2.2577E-07
- I.S.M.M.E.E.*	0.00024401	0.00026024	0.00012832	4.5452E-05	4.6973E-06	1.5879E-06
- Matériaux de Construction &Verre	9.5659E-06	6.8331E-06	3.1982E-07	1.238E-05	2.5665E-06	2.0803E-08
- Bâtiments et Travaux Publics	0.0004783	0.00196575	2.0069E-05	0.00022439	0.00010251	0.00041038
- Chimie. Caoutchouc & Plastiques	6.6998E-06	3.8126E-07	3.2374E-06	3.6752E-07	6.5117E-07	5.5708E-08
- Industries Agroalimentaires	8.7629E-07	1.1538E-05	2.5742E-05	5.737E-07	5.0447E-05	2.0041E-07
- Industries Textiles	9.6456E-06	1.4367E-05	2.7143E-05	4.7106E-07	8.1782E-07	2.174E-07
- Industries des Cuirs et Chaussures	1.3507E-10	2.5776E-07	1.2331E-06	4.7719E-08	2.779E-08	7.1185E-09
- Industries du Bois et Papiers.	1.0002E-06	2.9978E-06	1.2847E-06	3.2581E-07	3.5205E-07	2.4107E-07
- Industries diverses	1.2187E-06	6.522E-07	5.2174E-05	6.3408E-06	4.9141E-06	2.2501E-06
- Transports et Communications	4.7884E-05	3.5198E-05	2.4539E-06	2.9773E-05	7.4942E-05	3.4833E-05
- Commerce	8.1956E-05	0.00039951	0.00043855	0.00043182	0.00058291	0.00041048
- Hôtels. Cafés & Restaurants	2.1156E-06	1.0731E-07	1.4354E-06	2.8105E-06	5.9852E-06	1.2762E-07
- Services fournis aux Entreprises	2.7445E-06	1.2556E-08	6.3517E-07	9.1687E-08	5.9693E-07	5.873E-06
- Services fournis aux Ménages	9.3313E-08	6.0694E-07	1.6171E-05	6.2658E-06	1.0481E-05	5.0622E-08

Source: *Student's calculations using data from the National Office of Statistics*

APPENDIX N (4-3): the co-variance matrix of sectoral portfolio by sector

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	_AGRICULTUI	_BATIMENT	_CHIMIE_(	_COMMERC	_EAU_ET_EI	_HOTELS_(	_HYDROCAI	_I_S_M_M_	_INDUSTRIE	_INDUST	_INDUSTRIE	_INDUSTRIE	_MATERIAU	_MINES_ET_	_SERVICES_	_SERVICES_	_SERVICES_
_AGRICULTURE_SYLVICULT																	
_BATIMENT	-4,41E-05																
CHIMIE(	1,41E-06	1,17E-05															
_COMMERC	-8,18E-06	4,30E-05	3,76E-06														
_EAU_ET_EI	3,03E-06	6,03E-06	9,71E-07	3,92E-06													
HOTELS(	3,34E-06	3,65E-06	8,91E-07	2,06E-06	8,52E-07												
_HYDROCAI	5,79E-05	-0,00038285	-4,40E-05	-0,0001186	-2,16E-05	-1,73E-05											
_I_S_M_M_	-2,76E-05	0,00010502	1,14E-05	2,56E-05	2,84E-06	3,16E-06	-0,0003324										
_INDUSTRIE	-2,16E-06	-3,77E-06	-9,78E-07	-6,49E-07	-3,47E-07	-5,92E-07	1,94E-05	-5,84E-06									
_INDUSTRIE	2,85E-07	-3,76E-07	-4,37E-08	8,38E-08	4,74E-08	-8,55E-09	1,28E-06	-6,64E-07	1,01E-07								
_INDUSTRIE	-8,55E-07	6,86E-06	9,16E-07	1,55E-06	2,10E-07	2,68E-07	-2,42E-05	7,22E-06	-4,58E-07	-3,73E-							
_INDUSTRIE	-3,81E-06	6,75E-06	2,30E-07	2,62E-06	3,05E-07	6,88E-09	-1,40E-05	3,37E-06	1,96E-07	1,58E-							
_INDUSTRIE	-1,11E-06	1,88E-05	2,74E-06	4,06E-06	5,41E-07	6,89E-07	-6,99E-05	2,07E-05	-1,10E-06	-4,77E-	3,35E-07						
_MATERIAU	-5,67E-07	1,67E-05	2,39E-06	4,37E-06	9,00E-07	1,02E-06	-6,02E-05	1,72E-05	-1,50E-06	-1,32E-	2,99E-07	3,67E-06					
_MINES_ET_	1,31E-06	-7,75E-07	4,37E-08	1,03E-07	1,62E-07	1,15E-07	9,29E-07	-8,18E-07	-2,40E-08	1,48E-	-4,95E-08	-9,36E-08	-3,66E-08				
SERVICES	-1,18E-05	1,50E-05	5,49E-07	2,44E-06	-7,21E-07	-6,87E-07	-3,41E-05	1,28E-05	2,91E-07	-4,97E-	8,79E-07	2,68E-06	1,21E-06	-3,37E-07			
SERVICES	-3,27E-06	1,15E-05	1,22E-06	2,75E-06	2,52E-07	2,72E-07	-3,62E-05	1,10E-05	-5,31E-07	-5,76E-	3,91E-07	2,42E-06	1,81E-06	-9,79E-08	1,59E-06		
SERVICES	-2,55E-06	2,73E-06	-6,25E-08	1,08E-06	1,07E-07	2,70E-08	-3,27E-06	9,67E-07	-7,03E-08	-4,20E-	2,48E-07	-5,80E-07	9,68E-08	-3,92E-08	1,22E-07	3,50E-08	
_TRANSPOI	-1,40E-05	4,79E-05	5,03E-06	1,14E-05	1,20E-06	1,49E-06	-0,00014898	4,57E-05	-2,99E-06	-3,93E-	1.52E-06	8.50E-06	7.96E-06	-4.12E-07	5.53E-06	4.88E-06	8.73E-07

APPENDIX N (4-4): the co-variance matrix of sectoral portfolio by sector

86-90

	_AGRICULTUI	_BATIMENT	_CHIMIE_(	_COMMERC	_EAU_ET_EI	_HOTELS_(	_HYDROCAI	_I_S_M_M_	_INDUSTRIE	_INDUSTRIE	_INDUSTRIE	_INDUSTRIE	_INDUSTRIE	_MATERIAU	_MINES_ET_	_SERVICES_	_SERVICES_	_SERVICES_
_AGRICULTURE_SYLVICULT																		
_BATIMENT	-0,000250213																	
CHIMIE(	-1,28E-05	4,53E-06																
_COMMERC	-4,15E-05	0,00015257	-8,88E-07															
_EAU_ET_EI	-1,27E-05	2,92E-05	-3,37E-07	8,81E-06														
HOTELS(	1,72E-06	2,61E-07	-6,15E-07	-9,55E-07	6,10E-07													
_HYDROCAI	0,000345425	-0,00083008	3,21E-06	-0,00034056	-5,65E-05	-1,01E-05												
_I_S_M_M_	-0,000130922	0,00019064	4,80E-06	4,31E-05	1,24E-05	2,82E-06	-0,00033046											
_INDUSTRIE	5,21E-06	-2,21E-05	-1,86E-07	-1,66E-05	-7,47E-07	1,12E-06	4,34E-05	-2,54E-06										
_INDUSTRIE	-4,44E-06	6,65E-06	1,43E-07	1,15E-06	3,94E-07	-1,95E-08	-9,53E-06	2,95E-06	-1,47E-07									
_INDUSTRIE	-7,33E-06	9,52E-06	3,67E-07	1,88E-06	5,57E-07	5,28E-08	-1,50E-05	5,08E-06	-1,48E-07	1,57E-07								
_INDUSTRIE	-3,48E-07	1,03E-05	-5,88E-07	1,07E-05	1,58E-06	2,12E-06	-5,54E-05	1,04E-05	2,54E-07	-1,16E-07	3,17E-07							
_INDUSTRIE	-1,17E-05	3,31E-05	-3,27E-08	1,64E-05	1,79E-06	-5,58E-07	-6,19E-05	8,84E-06	-3,18E-06	3,60E-07	4,33E-07	2,35E-07						
_MATERIAU	-2,39E-05	3,03E-05	1,19E-06	6,29E-06	1,95E-06	6,05E-07	-5,34E-05	1,81E-05	-8,70E-08	4,74E-07	9,28E-07	2,42E-06	1,12E-06					
_MINES_ET_	-4,25E-06	1,11E-05	-1,10E-07	5,19E-06	8,79E-07	4,15E-07	-2,70E-05	5,36E-06	-4,21E-07	1,00E-07	2,24E-07	1,68E-06	7,25E-07	9,68E-07				
SERVICES	-5,25E-05	9,15E-05	1,52E-06	2,59E-05	5,09E-06	-9,65E-07	-0,00014199	3,47E-05	-4,57E-06	1,40E-06	1,85E-06	-1,32E-06	6,50E-06	5,30E-06	1,49E-06			
SERVICES	8,74E-06	-6,34E-06	-6,91E-07	2,90E-06	-3,45E-08	6,56E-07	-5,44E-06	-2,28E-06	8,30E-10	-2,28E-07	-2,09E-07	2,52E-06	-2,11E-07	-2,57E-07	3,84E-07	-2,45E-06		
SERVICES	1,16E-05	1,78E-06	-1,55E-06	8,53E-06	6,57E-07	7,05E-07	-2,56E-05	-2,26E-06	-9,94E-07	-1,84E-07	-2,69E-07	2,66E-06	9,07E-07	-5,88E-07	6,25E-07	-1,08E-06	1,42E-06	
_TRANSPOI	-3,16E-05	6,20E-05	3,35E-07	2,17E-05	4,30E-06	1,14E-06	-0,00012401	2,87E-05	-2,13E-06	7,76E-07	1,34E-06	4,86E-06	3,84E-06	4,97E-06	2,10E-06	1,04E-05	3,08E-07	1,23E-06

APPENDIX N (4-5): the co-variance matrix of sectoral portfolio by sector

91-95

	_AGRICULTUI	_BATIMENT	_CHIMIE_(	_COMMERC	_EAU_ET_EI	_HOTELS_(	_HYDROCAI	_I_S_M_M_	_INDUSTRIE	_INDUSTRIE	_INDUSTRIE	_INDUSTRIE	_INDUSTRIE	_MATERIAU	_MINES_ET_	_SERVICES_	_SERVICES_	_SERVICES_
_AGRICULTURE_SYLVICULT																		
_BATIMENT	6,51E-06																	
CHIMIE(	-5,56E-06	-3,87E-06																
_COMMERC	-8,33E-05	8,60E-05	-7,39E-06															
_EAU_ET_EI	6,47E-06	3,80E-06	-1,06E-06	6,70E-06														
HOTELS(	1,92E-06	5,35E-06	-7,16E-07	1,19E-05	8,19E-07													
_HYDROCAI	-0,000128023	-0,00016676	2,03E-05	-0,0002792	-2,16E-05	-2,35E-05												
_I_S_M_M_	3,88E-05	-1,41E-05	2,79E-06	-8,13E-05	-2,50E-06	-2,71E-06	2,69E-05											
_INDUSTRIE	1,16E-05	1,82E-06	1,81E-06	-1,57E-05	-7,61E-07	-1,72E-07	-1,71E-05	1,38E-05										
_INDUSTRIE	1,21E-06	-1,06E-06	3,83E-07	-5,33E-06	-3,83E-07	-2,61E-07	3,58E-06	2,75E-06	1,22E-06									
_INDUSTRIE	1,33E-06	1,45E-05	-3,26E-06	4,32E-05	3,39E-06	2,71E-06	-6,15E-05	-1,65E-05	-5,82E-06	-1,60E-06								
_INDUSTRIE	2,39E-06	2,15E-06	-1,29E-07	3,93E-07	-3,29E-07	4,69E-08	-9,43E-06	2,32E-06	7,75E-07	2,33E-07	-8,77E-07							
_INDUSTRIE	2,11E-06	-1,00E-05	2,13E-06	-3,26E-05	-2,27E-06	-1,88E-06	4,01E-05	1,27E-05	4,30E-06	1,17E-06	-8,69E-06	7,64E-07						
_MATERIAU	9,90E-06	1,53E-06	-7,08E-07	-3,30E-06	8,76E-07	3,90E-07	-1,49E-05	1,57E-06	4,43E-07	-6,28E-08	1,26E-06	-7,42E-09	-6,59E-07					
_MINES_ET_	1,02E-06	-4,69E-07	6,12E-08	-2,15E-06	-2,72E-08	-6,55E-08	1,02E-06	8,01E-07	2,92E-07	5,31E-08	-3,36E-07	4,53E-09	2,60E-07	5,75E-08				
SERVICES	-2,96E-06	1,17E-05	-1,44E-06	3,27E-05	1,58E-06	1,80E-06	-4,56E-05	-9,24E-06	-1,62E-06	-7,46E-07	6,52E-06	-1,06E-07	-4,71E-06	3,31E-07	-2,23E-07			
SERVICES	-3,24E-06	2,50E-06	-2,02E-07	9,18E-06	2,35E-07	3,71E-07	-7,60E-06	-2,95E-06	-5,95E-07	-1,98E-07	1,47E-06	-9,92E-08	-1,13E-06	-1,30E-07	-7,16E-08	1,07E-06		
SERVICES	-8,14E-06	6,36E-06	-1,47E-06	2,74E-05	1,21E-06	1,16E-06	-1,94E-05	-1,16E-05	-4,75E-06	-9,55E-07	6,29E-06	-4,83E-07	-4,63E-06	-1,00E-07	-2,62E-07	3,40E-06	9,44E-07	
_TRANSPOI	2,70E-05	1,39E-05	-2,94E-06	1,12E-05	2,58E-06	2,07E-06	-7,81E-05	2,06E-06	9,39E-07	-2,43E-07	5,65E-06	1,48E-06	-3,21E-06	2,53E-06	1,24E-08	3,17E-06	1,19E-07	1,08E-06

APPENDIX N (4-6) the co-variance matrix of sectoral portfolio by sector

96-2000

	_AGRICULTUI	_BATIMENT	_CHIMIE_(	_COMMERC	_EAU_ET_EI	_HOTELS_(	_HYDROCAI	_I_S_M_M_	_INDUSTRIE	_INDUSTRIE	_INDUST	_INDUSTRIE	_INDUSTRIE	_MATERIAU	_MINES_ET_	_SERVICES_	_SERVICES_	_SERVICES_
_AGRICULTURE_SYLVICULT																		
_BATIMENT	0,000144558																	
CHIMIE(	6,17E-06	7,39E-06																
_COMMERC	0,000212485	0,00016149	8,96E-06															
_EAU_ET_EI	1,06E-05	6,56E-06	4,50E-07	9,19E-06														
HOTELS(	1,87E-05	1,58E-05	9,19E-07	2,05E-05	1,05E-06													
_HYDROCAI	-0,000276043	-0,00010237	-5,18E-06	-0,00013417	-3,35E-05	-1,35E-05												
_I_S_M_M_	3,17E-05	1,61E-05	4,90E-07	2,22E-05	-2,05E-06	1,57E-06	2,16E-05											
_INDUSTRIE	4,67E-05	2,57E-05	1,50E-06	3,66E-05	5,20E-06	3,80E-06	-9,62E-05	-2,47E-06										
_INDUSTRIE	1,84E-06	1,69E-06	9,56E-08	2,04E-06	5,49E-08	1,94E-07	-1,56E-06	2,76E-07	2,60E-07									
_INDUSTRIE	1,81E-05	1,94E-05	1,16E-06	2,42E-05	6,70E-07	2,40E-06	-2,00E-06	2,56E-06	2,89E-06	2,50E-07								
_INDUSTRIE	6,51E-06	5,16E-06	2,93E-07	6,70E-06	3,37E-07	6,53E-07	-5,41E-06	5,89E-07	1,25E-06	6,58E-08	7,63E-							
_INDUSTRIE	7,34E-06	3,34E-06	1,35E-07	4,94E-06	1,66E-07	4,25E-07	-4,94E-06	9,10E-07	9,03E-07	4,37E-08	4,32E-	1,48E-07						
_MATERIAU	2,32E-05	1,97E-05	1,04E-06	2,42E-05	4,77E-08	2,21E-06	-7,94E-06	4,68E-06	1,79E-06	2,97E-07	3,00E-	7,54E-07	5,86E-07					
_MINES_ET_	4,54E-06	3,30E-06	1,57E-07	4,16E-06	-8,79E-08	3,56E-07	-3,87E-07	1,07E-06	1,23E-07	5,21E-08	5,02E-	1,25E-07	1,19E-07	7,24E-07				
SERVICES	1,22E-05	1,26E-05	7,83E-07	1,54E-05	9,76E-07	1,57E-06	-1,60E-05	6,49E-07	3,15E-06	1,64E-07	1,87E-	5,10E-07	2,61E-07	1,73E-06	2,55E-07			
SERVICES	5,56E-06	4,55E-06	2,72E-07	5,87E-06	4,31E-07	5,92E-07	-7,19E-06	2,19E-07	1,40E-06	5,63E-08	6,50E-	1,93E-07	1,19E-07	5,83E-07	8,60E-08	4,89E-07		
SERVICES	2,46E-05	2,21E-05	1,30E-06	2,84E-05	1,26E-06	2,81E-06	-1,44E-05	2,43E-06	4,71E-06	2,78E-07	3,44E-	9,04E-07	5,64E-07	3,21E-06	5,25E-07	2,19E-06	8,05E-07	
_TRANSPOI	5,89E-05	3,52E-05	2,41E-06	5,16E-05	1,04E-05	5,90E-06	-0,00016351	-1,11E-05	2,83E-05	2,45E-07	3,86E-	1,84E-06	9,46E-07	-2,16E-07	-5,57E-07	5,11E-06	2,32E-06	7,07E-06

APPENDIX N(4-7): the co-variance matrix of sectoral portfolio by sector

2001-05

	_AGRICULTUI	_BATIMENT	_CHIMIE_(	_COMMERC	_EAU_ET_EI	_HOTELS_(	_HYDROCAI	_I_S_M_M_	_INDUSTRIE	_INDUSTRIE	_INDUST	_INDUSTRIE	_INDUSTRIE	_MATERIAU	_MINES_ET_	_SERVICES_	_SERVICES_	_SERVICES_
_AGRICULTURE_SYLVICULT																		
_BATIMENT	6,52E-05																	
CHIMIE(	5,35E-06	4,63E-06																
_COMMERC	0,000121671	9,11E-05	7,62E-06															
_EAU_ET_EI	1,29E-05	9,23E-06	7,72E-07	1,78E-05														
HOTELS(	1,29E-05	9,82E-06	8,26E-07	1,86E-05	1,89E-06													
_HYDROCAI	-0,000399035	-0,00028996	-2,42E-05	-0,00052853	-5,39E-05	-5,62E-05												
_I_S_M_M_	1,03E-05	6,93E-06	5,76E-07	1,41E-05	1,44E-06	1,49E-06	-4,23E-05											
_INDUSTRIE	3,30E-05	2,56E-05	2,14E-06	5,10E-05	5,13E-06	5,39E-06	-0,0001502	4,11E-06										
_INDUSTRIE	8,37E-07	7,11E-07	5,97E-08	1,32E-06	1,32E-07	1,40E-07	-3,97E-06	1,04E-07	3,88E-07									
_INDUSTRIE	1,23E-05	8,84E-06	7,43E-07	1,67E-05	1,71E-06	1,79E-06	-5,08E-05	1,34E-06	4,76E-06	1,24E-07								
_INDUSTRIE	3,60E-06	2,99E-06	2,51E-07	5,10E-06	5,16E-07	5,47E-07	-1,60E-05	3,92E-07	1,44E-06	3,96E-08	4,91E							
_INDUSTRIE	4,27E-06	3,00E-06	2,51E-07	6,14E-06	6,24E-07	6,51E-07	-1,81E-05	5,04E-07	1,80E-06	4,55E-08	5,82E	1,70E-07						
_MATERIAU	6,59E-06	6,37E-06	5,30E-07	1,21E-05	1,18E-06	1,25E-06	-3,57E-05	9,44E-07	3,66E-06	9,83E-08	1,05E	3,59E-07	4,13E-07					
_MINES_ET_	2,14E-06	1,43E-06	1,19E-07	3,39E-06	3,41E-07	3,53E-07	-9,48E-06	2,87E-07	1,04E-06	2,50E-08	3,09E	8,40E-08	1,27E-07	2,42E-07				
SERVICES	6,17E-06	4,68E-06	3,92E-07	9,70E-06	9,75E-07	1,02E-06	-2,81E-05	7,88E-07	2,89E-06	7,32E-08	9,04E	2,66E-07	3,48E-07	6,86E-07	2,05E-07			
SERVICES	4,92E-06	4,19E-06	3,56E-07	7,25E-06	7,36E-07	7,91E-07	-2,23E-05	5,54E-07	2,06E-06	5,60E-08	7,14E	2,29E-07	2,45E-07	4,79E-07	1,22E-07	3,85E-07		
SERVICES	1,65E-05	1,21E-05	1,01E-06	2,34E-05	2,37E-06	2,49E-06	-7,03E-05	1,88E-06	6,77E-06	1,75E-07	2,23E	6,74E-07	8,21E-07	1,57E-06	4,53E-07	1,29E-06	9,67E-07	
_TRANSPOI	-3,83E-05	-2,17E-05	-1,83E-06	-5,38E-05	-5,57E-06	-5,80E-06	0,00014844	-4,63E-06	-1,60E-05	-3,69E-07	-5,31E	-1,27E-06	-2,07E-06	-2,86E-06	-1,27E-06	-3,24E-06	-2,06E-06	-7,37E-06

APPENDIX N (4-8): the co-variance matrix of sectoral portfolio by sector

2006-11

	_AGRICULTI	_BATIMENT	_CHIMIE_(	_COMMERC	_EAU_ET_EI	_HOTELS_(	_HYDROCAI	_I_S_M_M_	_INDUSTRIE	_INDUSTRIE	_INDUSTRI	_INDUSTRIE	_INDUSTRIE	_MATERIAU	_MINES_ET_	_SERVICES_	_SERVICES_	_SERVICES_
_AGRICULTURE_SYLVICULT																		
_BATIMENT	0,00018015																	
CHIMIE(	3,34E-06	3,39E-06																
_COMMERC	0,00018353	0,00024354	3,70E-06															
_EAU_ET_EI	8,31E-07	-2,13E-06	1,46E-07	-1,16E-06														
HOTELS(	1,34E-05	1,58E-05	3,85E-07	1,60E-05	1,89E-07													
_HYDROCAI	-0,00066984	-0,00081872	-1,60E-05	-0,00082236	-3,57E-06	-6,06E-05												
_I_S_M_M_	1,59E-05	2,06E-05	4,09E-07	2,09E-05	4,47E-08	1,51E-06	-7,37E-05											
_INDUSTRIE	2,24E-05	2,40E-05	5,71E-07	2,41E-05	3,53E-07	2,01E-06	-9,46E-05	2,18E-06										
_INDUSTRIE	-6,22E-08	-2,46E-07	7,09E-09	-2,04E-07	2,10E-08	3,83E-09	2,55E-07	-8,28E-09	8,30E-09									
_INDUSTRIE	1,64E-07	-3,26E-06	1,56E-07	-2,49E-06	4,06E-07	1,71E-07	-4,08E-07	-4,96E-08	3,50E-07	2,65E-08								
_INDUSTRIE	-3,38E-07	-1,48E-06	4,37E-08	-1,20E-06	1,31E-07	2,40E-08	1,35E-06	-4,74E-08	5,39E-08	8,61E-09	1,60E-07							
_INDUSTRIE	1,49E-07	-9,20E-07	5,75E-08	-6,10E-07	1,39E-07	7,03E-08	-8,68E-07	8,26E-09	1,25E-07	8,67E-09	1,65E-07	5,30E-08						
_MATERIAU	5,39E-06	5,22E-06	2,04E-07	5,78E-06	2,22E-07	5,62E-07	-2,50E-05	6,04E-07	8,85E-07	8,54E-09	2,06E-07	5,79E-08	8,00E-08					
_MINES_ET_	3,47E-06	5,39E-06	8,73E-08	5,45E-06	-4,66E-08	3,49E-07	-1,74E-05	5,03E-07	4,25E-07	-5,15E-09	-8,13E-08	-3,18E-08	-1,88E-08	1,15E-07				
SERVICES	-2,30E-06	-7,53E-06	3,86E-07	-3,36E-06	9,29E-07	2,86E-07	-3,14E-06	2,56E-07	4,62E-08	4,59E-08	8,28E-07	3,12E-07	3,38E-07	6,79E-07	2,85E-08			
SERVICES	1,98E-05	2,67E-05	2,83E-07	2,54E-05	-3,20E-07	1,57E-06	-8,39E-05	2,04E-06	2,56E-06	-3,09E-08	-4,22E-07	-1,91E-07	-1,37E-07	4,40E-07	5,15E-07	-1,55E-06		
SERVICES	1,06E-05	1,13E-05	3,23E-07	1,21E-05	2,35E-07	1,02E-06	-4,71E-05	1,17E-06	1,58E-06	6,77E-09	2,06E-07	4,51E-08	8,32E-08	4,91E-07	2,61E-07	5,85E-07	1,10E-06	
_TRANSPOI	5,20E-05	4,34E-05	2,41E-06	4,92E-05	3,22E-06	5,95E-06	-0,00024507	5,70E-06	9,62E-06	1,55E-07	3,37E-06	9,95E-07	1,22E-06	3,76E-06	8,71E-07	8,61E-06	3,21E-06	5,26E-06

Appendices

Appendix (4-9): results of the unit-root Augmented Dickey-Fuller test

Null Hypothesis: HHI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.523877	0.5080
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

Null Hypothesis: HHI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.638736	0.9688
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: HHI has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.569786	0.8337
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

Null Hypothesis: D(HHI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.086490	0.0003
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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Null Hypothesis: D(HHI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.416509	0.0013
Test critical values:	1% level	-4.440739	
	5% level	-3.632896	
	10% level	-3.254671	

Null Hypothesis: D(HHI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.000285	0.0000
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

Null Hypothesis: LRGDP has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.877419	0.7803
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Null Hypothesis: LRGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.026329	0.0224
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

Null Hypothesis: LRGDP has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.744033	0.8696
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

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Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.085440	0.0389
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.193481	0.1054
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.020206	0.0038
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.315681	0.9108
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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Null Hypothesis: CPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.797676	0.2092
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: CPI has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.269125	0.9443
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

Null Hypothesis: D(CPI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.434657	0.1415
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Null Hypothesis: D(CPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.391101	0.3761
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: D(CPI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.087132	0.2442
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

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Null Hypothesis: D(CPI,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.463016	0.0001
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Null Hypothesis: D(CPI,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.362356	0.0009
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

Null Hypothesis: D(CPI,2) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.540816	0.0000
Test critical values:	1% level	-2.650145	
	5% level	-1.953381	
	10% level	-1.609798	

Null Hypothesis: GCF has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.908153	0.7716
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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Null Hypothesis: GCF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.455564	0.3460
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: GCF has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.366720	0.7841
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

Null Hypothesis: D(GCF) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.596846	0.0001
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Null Hypothesis: D(GCF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.848254	0.0003
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

Null Hypothesis: D(GCF) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.401324	0.0000
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

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Null Hypothesis: GOVEXP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.419840	0.1453
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Null Hypothesis: GOVEXP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.220819	0.4611
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: GOVEXP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.084359	0.7020
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

Null Hypothesis: D(GOVEXP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.974575	0.0049
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

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Null Hypothesis: D(GOVEXP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.070763	0.0172
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: D(GOVEXP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.058381	0.0002
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.036299	0.2706
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

Null Hypothesis: FDI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.595170	0.2848
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: FDI has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.074187	0.2492
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

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Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.523400	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.634148	0.0000
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

Null Hypothesis: D(FDI) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.552363	0.0000
Test critical values:	1% level	-2.650145	
	5% level	-1.953381	
	10% level	-1.609798	

Null Hypothesis: OPENNESS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.240352	0.6434
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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Null Hypothesis: OPENNESS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.495821	0.3277
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: OPENNESS has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.195580	0.7361
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

Null Hypothesis: D(OPENNESS) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.490455	0.0001
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Null Hypothesis: D(OPENNESS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.528901	0.0005
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: D(OPENNESS) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.415188	0.0000
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

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Null Hypothesis: OILVOLATILITY has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.369705	0.0001
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

Null Hypothesis: OILVOLATILITY has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.280713	0.0009
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: OILVOLATILITY has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.112561	0.0353
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

Null Hypothesis: ICRG has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.683933	0.4289
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

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Null Hypothesis: ICRG has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.709364	0.7220
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: ICRG has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.567736	0.4628
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

Null Hypothesis: D(ICRG) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.761810	0.0007
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Null Hypothesis: D(ICRG) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.739949	0.0036
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: D(ICRG) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.835486	0.0000
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

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Null Hypothesis: REER has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.784215	0.0001
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

Null Hypothesis: REER has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.895869	0.0026
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

Null Hypothesis: REER has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.280786	0.1796
Test critical values:	1% level	-2.653401	
	5% level	-1.953858	
	10% level	-1.609571	

Null Hypothesis: D(REER) has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.622189	0.0134
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

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Null Hypothesis: D(REER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.928488	0.0273
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

Null Hypothesis: D(REER) has a unit root
Exogenous: None
Lag Length: 6 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.404905	0.0016
Test critical values:	1% level	-2.669359	
	5% level	-1.956406	
	10% level	-1.608495	

Null Hypothesis: PRIVATE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.166745	0.2218
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

Null Hypothesis: PRIVATE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.117698	0.9091
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: PRIVATE has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.405104	0.0179
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

Appendices

Null Hypothesis: D(PRIVATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.941208	0.0053
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

Null Hypothesis: D(PRIVATE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.490982	0.0066
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

Null Hypothesis: D(PRIVATE) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.879277	0.0004
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

Appendices

Appendix (4-10): results of the Two-Stages least squares estimation

Dependent Variable: D(HHI)
Method: Two-Stage Least Squares
Date: 08/17/16 Time: 15:05
Sample (adjusted): 1987 2015
Included observations: 29 after adjustments
Instrument specification: D(CPI,2) D(GOVEXP) D(PRIVATE) OILVOLATILITY D(FDI) D(GCF) D(ICRG) D(OPENNESS) D(REER) D(LRGDP)(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP)	-0.564950	0.289112	-1.954089	0.0641
OILVOLATILITY	-0.324892	0.084276	-3.855096	0.0009
D(FDI)	0.185908	1.469020	0.126553	0.9005
D(GCF)	0.393852	0.200301	1.966301	0.0626
D(ICRG)	-0.001829	0.001724	-1.060656	0.3009
D(OPENNESS)	0.556248	0.181635	3.062446	0.0059
D(REER)	0.000711	0.000348	2.042307	0.0539
C	0.051294	0.013035	3.934922	0.0008

R-squared	0.517687	Mean dependent var	0.007664
Adjusted R-squared	0.356917	S.D. dependent var	0.040344
S.E. of regression	0.032353	Sum squared resid	0.021981
F-statistic	3.220034	Durbin-Watson stat	1.709632
Prob(F-statistic)	0.017610	Second-Stage SSR	0.021981
J-statistic	1.351588	Instrument rank	11
Prob(J-statistic)	0.716921		

Appendices

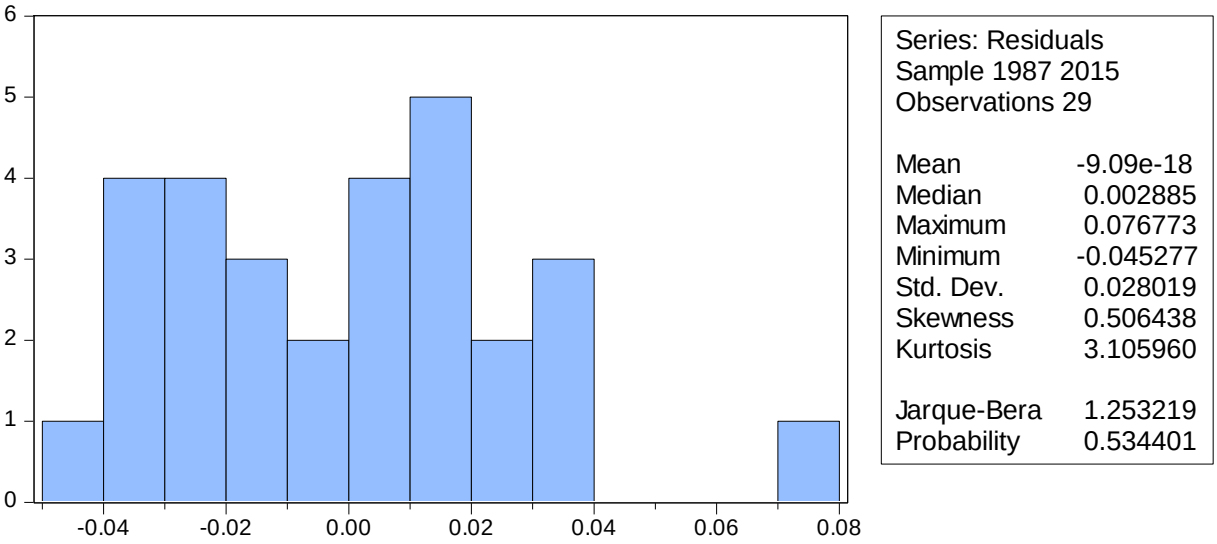
Appendix (4-11): Results of the Residual tests (Breuch-Godfrey serial correlation and Breush-Pagan-Godfrey Heteroscedasticity tests and Normality)

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	1.092941	Prob. Chi-Square(2)	0.5790

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.496023	Prob. F(7,21)	0.2225
Obs*R-squared	9.649564	Prob. Chi-Square(7)	0.2093
Scaled explained SS	5.328076	Prob. Chi-Square(7)	0.6200



Abstract :

The problem of oil price volatility has always worked as a buffer against the good performance of oil rich economies. This problem is associated with economic diversification, indeed, countries whose exports and domestic sectors are more concentrated are more likely to experience volatility in their revenues and output; and countries with diversified economies could reduce the volatility and escape the oil curse.

Thus, our study searches in the Algerian case as one of the most important oil producers and exporters and it seeks to show the effect of oil price volatility on the economic diversification in Algeria by developing the guidelines for the Algerian state and non-state actors in managing the volatility of oil revenues then to diversify the economy. The study used different empirical tools to analyze the economic diversification reality and its relationship with the oil volatility and other economic and institutional variables namely the portfolio theory and the two stages least squares. The results showed a positive relationship between oil price volatility and economic diversification in Algeria but no role has been found for the other variables explaining the weak base and environment of this diversification. Consequently, the research recommended to the Algerian government to give more attention to the strategy implemented in the long term and not to focus on temporary decisions as interaction to the international fluctuations.

Key words: ***Oil price volatility, economic diversification, Algeria, Portfolio theory, Two-stages least squares.***

Résumé :

Le problème de la volatilité des prix du pétrole a toujours été un obstacle bloquant la bonne performance des économies riches en pétrole. Ce phénomène est lié à la diversification économique, en effet, les pays dont les exportations et les secteurs domestiques sont plus concentrés connaissent volatilité de leurs revenus et de la production; en revanche, les pays à économies diversifiées pourraient réduire la volatilité et échapper à la malédiction du pétrole.

Ainsi, notre étude cherche dans le cas de l'Algérie classé parmi les pays les plus importants producteurs et exportateurs du pétrole, à montrer l'effet de la volatilité des prix du pétrole sur la diversification de l'économie Algérienne en développant les lignes directrices pour les acteurs étatiques et non étatiques dans la gestion de la volatilité des recettes pétrolières alors de diversifier l'économie. L'étude a utilisé différents outils empiriques pour analyser la réalité de la diversification économique et sa relation avec la volatilité du pétrole et d'autres variables économiques et institutionnelles à savoir la théorie du portefeuille et la méthode du Doubles moindres carrés. Les résultats ont montré une relation positive entre la volatilité des prix du pétrole et la diversification économique en Algérie mais aucun rôle n'a été trouvé pour les autres variables expliquant la base et l'environnement faibles de cette diversification. Par conséquent, la recherche a recommandé aux pouvoirs publics de donner plus d'attention à la stratégie à mettre en œuvre à long terme et ne pas se concentrer sur les décisions temporaires comme une réaction aux fluctuations internationales.

Mots clés ***: Volatilité des prix du pétrole, diversification économique, Algérie, Théorie du portefeuille, Double-Moindre carrées.***

الملخص:

عملت مشكلة تطايرية أسعار النفط دائما كعائق أمام الأداء الجيد للاقتصاديات الغنية بالنفط. ترتبط هذه المشكلة بالتنويع الاقتصادي ، فالدول ذات الصادرات و القطاعات المحلية الأكثر تركيزا هي أكثر تعرضا للتقلبات في إيراداتها و إنتاجها ؛ والبلدان ذات الاقتصاديات المتنوعة يمكن لها أن تقلل من تقلبات والهروب من لعنة النفط.

تبحث دراستنا في حالة الجزائر كواحدة من أهم الدول المنتجة و المصدرة للنفط بحيث تسعى لإظهار تأثير تقلبات أسعار النفط على التنويع الاقتصادي في الجزائر من خلال تطوير المبادئ التوجيهية للجهات الحكومية وغير الحكومية في إدارة تقلب عائدات النفط و بالتالي تنويع الاقتصاد. واستخدمت الدراسة أدوات التجريبية المختلفة لتحليل واقع التنويع الاقتصادي وعلاقته مع تقلبات النفط والمتغيرات الاقتصادية والمؤسساتية الأخرى وهي نظرية المحفظة و طريقة المربعات الصغرى ذات المرحلتين. وأظهرت النتائج وجود علاقة إيجابية بين تقلبات أسعار النفط والتنويع الاقتصادي في الجزائر ولكن لم يتم العثور على أي دور للمتغيرات الأخرى هذا ما يفسر ضعف البيئة و القاعدة المجهزة لهذا التنويع. ونتيجة لذلك، أوصى البحث للحكومة الجزائرية لإعطاء المزيد من الاهتمام لاستراتيجية تنفذ على المدى الطويل وعدم التركيز على قرارات مؤقتة كردة فعل للتقلبات الدولية.

الكلمات المفتاحية: ***تطايرية أسعار البترول، التنويع الاقتصادي، الجزائر، نظرية المحفظة، المربعات الصغرى ذات المرحلتين.***