Educational Administration: Theory and Practice
2025, 31(1), 354-365
ISSN:2148-2403
https://kuey.net/

Research Article

Natural resource curse and economic diversification: a survey of literature with an empirical analysis of the Algerian case

Abdelali Dahmani[1*], Laid Gherbi [2]

[1*]PhD student at Eloued University- Algeria; E-mail: abdelali-dahmani@univ-eloued.dz
[2]Laboratory of Business Administration and Sustainable Economic Institutions A senior lecturer at Eloued university-Algeria; E-mail: gherbi-laid@univ-eloued.dz

Citation: Abdelali Dahmani, et al. (2025). Natural resource curse and economic diversification: a survey of literature with an empirical analysis of the Algerian case, *Educational Administration: Theory and Practice*, 31(1) 354-365
Doi: 10.53555/kuey.v31i1.9365

ARTICLE INFO

Received:01-05-2024
Accepted: 01-11-2024
Published: 20-01-2025

ABSTRACT

This paper tried to analyze the different studies dealing empirically with the resource curse, economic diversification. The paper is divided into three sections: the first one displays the different works dealing with the resource curse; 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. Then, the paper summarizes the issues raised by all the studies presented in the previous sections. Finally, we chose Algeria as an oil rich country and analyzed its economic diversification determinants.

Key words: natural resources; resource curse; economic diversification; Algeria.

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. 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.

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, this paper is divided into three sections: the first one displays the different works dealing with the resource curse; 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. Then, the paper summarizes the issues raised by all the studies presented in the previous sections. Finally, we chose Algeria as an oil rich country and analyzed its economic diversification determinants.

Literature on the resource curse

The evidence which supports the traditional resource curse hypothesis suggests that thereis a negative relationship between resource abundance and economic growth in resource richcountries.

(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) 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.

(ElissaiosPapyrakis and ReyerGerlah, 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;
- 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.

(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

* 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.

growth rates of: income terms of trade; domestic credit available to the private sector as a percentage of GDP; inflation; net accumulation of physical capital per capita; latitude; initial GDP and governance.
Rambaldi, Hall and Brown arrived to the following results:
- The negative relationship between resource intensity still hold for the SW measure but it was not the case for the GZ measure because of the type of data used (Panel instead of cross country);
- No direct nor indirect evidence of the resource curse hypothesis when PCRents is used (appositive relationship);
- They concluded that testing the resource curse can be strongly dependent on the definition of resource intensity and measurement and modeling of economic growth.
(RabehArezki 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.
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.
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 fromaHeckscher-Ohlin factor endowment model. He testedtheseimplications in a highly-disaggregated manufacturing sector data across a wide group of countriesincluding 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 impacton manufacturing sectors in countries with more open capital markets to foreign investment. This result is due to outflow of investment in manufacturing following a decliningmarginal 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 affectedby windfall shocks, possibly due to a larger share of the effect being absorbed by the laborintensivetradable sectors.

The conclusion of the fourth result is that a diverse manufacturing sectormay be more cushioned from the effect of oil shocks. This is due to capital-intensive sectorsbeing less affected by the increased demand for labor by labor-intensive non-tradables during oilboom, while labor-intensive sectors help cushion adjustment during oil busts by absorbing the laborshed by declining non-tradables.

(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.

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, 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.

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.

Literature on the role of economic diversification

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.

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.

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 haspolitical 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 canbecome an ongoing one.

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

(Hesse, 2008) in his paper suggested that developing countries shoulddiversify their exports since this canhelp them to overcome export tinstability 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 structuraltransformation where countries move from producing “poor-country goods” to“rich-country goods.”

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)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) 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) In a Phd thesis, Ndjambou analyzed how territorial economic diversification canbe the strategy to implement in Gabon in order to reduce its dependence on oil revenues. The method of OrdinaryLeast Squares (OLS) has been used to find out factors of the Gabonese economicdiversification from 1980 to 2010. His model contained eight independent variables (level of development, public investment,

foreigndirect investment, inflation, exchange rate, trade openness, and entrepreneurship) and onedependent variable (Hirschman-Herfindalh-Standardized Index).It appeared from the statistical inference and the descriptive analysis that Gaboneseeconomic diversification was affected by trade openness, the exchange rate and inflation.
Moreover, Ndjamboudefined a diversification strategy that can boost territorial development of the country inthe long term. This strategy of territorial economic diversification consists of five pillarsthat are: « Green Gabon », « Gabon energy », « Mining Gabon », « Blue Gabon » and «Gray Gabon ».
(Alodadi A.A.S, 2016)here applied three models to examine the most importantdeterminants of oil and non-oil sector economic growth in two of the largest economiesin the Gulf Cooperation Council (GCC), namely Saudi Arabia and the UAE.Given thegovernments'determination to reduce dependence on oil income, Alodali's thesis focused on the role ofnon-oil sectors. Explanatory variables in the models included exports, governmentspending, investment (private and public), tourism (religious and international), labourand capital, while GDP is used as the dependent variable.Through isolating the non-oil sector from the oil sector, the studyhighlighted the potential role of tourism as a future crucial factor indetermining economic growth in oil rich countries, especially in the GCC.

Issues raised from the literature review:

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.

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.

An empirical analysis on the economic diversification determinants in Algeria:

1- Methodology and data

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 1995-2020 basing on the two stages least squares method.
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:

$$HHI_t = \alpha_0 + \alpha_1 RGDP_t + \alpha_2 oilvolatility_t + \alpha_3 FDI_t + \alpha_4 GCF_t + \alpha_5 ICRG_t + \alpha_6 Openness_t + \alpha_7 REER_t + \alpha_8 private_t + \varepsilon_t$$

- **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[4];
- **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.
- **Private:** the domestic credit provided to private sector to control for the development of the financial system.

- 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; 8 exogenous variables in the equation; 11 predetermined variables in the model.
2-1=1 < 2-1+11-8=4 => 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:

$$HHI_t = \alpha_0 + \alpha_1 RGDP_t + \alpha_2 oilvolatility_t + \alpha_3 FDI_t + \alpha_4 GCF_t + \alpha_5 ICRG_t + \alpha_6 Openness_t + \alpha_7 REER_t + \alpha_8 private_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

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)
Hypothesis

The empirical results of the economic diversification's determinants

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.

[4]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 .

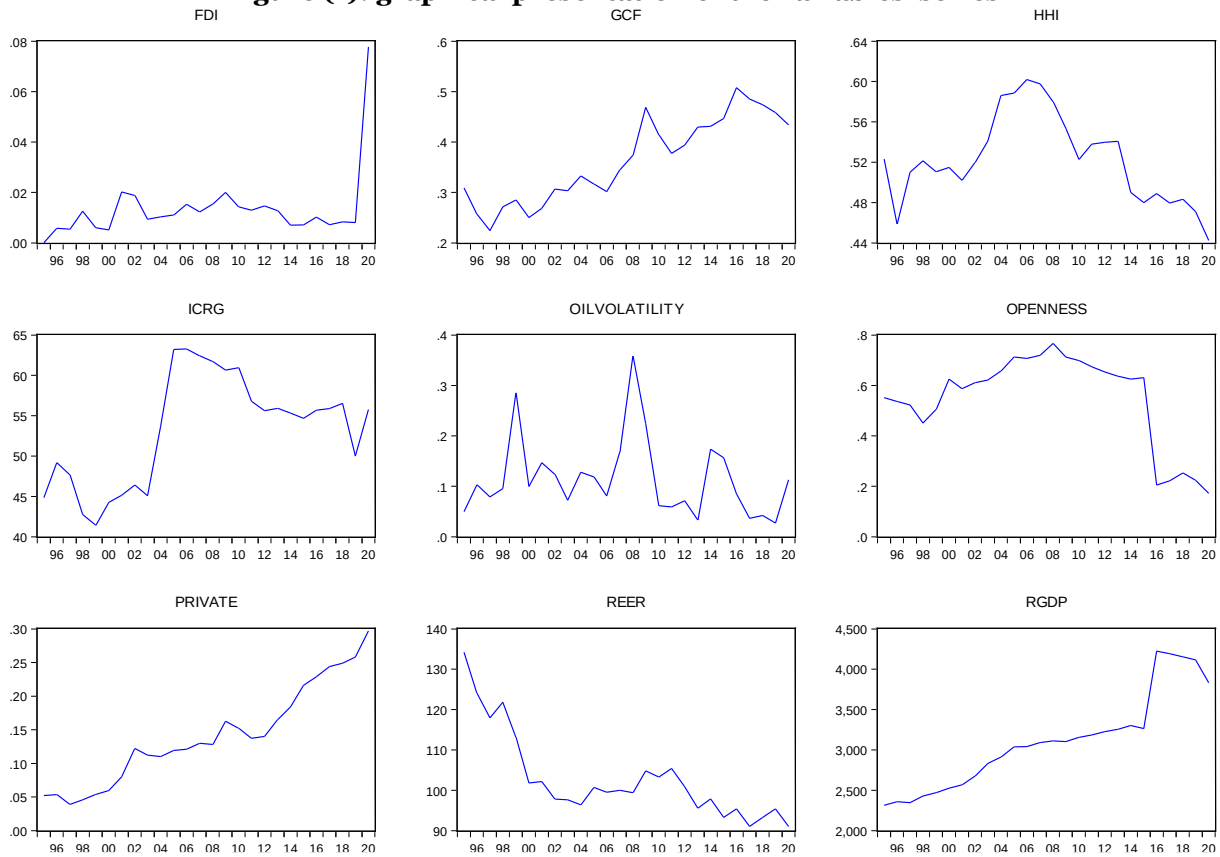
Table (1): Descriptive statistics of the variables

	FDI	GCF	HHI	ICRG	OILVOLATILITY	OPENNESS	PRIVATE	REER	RGDP
Mean	0.013388	0.364071	0.522508	53.26378	0.115074	0.549319	0.140786	102.8342	3104.794
Median	0.010716	0.359090	0.520480	55.47300	0.097603	0.623176	0.128930	99.76354	3097.597
Maximum	0.077699	0.507777	0.601838	63.29167	0.358115	0.766845	0.296949	134.1768	4224.037
Minimum	2.38E-08	0.224470	0.442453	41.41667	0.027214	0.171762	0.039074	91.02523	2313.563
Std. Dev.	0.014007	0.084138	0.043423	6.846489	0.078307	0.181805	0.072916	10.81158	591.7687
Skewness	3.878247	0.079042	0.249493	-0.184414	1.534055	-1.040055	0.445589	1.443019	0.572590
Kurtosis	18.54877	1.690853	2.287649	1.798856	5.215432	2.716450	2.289310	4.351146	2.427566
Jarque-Bera	327.0880	1.883762	0.819467	1.710347	15.51490	4.774525	1.407554	11.00104	1.775710
Probability	0.000000	0.389894	0.663827	0.425209	0.000428	0.091881	0.494713	0.004085	0.411537
Sum	0.348092	9.465839	13.58520	1384.858	2.991930	14.28228	3.660444	2673.690	80724.64
Sum Sq. Dev.	0.004905	0.176979	0.047138	1171.860	0.153301	0.826324	0.132918	2922.255	8754756.
Observations	26	26	26	26	26	26	26	26	26

Source: *authors' 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 (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 (1): graphical presentation of the variables' series



Source: *authors' 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, which allows us to use these series in the estimation. The results for these tests are summarized in the table (2).

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

Variables		None	Intercept	Trend and intercept	
HHI	Level	0.05	-2.92	-3.06	I(1)
	1st difference	-5.17***	-5.05***	-5.88***	
RGDP	Level	1.92	-0.89	-2.75	I(1)
	1st difference	-4.82***	-5.22***	-5.05**	
CPI	Level	1.71	0.09	-2.23	I(1)
	1st difference	-1.704*	-2.63*	-2.59	
GCF	Level	0.46	-1.03	-3.09	I(1)
	1st difference	-4.92***	-4.92***	-4.67***	
GOVEXP	Level	0.59	-0.47	-1.78	I(1)
	1st difference	-5.51***	-5.59***	-5.88***	
FDI	Level	0.33	-1.35	-1.81	I(1)
	1st difference	-2.02***	-2.09	-1.81	
Openness	Level	-0.77	-0.51	-1.09	I(1)
	1st difference	-5.13***	-5.11***	-5.66***	
Oilvolatility	Level	-1.89*	-3.55**	-3.57**	I(0)
	1st difference	///	///	///	
ICRG	Level	0.12	-1.40	-1.65	I(1)
	1st difference	-4.66***	-4.57***	-4.43***	
REER	Level	-1.75	-1.90	-1.97	I(1)
	1st difference	-5.07***	-4.39**	-4.37**	
PRIVATE	Level	3.23	1.34	-1.89	I(1)
	1st difference	-3.10***	-3.98***	-4.54***	

, ** 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 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

Table (3) summarizes the different tests to show the validity of the model specified:

Table (3): tests for model's validity

J-Statistic **Prob. J-stat.**	3.56 0.18
Jarque- Bera normality	2.24 P= "0.32"
Durbin Watson	2.81
Heteroscedasticity **Breusch-Pagan-Godfrey**	3.14 P= "0.92"

Source : constructed by the authors using EVIEWS' output

The Durbin Watson and the heteroscedasticityBreusch-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 (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 (5): summary of the estimation results
Dependent variable: D(HHI)

Variables	D(LR GDP)	Oilvolatility	D(FDI)	D(GCF)	D(ICRG)	D(OPENNESS)	D(REER)	D(private)	Cons tant
	0.54 (2.36) **	-0.26 (-3.30)***	1.6 (2.72)**	0.70 (2.87)**	-0.0026 (-1.41)	0.42 (3.38)***	0.00017 0.12	-1.29 (-1.69)***	0.03 (3.29) ***

R-Squared66%	**F-statistic**4.28***
Adjusted R-Squared51%	**Durbin- Watson**2.81

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

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

- **Hypotheses testing:**

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

From the results above, there is a positive and significant **effect of RGDP on the export concentration (HHI)**. 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 greater than the t-student tabulated at 5%, thus, we accept 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 a small 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 5%, 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 significant relationship with export diversification in Algeria showing the weakness of investment policy.

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 less than the t-student tabulated at 5%, thus, we accept the hypothesis 7 indicating the absence of the **effect of REER on the export concentration (HHI)**.

The results also indicated a negative and significant effect of financial system development measured by the credit provided by the private sector, on the export concentration which reflects a positive role played by this sector in the diversification and this was due to the government trying regarding the financial system.

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 paper tried to analyze the different studies dealing empirically with the resource curse, economic diversification. The paper has been divided into three section; one showing the literature on the natural resource curse; the other providing the impact of the economic diversification by summarizing a set of empirical works. The third section developed the issues raised by those studies.

- The diversified economies work better than the resource intensive countries;
- Institutions and governance do matter in escaping or deepening the curse hypothesis,;
- 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 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;
- Appropriate monetary policy is also required to deal with the natural resource price shock and their inflationary pressures which hamper the growth.

The empirical part showed:
- The volatility in oil prices measured by the standard deviation has negative and significant effect on export concentration in Algeria;
- The domestic investment measured by the gross capital formation has negative and 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, but such effect was statistically insignificant.

References:

1. Akinwale Y.O.(2012)**"Empirical analysis of the resource curse in Nigeria"**, International Journal of Economics and Management Science, Vol.1 N6, PP 19-25.
2. Alaya M. (2012) ;**"The determinants of MENA export diversification: an empirical analysis"**; Economic Research Forum 18th annual conference about "Corruption and economic development"; Cairo-Egypt.
3. Alichi A. and Arezki R., "**An alternative explanation for the resource curse: the income effect channel"**, IMF working paper, May 2009.
4. Al-Kawaz A. (2008); **"Economic diversification: the case of Kuwait with reference to oil producing countries"**; Journal of Economic Cooperation 29.3; PP 23-48.
5. Alodadi A.A.S. (2016)**"Aneconometricanalysisof oil/non-oilsectorsand economic growthin the GCC: evidence from SAUDI ARABIA and the UAE";** A thesis submitted to Plymouth University in partial fulfilment for the degree of DOCTOR OF PHILOSOPHY; Graduate School of Management Faculty of Business Plymouth University ENGLAND.
6. Arezki R. and Van der Ploeg F.(August 2007), **"Can the natural resource curse turn into a blessing? Role of trade policies and institutions."**, IMF working paper.
7. Elbadawi I. and Soto R.(2012), "**Resource rents, political institutions and economic growth"**, Economic research forum paper.
8. Gylfason T. (2011) **"Natural resource endowment: a mixed blessing",**CESifo papers.
9. Gylfason T. and Zoega G.(2002) **"Inequality and economic growth : do natural resources matter ?"**, CESifo working paper N° 712.
10. Herzed D. and NOWAK-LEHMANN D. (2006), **"What Does Export Diversification Do For Growth? An Econometric analysis"**, Applied Economics journal 38, 15 pp 1825-1838.
11. Hesse H. (2008), **"Export diversification and economic growth",** Commission on growth and development, The world Bank, Working paper No 21.
12. Kabbashi S.M. (2012) **"Understanding and avoiding the oil curse in Sudan"**, ERF working paper 735.
13. Kareem Ismail, (2010) "**The structural manifestation of the Dutch disease: the case of oil exporting countries**», IMF working paper n° 10/103.
14. Ndjambou P. (2013)**"Diversification économique territoriale : enjeux, déterminants, stratégies, modalités, conditions et perspectives**.";THÈSE DE DOCTORAT ; Université du Québec.
15. Olumide S.A. and Akongwale S. (2013)**"Economic Diversification in Nigeria: Any Role for Solid Mineral Development?"** ; Mediterranean Journal of Social Sciences Published by MCSER-CEMAS-Sapienza University of Rome; Vol 4 No 6; PP 691-703.
16. Papyrakis E. and Gerlah R., « T**he resource curse hypothesis and its transmission channels"**, Journal of comparative economics, 32 (2004).
17. Rodrik D. (2005), **"Policies for economic diversification"**, CEPAL Review 87 PP 7- 24.
18. Sachs J. and Warner A., **"Natural resource abundance and economic growth",** National Bureau of Economic Research, Cambridge 1995.
19. ***www.unctadstat.unctad.org***
20. ***www.worldbank.org***