

## **Poverty and Macroeconomic Development in Algeria: What is the contribution of Oil Revenues?<sup>1</sup>**

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*The objective of our research is the analysis the relationship between macroeconomic growth and poverty reduction. Indeed, macroeconomic growth has long been viewed as one of the most effective ways to reduce poverty. Historically, the rising tide of labor market opportunities that accompanies an economic expansion has helped the poor more than the rich, leading to a narrowing of the income distribution and a fall in poverty*

*Our objective is to investigate for the impact of economic growth on poverty in Algeria. What should be noted in the case of Algeria is that the oil sector has a heavy direct effect on the economy, as exports consist nearly entirely of hydrocarbon, and over two thirds of government revenues originate from this sector. However, its contribution to total employment is minimal (around 3%). Statistically speaking, the majority of the research studies that have looked for the relationship between oil revenues and economic activity have tested the linear (symmetric) relationships between oil prices and other macroeconomic variables.*

*Recently, the concern has shifted to the asymmetry of the impact of oil price shocks on economic activity. Accordingly, the main question is as follows: Is there an asymmetric relationship between macroeconomic variables and oil prices in Algeria?*

*Another point to be raised in this research is the fact that Algeria is suffering from a Dutch Disease which is essentially caused by a high degree of corruption and bad governance (social infrastructure). Moreover, the positive effect of oil prices is only conditional to having good institutions. Thus, it is very important to analyze the impact of the social infrastructure on poverty reduction. The question here, is the social infrastructure favorable for a macroeconomic growth? And does it allow for an equitable distribution of revenues?*

**Key Words:** Poverty – development – inequality- gender –informality – oil –institutions- Algeria.

**JEL:** E26, I32, O11, O17.

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## **Introduction:**

The importance of the relationship between macroeconomic growth and poverty has pushed many researchers to investigate for the nature of the such relationship (Blank, 2000 ; Haverman and Schwabish, 2000 ; Freeman, 2001 ; Freeman, 2003 ; Agénor, Bayraktar and El Aynaoui, 2007 ; Rebecca M. Blanc and David Card, 1993 ; J. Page, 2007). According to these studies, unemployment is the most important factor affecting the poverty rate. Other factors, such as: oil shocks, high levels of inflation and demographic problems could affect the unemployment rate and consequently the poverty rate.

To investigate for the impact of economic growth on poverty in Algeria, our study analyses the relationships between growth variables (i.e., GDP, unemployment, inflation...) and social indicators as well as poverty indicators. What should be noted in the case of Algeria is that the oil sector has a heavy direct effect on the economy, as exports consist nearly entirely of hydrocarbon, and over two thirds of government revenues originate from this sector. This sector also accounts for a third of GDP.

However, its contribution to total employment is minimal (around 3%). Statistically speaking, the majority of the research studies that have looked for the relationship between oil revenues and economic activity have tested the linear (symmetric) relationships between oil prices and other macroeconomic variables. In this context, we can argument with the contributions of John A. Tatom (1988) and James D. Hamilton (1988). They tested for the symmetric aspect of the relationship between oil prices and economic activity.

Recently, the concern has shifted to the asymmetry of the impact of oil price shocks on economic activity (J. Cunado & F. Perez de Gracia, 2005 ; Sandrine Lardic & Valérie Mignon, 2005 ; J. Cunado & F. Perez de Gracia, 2003 ; Bwo-Nung Huang & M.J. Hwang & Hsiao-Ping Peng, 2005).

Accordingly, the main question is as follows: Is there an asymmetric relationship between macroeconomic variables and oil prices in Algeria? If yes, in which way this asymmetry could affect the relationship between macroeconomic growth and poverty? Otherwise, what is the contribution of oil revenues on poverty reduction in Algeria?

Another point to be raised in this research is the fact that Algeria is suffering from a Dutch Disease which is essentially caused by a high degree of corruption and bad governance (social infrastructure). Moreover, the positive effect of oil prices is only conditional to having good institutions. Thus, it is very important to analyze the impact of the social infrastructure on poverty reduction. The question here, is the social infrastructure favorable for a macroeconomic growth? And does it allow for an equitable distribution of revenues?

The work in hand is articulated as follows: The following section will deal with the literature review on the relationship between oil prices and macroeconomic variables. The third section will shed light on the conceptual framework that we will be using in our analysis. Then, the fourth part will deal with the research methodology. Consequently we will describe the variables we will be using as well as the estimation techniques. Test results will be presented in the fifth part: It is divided into three main parts: First we will test the relationship between oil prices and different macroeconomic variables in Algeria. Then, we will test the asymmetric aspect of the relationship between oil prices and economic activity. And finally, we will investigate for the relationship between oil and poverty as well as for the relationship between oil, corruption and political stability in Algeria. Finally the sixth part will give the main conclusions and policy recommendations.

## 1. Literature Review:

The last two decades has witnessed a booming literature on the links among growth, inequality, and poverty reduction.

As a result of this debate, a more or less broad consensus has emerged on a few findings. First nobody seems to doubt the importance of growth for poverty reduction. Indeed The main relationship between economic growth, poverty and inequality found in the literature is that faster rates of economic growth reduce poverty, and have little impact on income inequality (Adams and Page, 2003). In an econometric study based on 50 developing countries, Adams (2003) found that a 10% increase in growth (mean per capita income) can be expected to produce a 25.9% decrease in the proportion of people living in poverty (\$1.00 per person per day). In the same study Adams also found that economic growth had no statistical effect on income distribution: inequality may rise or fall with economic growth.

Second, progressive distributional changes are good for poverty reduction. (Bourgignon, 2001) argued that growth associated with progressive distributional change will have a greater impact in reducing poverty than growth, which leaves the distribution unchanged. Regressive distributional change, on the other hand, can offset the benefits of growth to the poor. There are two main reasons for this. The first is simply the direct, positive impact that progressive distributional change has on poverty reduction for any given rate of growth. There is, however, a second, indirect and positive impact of a fall inequality. Reductions in inequality increase the impact of future growth on poverty reduction.

The third finding is that there is no strong empirical evidence suggesting a general tendency for growth as such to make income distribution more or less equal. For example, Dollar and Kraay (2002) find that, on average, the income of the poorest fifth of society rises proportionately with average incomes. Other studies concluding that changes in income and changes in inequality are unrelated include Deininger and Squire (1996), Chen and Ravallion (1997), and Easterly (1999).

Fourth, Although many studies focus on the relationship between oil prices and economic growth, very few, however, looked the relationship between oil prices and poverty. For instance, Page (2007) argued that the oil boom of the 1970s and early 1980s permitted both oil exporters and non-oil exporters in the MENA region to reduce poverty rapidly. By the mid-1990s, those living on less than US\$ 1.00 per day in MENA had fallen to less than 2% of the region's population, a point where, among developing countries, MENA trailed only the economies of Eastern Europe and Central Asia in terms of the incidence of extreme poverty.

Yet, despite these enviable statistics, widespread concern emerged in the region during the last decade of the twentieth century about the durability of MENAs success in reducing poverty.

The majority of studies that have investigated for oil economics in the MENA region have concentrated on the impact of oil prices on economic activity rather than than its impact on poverty. Indeed the study of the impact of oil prices on economic activity is not a new debate. In fact since the beginning of the eighties many authors have looked for the relationship between oil prices and other macroeconomic variables (Jagdeep S. Bhandari, 1981; Gideon Fishelson, 1982; Hamilton, 1983).

Different estimation methods have been used as well as sampling periods to test for the impact of oil prices on economic activity, for instance, (Richard Westoby, 1986 ; John H. Hoag & Mark Wheeler, 1996 ; J. Peter Ferderer, 1996 ; Tilak Abeyasinghe, 2001 ; Youngho Chang & Joon Fong Wong, 2003; Jagdeep S. Bhandari, 1981; Gideon Fishelson, 1982; Michael M. Hutchison, 1993; Jose Luis Nicolini, 1985; Rajeev K. Goel & Mathew J. Morey, 1993; Gideon

Fishelson, 1983; Byung Rhae Lee & Kiseok Lee & Ronald A. Ratti, 2001; Y. H. Farzin, 2001; Mark A. Hooker, 1996a; James D. Hamilton, 1996; Mark A. Hooker, 1996b). These authors reach the conclusion that oil prices influence economic activity in the many countries they have taken even though their data, methods, and definitions vary. Other studies have concentrated on the impact of oil prices on one variable only. Among these, we can note the contributions of Steven J. Davis & John Haltiwanger (2001) and Hillard G. Huntington (2004) that investigated for the relationship between oil prices and unemployment. Per E. Thoresen (1982) and Richard G. Sheehan & Neil Kelly (1983) have studied the impact of oil prices on inflation; Ying Huang & Feng Guo (2006) have examined the relationship between oil prices and the real exchange rate. Another group of researchers have analysed what we call “the Dutch Disease”.

Contributions here are those of Robert E. Looney (1991); Richard G. Zind (1999); ohsen Fardmanesh (1991); Andrew Feltenstein (1992) among others. Statistically speaking, the majority of these contributions have tested the linear (symmetric) relationships between oil prices and other macroeconomic variables. In this context, we can argue with the contributions of John A. Tatom (1988) and James D. Hamilton (1988). They tested for the symmetric aspect of the relationship between oil prices and economic activity.

Recently, the concern has shifted to the asymmetry of the impact of oil price shocks on economic activity (J. Cunado & F. Perez de Gracia, 2005 ; Sandrine Lardic & Valérie Mignon, 2005 ; J. Cunado & F. Perez de Gracia, 2003 ; Bwo-Nung Huang & M.J. Hwang & Hsiao-Ping Peng, 2005). These studies use more appropriate methods and techniques to capture the asymmetric relationships between macroeconomic variables.

The literature review of oil prices in MENA countries are varied but have neglected the asymmetric impact of oil prices on economic activity in these region. M. Shams (1989) tested the impact of oil revenues on major economic indicators of the OPEC countries. The results conclude that economic activity depends heavily on oil revenue. Metwally M. M. & Perera N. (1995) showed that as a consequence of the decline in oil prices, the GCC countries need a relatively higher proportional rate of growth in their government expenditure to maintain a given percentage of income growth in the long run.

This may, however, prove difficult, which necessitates greater reliance on other means of control. In their article, Eltony M. N. & Al-Awadi M. (2001), using a VAR and VECM models, found that oil price shocks have significant impact on government expenses, imports and M2 in Kuwait during the period 1984-1998.

Hakan Berument & Hakan Tasci (2002) have used the 1990 input–output table to investigate the inflationary effects of crude oil prices in Turkey. Under fixed nominal wages, profits, and interest and rent earnings, the effect of increasing prices of oil on inflation is limited. However, when wages and the other three factors of income (profit, interest and rent) are adjusted to the general price level that includes the oil price increases, the inflationary effect of oil prices becomes significant. Hence, indexation could have very severe effects on an economy when oil prices increase and, in some cases, could even lead to hyperinflation. Sel Dibooglu & Eisa Aleisa (2004) have shown that there is an important impact of the real price of oil in Saudi Arabia, mainly in the short run, and an important part of its output fluctuations can be explained by the real price of oil. Moreover, the real price of oil has a great influence on the conduct of real exchange rate and price movements.

Hakan Berument and Nildag Basak Ceylan (2005), for instance, have used a VAR model and an impulse analysis to study the impact oil price shocks on economic development in the MENA region. They found that there is a significant impact in some countries (Algeria, Iran,

Iraq, Jordan, Kuwait, Oman, Qatar, Syria, Tunisia and United Arab Emirates) whereas the impact is insignificant in others (Bahrain, Djibouti, Egypt, Lebanon, Morocco and Yemen).

Another point that has been raised in the literature in the context of growth development nexus is the role of institutions. Recent empirical studies have shown that institutions play a determinant role in the growth process (Hall and Jones, 1999). Such studies have corroborated the Douglas North (1990) hypothesis that institutions are the underlying determinant of long run economic performance of nations. Countries with better institutions not only invest more in physical and human capital but also use these factors more efficiently. Countries need appropriate institutions to sustain and consolidate the move to market led growth. The definitions of "institutions" range from the formal and informal "rules of the game" for society, affecting incentives and therefore growth performance, through to the formal organizations, procedures, and regulatory frameworks that can foster or prevent good policy choices.

There is an extensive literature on the interrelationship between institutions and economic growth that have been developed substantially over the past two decades, drawing on larger and richer databases and utilizing better econometric tools to explain how institutions relate to cross-country differences in growth performance.

We can document here the early contributions of Knack and Keefer (1995) and Mauro (1995). Hall and Jones (1999), Acemoglu, Johnson and Robinson (2001, 2002), Easterly and Levine (2003), Dollar and Kraay (2003), and Rodrik, Subramanian, and Trebbi (2002), have reached close to an intellectual consensus that the political institutions of limited government cause economic growth.

As far as the MENA region, many studies have been taken to investigate for the institutions growth nexus. In this respect, we can find Makdissi, Fateh and Limam (2000), Keller and Nabli (2002), Sala-i- and Ardati (2002), Abed (2003), Abdelali Jbili (ERF, 2003), Hakura (2004), and recently Nugent and Pesaran (2006) among others. The main outcome of the these studies is that the weak performance of growth in MENA regions is essentially due to weak institutions, large dominance of the public sector, underdeveloped financial markets, highly restrictive trade regimes, and inappropriate exchange rate regimes. Thus, according to them, MENA countries need to strengthen institutional quality, such as improving governance, fighting corruption, and fostering transparency and accountability. As can be seen, there are many important studies that have been undertaken in the MENA region in order to investigate for either the impact of oil prices on macroeconomic variables, the impact of macroeconomic growth on poverty or the impact of institutions on poverty..

However, as have been said, very few studies looked for the relationship between oil prices and poverty reduction or either a combination of the impact of growth, oil, institutions on poverty. This is the main objective of the work in hand.

## **2. Conceptual Framework:**

Macroeconomic growth has long been viewed as one of the most effective ways to reduce poverty. Historically, the rising tide of labor market opportunities that accompanies an economic expansion has helped the poor more than the rich, leading to a narrowing of the income distribution and a fall in poverty (Rebecca M. Blanc and David Card, 1993).

The importance of such relationship has pushed many researchers to investigate for the nature of the relation between macroeconomic factors and poverty reduction (Blank, 2000 ; Haverman and Schwabish, 2000 ; Freeman, 2001 ; Freeman, 2003 ; Agénor, Bayraktar and El Aynaoui, 2007 ; Rebecca M. Blanc and David Card, 1993 ; J. Page, 2007). According to these

studies, unemployment is the most important factor affecting the poverty rate. Other factors, such as: oil shocks, high levels of inflation and demographic problems could affect the unemployment rate and consequently the poverty rate<sup>4</sup>.

Our objective is to investigate for the impact of economic growth on poverty in Algeria. Thus, the study analyses the relationships between growth variables (i.e., GDP, unemployment, inflation...) and social indicators as well as poverty indicators.

Algeria is a particular case in the MENA region. Whereas this country is vast and very rich in natural resources (as exports consist nearly entirely of hydrocarbon 96%, and over two thirds of government revenues originate from this sector. This sector also accounts for a third of GDP. However, its contribution to total employment is minimal (around 3%, [B. Laabbas, 2001](#)). oil represents 96% of total exports), it has not managed to benefit from it efficiently. [Chemingui \(2003\)](#) argued that the Algerian economic experience is often regarded as a spectacular failure despite the great investment effort in infrastructures and heavy industries since its independence. Chemingui added that the difficult political context (civil war during the nineties), corruption, the weakness of the private sector, the weakness of the financial system are seen to be the main causes which continue to slow down the economic takeoff of the country.

As noted before, oil-producing countries face the challenge of managing the extra oil revenue. In many oil-producing countries, oil production accounts for a large share of their GDP, tax revenue and exports. The oil cash gift, if properly managed, could help oil producing countries grow quickly. However, governments should be aware of the distortions that an oil boom can create through inflows of sizable foreign exchange earnings. The real exchange rate can appreciate through growing inflation and nominal currency revaluation.

The non-traded sector could expand and non-oil traded goods lose competitiveness and decline. This is the classical Dutch-disease pattern. Consequently, it is advisable that the monetary authorities adopt a non-inflationary policy to avoid hyperinflation and to maintain monetary credibility. Moreover, the prudent use of oil windfalls requires appropriate governance structures, which are based on transparency and accountability. It is important that the extra oil revenue be used to increase the set of production possibilities through investment in physical (e.g. infrastructure) and human capital. From another angle, the challenge is to translate those higher growth numbers, and value of oil stocks, into lower poverty rates\*. This requires that oil-producing countries adopt sound institutions and appropriate macroeconomic policies. They need to invest in projects which yield the highest social rates of returns, such as education and infrastructure, and not in prestige enhancing projects. Moreover, care must be taken that the extra oil revenue does not accrue only to some segments of the population while the living standard of the others remains unchanged or worsens.

So the question to be addressed here; is it possible for Algeria countries to meet the above objectives in the actual situation of favorable oil prices. Many other questions are addressed and need to be investigated:

- Is there an asymmetric relationship between macroeconomic variables and oil prices in Algeria? If yes,

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<sup>4</sup> \* For instance, the impact of oil price increase on poverty alleviation issue was tackled by [Musgrove, P. \(1981\)](#). In his article, he concluded that the oil price increases in the period 1973-1974 was to some extent beneficial for the poor. The proportion of households or of population below the poverty line decreased significantly, but the mean real income of those left in poverty was unchanged or even declined.

- In which way this asymmetry could affect the relationship between macroeconomic growth and poverty? Otherwise,

- What is the contribution of oil revenues on poverty reduction in Algeria?

- How can the Algeria benefit from the high price of oil and how can the poor be insulated from it?

And in order to account for the impact of institutions on economic growth and thus, on the reduction of poverty two main questions are addressed:

- Is the social infrastructure favorable for a macroeconomic growth? And

- Does it allow for an equitable distribution of revenues?

- What is the optimal policy mix to accommodate output and price adjustments as a result of the high price of oil?

### **3. Research Methodology:**

Our study will be divided into three main parts. First, we will analyze the relationship between macroeconomic variables and poverty indicators in Algeria. Thus, we will be using available data from previous studies (The national Household surveys in Algeria 1988 and 1995) and data obtained from MECAS\* research center (200, 2004, 2005, 2006 and 2007).

Moreover, our objective is to launch a research survey in 2008. Poverty indicators that are used in this part are *Head Count Ratio*, *Poverty Gap* and *GINI Index* (we note here that the *GINI index* will allow us to see how revenues are distributed). It should be noted that the available data do not allow us to use advanced statistical and econometric methods. This is why we will be using simple regressions and descriptive statistics to analyze the relationship between the evolution of macroeconomic indicators such as unemployment, inflation and GDP growth and the evolution of poverty indicators.

In the second part, we will test the impact of oil prices on macroeconomic growth variables.

We will consider the asymmetric aspect of oil shocks on other macroeconomic variables due to the fact that recent developments have shown that economic activity responds asymmetrically to these shocks (J. Cunado & F. Perez de Gracia, 2005; J. Cunado & F. Perez de Gracia, 2003; Bwo-Nung Huang & M.J. Hwang & Hsiao-Ping Peng, 2005). In fact, rising oil prices appear to retard aggregate economic activity by more than falling oil prices stimulate it (Sandrine Lardic & Valérie Mignon, 2005). To account for the asymmetric impact of oil prices, we will be using the asymmetric cointegration framework as proposed by Schorderet (2004). The objective of this method is to investigate for the properties of a particular case of cointegration emerging from a decomposition of time series into positive and negative partial sums, and this is due to the fact that there exists potential asymmetries in the interaction among main macroeconomic variables. Furthermore, and in order to consolidate our approach, we use the multivariate threshold autoregressive model (MVTAR) proposed by Tsay (1998). The aim of this test is to look for the nonlinear properties of a vector of time series. If the VAR has a nonlinear threshold relationship, it is necessary to differentiate the regime based on a threshold level of the switching variable (In our case, we expect that the switching variable is the oil price and its volatility). The arguments for using the MVTAR are that the price adjustment may not immediately impact economic variables.

There is a resistance to change in economic activities from price changes due to uncertainty and related costs involved. The volatility of prices must cross a certain threshold

value before economic impacts can be realized. An economic threshold for an oil price impact is the amount of price increase beyond which an economic impact on production and stock prices is palpable. When an oil price change or its volatility exceeds the threshold level, its impact on the economy may well be negative. The threshold value varies from country to country depending on the natural endowment of the economy (Huang *et al.* 2005).

The aim of this test is to look for the nonlinear properties of a vector of time series. If the VAR has a nonlinear threshold relationship, it is necessary to differentiate the regime based on a threshold level of the switching variable (In our case, we expect that the switching variable is the oil price and its volatility).

Once again, a variance decomposition based on the MVTAR model is performed to test the impact of oil prices on other macroeconomic variables.

In order to test the impact of this asymmetry on the relationship between macroeconomic growth and poverty, we will proceed as follows:

First, data will be organized in a decreasing or an increasing order according to the switching variable (which is oil prices in our case). Second, our sample will be divided according to this order and the estimated MVTAR threshold models. For instance, if the MVTAR model is composed of two thresholds (i.e. three regimes), we should obtain three sub-samples. Third, each sub-sample will be reorganized according to time chronology. The next step consists of using descriptive statistics to analyze the relationship between the evolution of macroeconomic growth and the evolution of poverty indicators of each sub-sample. Finally, the comparison between the results of different sub-samples will allow us to detect the impact of the asymmetry on the relationship between macroeconomic growth and poverty.

In the third part of our study we will investigate for the impact of the social infrastructure on macroeconomic growth in Algeria. In this part, we will be using two indexes of social infrastructure (as developed by Hall and Jones , 1999) The first index is called *government antidiversion policies* (GADP) and it includes five aspects: *law and order, bureaucratic quality, corruption, risk of expropriation and government repudiation of contracts* (Knack and Keefer , 1995). The second index focuses on the openness of a country to trade with other countries (Sach and Warner, 1995). In this context , we will first study the relationship of these indexes with macroeconomic growth variables using regressions and descriptive statistics such as correlation and dependence coefficients. The results will tell us how the social infrastructure is affecting macroeconomic growth in Algeria.

Finally, and in order to account for the impact of the social infrastructure on the distribution of revenues, we will analyze the relationships between the behaviour of social infrastructure indicators and the behaviour of GINI index which is the element that could capture the distributional effect of revenues. In this context, it should be noted that the available data would only allow us to use descriptive statistics and correlation, dependence and variation coefficients.

#### **4-1. Data Description:**

As far as the data is concerned, we will be using the data provided by the International Monetary Fund (International Financial Statistics) and the World Bank data. The data covers the period from January 1970 to June 2006. Due to the lack of monthly data for the GDP, we will use the production of industrial sector. The other variables are oil prices, inflation rate, unemployment rate, interest rate and money.

We carry a collection of data from international agencies such as IMF and the World Bank. It is noted that data on African countries suffer from a shortage, especially unemployment and industrial production. This lack becomes very visible with frequencies that are less than a year. This effect makes the study very difficult, because the power of econometric tests depends on the sample size of the study. This requires, generally, that the researcher have to conduct himself extrapolation or interpolation to complete the missing data, which weakened the reliability of these data, or testing while removing the variables that have a lack of study. This reduces the scope of the study. Thus, to conduct tests using annual data, this means a small sample size, which affects the power of the tests.

A main question arises in this context is the role of national statistical agencies of these countries? This lack of data, it is not a characteristic of underdevelopment of these countries<sup>5</sup>? And how are the economic policies of these countries without recourse to information on their economic environments?

Many other questions can be asked, but it coincides with the lack of a bad index of corruption for these countries (see table (9)). This may provide some explanation of the economic policy of these countries in the absence of information (or made very difficult to make access to information).

We note in this context that several agencies and institutions organize surveys to gather information about these countries, but also huge costs that these organizations face, such information is insufficient. In addition, access to this information remains limited to the member of these organizations, making use of this information far from optimal.

#### 4-2. Estimation Techniques:

In this paper, we first estimate a simple VAR model (one regime VAR model). Before estimating this model, one should be sure that the variables in question are stationary. If no, we should test for cointegration relationships.

The first test that will be used is the one presented by [Phillips & Perron \(1988\)](#). This test is another alternative (nonparametric) representation of the [Dickey & Fuller \(1979\)](#). It is used to investigate for any serial correlation in the unit root tests. We note here that under the null hypothesis, the series are non stationary. However, in order to get consistent results, other tests will be used. The [Kwiatkowski & Phillips & Schmidt & Shin \(1992\)](#) test is different due to the fact that it considers that the variables are stationary under the null hypothesis. In fact, this test is complementary to [Phillips & Perron \(1988\)](#) and [Dickey & Fuller \(1979\)](#) tests. By testing the unit root hypothesis and the stationary hypothesis, we can distinguish series that appear to be stationary, series that appear to have a unit root, and the series for which the data (or tests) are not sufficiently informative to be sure whether they are stationary or integrated.

Furthermore, as noted by [Perron \(1989\)](#), the use of long span series may be a bias to unit root test results when breakpoints are present. To overcome this problem, we use the test presented by [Zivot & Andrews \(1992\)](#) that takes into account the present of such breakpoints. Moreover, and in order to consider seasonal effects in monthly data, we use the [Hylleberg & Engle & Granger & Yoo \(1990\)](#) test. Finally, and to account for a multivariate framework in the VAR models and thus correct for both possible presence of endogeneity among variables and for the problem of serial correlation of the estimated errors, we use the [Im & Pesaran & Shin \(2003\)](#) test.

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<sup>5</sup> It is noted that the average corruption index for developed countries is 7.88, for emerging countries is 3.40, for Africa is 2.85.

After the unit root test, we are faced with a problem on how to use non stationary series in the VAR model. Thus, it is necessary to look for cointegration relationships among variables (Engle R.F. & Granger C.W., 1987). We use the Johansen S. & Juselius K. (1990) test. The test results of cointegration a unit roots will determine the forms of the variables entering in the VAR model. In the case of cointegration relationship, one should use an error correction term in the model. Here, we will proceed to variance decomposition in order to analyse the impact of oil shocks on the other macroeconomic variables. Other tests, of course, will be used to test the stability of the model. For instance, the tests to be used are Chow (1960); Hansen (1991) ; Bai & Perron (1998) and Bai & al. (1998).

In the second part of our analysis, we will consider the asymmetric aspect of oil shocks on other macroeconomic variables due to the fact that recent developments have shown that economic activity responds asymmetrically to these shocks (J. Cunado & F. Perez de Gracia, 2005; J. Cunado & F. Perez de Gracia, 2003 ; Bwo-Nung Huang & M.J. Hwang & Hsiao-Ping Peng, 2005). In fact, rising oil prices appear to retard aggregate economic activity by more than falling oil prices stimulate it (Sandrine Lardic & Valérie Mignon, 2005). To account for the asymmetric impact of oil prices, we will be using the asymmetric cointegration framework as proposed by Schorderet (2004). The objective of this method is to investigate for the properties of a particular case of cointegration emerging from a decomposition of time series into positive and negative partial sums, and this is due to the fact that there exists potential asymmetries in the interaction among main macroeconomic variables. Furthermore, and in order to consolidate our approach, we use the multivariate threshold autoregressive model (MVTAR) proposed by Tsay (1998). The aim of this test is to look for the nonlinear properties of a vector of time series. If the VAR has a nonlinear threshold relationship, it is necessary to differentiate the regime based on a threshold level of the switching variable (In our case, we expect that the switching variable is the oil price and its volatility). Once again, a variance decomposition based on the MVTAR model is performed to test the impact of oil prices on other macroeconomic variables.

Finally, we compare the results of the one regime TAR model with the MVTAR model in order to show the importance of nonlinear models for the explanation of the relationship between oil prices and economic activity.

#### **4. Test Results:**

The test results will be divided into three main parts. The first will deal with the impact of oil prices on some macroeconomic variables in Algeria (namely, the GDP, Money, inflation and interest rates), whereas the second part deals with the relationship between oil prices and corruption (with some governance indicators) and finally we will draw some results as far as the relationship between oil prices and poverty.

##### **5-1. Oil prices and Macroeconomic variables**

The objective of our study is to analyze the impact of changes in oil prices (or price volatility) on the macroeconomic variables in Algeria. We note in this context that several studies have used VAR models, impulse analysis and variance decomposition. These include for example Rafiq S. et al. (2008), Leduc S. and K. Sill (2004), Papapetrou E. (2001). Indeed, the VAR models are an appropriate tool in the analysis of relations between variables.

When using VAR models, we are faced with an important debate between the gents who prefer information and gents who prefer efficiency. On the one hand, we can find Sims (1980) who notes that the variables need not be distinguished even if they are not stationary, because the differentiation of the series is losing the information on these series. On the other hand, Maddala and Kim (1998) notes that if the series are not stationary or cointegrated, then they must be used

in 1st difference. However, if the variables are cointegrated with  $r$  cointegration relations, then the model must be estimated with  $r$  linear combinations and  $(n-r)$  variables in first difference. In our case, we are more concerned with the efficiency of the model, and therefore we will adopt the approach of [Maddala and Kim \(1998\)](#).

To test the stationarity, we use more formal tests of unit roots. The formal tests of unit roots on additional interest to economists because they can help assess the nature of the non-stationarity observed in most macroeconomic data. In particular, they help to determine if the trend is stochastic (through the presence of unit roots) or deterministic (through the presence of a linear trend or quadratic polynomial).

The first formal test we use is that of [Phillips and Perron \(1988\)](#) (PP). This test is an alternative test (nonparametric with respect to nuisance parameters) to that of [Dickey and Fuller \(1979\)](#). Unlike the test of [Dickey and Fuller \(1979\)](#) (DF), it can control the autocorrelation of the errors in the test unit roots. This test allows us to test a very large class of models for time series there are unit roots, including ARIMA models with heterogeneous innovations or innovations identically distributed. Moreover, this test is an extension to that of [Phillips \(1987\)](#) in case the specification includes a drift or a drift and a linear trend. Test is based on estimating the following model:

$$\Delta y_t = \alpha y_{t-1} + x_t' \delta + \varepsilon_t$$

The test-statistic is calculated as follows :

$$\tilde{t}_\alpha = t_\alpha \left( \frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2f_0^{1/2}s}$$

with  $\hat{\alpha}$  the estimated value,  $se(\hat{\alpha})$  is the coefficient standard error, and  $s$  the regression standard error.  $\gamma_0$  is the the consistant estimator of the error variance calculated as follows :  $(T-k)s^2/T$  , with  $k$  as the number of regressors. The term  $f_0$  is the estimator of the residual spectrum at frequency zero. We note that the asymptotic distribution of this statistic is the same as the ADF test statistics developed by [Mackinnon \(1996\)](#). Additionally, the hypothesis tests of PP, DF and ADF is the existence of unit roots.

The second unit root test used in our work is that of [Kwiatkowski & Phillips & Schmidt & Shin \(1992\)](#) (KPSS). This test is different from other tests (ADF and PP) of that test the hypothesis of stationarity. This test is based on the regression residuals of the following:

$$y_t = x_t' \delta + u_t$$

With  $x_t$  represents the exogenous variables. LM statistics used in this test is calculated as follows:

$$LM = \sum_t S(t)^2 / (T^2 f_0)$$

With  $S(t)$  the cumulative residue calculated as follows:  $S(t) = \sum_{r=1}^t \hat{u}_r$  . This function is based on residuals  $\hat{u}_t = y_t - x_t' \hat{\delta}(0)$ .

Moreover  $f_0$  is the estimator of the residual spectrum at frequency zero. Kwiatkowski *et al.* (1992) have tabulated critical values for the LM test statistics by using simulations based on asymptotic results.

The test of Kwiatkowski *et al.* (1992) can be considered as a complementary test to that of Phillips & Perron (1988) and Dickey and Fuller (1979). Indeed, in testing the unit root hypothesis and the assumption of stationarity, we can distinguish the stationary series, non-stationary series, and series for which data do not provide sufficient information concerning the stationarity.

The results of the stationarity tests are presented in Table (1). According to this table, the results of the PP and KPSS tests are contradictory. It was also noted that the variable money is the variable most affected by this lack of information. The money variable does not contain enough information about stationarity. To solve the problem, we have used the greatest probability and critical values. For example, in case where the unit root hypothesis is accepted by a PP test with a low probability, while the assumption of stationarity is accepted by a KPSS test with a large critical value, thus we will use the KPSS test result, So that the series is stationary.

The results are summarized in Table (2). According to this table, Money is integrated of order 1 in. The variable interest rate is also integrated of order 1. As far as the inflation rate is concerned, it is also integrated of order 1.

After testing unit roots, we are faced with the problem of using non-stationary series in the VAR model. So it becomes necessary to test the relations of cointegration (Engle RF & Granger CW, 1987) between non-stationary variables. For this, we will use the method of Johansen S. & K. Juselius (1990). The test results of unit roots and cointegration will determine the form of variables that go into the VAR model. In the case of the presence of a cointegration vector, a term for error correction must be included in the model.

The results of cointegration tests are presented in Table (3).

The results of Table (3) show that there are three cointegration relations in the case of Algeria. A relationship between inflation, interest rate and money, a second relationship between inflation, money, and oil prices, and a third relationship between the interest rate, money, and oil prices. We can easily notice from these results, that the price of oil has a long-term effect on the money variable in Algeria. The cointegration and stationarity test results allow us to know the form of variables to include in the VAR model. In our case, the variables will be used to level terms with error correction.

To test the impact of oil price volatility, we have to estimate this volatility. To do so, we will adopt the approach of Sadorsky (1999) by estimating the residual  $v_t$  of a standard GARCH model (1.1) as follows:

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1}$$

With  $I_{t-1}$ , the information set of the period  $t-1$ . The standardized residual error is estimated as  $\hat{v}_t = \varepsilon_t / h_t^{1/2}$ , with  $h_t$  the conditional variance in time  $t$ . It is noted that  $\hat{v}_t$  represent the volatility of changes in oil prices. The results of this estimation are presented in Table (6).

According to the results of Table (4), it appears that the GARCH model (1.1) has good estimators. Indeed, the parameters are significant at the 5% and the statistics of Durbin-Watson and Ljung-Box show that there is no autocorrelation. Moreover, the correlation coefficient between the first differences of oil prices is the volatility of these prices is 0.7217. Therefore, we

cannot introduce these two variables at the same time in the same model. So, we will estimate two VAR models, the first using the oil price, and the second using the volatility of these prices.

The estimated VAR model will allow us to make variance decomposition, and estimate the response functions. The *variance* decomposition allows us to calculate the percentages of the impact of the change of each variable on the change of other variables. The response functions allow us to know the signs of change, and periods of shocks. The results from the variance decomposition are presented in Table (5).

According to the results of Table (5), no significant impact could be attributed to oil prices and the volatility of these prices in the case of Algeria,. As a result, oil prices and volatility of these prices have no explanatory power for inflation, interest rate and money.

### **5-1-1. Impulse response functions:**

Figure (1) clearly shows that all variables have a response to oil prices shocks and the volatility of these prices. For oil prices, there is an initial negative response of the price that lasts only one period. For interest rates, there is a positive initial response that continues to increase until the third period. This response tends to decline with no return to equilibrium. In the case of money, there is a positive initial response that tends to increase until the second period and then decreases in the fourth period to increase without return to equilibrium.

The response of these variables to shocks of the volatility of oil prices is different. Indeed, inflation has a positive initial response to the volatility of oil prices. This response tends to increase until the second period, then decreases negatively in the third period, and remains stable until the fourth period, and then returns to equilibrium in the fifth period. Similarly, the response of interest rates and is also different. Figure (1) shows a positive initial response that tends to increase until the third period to equilibrate to the fourth period. As far as money is concerned, there is a positive initial response that tends to increase until the third period, and then decreases to reach equilibrium in the sixth period.

According to figure (1), there is a response to shocks in oil prices which is different from the shock of oil prices volatility.

The inability to find explanations for these observations led us to think in alternative. First, we will consider the form of the model chosen. In fact, we have used a VAR model to estimate the response functions and variance decomposition, or the previous studies were in favor an asymmetric relationship between oil prices (or the volatility of these prices) and other macroeconomic variables. Therefore, we will test the non-linearity between variables using a MVTAR model.

A second possible source of these anomalies is not taken into account in the design of several factors which may be decisive in our study. Indeed, the social environment, security, and social infrastructure of Algeria has a large influence on the growth process. More recent studies show that the social infrastructure may be the key factor in explaining the development and growth. It was also noted that Most African countries suffer from bad governance and corruption.

### **5-2. Testing for the asymmetric impact**

In this section we present the MVTAR (Multivariate threshold Autoregression) model that we will be using in our empirical work. Appropriate hypotheses and test structures are discussed.

#### **5-2-1. The MVTAR model**

MVTAR (Multivariate Threshold Autoregressive) models are models that could take different regimes. Each regime can be represented by a VAR (Vector Autoregressive) model. However, the switching of the regime is governed by a switching variable so that any crossing above or below the threshold will trigger the regime to change. These models are presented by Tsay (1998) as follows:

$$Y_t = \begin{cases} f_1(Y_{t-1}, Y_{t-2}, \dots; \varepsilon_{1t} | \theta_1) & \text{if } z_{t-d} \leq r \\ f_2(Y_{t-1}, Y_{t-2}, \dots; \varepsilon_{2t} | \theta_2) & \text{if } z_{t-d} > r \end{cases} \quad (1)$$

Where,  $Y_t = (\text{real GDP, CPI, oil price, world real GDP})$ ,  $f_i(\cdot)$  is a function defined as  $f_i(\cdot) \neq f_j(\cdot)$  if  $i \neq j$ ,  $\theta_i$  are parameters with finite dimensions,  $d$  is a positive integer representing the delay of the switching variable  $z_{t-d}$  that should be stationary (Hansen, 1996) (In our case, this variable is the oil prices<sup>6</sup>).

In his work, Tsay (1998) use a linear model that depends on a vector of endogenous variables  $Y_t$ , and a  $V$ - dimension vector of exogenous variables  $X_t = (X_{1t}, \dots, X_{vt})'$ , with  $r \in \Gamma = [r, \bar{r}]$ ,  $\Gamma$  is an interval (Usually balanced) of the possible threshold values. In these conditions, Tsay (1998) notes that  $Y_t$  follow an MV TAR model with a switching variable lagged  $d$  period, if it satisfies the following form:

$$Y_t = c_j + \sum_{i=1}^p \phi_i^{(j)} Y_{t-i} + \sum_{i=1}^q \beta_i^{(j)} X_{t-i} + \varepsilon_t^{(j)} \quad \text{if } r_{j-1} \leq z_{t-d} \leq r_j \quad (2)$$

with  $j = 1, \dots, s$ ,  $c_j$  vectors of constants,  $p$  and  $q$  are numbers of non-negative integer. The satisfied innovations  $\varepsilon_t^{(j)} = \sum_{j=1}^{1/2} a_t$ , and  $\sum_{j=1}^{1/2}$  symmetrical positive matrixes and defines,  $\{a_t\}$  a sequence of random vectors that are not auto-correlated with a 0 mean and a covariance matrix covariance  $I$  (the identical matrix). The switching variable is stationary with a continuous distribution. This model with  $s$  regimes is considered linear in the threshold space  $z_{t-d}$ , but non linear in time where  $s > 1$ .

For the estimation of model (2), Tsay (1998) adopt a generalization of the results of Chan (1993) and Hansen (1996) of the uni-variate case. To simplify, the model is written in:

$$Y_t = \begin{cases} X_t' \Phi_1 + \sum_1^{1/2} a_t & \text{if } z_{t-d} \leq r_1 \\ X_t' \Phi_2 + \sum_2^{1/2} a_t & \text{if } z_{t-d} > r_1 \end{cases} \quad (3)$$

With  $a_t = (a_{1t}, \dots, a_{kt})'$ ,  $z_{t-d}$  is stationary and continuous with a density function  $f(r)$  on a defined subset function of the real line  $R_0 \subset R$ ,  $d \in \{1, \dots, d_0\}$ ,  $d_0$  is a fixed positive integer. In order to estimate the parameters of model (3)  $(\Phi_1, \Phi_2, \sum_1, \sum_2, r_1, d)$ , Tsay (1998) use two stage conditional least squares. First, and taking into account the values of  $d$  and  $r$ , the model (3) is divided into two multivariate linear regressions with the least squares estimators of  $\Phi_i$  et  $\sum_i$  (with  $i = 1, 2$ ):

$$\hat{\Phi}_i(r_1, d) = \left( \sum_t^{(i)} X_t X_t' \right)^{-1} \left( \sum_t^{(i)} X_t Y_t' \right)$$

and

$$\hat{\sum}_i(r_1, d) = \frac{\sum_t^{(i)} (Y_t - X_t' \hat{\Phi}_i) (Y_t - X_t' \hat{\Phi}_i)'}{n_i - k} \quad (4)$$

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<sup>6</sup> The choice of oil prices as the switching variable comes from the fact that it is used by previous studies such as: Huang, Hwang, et Peng (2005); Sadorsky (1999); and Ferderer (1996), in addition of the important role of oil revenues in the Algerian economy.

With  $\sum_t^{(i)}$  the sum of all the observations in the regime  $i$ ,  $\Phi_i^* = \Phi_i(r_1, d)$ ,  $n_i$  the number of observations in the regime  $i$ , and  $k$  is the dimension of  $X_t$  ( $k < n_i$  for  $i = 1, 2$ ). The sum of the squared errors is :

$$S(r_1, d) = S_1(r_1, d) + S_2(r_1, d)$$

With  $s_i(r_1, d)$  the trace of  $(n_i - k)\bar{\Sigma}_i(r_1, d)$ . Secondly, the estimators of the conditional least squares of  $r_1$  and  $d$  are obtained by :

$$(\hat{r}_1, \hat{d}) = \operatorname{argmin} S(r_1, d)$$

With  $1 \leq d \leq d_0$  and  $r_1 \in R_0$ . The results of the estimators of the least squares of (4) are:

$$\hat{\Phi}_i = \hat{\Phi}_i(\hat{r}_1, \hat{d})$$

And

$$\hat{\Sigma}_i = \hat{\Sigma}_i(\hat{r}_1, \hat{d})$$

To establish the asymptotic properties of these estimators, Tsay (1998) adopt the same approach of Chan (1993) and Hansen (1996).

To test for the non linearity of the model (i.e. test for the significance of the MVTAR model against the VAR model), Hansen (1996) propose the Wald test. In this test, The null hypothesis is :  $\Phi_1 = \Phi_2$ , which means that the coefficients are equal for the two regimes (the alternative hypothesis for the non linearity is  $\Phi_1 \neq \Phi_2$ ). However, the difficulty of this test resides in the existence of the nuisances parameters<sup>7</sup>. Indeed, the threshold  $r_1$  is not defined under the null hypothesis. In these conditions, when the errors are *iid*, the most powerful statistic test is the F statistic which is as follows:

$$F = \sup_{r_1 \in \Gamma} F(r_1)$$

Due to the fact that  $r_1$  is not identified, this statistic does not follow a chi-square distribution. To overcome this problem, Hansen (1996) proposes an approximation with the bootstrap procedure.

### 5-2-2. The Generalized Response Functions

In the work in hand, we use an MVTAR model to analyze the impact of the monetary policy shocks on the interest rate in Algeria. We are exploring the impact of the variables change of the monetary policy on the interest rate during the periods of high inflation, and the periods of low inflation. To do so, we use the generalized response functions as proposed by Koop, Pesaran and Potter (1996). Indeed, these functions could be used to examine the shocks in the non linear models. The difference between the response of a variable after a shock and the base line (No shock) represents the value of the generalized response function:

$$GI_y(k, \varepsilon_t, \Omega_{t-1}) = E[Y_{t+k} | \varepsilon_t, \Omega_{t-1}] - E[Y_{t+k} | \Omega_{t-1}] \quad (5)$$

With  $k$  representing the forecasting horizon,  $\varepsilon_t$  is the shock , and  $\Omega_{t-1}$  the initial values of the model variables. The generalized response functions *GI* should be calculated using some simulations in the model. Moreover, we assume that the nonlinear model that produces the variables  $Y$  is known. The shock of the  $i^{th}$  variable of  $Y$  is produced in the period 0, and the responses are calculated for the  $l$  periods that follow. In order to calculate, we use the algorithm

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<sup>7</sup> The problem of the nuisance parameters non identified under the null hypothesis is well explained in Ploberger (1994), Hansen (1996), and Stinchcombe et White (1998).

of [Atanasova \(2003\)](#) taking into account the same number of replications adopted by [Koop, Pesaran and Potter \(1996\)](#) ( $R = 500$ ).

The results of linearity testing are presented in Table (6). We note that this table is composed of two parts. A party with a model with oil prices as a switching variable and another part with a model using the volatility of oil prices as a variable transition.

Table (6) shows that, the assumption of non linearity is accepted in the case of oil prices as a variable transition, however, it is rejected in the case of using the price volatility oil as a transition variable.

So the test of nonlinearity provides a convincing argument for incorrect specification of the VAR models used in the case of Algeria.

The response functions based on MVTAR models are shown in Figure (2). According to this figure, and in the case of Algeria, there is no significant response to shocks in oil prices before the fifth period for all variables. After the fifth period, there is a positive response to inflation, interest rates and money supply, in the case of the upper regime. In the lower regime, however, the opposite is happening: after the fifth period, there is a negative response for the three variables. We note that in the case of Algeria shocks do not tend to get cancelled.

In the case of interest rates and money supply, there is a significant negative response which tends to vanish after the twelfth period. Broadly speaking, we note that the difference between the lower and the upper regimes is that positive responses are becoming negative ones.

As a result, we note that non-linear models can provide explanations on the relationship between oil prices and other variables. However, even with these explanations, this phenomenon is difficult to interpret. Therefore, we will try to explore the relationship between oil prices and corruption in Algeria and with a comparative study with some African countries to clarify the mechanisms of the impact of these prices on economic growth in these countries. Indeed, [John Halls \(1999\)](#) notes that social infrastructure is the key factor that explains the difference in growth between countries.

### **5-3. Oil, Corruption and Political stability:**

In our work we will focus only on two aspects of social infrastructure: the corruption and political instability. Indeed, African oil exporting countries are among the most corrupt countries in the world, and yet that these countries suffer from political instability, violence and civil war. For instance Ian Gary (2003) states that: “Fights over oil revenues become the reason for ratcheting up the level of pre-existing conflict in a society, and oil may even become the very rationale for starting wars. This is especially true as economies move into decline. Petroleum revenues are also a central mechanism for prolonging violent conflict and only rarely a catalyst for resolution. Think, for example, of Sudan, Algeria, the Republic of Congo, and Nigeria”

Corruption refers to the use of official position for personal enrichment. What differentiates corruption in African economies is its relative impact on economic growth and political coalitions. High levels of corruption correlate with low levels of political freedoms; hence we examine the connection between corruption, oil, windfalls and political stability.

Corruption is often the “glue” by which a dictator rewards supporters and binds beneficiaries of a regime to the leadership structure. Facilitating corruption is a practice of mortgaging future production by taking loans from international oil companies that enjoy a distinct advantage in their access to information and capital when compared to the poverty of African states (Nankani 1979). However, the oil companies face certain risks as well. They are caught in an “obsolescing bargain,” wherein they must “make major capital investments before

they can expect to reap any profit. These investments amount to a kind of ‘hostage’” (Bray 2003). Oil firms make substantial investments before they receive any returns that may trap them in an uneasy commitment to a vicious autocracy.

The citizens of many African petro-economies live in conditions of poverty that belies their country’s oil wealth. With the sole exception of Gabon, African oil exporters are poor economies characterized by low rates of GDP growth, low per capita incomes (whether measured by parity purchasing power or GNI), poor performance in non-oil sectors, and in many cases, civil violence and war. The statistics on corruption among African petro-economies are dismal: Angola, Cameroon, and Nigeria are among the most corrupt states in the world with respective rankings of 124, 126, and 132 (out of 133).

Indeed, among other developing oil exporters, **Algeria is ranked 88**, Angola and Cameroon at 125. These statistics suggest an alarming correlation between petro-economies and corruption.

According to the Corruption Perception Index (CPI) de Transparency International, 31 from 47 African countries scored below 3 (on a scale of 10), which indicates a rampant corruption. In addition 13 countries are in arrange between 3 and 5, which means that corruption is generalized in Africa. In these countries, corruption and scandals cases involving senior officials remain widespread, which led to a risk of undermining political stability and even the ability of governments to effectively deliver basic services.

CPI reveals that corruption is particularly complex in fragile states where it exacerbates political instability. Once again, Somalia has the lowest ranking, with a score of 1: a continuing conflict and endemic corruption lock the country into political chaos and economic structural reform banning.

Nigeria, Sierra Leone, DRC, Guinea, Sudan and Chad-all richly endowed with resources-can be found at the bottom of the rankings with a score less than or equal 2 despite the wealth they have and national resources that could easily feed the state budget, like Niger, Mauritania and Madagascar, among the most unstable states.

Table (7, 8) indicates the indices of corruption and political instability in African countries. To show the relationship between oil prices on the one hand and corruption and political stability on the other hand, we present some correlation tests in tables (9, 10). According to these tables, we note that the correlations are higher in the case of oil exporting countries. For example, in the case of Algeria, a significant correlation of 09.41 exists between oil prices and corruption, and another significant correlation of 09.28 between political stability and oil prices. In the case of Nigeria, a significant correlation of -0.7307 between oil prices and political instability. In the case of Cote d'Ivoire, a significant correlation of -0.7604 was detected between oil prices and corruption, and a significant correlation of -0.7366 was detected between oil prices and political instability.

Accordingly, the more a country has more resources, more it will suffer from corruption and political instability.

A number of studies argue that causality is from corruption to political instability. Corruption has a severe impact on African economies as well as on their political governance systems. Indeed, corruption is a major cause of bad governance in Africa.

#### **5-4. Oil and Poverty**

There exists little literature on poverty in Algeria. Indeed, before 1990, Algeria was a planned economy and the question of poverty at that time was almost a "taboo" problem. After

the reforms imposed by international institutions and mainly the IMF, it was obvious that Algeria was encountering severe social problems (high unemployment, poverty...). The emergence of few writings on poverty had shed light on the dynamics of this phenomenon in Algeria. We can document here, [Laabas B \(2001\)](#) who gave a detailed poverty profile for Algeria and study its dynamic between 1966 and 1995. The framework used in this poverty assessment will enable to evaluate poverty levels for non-survey years using only available data on aggregate per capita consumption and inflation, assuming a certain level of income distribution.

[Laabas \(2001\)](#) argued that poverty is deeply rooted in the Algerian society since the days of colonialism. The French colonial policy in Algeria was a deliberate destruction of the country's national identity and indigenous social system, which was based on the society's basic needs. The post independence development efforts helped improve the welfare of the population. The massive increase of oil windfalls and the extensive foreign borrowing meant that an egalitarian socialist program of development and generous social policy was implemented quite easily, though not sustainable in the long run as demonstrated by recent experience.

Before 1990, i.e. the transition towards a market oriented economy, Algeria has known two different periods. The first one is before 1986, where there was an oil boom; the state had the resources to provide employment, infrastructure and services through a centrally controlled planning system. Social indicators improved markedly and poverty was kept under control thanks to employment generation, investment in education, health and in basic infrastructure, and generous subsidies. The second period is witnessed by the collapse of oil prices in 1986 which made severe problems to continue with this generous social policy. The reforms introduced since 1986, although gradually, are increasing the number of the poor and the vulnerable. This is a beginning of a serious social crisis in Algeria.

Austerity measures at that time paved their way as dwindling exports were coupled with ever increasing external debt.

After 1990 many programs have been put forward to deal with the social crisis. Indeed, Algeria introduced many reforms since 1992 in order to better reach the poor by introducing a new system in 1993 that reached almost 60% of the population, and its cost was almost 2% of GDP.

In 1994, the IMF supported Stand By Arrangements had urged policy makers to go further in reforms aimed at improving its targeting by transforming one of the benefits into cash transfers to poor households unable to work.

According to these estimates the proportion of poverty as measured by the head count was 54% in 1966 which dramatically derides to 28% in 1980 ([Laabas, 2001](#)). According to [Laabas](#): "The decline in the degree of poverty continued through to 1988, where the head count decreased to just 16%. Per capita expenditure was further improved as higher oil windfalls after 1979 permitted to finance a consumer boom in the first half of the eighties. However, the prompt decline in oil price, the acceleration of inflation and the decline in per capita income pushed the proportion of poverty to 22% giving an increase of 38% between 1988 and 1995. This increase could have been even worse if the government lifted subsidies earlier than 1994. By applying the upper poverty line head count decreased from 71% in 1966 to 26.71 % in 1988 and then increased to 33.25% in 1995."

This situation remains unchanged during the following years (from 1995 to 2004). In fact studies show that the level of poverty is still high even compared with the neighbors' countries. [Benhabib et al \(2007\)](#) and using some multidimensional analysis of poverty in Algeria found that using the fuzzy set approach gives a higher percentage of poor, i.e 26.49 % while the Logit-

Probit gives 24.30 %, and applying the upper poverty line exhibits a lower percentage of 23.80%.

Algeria has gained too much after the oil boom starting from 1999. In fact it is a growth acceleration period, 1999–05, with high growth rates mainly associated with the oil price boom. In this period, the Algerian economy took off. Growth rates averaged 5 percent. Average inflation rates remained below 3 percent. The oil windfall helped other sectors reach high growth rates—construction, telecommunication, and other services. However the level of poverty did not benefit too much from this windfall and remained unchanged. Table (10) show that “Head Counts” of Income Poverty, 1990-2004 is 22,6% which is higher than Morocco and Tunisia. Moreover, if we have a look at the UNDP Poverty Index (“HPI-1”) for Selected Maghreb Countries in Table (11) we can see that Algeria is ranked 58 just above the GABON, whereas Tunisia is ranked 45. Clearly we can see that oil windfalls had not helped too much alleviating poverty in Algeria.

## 5. Conclusion

Our objective is to investigate for the impact of economic growth on poverty in Algeria. We can easily notice from these results, that the price of oil has a long-term effect on the money variable in Algeria. The cointegration and stationarity test results allow us to know the form of variables to include in the VAR model. In our case, the variables will be used to level terms with error correction.

Using a variance decomposition no significant impact could be attributed to oil prices and the volatility of these prices in the case of Algeria,. As a result, oil prices and volatility of these prices have no explanatory power for inflation, interest rate and money. There is a response to shocks in oil prices which is different from the shock of oil prices volatility.

The inability to find explanations for these observations led us to think in alternative. First, we have considered the form of the model chosen. In fact, we have used a VAR model to estimate the response functions and variance decomposition, or the previous studies were in favor an asymmetric relationship between oil prices (or the volatility of these prices) and other macroeconomic variables. Therefore, we have tested the non-linearity between variables using a MVTAR model

A second possible source of these anomalies is not taken into account in the design of several factors which is decisive in our study. Indeed, the social environment, security, and social infrastructure of Algeria have a large influence on the growth process. More recent studies show that the social infrastructure may be the key factor in explaining the development and growth. It was also noted that Most African countries suffer from bad governance and corruption.

As a result, we note that non-linear models can provide explanations on the relationship between oil prices and other variables. However, even with these explanations, this phenomenon is difficult to interpret. Therefore, we have tried to explore the relationship between oil prices and corruption in Algeria and with a comparative study with some African countries to clarify the mechanisms of the impact of these prices on economic growth in these countries.

Results show that there exists a significant correlation of 09.41 exists between oil prices and corruption, and another significant correlation of 09.28 between political stability and oil prices in the case of Algeria. Indeed, corruption is a major cause of bad governance in Algeria as well as is most all African Countries.

Last, Even if the oil windfalls have some small positive effects in the case of promoting growth and infrastructures, it has got a little effect on alleviating poverty in Algeria.

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*Table (1): Stationarity test results*

inflation				Interest rate				money			
Level		1st difference		level		Level		1st difference		level	
PP	KPSS	PP	PP	KPSS	PP	PP	KPSS	PP	PP	KPSS	PP
-1.7633	1.9982	16.9317	-1.7633	1.9982	16.9317	-1.7633	1.9982	16.9317	-1.7633	1.9982	16.9317
[0.7203]		[0.0000]	[0.7203]		[0.0000]	[0.7203]		[0.0000]	[0.7203]		[0.0000]

	level		1st difference	
	PP	KPSS		PP
oil	0.1190	0.7441	oil	0.1190
	[0.9974]			[0.9974]
v	-12.0635	0.2487	v	-12.0635

*Values between brakets are probabilities.*

*KPSS critical values for 1%, 5% and 10% are 0.739, 0.463 and 0.347 respectively*

***Table (2) : Summary of stationarity tests***

inf	I	M
I(1)	I(1)	I(1)

***Table (3) : Cointegration test results***

	CPI, I, M, oil	CPI, I, M	CPI, I, oil	CPI, M, oil	I, M, oil
R=0	103.3678 [0.0000]	47.6543 [0.0014]	42.3401 [0.0570]	70.2629 [0.0000]	66.3116 [0.0001]
R≤1	53.9857 [0.0028]	10.6669 [0.4184]	-	23.0822 [0.1070]	24.0557 [0.0827]
R≤2	27.1462 [0.0336]	-	-	-	-
R≤3	7.8508 [0.2641]	-	-	-	-

*Values between brackets are probabilities*

***Table (4) : Estimation results of the model GARCH(1,1)***

Parameter	Estimate	Standard error
$\beta_0$	-0.0148	0.0230
$\beta_1$	0.4542	0.0598
$\alpha_0$	0.0122	0.0032

$\alpha_1$	0.4885	0.0444
$\alpha_2$	0.6712	0.0217

$\bar{R}^2 = 0.1052$ ;  $SSE = 1.4865$ ;  $DW = 2.0073$ ;  $Q(6)=0.245$  ;  $Q(12)=0.233$  ;  $Q(24)=0.106$

*Table (5) : Variance decomposition results*

	$\Delta\text{oil}$				
	Forecast error	$e^{\text{cpi}}$	$e^i$	$e^m$	$e^{\text{oil}}$
$\Delta\text{cpi}$	3.8873	85.7741	5.2533	8.5205	0.4519
$\Delta i$	1.7217	9.5816	88.9247	1.3879	0.1056
$\Delta m$	77.6318	0.3150	9.2674	88.9571	1.4603
$\Delta\text{oil}$	4.3263	1.1231	1.0727	8.6244	89.1797

	$v$				
	Forecast error	$e^{\text{cpi}}$	$e^i$	$e^m$	$e^{\text{oil}}$
$\Delta\text{cpi}$	3.7965	87.5613	11.0354	1.3773	0.0253
$\Delta i$	1.7676	3.8141	95.9313	0.1987	0.0557
$\Delta m$	79.6932	0.0757	7.1928	92.3075	0.4238
$\Delta\text{oil}$	3.3522	0.3921	0.0296	0.0341	99.5440

Values between parentheses are standard errors.

*Table (6) : Linearity test results*

<i>Oil</i>				<i>V</i>			
Threshold estimate	M test for no threshold	bootstrap P-value	Chi squared value	Threshold estimate	M test for no threshold	bootstrap P-value	Chi squared value
2.545	163.502	<b>0.000</b>	2.9598E-03	0.348	55.5	0.622	3.459E-00

Values in Bold means the acceptance of the null hypothesis

**Table (7)** : control of corruption index

	199	199	200	200	200	200	200	200	200
Algeria	-	-	-	-	-	-	-	-	-
Angola	-	-	-	-	-	-1,3	-	-	-
Benin		-	-	-	-	-	-	-	-
Botswana	0,38	0,75	0,74	0,69	1,1	0,91	1,08	0,86	0,9
Burkinafaso	-	-	0	0,03	0,07	-	-0,2	-0,4	-0,4
Cameroon	-	-	-	-	-	-	-	-1	-
Cape Verde		-	0,18	0,36	0,32	0,35	0,38	0,6	0,76
Central African Republic		-	-1,3	1,09	-	-	-	-1	-0,9
Chad		-1	-	-	-	-	-	-1,2	-
Comoros		-	-1,1	-	-	-	-	-	-
Congo	-	-	-	-	-	-	-	-	-
Congo Democratique	-	-	-1,6	-	-	-	-	-	-
Cote d'Ivoire	0,38	-	-	-	-1	-	-	-	-
Egypt	0,06	-	-	-	-	-	-	-	-
Gabon	-	-	-	-	-0,5	-	-	-0,9	-
Gambia	0,37	-	-0,4	-	-	-0,6	-	-	-
Ghana	-0,5	-	-	-	-	-	-	-0,1	-
Guinea	0,37	-	-	-	-0,8	-	-	-1	-
Guinea Bisseau	-	-	-	-	-	-	-	-	-
Kenya	-	-	-	-	-	-	-	-	-
Libya	-	-	-	-	-	-	-	-	-
Madagascar	0,37	-0,4	-	0,11	0,12	-	-	-	-
Malawi	-0,5	-	-	-	-	-0,8	-	-	-
Mali	-	-	-	-	-	-	-	-	-
Mauritania		-	-	0,26	0,31	-	-	-0,6	-0,5
Mauritius		0,44	0,43	0,47	0,39	0,3	0,33	0,36	0,41
Morocco	0,22	0,13	0,06	-	-	-	-	-	-
Mozambic	-	-	-	-	-	-	-	-	-
Namibia	0,7	0,67	0,55	0,03	0,05	-	0,04	0,14	0,19
Niger	-	-	-	-	-	-	-0,8	-	-
Nigeria	-	-	-	-	-	-	-	-	-
Senegal	-	-	-	-	-	-	-	-	-
Seychelles		0,47	0,61	0,42	0,28	0,2	0,12	0,07	0,04
Sierra Leone	-	-	-	-	-	-	-	-1,1	-
Somalia	-	-	-	-	-	-	-	-	-
South Africa	0,62	0,64	0,56	0,35	0,35	0,44	0,54	0,44	0,32
Sudan	-	-1	-0,9	-	-	-	-	-	-
Togo	-	-	-	-	-	-0,9	-	-	-
Tunisia	-0,1	0,14	0,14	0,47	0,42	0,28	-	0,02	0,08
Uganda	-	-	-	-	-	-	-	-	-
Zambia	-	-	-0,9	-	-	-	-	-	-0,6

Zimbabwe	-	-	-	-1,2	-	-	-	-	-
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Source: World Bank Data  
**Table (8): Political stability index**

	1996	1998	2000	2002	2003	2004	2005	2006	2007
Algeria	-2,44	-2,33	-1,9	-1,88	-1,85	-1,48	-1,14	-1	-1,18
angola	-2,27	-2,23	-2,39	-1,41	-1,09	-0,95	-0,78	-0,44	-0,46
Benin	1,05	0,61	0,67	0,72	0,36	-0,04	0,29	0,39	0,38
Botswana	0,69	0,82	0,95	0,83	0,98	0,92	1,02	0,96	0,84
burkinafaso	0,04	-0,1	-0,09	-0,38	0,04	-0,21	-0,01	-0,08	0,09
Cameroon	-1,35	-0,77	-0,53	-0,65	-0,6	-0,6	-0,39	-0,31	-0,39
Cape Verde	1,05	1,05	1,08	0,65	0,97	1,11	0,73	1	1,01
central african	-0,2	-1,14	-1,32	-1,79	-1,44	-1,21	-1,14	-1,79	-1,78
chad	-0,74	-1,31	-1,36	-1,6	-1,23	-1,22	-1,32	-1,87	-1,97
comoros	1,05	0,47	-0,18	0,32	-0,57	0,02	-0,18	-0,2	-0,4
congo	-0,83	-2,04	-1,14	-1,28	-0,91	-1,09	-1,23	-0,97	-0,83
congo democratique	-1,88	-3,06	-2,64	-2,22	-2,19	-2,22	-2,32	-2,39	-2,26
cote d'ivoire	-0,14	-0,28	-0,86	-1,81	-1,89	-2,16	-2,45	-2,15	-2,12
Egypt	-1,07	-0,42	-0,36	-0,71	-0,83	-0,99	-0,92	-0,94	-0,77
gabon	-0,33	-0,04	0,29	0,1	0,16	0,19	0,08	0,13	0,2
gambia	0,11	0,62	0,47	0,68	0,37	0,25	0,24	-0,03	-0,14
Ghana	-0,18	-0,05	-0,21	-0,05	0	0,05	0,29	0,26	0,22
guinea	-1,42	-0,58	-1,79	-1,29	-0,61	-0,87	-1,1	-1,76	-2,02
guinea bisseau	-0,59	-1,79	-0,81	-0,7	-0,43	-0,34	-0,52	-0,41	-0,41
kenya	-0,67	-1,02	-1,09	-1,21	-1,27	-1,05	-1,19	-1,02	-1,1
libya	-1,76	-1,23	-0,69	-0,38	-0,24	0,03	0,18	0,26	0,47
madagascar	0,08	0,03	0,14	-0,24	0,44	-0,04	-0,02	0,07	-0,06
malawi	-0,25	-0,13	-0,56	-0,17	-0,2	-0,11	0,04	0	-0,01
mali	0,6	0,08	0,2	0,19	0,23	0,33	0,03	-0,03	-0,13
mauritania	0,56	0,22	0,1	0,18	-0,14	-0,13	-0,46	-0,13	-0,33
mauritiu	0,7	1	0,73	0,93	0,93	0,98	1,01	0,67	0,76
morocco	-0,61	0,11	-0,21	-0,32	-0,33	-0,43	-0,48	-0,32	-0,52
mozambic	-0,83	0	-0,01	0,29	0,1	-0,1	0,11	0,52	0,37
namibia	0,53	0,52	-0,3	0,23	0,35	0,56	0,58	0,81	0,9
niger	-0,03	-0,48	-0,15	-0,27	-0,14	-0,59	-0,39	-0,33	-0,55
nigeria	-1,63	-0,64	-1,58	-1,71	-1,65	-1,81	-1,63	-2,05	-2,07
senegal	-0,26	-0,94	-0,51	-0,42	-0,41	-0,1	-0,12	-0,27	-0,18
seychelles	1,05	0,99	1,15	0,83	0,6	0,76	1,16	1,08	1,01
sierra leone	-2,28	-2,18	-1,9	-0,93	-1,11	-0,38	-0,41	-0,46	-0,3
somalia	-2,3	-2,38	-2,48	-2,31	-2,32	-2,6	-2,64	-2,75	-3,01
south africa	-1,24	-0,83	-0,4	-0,42	-0,35	-0,22	-0,06	0,05	0,18
sudan	-2,58	-2,08	-2,39	-2,04	-2,13	-1,85	-2,12	-2,13	-2,3
togo	-0,54	-0,71	-0,17	0,02	-0,4	-0,43	-1,5	-0,7	-0,52
tunisia	0,16	0,28	0,25	0,1	0,16	0,1	0,07	0,33	0,1
uganda	-1,31	-1,27	-1,53	-1,66	-1,53	-1,42	-1,38	-1,29	-1,15

zambia	-0,51	-0,09	-0,39	-0,33	-0,11	0,08	0	0,31	0,24
zimbabwe	-0,6	-0,86	-1,44	-1,76	-1,61	-1,55	-1,55	-1,06	-1,3

Source : World Bank

Algeria	<b>0.941</b>	<b>[0.000]</b>	Gabon	-	[0.055]	Namibia	-	[0.298]
Angola	0.5579	[0.151]	Gambia	-	<b>[0.012]</b>	Niger	0.6514	[0.080]
Benin	0.3887	[0.341]	Ghana	<b>0.7092</b>	<b>[0.049]</b>	Nigeria	0.4936	[0.214]
Botswana	0.3795	[0.354]	Guinea	-	<b>[0.016]</b>	Senegal	-0.645	[0.084]
Burkinafaso	-	<b>[0.001]</b>	Guinea	-	[0.613]	Seychelles	-	<b>[0.006]</b>
Cameroon	0.3217	[0.437]	Kenya	0.4592	[0.252]	Sierra	-	<b>[0.035]</b>
Cape Verde	<b>0.8634</b>	<b>[0.006]</b>	Libya	-	<b>[0.037]</b>	Somalia	-	[0.270]
Central African	-	[0.674]	Madagascar	-	[0.854]	South	-	[0.312]
Chad	-	<b>[0.036]</b>	Malawi	-	[0.439]	Sudan	-	[0.151]
Comoros	<b>0.7881</b>	<b>[0.020]</b>	Mali	0.575	[0.136]	Togo	-	<b>[0.002]</b>
Congo	0.1502	[0.722]	Mauritania	-	<b>[0.038]</b>	Tunisia	-	[0.122]
Congo	<b>0.7708</b>	<b>[0.025]</b>	Mauritius	-	[0.264]	Uganda	<b>0.6572</b>	<b>[0.077]</b>
Cote d'Ivoire	-	<b>[0.028]</b>	Morocco	-	<b>[0.002]</b>	Zambia	<b>0.9292</b>	<b>[0.001]</b>
Egypt	-	<b>[0.000]</b>	Mozambic	<b>0.9007</b>	<b>[0.002]</b>	Zimbabwe	-0.673	[0.067]

**Table (9): Correlation between oil prices and corruption index**

**Table (10) : correlation between oil price and political stability**

Algeria	<b>0.928</b>	<b>[0.000]</b>	Gabon	0.419	[0.261]	Namibia	0.598	[0.089]
Angola	<b>0.854</b>	<b>[0.003]</b>	Gambia	-	<b>[0.010]</b>	Niger	-	[0.236]
Benin	-	[0.165]	Ghana	<b>0.855</b>	<b>[0.003]</b>	Nigeria	-	<b>[0.025]</b>
Botswana	0.403	[0.281]	Guinea	-	[0.092]	Senegal	0.650	[0.058]
Burkinafaso	0.341	[0.368]	Guinea	0.601	[0.086]	Seychelle	0.286	[0.454]
Cameroon	<b>0.696</b>	<b>[0.037]</b>	Kenya	-	[0.592]	Sierra	<b>0.810</b>	<b>[0.008]</b>
Cape Verde	-	[0.852]	Libya	<b>0.837</b>	<b>[0.005]</b>	somalia	-	<b>[0.000]</b>
Central	-	[0.162]	Madagasca	-	[0.673]	South	<b>0.852</b>	<b>[0.004]</b>
Chad	-	[0.443]	Malawi	0.593	[0.092]	Sudan	0.067	[0.863]
Comoros	-	[0.091]	Mali	-	<b>[0.046]</b>	Togo	-	[0.311]
Congo	0.497	[0.173]	Mauritania	-	<b>[0.016]</b>	Tunisia	-	[0.729]
Congo	0.215	[0.578]	Mauritius	-	[0.418]	Uganda	0.486	[0.184]
Cote	-	<b>[0.024]</b>	Morocco	-	[0.210]	Zambia	<b>0.794</b>	<b>[0.010]</b>
Egypt	-	[0.340]	Mozambic	0.595	[0.091]	Zimbabw	-	[0.668]

*Values between brackets are probabilities.*



**Table (11): National “Head Counts” of Income Poverty, 1999-2004**

*Country* *Percent of Population*  
*Poor*

Algeria	22.6%
Mauritania	46%
Morocco	19%
Tunisia	7.6%

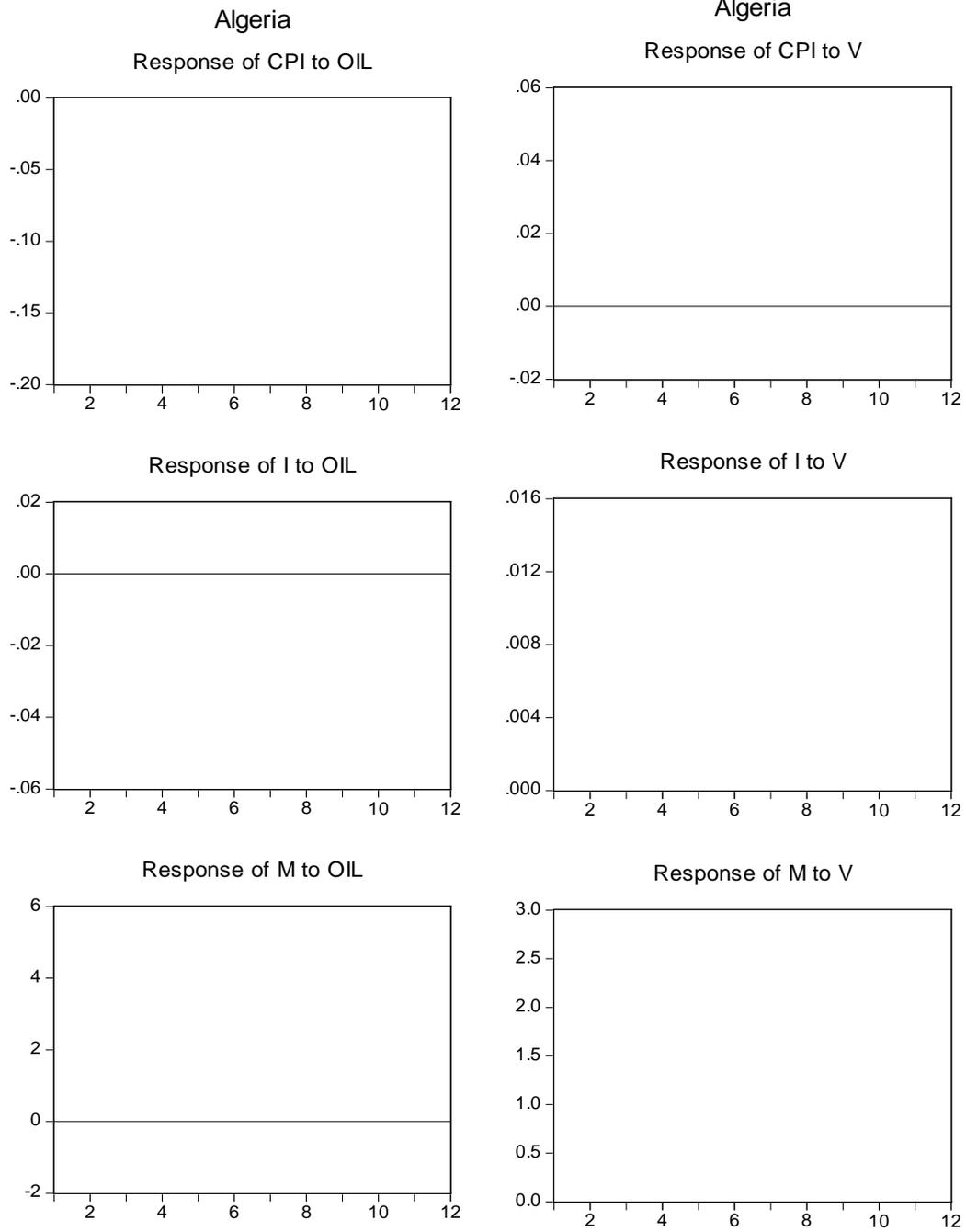
Source: UNDP

**Table 12****UNDP Poverty Index (“HPI-1”) for Selected Maghreb Countries**

<i>Country:</i>	<b>Algeria</b>	<b>Mauritania</b>	<b>Morocco</b>	<b>Tunisia</b>
<i>Rank Number:</i>	58	87	68	45
<i>Country Ranking Just Above:</i>	Gabon	Bhutan	Equatorial Guinea	Sri Lanka
<i>Country Ranking Just Below:</i>	Fiji	Congo (DR)	Sudan	Nicaragua

Source: UNDP

**Figure (1) :** Impulse response functions (VAR Model)



**Figure (2) : Impulse response functions (MVTAR model)**

Algeria (oil prices as a switching variable)

