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Abstract

In this paper we examine the interaction between oil-export revenue and long-run economic growth in Algeria during the period from 1979 until 2013. Our empirical analysis shows that oil revenue has a positive effect on economic growth. This means that resource abundance in itself, as proxied by oil revenue, has been a blessing for the Algerian economy and its growth and development. Our empirical findings also suggest that there is a negative relationship between oil revenue volatility and economic growth in Algeria. This finding confirms that the source of the resource curse is the high volatility existing in oil revenues, rather than abundance of oil in itself, which is consistent with the empirical results in Esfahani et al. (2012) and Mohadees and Pesaran (2013). Therefore, this study identifies that oil abundance in Algeria has been both a blessing and a curse, this is major reason why it is important for Algeria to diversify its economy and improve the quality of its institutions in order to benefit more from their natural wealth and offset the negative volatility effects of oil revenue.

JEL Classification: E2, Q3, O1

Keywords: Resource Curse, Oil revenues, Oil revenues volatility, Economic Growth, Cointegrated Vector Autoregression (VARX*), Algeria

ملخص

نبحث في هذه الدراسة التفاعل بين إيرادات تصدير النفط والنمو الاقتصادي على المدى الطويل في الجزائر خلال الفترة من عام 1979 حتى عام 2013. ويبين تحليلنا التطبيقى ان عائدات النفط لها تأثير إيجابي على النمو الاقتصادي. وهذا يعني أن وفرة الموارد في حد ذاته، والذي يتم استبداله من قبل عائدات النفط، كانت نعمة بالنسبة للاقتصاد الجزائري ونموه وتطوره. تشير النتائج التجريبية التي توصلنا إليها أيضا أن هناك علاقة سلبية بين تقلب عائدات النفط والنمو الاقتصادي في الجزائر. يؤكد هذا الاستنتاج أن مصدر لعنة الموارد هو ارتفاع معدل التذبذب الموجود في عائدات النفط، بدلا من وفرة النفط في حد ذاته، وهو ما يتسق مع النتائج التجريبية في أصفهاني وآخرون. (2012) ومحدث وبساران (2013). وبالتالي، فإن هذه الدراسة تحدد أن وفرة النفط في الجزائر كان بمثابة نعمة ونقمة، وهذا هو السبب الرئيسي بالنسبة للجزائر لتنويع اقتصادها وتحسين نوعية مؤسساتها من أجل الاستفادة أكثر من ثرواتهم الطبيعية و تعويضها عن آثار التقلبات السلبية لعائدات النفط.

1. Introduction

Many natural resource exporters, and specifically oil countries, are suffering from the Resource Curse. However, it has been observed for many decades that a large number of oil and mineral exporting countries in the Middle East, Africa, and Latin America record weak social and economic development, more corruption, lower equality, lower political liberty, and lower education and health compared to other countries that are less well endowed with such resources. This situation makes such countries cursed by their natural resources instead of being blessed. A wide number of explanations for this detrimental impact of natural resources have been advanced, namely: Dutch Disease, pro-cyclicality of fiscal policy, natural resource revenue volatility, and the weak quality of both political and economic institutions.

Moreover, the traditional resource curse literature argues that it is the level of resource abundance that negatively affects economic growth performance in resource abundant countries (Sachs and Warner 1995, 1997, 2001). While the recent resource curse literature, such as Leong and Mohaddes (2011), Cavalcanti et al. (2012), and Mohaddes and Pesaran (2013), provides evidence against the conventional resource curse literature and argues that the large volatility existing in the prices of natural resources, particularly oil, drives the resource curse paradox, rather than the level of such resources.

The present paper analyses the effects of oil revenues on the Algerian economy. Algeria is one of the major exporters of oil and gas in Africa. It is the 14th largest world exporter of oil, and is the sixth largest gas producer. As is the case with the majority of oil-exporting countries, Algeria has become dependent on oil as a main source of exports and government revenue. Hydrocarbons make up over one third of the Algerian GDP (49 percent in 2005, and 33 percent in 2012), over 98 percent of total exports, and over 60 percent of government revenues. The fact is that for more than four decades, no significant advances has been made to reduce this dependency on hydrocarbons - in the sense that since the 1970's, the economy of Algeria maintained the same characteristics, of an economy based primarily on the production and export of oil. Consequently, Algeria's economy has become subject to the high volatility of oil revenues, and the adverse effects of the resource curse. More specifically, this paper aims to answer the following questions: Is there any evidence of an oil curse in Algeria? And, does the abundance of revenues from oil exports in itself drive the resource curse paradox in Algeria, or is the real driver oil revenue volatility?

This paper is organized in seven sections, in addition to the introduction. Section two summarizes the theoretical framework of the resource curse and its main explanations. Section three offers an overview of key characteristic of the Algerian economy. Section four presents the theory based long-run output equation for Algeria, and the long run restrictions that can be tested, also this section describes the data and methodology employed in the empirical estimation. Section five presents the results and discussions. Section six investigate the link between volatility of oil revenues and growth performance of the Algerian economy. Section seven concludes and summarizes the main results and policy recommendations.

2. The Resource Curse: Theory and Literature Review

Natural resource abundance has traditionally been viewed as a positive determinant of economic development. The empirical support of this view dates back to the late nineteenth century, when a number of advanced nations endowed with natural resources, such as the United States, Britain, Canada, and Australia, experienced particularly rapid industrial development. However, since the 1960s, the experience of a number of resource-rich countries shows that resource abundance clearly does not always lead to sustainable economic development. Most recent studies have shown that developing countries with more natural resources tend to have lower rates of growth and tend to underperform economically and socially compared with resource poor countries. For example, many resource abundant

countries in Africa, the Middle East, and Latin America are experiencing weaker economic performance compared with resource deficient countries such as Japan, Korea, Singapore, Taiwan, and Hong Kong. This puzzling phenomenon became known as the Natural Resource Curse. In fact, The so-called "Natural Resource Curse" suggests that there exists a negative relationship between endowment with natural resources and social and economic development (e.g., Auty 1993; Sachs and Warner 1995, 1997, 2001).

The term "Resource Curse" was first used by Richard M. Auty (1993, 2001) to describe this paradoxical phenomenon of negative association between natural resource abundance and economic growth. Moreover, Auty found that countries with substantial resources not only failed to use their abundant natural resources to foster economic and social development, but they also exhibited a tendency to perform worse than those not similarly endowed.

Furthermore, theoretical literature and empirical studies have proposed a wide number of explanations for this puzzling phenomenon that affects countries with great natural resource wealth and undermines their abilities to achieve sustainable growth and development.

(i) The earlier explanation of the resource curse and the most famous one was the Dutch Disease Theory (Corden and Neary, 1982; Corden, 1984; van Wijnbergen, 1984; Neary and van Wijnbergen, 1986). As is well known in the literature, the Dutch Disease phenomenon was first observed in the Netherland in the 1960s, when the discovery and exploitation of large reserves of natural gas in the North Sea led the real exchange rate to rise, negatively affecting the Dutch agricultural and manufacturing export sectors, and thus lowering overall economic growth.

As Corden (1984) suggests, Dutch Disease adversely affects economic growth through two channels. First, the appreciation of a country's real exchange rate (as the relative price of non-tradables to tradables) caused by a rise in the global price of the resource; and second, the shift of mobile factors (capital and labor) out of country's manufacturing and agricultural sectors toward the booming resource sector leading to a decline in manufactured exports.

As a consequences, combined these effects hinder the manufacturing sector, which is perceived as the main driving force of economic growth, because, as shown by Sachs and Warner (1997), manufacturing is characterized by larger positive externalities in production than other forms of economic activity and thus the shrinkage of this sector caused by the Dutch Disease can lead to a decline in growth.

(ii) Recent studies on resource abundance and economic growth have presented evidence to suggest that the major problems created by the abundance of particular resources are mostly related to the quality of institutions (e.g., Tornell and Lane, 1999; Acemoglue et al., 2005; Ross, 2012). For instance, Fernanda Brollo and others (2010) argue that the windfall of natural resources can have further adverse effects on economic performance in resource rich developing countries because they worsen the functioning of institutions and deteriorate the quality of political elites. Barro (1999) and Leite and Weidmann (1999) demonstrated that resource abundance, particularly fuel and ores, increase rent seeking measured by the level of corruption, and that corruption in turn hampers economic growth. Sala-i-Martin and Subramanian (2003) found that the abundance of point sources natural resources has an indirect negative impact on growth through the quality of institutions. Furthermore, the authors also argued that the abundance of oil has a negative and significant effect on the rule of law as a measure of institutions. The resource curse literature also contains a number of studies that suggest that natural resource wealth tends to favor civil conflict and influences its duration and intensity (Collier and Hoeffler, 1998).

The empirical support for this view, referred to as the resource curse thesis was originally provided by Sachs and Warner in their seminal research first published in 1995. Sachs and Warner (1995) analyzed the association between resource abundance and economic growth,

where they have shown that "*Economies with a high ration of natural resource exports to GDP in 1971 tended to have low growth rates during the subsequent period 1971-89*." In their paper, Sachs and Warner found that resource abundance is negatively correlated with growth. They empirically demonstrated that an increase of one standard deviation in natural resource intensity leads to a reduction of about 1% per year in growth, even after controlling for other determinant variables of growth, such as initial per capita income, trade policy, government efficiency, and investment rates. Since then, a sufficiently large body of empirical work on these question, such as Gelb (1989), Sachs and Waner (1999, 2001), Gylfason, (2001), Ross (2001), Sala-i-Martin and Subramanian (2003), Paul Stevens (2003), Karl Terry Lynn (1997) and others, have confirmed Sachs and Warner's results about the inverse correlation between economic growth and the presence of abundant deposits of natural resources.

While there is strong theoretical and empirical evidence that points that the curse of natural resources exists, many economists argue that the so called resource curse thesis does not exist and arrive at results that outright contradict this puzzling phenomenon (i.e., they argue that resource abundance positively affects economic growth). Thus, several recent empirical studies (such as: Arezki and van der Ploeg, 2007; Brunnschweiler and Bulte, 2008; Cavalcanti et al., 2011a; Cavalcanti et al., 2011b; Leong and Mohaddes, 2011; and Esfahani, Mohaddes and Pesaran,2012), using alternative methods and models, find considerable support for the view that resource wealth is associated with positive growth. This emerging literature has argued that the methodological approaches used for testing the resource curse thesis, particularly the homogenous panel data techniques, impose a high degree of homogeneity that can produce very misleading estimates of the values of the parameters when applied for estimating the nexus between growth and resource abundance, because the growth process for resource abundant economies exhibit substantial differences (Cavalcanti, Mohaddes & Raissi, 2011a).

Using a heterogeneous panel data approach in a panel of 53 oil exporting and importing countries over the period 1980 to 2006, Cavalcanti et al. (2011a,b) show that there is a long-run relation between real income and oil production. Moreover, the authors conclude that oil abundance often has a positive effect on short-run economic growth and long-run income levels, and they completely reject the common view that oil abundance affects economic growth negatively. Further Cavalcanti et al. (2011a,b) suggest that oil dependent countries could benefit more from their oil wealth by enhancing their institutional framework.

Esfahani, Mohaddes and Pesaran (2012) empirically test the validity of their long run output equation on eight large oil exporting countries (Iran, Kuwait, Libya, Nigeria, Saudi Arabia, Venezuela, Norway and Mexico) with varying levels of development experiences and institutional quality, using cointegration vector autoregressive error correction model (VARX) analysis augmented by a foreign output variable. The results obtained by the researchers support their theory and the existence of a long-run relation between real domestic output, real oil income and real foreign output for all oil countries under consideration except for Norway and Mexico. The authors show that in the case of Norway and Mexico their oil reserves are low compared to the other major oil exporters, and the revenues from oil has not been sufficiently dominant in these economies.

In addition, Mohaddes and Pesaran (2013) and Esfahani et al. (2012b) argue that resource wealth itself is not necessarily harmful for growth and development, and that the curse lies in volatility existing in the prices of oil and other minerals products and the adverse political and institutional implications. These results are in line with the findings of other studies, such as Arezki and Gylfason (2011), Van der Ploeg and Poelhekk (2008), and Jeffry Frankel (2012) whose results argued that the high volatility of natural resource prices represents an important transmission mechanism for the "resource curse," and that volatility increases the volatility of both government expenditures and the exchange rate in high rent countries.

In short, the more recent empirical literature on resource abundance and economic growth seems to dismiss the view that resource abundance is a curse on economic performance, and argues for a positive relationship between resource revenues and economic growth and development. Using appropriate macro-econometric models, this emerging literature argues that while the level of resource abundance affects economic growth positively, the volatility of commodity prices affects it negatively.

3. Algeria: Oil Dependence and Failed Diversification

A large number of studies suggest that the great challenges facing most oil producing countries are to overcome their dependency on oil and to diversify their economies. However, Algeria, like many other well-endowed countries, has totally failed to competitively diversify the economy away from hydrocarbons - despite the multiplicity of economic reforms and the substantial amount of revenues allocated to the economy. In fact, the resource curse literature links the failure of development in the majority of developing natural resource abundant states, like Algeria, to the weakness of their institutions and governance. Whether or not that is the fundamental reason, there is no doubt that Algeria's institutional environment has several shortcomings.

3.1 Algeria: The structural dependence on hydrocarbons

Algeria is one of the major exporters of oil and gas in Africa. It is the 14th largest world exporter of oil, and is the sixth-largest gas producer. Algeria's proven crude oil reserves are estimated at 12.2 billion barrels, as of January 1, 2013, which is equivalent to about 20 years of current production. Algeria's proven natural gas reserves are estimated at about 159.1 trillion cubic feet (Tcf) as of January 2013 - the ninth largest natural gas reserves in the world and the second largest in Africa. According to US Energy Information Administration, Algeria also holds vast unexploited shale gas resources located in eastern Algeria in Ghadamas Basin.

Since its independence in 1962, Algeria has reaffirmed its intention to use its oil revenues to finance its economic development strategy. Thus, the role of the hydrocarbons sector has been particularly crucial in generating resource rents to fund growth and development. Indeed, the hydrocarbons sector is the locomotive of the Algerian economy and the contribution of oil sector in GDP has not ceased to rise - jumping from less than 15% in 1969 to more than 43.6 % in 2011. As Figure 1 shows, during the years of oil windfalls in the1970s and early 1980s, high hydrocarbon revenues substantially contributed to the increases in real GDP. As the sharp decline of oil prices during 1984-1987 led to a brutal reduction in Algeria's oil revenues, real GDP followed suit. On the other hand, given the significantly higher level of oil revenues as a result of the oil windfall from the beginning of the 2000s, Algeria has recorded a relatively higher growth.

Furthermore, public investment has played an important role in economic development since Algeria's independence in 1962 and more recently after the extraordinary oil windfall in the early 2000s.

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

However, the substantial public investment efforts lunched by the government have enabled Algeria to maintain respectable levels of economic growth since 2002. In parallel, the unemployment rate fell by half in five years - from 30 percent in 2001 to 15.3 percent in 2005 and 10 percent in 2012. Since 1996, the annual inflation rate decrease from 22 percent to 4.5 percent in 1997 and 4 percent in 2012. Due to the significant accumulation of foreign exchange reserves, at the end of 2006, acceleration of advance payments enabled the government to reimburse more than USD 10.5 billion of their external debt. These repayments brought a substantial reduction in Algeria's external debt, from USD 17.19 billion in 2005 to less than USD 5 billion at the end of 2012 (see Table 1).

As shown in Table 1, large public investment in all sectors of the economy has helped drive significant growth rates, and contributed to reduction in unemployment during this decade. However, compared to the volume of investment during this same period, the contribution of public investment to economic growth seems lower than expectations for the country. Algeria has invested average annual rates of 10 percent of GDP to get less than 4.5 percent as an average annual rate of growth between 2001-2007. This poor contribution of public expenditure in economic growth confirms that not all the investments undertaken in Algeria in this period were productive, and also confirms that Algeria loses more than 5 percent of the value of its economy annually.

With regard to the enormous financial resources allocated to the different sectors of the economy under the public investment programs for 2001-2014, the Algerian economy is still poorly diversified, and the contribution of the non-oil sector in total GDP remains weak compared to the hydrocarbon sector.

3.2 Algeria: The failed economic diversification

The most important challenge facing the Algerian economy since independence has been its excessive and increasing dependence on the hydrocarbon sector. Despite the multiplicity of economic reforms pursued by successive Algerian governments - since independence - to diversify the economy away from the oil and gas sectors, the Algerian economy maintains the same characteristics of an economy that is dependent primarily on the production and export of oil. Consequently, all these efforts have failed to establish a sustainable economy and to promote private-sector led, non-hydrocarbon growth. Today, Algeria's economy is among the least diversified in the world. In the late 1960s and early 1970s, Algeria's non-hydrocarbon exports represented 40 percent of total exports; in recent years, they barely exceeded the symbolic level of 3 percent and remain too weak (Figure 2).

In Algeria, the structural dependence on hydrocarbons is the result of the failures of reform policies, notably in terms of post-independence agricultural reforms, the vast industrialization program launched by the government in the 1970s and early 1980s, and the privatization process for government-owned enterprises under the structural adjustment reforms in the 1990s. The failure of these attempts to integrate the Algerian economy into the world economy can be attributed for the most part to political opposition to economic reforms, bad governance and rent seeking behavior (Auty, 2003, Hakim Darbouche, 2011).

4. Long-Run Estimates and Tests

In this section, we apply the econometric techniques described in Pesaran et al. (2000) to the VARX* model. The first stage in our analysis is to establish the order of integration of the variables, then we select the order of the VARX* using AIC and SBC and we carry out the cointegration tests. Having decided the number of cointegrating vectors, we estimate the exact-identified model and test the validity of the over-identified, long-run restrictions. Finally, we examine the short term dynamics using persistence profiles and generalized impulse response functions.

4.1 Unit root test results

Cointegration VARX analysis necessitates that the variables under consideration be integrated of the same order. Hence, it is necessary to investigate the order of integration of the individual time series before cointegration analysis. In this study three types of unit root tests are conducted : Augmented Dickey-Fuller (ADF) test, the generalized least squares version of the Dickey-Fuller test (ADF-GLS) proposed by Elliott et al. (1996), and the weighted symmetric ADF test (ADF-WS) of Park and Fuller (1995). The Schwarz Bayesian Criterion (SBC) is used to select the order of the ADF regression. The results of the tests are presented in Table (2).

Since the variables (y_t , $e_t - p_t$, y_t^* , xo_t) are trended, only the ADF statistics for models with an intercept and models with an intercept and linear trend are relevant; while, for the first differences of these variables we include only the ADF statistics for models with an intercept.

The evidence in the table indicates that according to both the ADF, ADF-GLS and ADF-WS unit root tests, the four variables (y_t , $e_t - p_t$, y_t^* , xo_t) are non stationary at the levels and are stationary after first differencing.

4.2 Order Selection and Deterministic Components

Before proceeding to the cointegration test of long run relationship, we have to determine the lag orders of endogenous and exogenous variables s and s* respectively, in the VARX(s, s*) model outlined in equation (1). For this purpose, the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC) are applied to the underlying unrestricted VARX model, setting the maximum lag orders to $s_{\max} = 4$ and $s^*_{\max} = 2$. The results are summarized in Table 3.

Schwarz Bayesian Criterion (SBC) selects the order 2 for both endogenous and exogenous variables s=s*=2, while Akaike Information Criterion (AIC) selects the order 3 for the endogenous variables and 2 for the exogenous variables. We follow SBC and we base the VARX(2,2) in the cointegrating VARX analysis that follows.

4.3 Long-run relationship and restriction tests

Having established the order of the VARX to be (2,2), the next step is to test for possible cointegration between the variables. The cointegration VARX model contains two domestic variables (y_t , $e_t - p_t$), and two foreign variables (y_t^* , xo_t). Following Pesaran, et al. (2000), the modified Johansen-Juselius (1992) cointegration test is conducted using two test statistics for testing the number of cointegrating vectors: the trace and the maximum eigenvalue statistics. The results from the cointegration test are presented in Table 4.

Both the trace and the maximum eigenvalue statistics indicate the presence of one cointegrating vector at 5 and 10 % significant level. Such results are in line with the findings of Esfahani et al. (2012) whose empirical results support their theoretical model and the existence of a long-run relation between real domestic output, real oil income and real foreign output for major oil exporting countries.

In order to exactly identify the long-run relation of Algeria's output equation, we impose exact identifying /normalized restriction ($y_t = -1$). The results of estimated VARX model subject to the above restriction are reproduced in Table 5.

For the long-run output equation, the coefficients on oil revenues (xo_t), real exchange rate ($e_t - p_t$), and foreign output (y_t^*) are statistically significant and carry the expected positive sign.

Using the above exactly identified model, we proceed to test for additional hypotheses using over-identifying restrictions.

First, we test the co-trending restriction (that is whether the trend coefficient is zero in the cointegrating relation). However, given the small size of the sample, the bootstrapped critical values based on 1000 replications of the LR statistic are computed (Esfahani et al., 2012).

The test results in Table 6, hypotheses (a) indicate that the LR statistic (4.9854) is below its bootstrapped critical value at the 95 and 99 percent significance level (6.1056, 9.8858) respectively. Therefore, the co-trending restriction on cointegrating relation cannot be rejected for Algeria.

Secondly, we maintain the co-trending restriction ($\gamma_y = 0$), and we impose the additional theory restriction suggests that real exchange rate ($e_t - p_t$) and oil revenues (xo_t) enter the long-run output equation with the same coefficients, that is $\psi_2 = \psi_3 = \alpha$. The test results are summarized in Table 6, hypotheses (b). The LR statistic for testing these restrictions is 6.48, which is well below the bootstrapped critical values of 9.04 at the 5 percent level and 13.27 at the 1 percent level. Consequently, the over-identifying restrictions of $\gamma_y = 0$ and $\psi_2 = \psi_3$ cannot be rejected both at 1 and 5 percent significance levels. However, the implicit estimate of θ computed as $[0.15/(1-0.65)] = 0.43$ is significantly less than the one, which means that the technological growth in Algeria is less than that of their major trading partners, suggesting inefficiency and partial diffusion of advanced techniques for the Algerian economy in the long-run.

These estimates are in line with the findings of Esfahani et al., 2012, whose results stressed that the value of θ is below unity for the five major oil exporting countries under consideration (Kuwait, Libya, Nigeria, Saudi Arabia, and Venezuela), except for Iran where the value of θ exceed the unity. The authors related weak diffusion of technology to the widespread rent seeking activities in these countries. In Algeria, value of $\theta = 0.43$ seems plausible, and reflects the extent to which Algeria's economic sector is particularly affected by rent seeking behavior.

Finally, we impose that $\theta = 1$, that is the technological progress in Algeria is on par with that of their major trading partners. The results are summarized in Table 6, hypotheses (c).

Imposing this restriction on the long-run output equation leads to substantial decline in the estimate of α , a large increases on the foreign output coefficient, and results in small increases in the LR statistic. This result suggests that higher technological progress in Algeria (similar to that of the rest of the world) reduced the dependence of the Algerian economy on hydrocarbons revenues.

4.4 Short-run dynamics

In what follows we examine the short-term dynamic responses of the Algerian economy to shocks in oil exports and foreign output. In particular we use Generalized Impulse Response Functions (GIRFs), as they are invariant to the ordering of the variables in the VARX model (Pesaran and Shin, 1998). However, before considering the impulse response analysis, we consider the Persistence Profile analysis developed by Pesaran and Shin (1996). The value of

this profile is equal to unity on impact, but must tend to zero as $N \to \infty$, if the long run relationship is cointegrating. Further, the Persistence Profile provides useful information about the speed with which the economy under consideration returns to its equilibrium in response to shocks.

Persistence profile

Figure 3 shows the plots of the persistence profile for the long-run relation. As can be seen, following a system wide shock the output equation converges towards zero, which confirms the cointegrating properties of the long-run relationship. This profile clearly shows that Algeria's output equation relation reverted to its equilibrium after five years following the initial shock. The speed of convergence to the equilibrium for the Algerian economy seems to be consistent with what was reported for Saudi Arabia and Nigeria (3-4 years), and slower than that of Kuwait and Venezuela (around 2 years); see Esfahani et al. (2012a).

However, in Algeria the slower speed of convergence in the aftermath of shocks reflected the heavy reliance of the Algerian economy on the revenues that are generated by the export of oil, and the lack of economic diversification.

Generalized Impulse Responses

According to Pesaran and shin (1998), Generalized Impulse Response Function (GIRF) are of great importance for shocks to the exogenous variables. In our model we consider the shock on oil export revenues (xo_t). Figure 4 gives the GIRF's of the two exogenous variables, namely domestic output and real exchange rate to a positive unit shock (equal to one standard error) to oil export revenues.

As can be seen, a shock to oil revenues leads to a significant increase in Algeria's real output by approximately 9 percent, which implies that oil abundance is a blessing for Algeria's economic growth - a pattern that is in contrast with the resource curse paradox, generally used to describe the negative association between natural resource and economic growth in resource rich countries.

The real exchange rate significantly appreciates by around 8 percent in the aftermath of oil revenues shock - a pattern consistent with the Dutch Disease phenomenon, which refers to the appreciation of a state's real exchange rate due to a sharp increase in exports of oil. This appreciation, in turn, diminishes the competitiveness of the manufacturing sector - thus reducing economic growth. However, our results indicate that a positive shock in oil revenues appreciates the real exchange rate and increases the level of real output - a result inconsistent with the Dutch Disease view, and similar to those reported for Iran in Esfahani et al. (2009).

Indeed, these results indicate that oil abundance itself is not harmful for growth and development, and that it may be the volatility existing in the prices of oil that transforms oil abundance into a curse rather than a blessing, as argued in several studies.

5. Oil Revenue Volatility and Economic Growth in Algeria

Unlike the traditional resource curse and the implied negative effect of resource abundance on economic growth, our empirical analysis shows that there is a strong positive association between oil revenues and long-run growth in Algeria's economy - a result in line with the empirical analysis of Esfahani et al. (2012a,b). However, a number of recent studies in the literature, such Leong and Mohadees (2012) and Mohadees and Pesaran (2013), argued that the source of the resource curse is the high volatility of natural resource prices, rather than the level of the resource abundance.

In this section, we investigate the link between volatility of oil revenues and the growth performance of the Algerian economy. For this purpose, we use the squared oil revenues series

$(DLOG(xo_t)\text{^}2)$ as a proxy of realized volatility. Figure 5 plots realized volatility of oil revenues from 1974 to 2013.

As can be seen from figure 5, high revenue volatility was observed between the first positive oil price shock of 1973 and the crash of 1986; in 1990-1991 with the second gulf war, when oil prices saw a positive shock; and during the global financial crisis of 2008-2009, the longest US recession since the great depression, which led to a reduction in the world demand for oil and, as a result, oil price collapsed.

To check whether oil revenue volatility is a curse for Algeria, we plot the correlation between annual observations on real GDP per capita growth and oil revenue volatility for the period 1974-2013. Figure 6 shows a scatter plot between the two variables. The graph generally shows a negative correlation between them, which implies that oil revenue volatility could hinder economic growth. Also, we can see from figure 6 that there is a positive correlation between oil revenue growth and output growth. These results are generally consistent with the recent literature on the resource curse hypothesis (Leong and Mohaddes, 2011; Cavalcanti et al., 2012; and Mohaddes and Pesaran, 2013), and confirm that the source of the resource curse is the high volatility existing in oil revenues, rather than abundance of oil in itself.

However, economists suggest that oil abundant countries can overcome the curse of oil by enhancing the institutional environment in the management of oil revenues. Cross-country studies also suggest that sound institutional frameworks seem to help in overcoming the resource curse. Such literature therefore argues that political and institutional reforms towards democratic and good governance in resource abundant countries must precede economic policy reform (Rosser 2007). Most recently, the IMF documented that countries rich in oil resources and poor in political governance and institutions pay a substantial costs for their lack of transparency and accountability. One example of these countries is Angola. More than US$1 billion of Angola's state oil revenues are reported missing from government accounts each year due to corruption (Global Witness, 2002). Moreover, Arezki, Hamilton, and Kazimov (2011) argue that transparency and accountability, are a critical component for improving the quality of institutions responsible for the management of natural resources.

In the last ten years, the IMF, the World Bank and a number of international nongovernmental organizations (such as Global Witness, Human Rights Watch, and the Revenue Watch Institute) have contributed heavily to promoting transparency, accountability and civil society participation in the management of revenues of resource abundant economies, through many international transparency initiatives (the Extractive Industries Transparency Initiative (EITI) is one of such initiatives).

Furthermore, some economists have also recommended the use of stabilization funds – referred to as oil funds in oil rich economies. In general, these funds aim at reducing the impact of resource price volatility on the economy and, in turn, counteract the tendency of government expenditure to be pro-cyclical. One other aim of such funds is to prevent corrupt political elites and those in the upper echelons of government from using resource revenues on their behalf or for the purposes of political-business cycle.

Algeria has implemented some of these policies, but has failed in important ones.

In order to improve the institutional environment, the Algerian government has launched many procedures. For fighting corruption more effectively, in 2006 the authorities adopted an anti-corruption law (Law No. 06-01 on the Prevention and the Fight against Corruption) to combat corrupt political and economic practices, reinforce existing anti-corruption legislation, and conform domestic legislation to the United Nations convention against corruption (which Algeria ratified in 2004), as well as facilitating international cooperation with Interpol against this scourge. The new law aimed at enhancing transparency in government and public

procurement, combating the illicit enrichment of public officials and obligating all public agents to declare their patrimony. Also, the new law highlights the important role of the civil society, including the media, through informing and increasing public awareness, and promoting civil society participation in the management of public affairs. Moreover, the new law called for the creation of a special anti-corruption agency. In August 2010, the Government of Algeria created the National Commission for the Prevention and Fight Against Corruption as part of an overall national strategy to battle corruption.

Despite the creation of this anti-corruption commission, and the passing of several commitments and laws, there are still serious shortcomings in enforcing such measures, due to the high inefficiency of Algeria's judicial system. According to some NGO's, such as the World Economic Forum (WEF) and Human Rights Watch, the Algerian judicial system is subject to political inference and the influence of officials and influential individuals. The WEF's Global Competitiveness Report 2012-2013 ranked Algeria 126th out of 139 countries on the independence of the judiciary, below neighboring countries in North Africa.

In addition, transparency is another important recommendation to overcome the curse, which Algeria has largely failed to achieve. According to the Open Budget survey, which assesses whether governments give the public access to information, Algeria's OBI in 2012 was 13 out of 100, which is well below the average score of 43 for all the 100 countries surveyed - this score indicates that Algeria's government provides the public with scant information on the government budget and financial activities, which makes it difficult for the public to oversee the government's management of public money.

To avoid pro-cyclicality of government expenditures, and achieve fiscal sustainability, Algeria has established a set of measures. A conservative referential oil price has been used in budget formulation, and between 2000 and 2005 the budget reference oil price has been US$19 per barrel and US$37 between 2008 and 2010, although average oil prices were in fact above US$45 per barrel in 2005 and US$60 in 2010. In this context, any increase in oil tax revenue above the budget benchmark oil price goes to the hydrocarbon stabilization fund (*The Revenue Regulation Fund),* which was established by the government in 2000 to shield government expenditures from fluctuations in oil revenues and prices.

However, and despite these procedures, government has failed to reduce dependence of the national budget on oil revenue, and therefore, the pro-cyclical bias of government spending continues.

6. Conclusion

The main purpose of this paper was to study the association between oil exports revenue and economic growth in Algeria. Following Esfahani et al. (2012), we have provided a cointegrating VARX* analysis of the Algerian economy. Our empirical results support the existence of a positive long-run relation between domestic output and oil exports revenue. This means that resource abundance in itself, as proxied by oil revenues, has been a blessing for the growth and development of the Algerian economy. Moreover, the short-run analysis using Generalized Impulse Response Function illustrated the importance of oil revenues shock for the Algerian economy.

However, our empirical findings also suggest that there is a positive correlation between oil revenue growth and real GDP per capita growth, but a negative relationship between oil revenues volatility and economic growth in Algeria. This finding confirms that the source of the resource curse is the high volatility existing in oil revenues, rather than abundance of oil in itself, which is consistent with the empirical results in Esfahani et al. (2012) and Mohaddes and Pesaran (2013).

Two conclusions can be drawn from the above results. First, the positive association between hydrocarbon abundance and economic growth reflects the heavy dependence of the Algerian economy on hydrocarbons revenues. Thus, in the event of a fall in oil prices the outcome is likely to be the same as the crisis experienced in 1986, or worse. The fall in government revenues from 13 billion US dollars to around 8 billion US dollars during 1985 and 1986 oil crisis, forced the Algerian government to cut back on public spending. This created social problems and led to political instability. As a result, this positive correlation between the two variables is not necessarily a blessing and may be a curse at any time. Second, in Algeria the abundance of oil resources has exacerbated institutional weaknesses. That is why it is important for Algeria to enhance its economic and political institutions if it wants to diversify its economy away from hydrocarbon sector. In fact, diversifying Algeria's economy is not an impossible task, with regard to the huge potential that the country has. However, before becoming an oil exporting country, Algeria had an important agricultural sector - it was the "Breadbasket" for the Roman empire during the Roman times, and was supplying many Mediterranean countries with agricultural goods. Even during the French colonial period, Algeria's agricultural exports comprised a large share of total exports. For example, in 1959, agricultural exports represented nearly 61% of total exports, while petroleum and mineral exports reached only 12% of total exports (World Bank, 1964). Furthermore, the scope of diversification of the Algerian economy should include: the development of the manufacturing industries, financial sector, in addition to the service and tourism sectors, which play a positive role in export diversification. However, the development of these sectors of the economy requires the existence of strong institutions. Thus, the institutional environment in Algeria should have more focus from the policy maker. This means that Algerian government should accept the reform of the country's institutional framework. Specifically, this means fighting corruption, cronyism, increasing the state's efficacy, and reforming justice.

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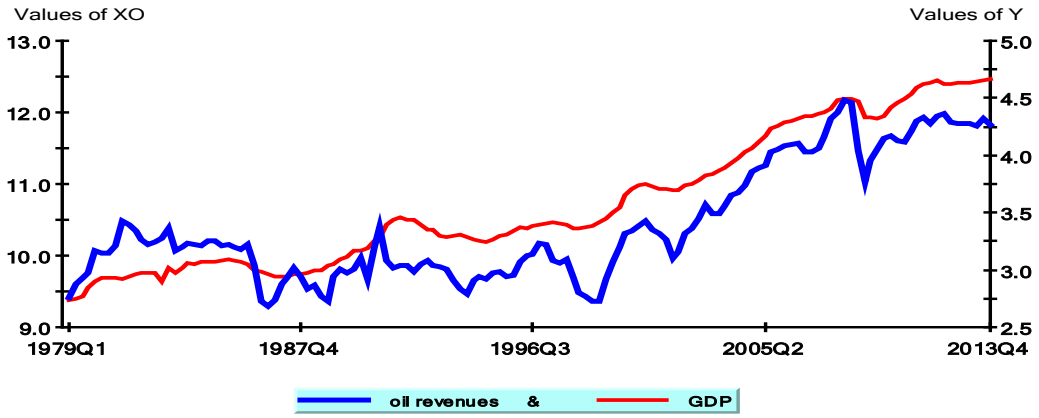
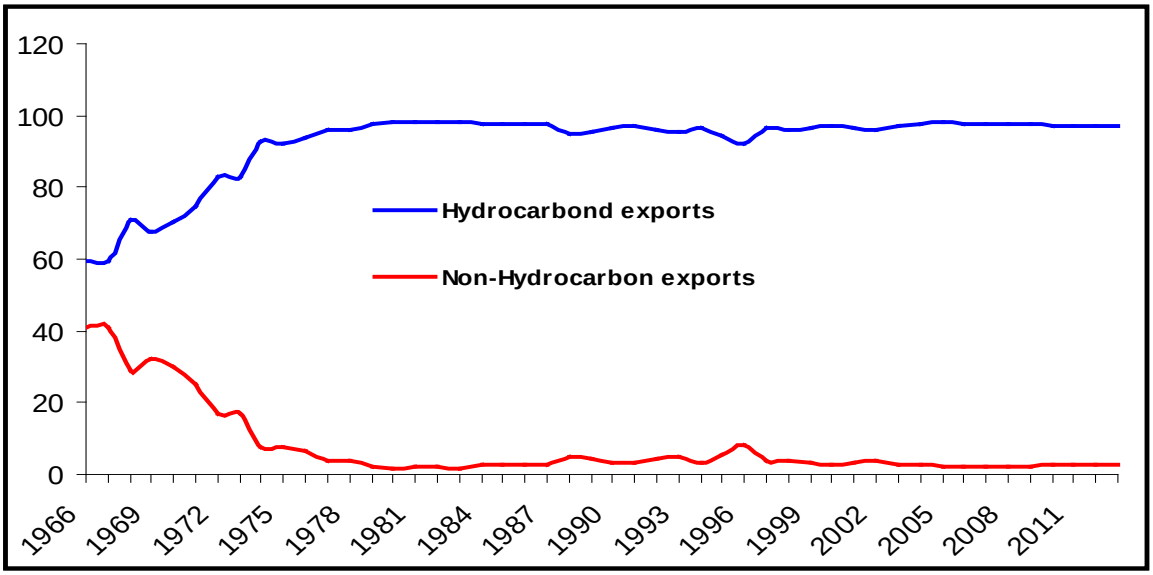
Figure 1: Oil Export Revenues (xo) and Domestic Output (y)



Source: World Bank data

Figure 2: Algerian Exports 1966-2013 (Percent of Total Exports)



Source: World Development Indicator database

Figure 3: Persistent Profile of the Effect of a System-Wide Shocks to the Cointegrating Relation

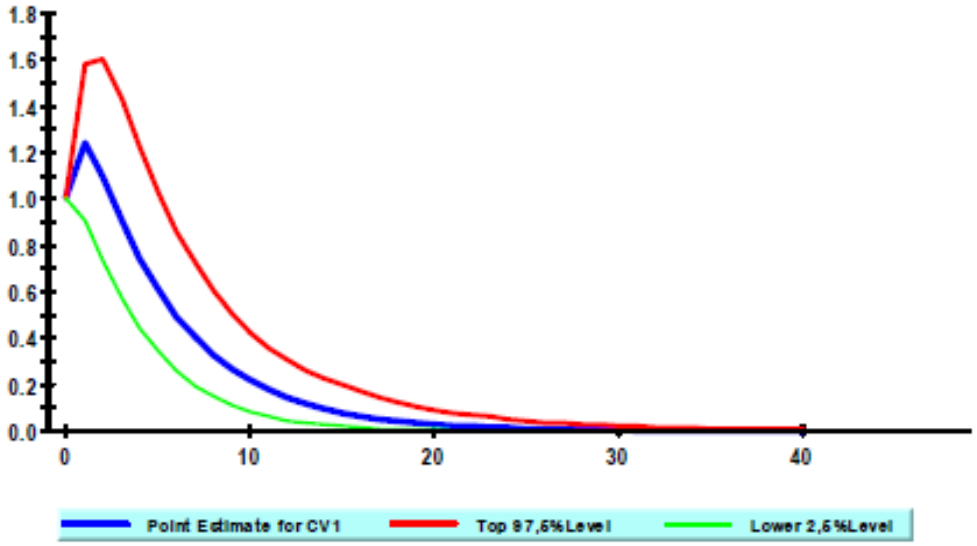
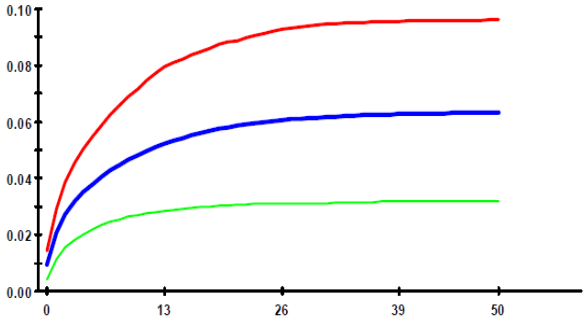


Figure 4: Generalized Impulse Responses of A Positive Unit Shock To Oil Export Revenues

Domestic output (y)



Domestic real exchange rate (ep)

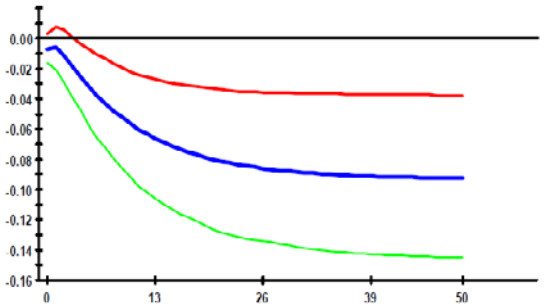


Figure 5: Realized Volatility of Oil Revenues (1974-2013)

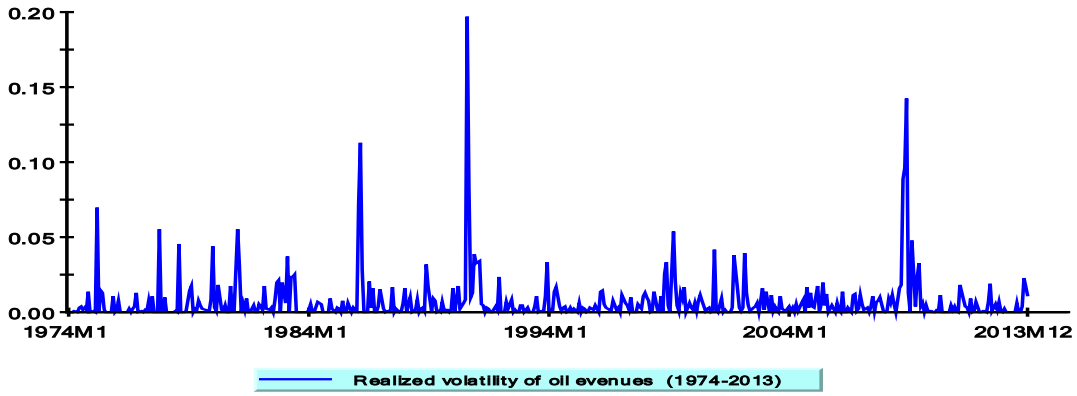


Figure 6: Scatter Plots of Oil Revenue Growth and Oil Revenue Volatility Against Real GDP Per Capita Growth, 1974-2013

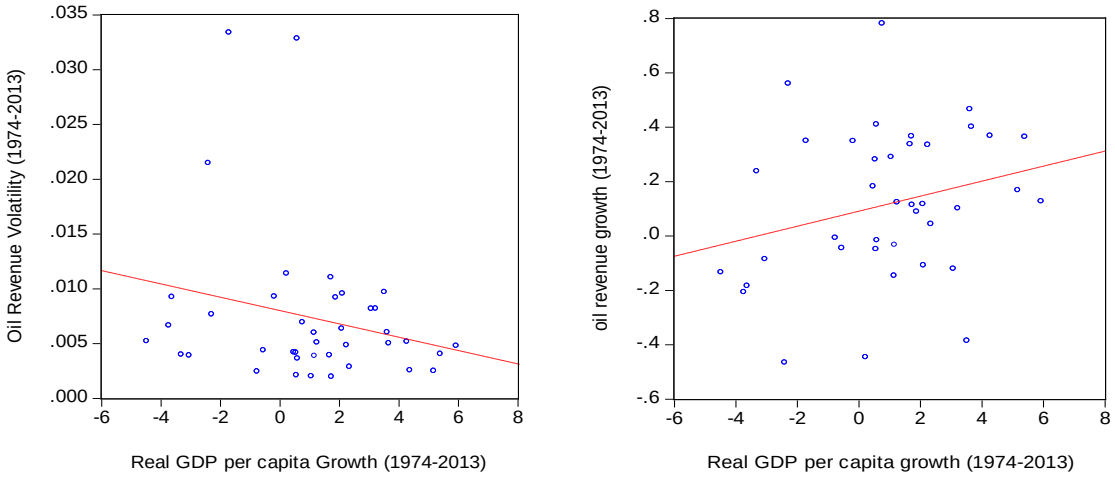


Table 1: Algeria: Selected Macroeconomic Indicators

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Growth rate	3.2	2.2	2.1	4.1	6.8	5.2	5.1	1.8	4.6	2.4	2.4	3.3	2.4
Unemployment rate	29.2	29.5	27.3	25.9	23.7	17.7	15.2	12.3	11.8	11	10	10	10
Inflation rate	2.64	0.33	4.22	1.41	2.58	3.56	1.64	2.5	3.5	4.5	5.7	3.9	4.5
External debt	27.9	25.2	22.5	22.8	23.5	22.1	17.2	5.67	5.66	5.58	5.41	5.16	4.4

Source: International Monetary Fund staff country report, statistical appendix (1998/2004/2006/2009/2012)

Table 2: Unit Root Tests

a. ADF (Augmented Dickey-Fuller) unit roots test

Variables	Unit root test statistics for the levels				Unit root test statistics for the first differences			
	ADF	CV	ADF	CV T	ADF	CV T	ADF	CV T
y_t	-.24907	-2.9047	-2.2723	-3.3524	-4.8456	-2.9898	-4.9443	-3.3483
$e_t - p_t$		-1.8985		-2.1031		-6.0079		-5.9951
y_t^*		-0.4472		-3.3146		-4.0669		-4.1816
xo_t		-0.86331		-1.7867		-6.4766		-6.5214

b. ADF-GLS (The generalized least squares version of the ADF test) unit roots test

Variables	Unit root test statistics for the levels				Unit root test statistics for the first differences			
	ADF-GLS	CV	ADF-GLS	CV T	ADF-GLS	CV T	ADF-GLS	CV T
y_t	1.3087	-2.0450	-2.1935	-2.8927	-4.3964	-2.1149	-4.6073	-2.8864
$e_t - p_t$		-1.7243		-1.8357		-5.7837		-5.9366
y_t^*		0.25612		-2.5836		-3.3524		-3.7399
xo_t		0.22848		-1.8178		-6.2436		-6.5146

c. ADF-WS (The weighted least squares ADF test)unit roots

Variables	Unit root test statistics for the levels				Unit root test statistics for the first differences			
	ADF-WS	CV	ADF-WS	CV T	ADF-WS	CV T	ADF-WS	CV T
y_t	0.55655	-2.5338	-2.4850	-3.2485	-4.8658	-2.5928	-4.8711	-3.1873
$e_t - p_t$		-2.1817		-2.0403		-6.2204		-6.2008
y_t^*		-0.48919		-3.0368		-4.2411		-4.2795
xo_t		-0.56672		-2.0934		-6.4322		-6.4196

Notes : The sample period runs from 1979Q1 to 2013Q4.CV T gives the 95 percent simulated critical values for the test with intercept and trend, while CV is the 95 percent simulated critical value for the test including an intercept only.

Table 3: Lag Order Selection Criteria

Lag length	AIC	SBC	Lag length	AIC	SBC
s= 1	488.2565	479.4315	s*=1	361.7261	352.9011
s= 2	498.6540	483.9458	s*=2	400.9192	386.2110
s= 3	502.4488	481.8573			
s= 4	499.8570	473.3822			

Notes: s, lag orders of endogenous variables, s*, lag orders of exogenous variables. AIC refers to the Akaike Information Criterion and SBC refers to the Schwarz Bayesian Criterion.

Table 4: VARX (2,2) Cointegrating Tests, 1979Q1-2013Q4

(a) Maximal eigenvalue statistic

Null	Alternative	Statistic	95% Critical Value	90% Critical Value
r = 0	r = 1	25.0094*	27.5452	24.5238
r<= 1	r = 2	15.3721	18.5227	16.5987

(b) Trace statistic

Null	Alternative	Statistic	95% Critical Value	90% Critical Value
r = 0	r= 1	40.3814**	38.3472	34.5254
r<= 1	r= 2	15.3721	18.5227	16.5987

Notes: ** and * denote rejection of the null hypothesis at the 95% and 90% confidence level respectively. The underlying VARX model contains unrestricted intercept and restricted trend and the optimal lag order (2, 2)

Table 5: Exact-identifying Restrictions

Exact-identifying Restriction ( )

	Y	EP	YS	XO	TREND
Vector 1	-1.0000	0.22 **	0.10*	0.38**	0.0063**
		(0.11)	(0.089)	(0.046)	(0.0011)

Notes: ** and * denote significant at 95% and 90% confidence level respectively. Asymptotic standard errors are reported in the parentheses. Vector 1 represents the cointegrating vector for output equation.

Table 6: Estimates of Long-Run Output Equation for Algeria

Hypotheses

a) Co-trending Restriction : ($\gamma_y = 0$)

$LR(\chi^2)$	Bootstrapped Critical Values	
(*d.f. = 1*)	1%	5%
4.9854	**9.8858**	**6.1056**

b) Co-trending and Theory Restriction : ($\gamma_y = 0 \ and \ \psi_2 = \psi_3 = \alpha$)

$\hat{\psi}_1$	$\hat{\psi}_2 = \hat{\hat{\psi}}_3 = \hat{\alpha}$	$\hat{\theta} = \frac{\hat{\psi}_1}{1-\hat{\psi}_2}$	$LR(\chi^2)$ $d.f. = 2$	Bootstrapped Critical Values	
				1%	5%
0.15	0.65	0.43	6.4805	13.2692	9.0367
(0.23)	(0.11)				

c) Co-trending and Over-identifying Restrictions: ($\gamma_y = 0$, $\psi_2 = \psi_3 = \alpha \ and \ \psi_2 + \psi_1 = 1$)

$\hat{\psi}_1$	$\hat{\psi}_2 = \hat{\hat{\psi}}_3 = \hat{\alpha}$	$\hat{\theta} = 1$	$LR(\chi^2)$ $d.f. = 3$	Bootstrapped Critical Values	
				1%	5%
0.43	0.57	1	8.9973	16.1846	12.0689
(0.074)	(0.074)				

Notes : The underlying VARX model is of lag order (2, 2) and contains unrestricted intercept with trend.LR is the log-likelihood ratio statistic for testing the long-run relations. The figures in brackets are asymptotic standard errors. The sample period runs from 1979Q1 to 2013Q4.