Resource curse and institutional quality in oil countries

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The examination of the relationship between oil resources and economic growth reveals that oil curse in oil countries is not reliable and these countries can be divided into countries with poor and rich institutions. In the first group, oil revenues have a negative and significant effect on the economic growth; in the second group, oil revenues have a positive and significant effect on economic growth. In other words, what causes curse or blessing of oil resources is the institution qualities of the countries; the lower the institution quality, the more negative effect of the oil revenues on the economic growth. In this article we derive the kink point of institutional index whereby oil revenues effect on the economic growth changes from positive to negative.

Keywords: economic growth, institutions, oil resources

JEL Codes: O13; O50; Q30

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1. Introduction

Paradoxical growth rates and conditions of resource rich countries, is one of the issues challenging scholars in economic development areas. According to empirical evidence, resource rich countries usually have lower rates of growth compared to resource poor countries. For example Asian tigers; Korea, Singapore, Taiwan and Hong Kong, that all have experienced dramatic and steady growths, are resource poor countries. Yet countries such as Iran, Venezuela, Saudi Arabia, Nigeria and Angola that are very rich in natural resources, have low and unsteady growth rates and thus are considered to be main losers in the development process. In development economics literature this paradox, is referred to as the "paradox of plenty". This strange finding, about which a rich body of literature has been developed in recent years, is known as the theory of "resource curse". Evidence gathered by many economists[1] tend support this theory.

There are exceptions however, for example we can refer to the resource rich regions in the world that were taken by the Europeans in past centuries (America, Canada, Australia, New Zealand, etc.), yet recent cases are very few: with the help of its natural resources, Norway has a high per capita income; Malaysia by diversifying its economy managed to get rid of its dependence on natural resources including petroleum and experienced high rates of growth; and Botswana is a successful exporter of raw materials and minerals. But in reality, successful cases are limited to these few countries. In this article we try to explain the reasons for such inability among petroleum rich countries to exploit natural resources for successful development.

One of the main challenges facing economists is, to determine and define the variables and mechanisms that abundance of resources cause reduction of economic growth via them. Generally speaking, five main channels (or variables) can be identified in this area that have exerted the greatest role and are most influential and frequently explored: Dutch disease[2],

[1] - Gelb (1988), Lane and Tornell (1996), Gylfason, Herbertsson and Zoega (1999), Sach and Warner (1995;1997 ; 2001), Ross (2001), Amuzegar (1999), Gylfason (2001a,b), Auty (2001), Papyrakis and Gerlagh (2004), Mehlum et al (2006a), Leite and Weidmann (1999), Lay And Omar Mahmoud (2004), Boschini et al (2004), Kronenberg (2004)

[2] - Sachs and Warner (1995; 1997; 2001)

education and crowding out of human capital[3], reduction in savings and crowding out of physical capital[4], Fluctuations in prices of natural resources and structural disorders[5], governance and institutional quality[6].

It should be mentioned that the analyses based on governance or institutional quality state that the differences among growth rates of resource rich countries are related to the way rents created by the resources are distributed through institutional arrangements. About this field, literature is rich and abundant.[7] In this area, Mehlum and others[8] use Sachs and Warner[9]'s statistics to show that by controlling for reciprocal effects of institutions and resources it can be illustrated that when institutions have a good performance, resources play a positive role in growth and vice versa. We try to show such a relationship in petroleum rich countries using a more appropriate measure than the one used by Mehlum and others. As it will be shown, institutions play an important role in this matter and this role is tackled as an exogenous factor. Thus, it is argued that considering the increase in potential petroleum generated revenues, good institutions can help in economic growth and bad institutions may bring curse and weak performance of petroleum rich economies. In other words, we argue that mixture of abundant natural resources with inefficient markets, shaky regulatory structure, and weak bureaucracy can lead to devastating results. The most famous devastated result is the struggle to earn ever greater rents of natural resources that may cause economic and political power to be concentrated among some elites, and these elites would use their rents to satisfy their supporting politicians and thereby retain their power. This can undermine democracy and decelerate economic growth.

In this article we try to test the resource curse hypothesis only in petroleum rich countries, applying a (nonlinear) threshold model in which negative effects of oil revenues on growth may well only kick in where institutional quality is poor. In this regard, recently macroeconomists have adopted an econometric technique simply by looking at the inflexion point or threshold in a

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[3] - Gylfason (2001 a)

[4] - Gylfason (2001 b), Sachs and Warner(1995 and 1999)

[5] - Like Auty (1998), Mikesell (1997) and Davis and Tilton (2005)

[6] - Mehlum et al. (2006 b), Sachs and Warner (1995), Lane and Tornell (1996) and Tornell and Lane (1999)

[7] - Karl(1997), Robinson et al. (2006), Baland and Francois (2000), Krueger (1974), Torvik (2002), Kronenberg (2004), Mehlum et al. (2006 a,b)

[8] - Mehlum et al. (2006 a)

[9] - Sachs and Warner (1995)

nonlinear relationship so that the impact of oil revenues growth on economic growth could be negative up to a certain threshold level of institutional quality index and beyond this level the effect turns to be positive. In other words, at this structural breakpoint the sign of the relationship between the two variables would switch. If so, harmful effects of oil revenues are not universal, but appear only below the "threshold" level of institutional quality. This approach can reconcile both the view of the resource curse and blessing, that is, in the countries enjoying a better institutional environment, oil revenues growth is helpful(a blessing) for economic growth but in the ones suffering from weak governance, oil booms is detrimental for the sustainability of economic growth.

The remainder of this paper is organized as follows: Section 2 discusses the methodology and data used to obtain the empirical findings reported in this paper. Section 3 provides empirical results. Finally, section 4 presents a summary of the main conclusions.

2. Data description

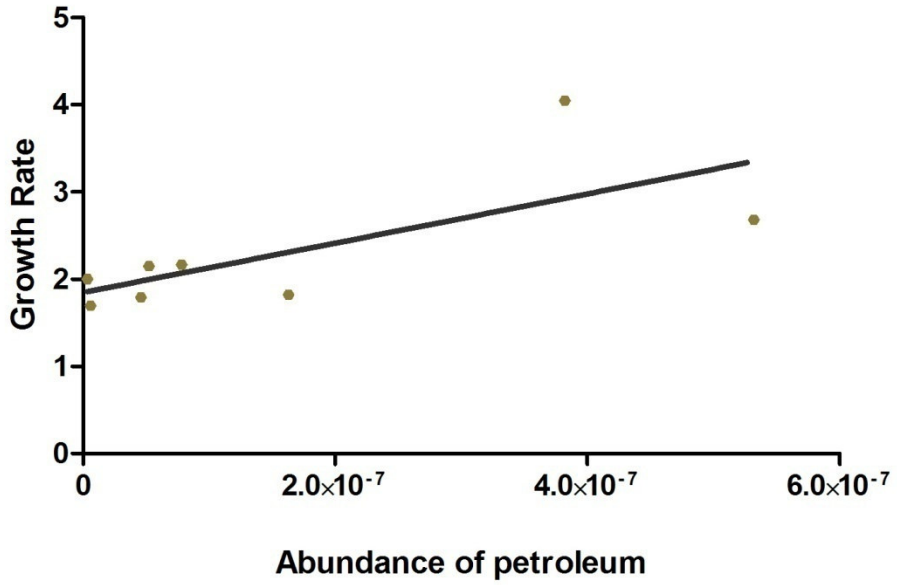
To describe existing data two classifications are used based on institutional quality index that is an unweighted average of six indexes based on data from World Bank: control of corruption, government effectiveness, political stability, regulatory quality, rule of law, voice and accountability bureaucratic quality[10.] The index runs from -2.5 to 2.5.
Based on this index which countries that have obtained positive score belong to the first group and countries that have negative scores belong to the second group. On this basis, the first group is labeled as countries with good institutional structure and the second one is labeled as countries with bad institutional structure.

If we take 30 year average growth of these countries, that is their average growth rates of GDP per capita between 1976 to 2006 as an index of their growth rate; also if we assume average potential oil revenue index divided by GDP to be an index of abundance of petroleum in these countries, we come to the chart 1 and chart 2 for the two above mentioned categories.

[10.] See "http://www.govindicators.org" for more information on governance indicators available for 212 countries during the 1996–2007 periods.

In chart 1 that depicts the relationship between petroleum abundance and economic growth, during 30 years in countries with good institutions, it is clear that there exists a positive relationship between growth rate and petroleum abundance index. It means that, in line with the theory, in countries whose institutions have acceptable capacities, the relationship between petroleum abundance and economic growth is positive rather than negative.[11]

Chart 1- Relationship between economic growth and abundance of petroleum in countries with good institutions

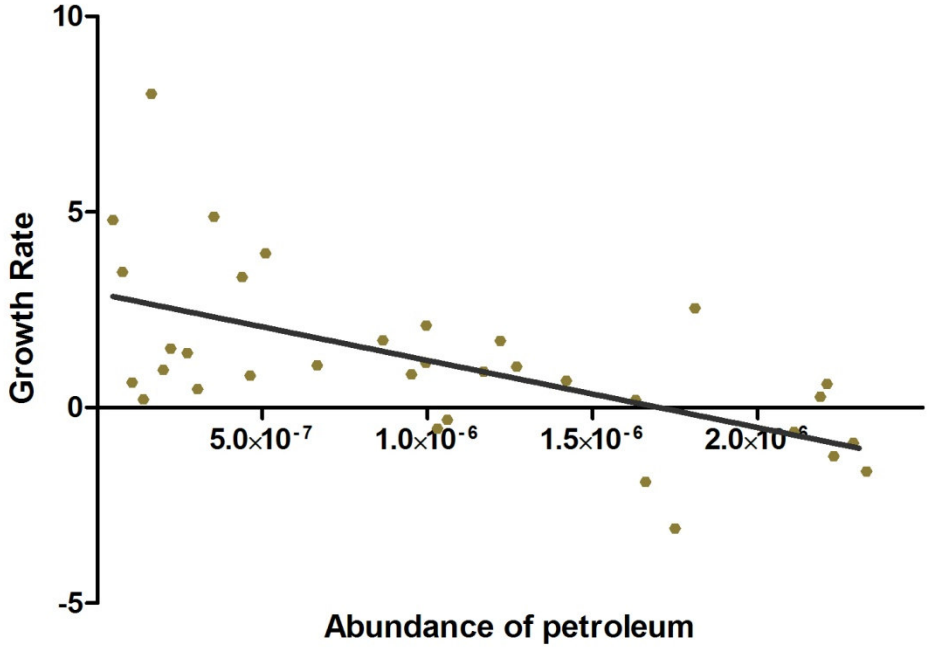


However, Chart 2 that shows the relationship between economic growth and petroleum abundance in countries with bad institutions is quite different from chart 1. In chart 2, petroleum abundance is shown to have a negative and inverse relationship with economic growth. In other words, as potential oil revenues of a country increase, its economic growth declines.[12]

[11] - In this sample countries of Italy, Malaysia, Netherlands, Norway, United Kingdom, United States, Canada and Denmark are present.

[12] - Countries with bad institutions included: Algeria, Argentina, Azerbaijan, Bahrain, Brunei, Cameroon, China, Colombia, Congo, Ecuador, Egypt, Gabon, India, Indonesia, Iran, Kazakhstan, Kuwait, Mexico, Nigeria, Oman, Peru, Romania, Russian Federation, Saudi Arabia, Sudan, Syrian Arab Republic, Thailand, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Uzbekistan, Venezuela, Vietnam and Yemen.

Chart 2- Relationship between economic growth and abundance of petroleum in countries with bad institutions



As is it is evident from the charts, in a cross country perspective, institutions are very vital and important, so that they can lead to good or bad performance of oil resources in different countries.

3. Methodology and Data

In a general sense three different paths can be distinguished in the empirical studies that focus on resource curse:

1. Studies related to one country in which a specific country is put under study and a negative relationship between natural resources (petroleum) and economic growth is shown to exist. In this group we can refer to case studies done by Auty[13], Mayer and others[14], Agnani, and Amaia Iza[15], Sala-i-Martin and Sobremanian[16].

[13] - Auty (2001)
[14] - Mayer et al. (1999)
[15] - Agnani, and Iza (2005)
[16] - Sala-i-Martin and Sobremanian (2003)

2. The literature focusing on the analysis of a number of specific channels of the resource curse, such as behavior of real exchange rate, sector related transfers like Dutch disease, financial dependencies especially trends in state expenditures in response to easy oil revenues during 1970s and 1980s which is studied by Gelb[17]. Also in a path parallel to this one, Collier and Gunning[18] in their case studies, focus on the structure of high revenues and saving reactions during this period.
3. Also there exists a large number of cross country studies in which scholars carry out research on mineral and oil rich countries and in a broader sense they study countries rich in natural resources and try to investigate the relationship between economic growth and natural resources; in this way they test different channels. However, most of these studies have taken a cross-sectional form.

In several ways, this paper is different from previous ones. First of all, in few studies there is a focus on petroleum rich countries. In this article, only petroleum rich countries will be studied. Second, the research methodology employed in the present study deals with panel data which distinguishes it from some other studies in this area. Third, in this paper an attempt is made to estimate the threshold of institutional quality index and find the kink point. The fourth characteristic of this article is that it uses a unique index to measure abundance of resources. In this article, for the first time, ratio of potential oil revenues to total GDP is used as a proxy for abundance of resources in a country. Also, total annual production of a country is calculated; then, this production is multiplied by global and average oil price in that year and the result is divided by the total GDP.

We think that this index is better than other indices in several ways. Because in the works done until today different indices such as dependence to raw materials[19], per capita area of land[20], work force in primary sector[21] and export orientation[22] have been employed that are not excellent for showing the effects of natural resources –petroleum- on economy. The index we are

[17] - Gelb (1988)
[18] - Collier and Gunning (1999)
[19] - Sachs & Warner (1995)
[20] - Wood & Berge (1997)
[21] - Gylfason et al. (1999)
[22] - Syrquin & Chenery (1989)

suggesting, can be better as it takes into account all potential annual oil revenues of a country (not merely revenues generated through exported oil) because in many petroleum rich countries such as Iran and Venezuela a great deal of oil is consumed domestically and at low prices, as a result these consumptions will not be taken into account in export statistics. However, this is a political advantage in such countries that is given to those who most benefit from this rent (cheap oil) and therefore this number should be entered into the calculation of any indices to measure a countries dependence on oil.

Overall we investigate the nonlinear effects of oil revenue changes on economic activities for 42 oil-dependent countries (Appendix) using annual data over the period 1965–2005. Following the work of Levine and Renelt[23], which searched for a set of robust variables to model growth and the theoretical contributions to the new growth theory literature, a degree of convergence on the most appropriate empirical specification for modeling growth, has occurred. Most models include as explanatory variables: investment ratio, inflation rate, and initial per capita GDP. We include these, together with the oil revenues ratio.

To model the non-linearity of the oil revenues-growth relationship and the estimation of the threshold of institutional quality index, this paper uses a spine technique, allowing the relationship to have a kink turning point. The equation to estimate the threshold of institutional quality index has been considered in the following form[24]:

$$\Delta \ln y_{it} = \alpha_i + \alpha_t + \beta_1 \Delta \ln oilratio_{it} + \beta_2 (\Delta \ln oilratio_{it}) D_{it} + \delta X_{it} + \varepsilon_{it}$$

$$D_{it} = \begin{cases} 1 & if \quad IQ_{it} > k \\ 0 & if \quad IQ_{it} \leq k \end{cases}$$

where y_{it} is the non oil real GDP per capita (based on constant local currency), α_i is a fixed effect, α_t is a time effect, $oilratio_{it}$ is oil revenues as a share of GDP and k is the threshold level of the institutional quality. D_{it} is a dummy variable that takes a value of one for institutional

[23]. Renelt (1992).

[24]. Obviously, oil revenues-growth regressions must include other plausible determinants of growth. The variables are chosen based on empirical literature, theories of economic growth, and diagnostic tests.

qualities greater than k and zero otherwise, X_{it} is a vector of control variables which includes investment as a share of GDP (igdp), the log of initial income per capita at 1965 $(\ln GDPC_0)$ and inflation (inf). The index "i" is the cross-sectional index while "t" is the time-series index. The data are obtained from OPEC Bulletins, BP Statistical Review of World Energy and Penn World Table[25]. Also the institutional quality index is an unweighted average of six indexes based on data from World Bank: control of corruption, government effectiveness, political stability, regulatory quality, rule of law, voice and accountability bureaucratic quality[26.] The index runs from -2.5 to 2.5.

The coefficient of the dummy variable (β_2) measures the incremental effect of oil revenues ratio on the economic growth when it is greater than the assumed structural break level (i.e. oil revenues ratio is high) and the opposite for the coefficient of β_1. In other words, the coefficient of β_2 indicates the difference in the oil revenues effect on growth between the two sides of the structural break. In the above threshold model, the sum of the two coefficients ($\beta_1 + \beta_2$) represents the economic growth rate when the oil revenues ratio are higher than k percent (the structural break point).

By estimating regressions for different values of k which is chosen in an ascending order (i.e., 0.01, 0.02 and so on), the optimal value k is obtained by finding the value that maximizes the R^2 from the respective regressions. This also implies that the optimal threshold level is that which minimizes the residual sum of squares (RSS). Moreover, it is important to determine whether the threshold effect is statistically significant. In equation (1), to test for no threshold effects amount simply to testing the null hypothesis $H_0 : \beta_2 = 0$. Under the null hypothesis, the threshold k is not identified, so classical tests, such as the t-test, have nonstandard distributions. Hansen[27] suggests a bootstrap method to simulate the asymptotic distribution of the following likelihood ratio test of Ho:

$$LR_0 = (RSS_0 - RSS_1) / \hat{\sigma}^2$$

[25]. Heston, Summers and Aten (2006).

[26.] see "http://www.govindicators.org" for more information on governance indicators available for 212 countries during the 1996–2007 periods.

[27]. Hansen (1996, 1999).

where RSS_0, and RSS_1 are the residual sum of squares under $H_0 : \beta_2 = 0$, and $H_1 : \beta_2 \neq 0$, respectively; and $\hat{\sigma}^2$ is the residual variance under H_1. In other words, RSS_0 and RSS_1 are the residual sum of squares for equation (1) without and with threshold effects, respectively. The asymptotic distribution of LR_0 is nonstandard and strictly dominates the χ^2 distribution. The distribution of LR0 depends in general on the moments of the sample; thus critical values cannot be tabulated. Hansen[28] shows how to bootstrap the distribution of LR_0 in the context of a panel.

4. Empirical Results

Table 1 provides the estimation results of equation (1), for the linear specification (without threshold effect) and the nonlinear one (with threshold effect). To take the significant heteroskedasticity in the panel into account, equation (1) has been estimated using Generalized Least Squares (GLS). Fixed effects and time dummies have been included (but not reported) to control for cross-country heterogeneity and time effects.

The first step to explore the relation between the oil revenues ratio and economic growth is to test for the existence of a threshold effect in the relationship between real GDP growth and oil revenues using the likelihood ratio, LR_0, discussed above. This implies estimating equation (1) and computing the residual sum of squares (RSS) or R^2 for different threshold levels of oil revenues growth (k). The optimal threshold level is the one that makes RSS minimum or makes R^2 maximum. Figure 1 gives an idea about the goodness-of-fit for different structural breaks. It shows the value of R^2 is maximized when the structural break point for oil revenues ratio (k) is 0.3. The row LR_0 in Table 1 gives the observed value of the likelihood ratio. The significance levels have been computed using the bootstrap distributions of LR_0[29]. The null hypothesis of no threshold effects can be rejected at least at the 1 percent significance, strongly supporting the existence of threshold effects.

The column 1 in Table 1 provides the estimation results of equation (1), conditional on the threshold estimate. Recall that the existence of a threshold effect cannot be inferred simply from

[28]. Hansen (1999).

[29] . For a more detailed discussion on the computation of the bootstrap distribution of LRo, see Hansen (1999).

the significance level of the coefficient on the interactive term $D(\Delta \ln oilratio)$ as the distribution of the t-statistic for this variable is highly nonstandard under the null hypothesis of no threshold effect. This is why the null hypothesis has been tested using the bootstrap distribution of the likelihood ratio LR_0. However, the distribution of the t-values of all explanatory variables retains their usual distribution under the alternative hypothesis of a threshold effect.

In countries with the worst institutional quality (when institutional index is below the threshold level 0.3), oil revenues has a significant negative effect on growth, while with high quality institutions, oil revenues have a positive effect on growth. In other words, when the institutional quality is below the 0.3 threshold level, an increase in the oil revenues of 10 percentage points leads to a decrease by 0.3% in the non-oil GDP growth. On the other hand, the effect of increasing oil revenues when institutional index is greater than 0.3 is positive and significant: an increase in the oil revenues of 10 percentage points leads to an increase by 0.5 % in the non-oil GDP growth. The sum of the two coefficients (0.2) means the annual growth rate of real GDP increases by 0.2% when the institutional quality index jumps over the structural breakpoint.

When the equation is re-estimated without the threshold effects(the column 2 in Table 1), panel results for the linear model (misleadingly) indicate that the coefficient of oil revenues ratio is positive and statistically significant at 10 percent, contrary to the resource curse effect. In this model a 10% increase in oil revenues ratio would increase economic growth by 0.1%, a relatively strong positive impact.

This suggests that not taking structural breaks into account will conceal the detrimental effects of oil revenues in countries with the worst institutional quality.

All of the (control) independent variables have the predicted sign. As expected, investment ratio has a positive and significant impact on economic growth. On average, an increase in the investment-GDP ratio of 10 percentage points will boost real GDP growth by 1.5 percentage points for non-linear specification and 1.9 percentage points for linear specification. In the empirical growth literature, the log of the initial GDP per capita has been generally included in growth regressions to test conditional convergence. Conditional convergence holds if the coefficient on $\ln GDPC_0$ is negative. The results for both specifications indicate that the negative convergence effect is confirmed at various levels of significance so that a low initial GDP is associated with faster growth in output. Moreover, the results of this study suggest a statistically and economically significant negative relationship between inflation and growth.

Chart 3: Goodness of Fit for Different Structural Breaks

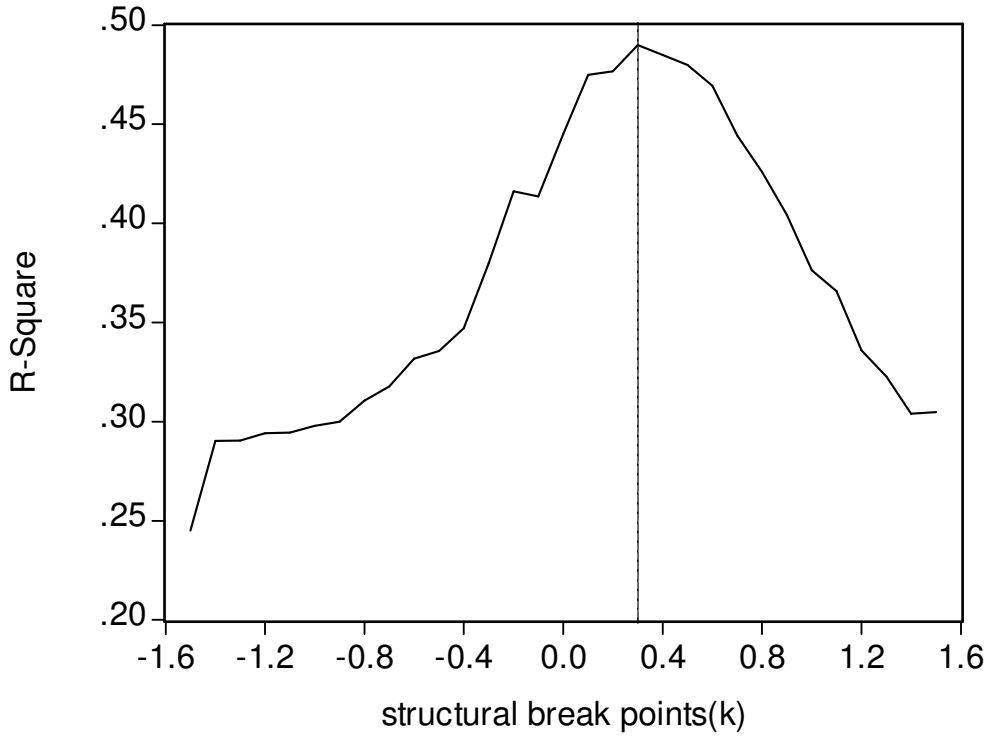


Table1: Estimation of Model (sample1965-2005)

(Dependent Variable: non-oil GDP growth)

Independent Variables	With threshold	Without threshold
$\Delta oilratio$	-0.03 (-2.01)b	0.01 (3.98)a
$(\Delta oilratio)D$	0.05 (6.50)a	-
$igdp$	0.15 (6.86)a	0.19 (1.98)b
$\ln GDPC_0$	-0.07 (-5.09)a	-0.08 (-5.91)a
inf	-0.16 (-1.91)b	-0.13 (-1.70)c
Optimal threshold(k)	0.3	-
LR_0	13.41a	-
Critical value(1%)	6.28	-
R^2	0.49	0.37
F-statistics	8.20a	6.88a

Notes: The t-statistics, given between parentheses, are computed from White heteroskedasticity-consistent standard errors. The letters "a", "b", "c", indicate statistical significance at 1, 5, and 10 percent, respectively. The growth rate of a variable x is approximated by the first difference of the log of x, dlog(x). The estimated time dummies and country-specific effects are not reported.

4. Conclusions

The present study, that examined the issue of the existence of threshold effects in the relationship between oil revenues and economic growth, shows that oil rich countries are not the losers of the economic growth rate. In this study, we tested how the curse of the oil resources and oil revenues can be determined for different countries. In this respect it was found that the results for the linear specification are consistent with the evidence found in ۴۳countries that suggest a positive relationship between growth and oil revenues. The results also showed that using the

structural breakpoint methodology proved that this relation tends to be negative just below a threshold for the institutional index equal to 0.3. After this point the effect tends to be positive.

This finding clearly shows that oil, as one the most important natural resources, constitutes a major source of income for many countries, and depending on the institutions of the country, can contribute to the long term economic growth of that country or lead to the poor long run economic performance. Therefore, solutions offered for different countries for the control and prevention of the oil effects on economy should be diverse depending on the institutions of that country. Unfortunately, so far, economists and international organizations such as World Bank have not taken into account these institutions in offering and practicing these solutions. In majority of cases, the solutions offered can never be put into action in countries with the worst institutional quality.

Therefore, considering the growth rate of oil prices in recent years and the probability of negative effects for these revenues on countries with the worst institutional quality, more research is recommended on the proper solutions that can be put into practice in these countries. It seems that among the offered solutions only the two solutions of direct distribution among people and privatization of the oil resources have been proposed with an eye on the basic problems of countries with the worst institutional quality; these solutions need further investigation.

Appendix:

42 oil-dependent countries

Countries with bad institutions : Algeria, Argentina, Azerbaijan, Bahrain, Brunei, Cameroon, China, Colombia, Congo, Ecuador, Egypt, Gabon, India, Indonesia, Iran, Kazakhstan, Kuwait, Mexico, Nigeria, Oman, Peru, Romania, Russian Federation, Saudi Arabia, Sudan, Syrian Arab Republic, Thailand, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Uzbekistan, Venezuela, Vietnam and Yemen.

Countries with good institutions: Italy, Malaysia, Netherlands, Norway, United Kingdom, United States, Canada and Denmark are present.

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