The Optimum Oil Revenue in Iran

Mohebollah Motahari (Corresponding Author)
Ph.D student, Department of Economics, Faculty of Economics and Business Administration, Ferdowsi University of Mashhad, Mashhad, Iran
E-mail: moheb_m_2000@yahoo.com

Mohammad Reza Lotfalipour
Associate Professor.Department of Economics, Faculty of Economics and Business Administration, Ferdowsi University Of Mashhad, Mashhad, Iran. E-mail: lotfalipour@um.ac.ir

Abstract
The purpose of this paper is finding the optimum oil revenue in Iran economy. To do so, first we divide Iran's economy into two sectors namely, public and non-public sector based on Ram model. Then we specified a nonlinear modified Ram model on explain the role of oil revenues on economic growth in Iran. The results indicate that there exists a threshold the share of oil revenue in GDP of 0.021. In other words, when the share of oil revenue in GDP is less than 0.021, economic growth is promoted, but when the share of oil revenue in GDP is larger than 0.021, economic growth is damaged. Therefore, the optimum oil revenue divided by GDP is 0.021.

Keywords: oil revenues, economic growth, threshold regression

1. Introduction

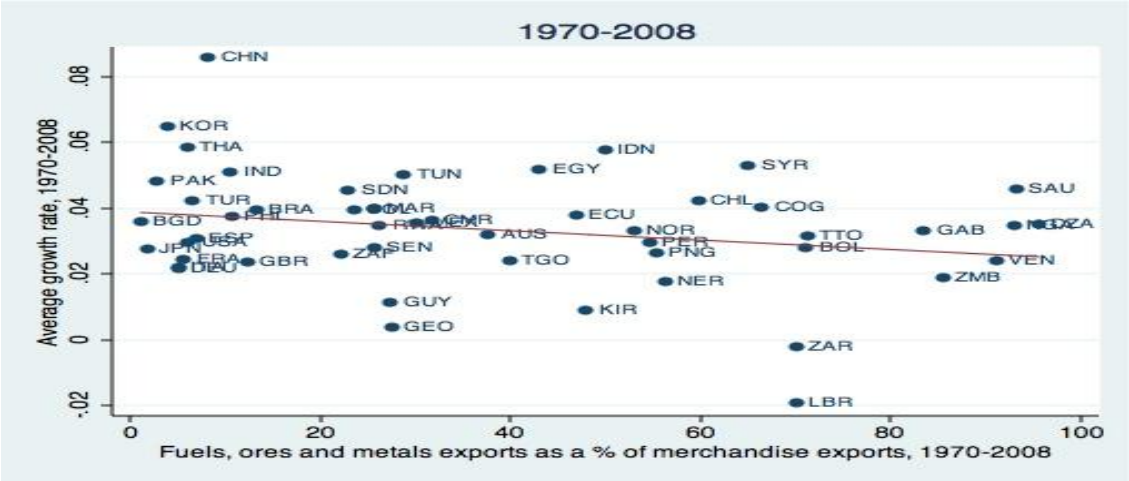
Iran's economy is highly dependent on the production and export of crude oil to finance government spending, and consequently is vulnerable to fluctuations in international oil prices. Although Iran has vast petroleum reserves, the country lacks adequate refining capacity and imports gasoline to meet domestic energy needs.

In this paper, we study different impact of oil revenues and investment on economic growth, in two regimes of high and low oil revenues. The main hypothesis of the paper is that during high oil revenues, the oil revenues have negative or weaker impact on economic growth than during moderate or low oil revenues. To examine this hypothesis, we use the Ram(1986) model based on the threshold method. The threshold method used in this study in some way shows that raising the oil revenues over a certain threshold results in higher economic growth, but covering that threshold, according to Dutch disease and resource curse, results in lower economic growth.

The claim of the resource curse is that, contrary to what might seem to be common sense, poor countries with large oil reserves do not often experience rapid or balanced economic growth. Oil rents encourage inefficient management, corruption, failure to plan for the long term, unresponsive and authoritarian government, and neglect of the needs of the population. Oil production distorts currency exchange rates, disrupts trade relations, and creates vested interests that leave little space for alternative growth models. Windfall revenues encourage excessive spending, even for legitimate purposes, without providing for economic diversification to offset the eventual exhaustion of resources.

Figure 1 shows a sample of countries, over the last four decades. Exports of fuels, ores and metals as a fraction of total merchandise exports appear on the horizontal axis and economic growth on the vertical axis. Conspicuously high in growth and low in natural resources are China, Korea, and some other Asian countries. Conspicuously high in natural resources and low in growth are Gabon, Venezuela and Zambia. The overall relationship on average is slightly negative. The negative correlation is not very strong, masking almost as many resource successes as failures. But the data certainly suggest no positive correlation between natural resource wealth and economic growth.

Figure 1: Statistical relationship between mineral exports and growth.



Data source: *World Development Indicators*, World Bank

How could abundance of hydrocarbon deposits, or other mineral and agricultural products, be a curse? What would be the mechanism for this counter-intuitive relationship? Broadly speaking, there are at least seven lines of argument. First, prices of such commodities could be subject to secular decline on world markets. Second, the high volatility of world prices of energy and other mineral and agricultural commodities could be problematic. Third, natural resources could be dead-end sectors in the sense that may crowd out manufacturing, which might be the sector to offer dynamic benefits and spillovers that are good for growth. (It does not sound implausible that "industrialization" could be the essence of economic development.) Fourth, countries where physical command of mineral deposits by the government or a hereditary elite automatically confers wealth on the holders may be less likely to develop the institutions, such as rule of law and decentralization of decision-making, that are conducive to economic development, as compared to countries where moderate taxation of a thriving market economy is the only way the government can finance itself. Fifth, natural resources may be depleted too rapidly, leaving the country with little to show for them, especially when it is difficult to impose private property rights on the resources, as under frontier conditions. Sixth, countries that are endowed with natural resources could have a proclivity for armed conflict, which is inimical to economic growth. Seventh, swings in commodity prices could engender excessive macroeconomic instability, via the real exchange rate and government spending.

In Section 2 we present some literature on resource curse with focus on the effects of oil revenues on economic growth. The non-linear specification is presented in Section 3. Section 4 presents empirical results. The last section gives the summary and conclusion.

2. A review of literature

The Natural Resource Curse is not confined to individual anecdotes or case studies, but has been borne out in some statistical tests of the determinants of economic performance across a comprehensive sample of countries. Sachs and Warner (1995) kicked off the econometric literature, finding that economic dependence on oil and mineral is correlated with slow economic growth, controlling for other structural attributes of the country. Sachs and Warner (2001) summarized and extended previous research showing evidence that countries with great natural resource wealth tend to grow more slowly than resource-poor countries. They say their result is not easily explained by other variables, or by alternative ways to measure resource abundance. Their paper claims that there is little direct evidence that omitted geographical or climate variables explain the curse, or that there is a bias in their estimates resulting from some other unobserved growth deterrent. Other studies that find a negative effect of oil, in particular, on economic performance, include Kaldor, Karl and Said (2007); Ross (2001); Sala-i-Martin and Subramanian (2003); and Smith (2004).

The result is by no means universal, especially when one generalizes beyond oil. Norway is conspicuous as an oil-producer that is at the top of the international league tables for governance and

economic performance.[1] As many have pointed out, Botswana and the Congo are both abundant in diamonds; yet Botswana is the best performer in continental Africa in terms of democracy, stability, and rapid growth of income,[2] while the Congo is among the very worst.[3]

Among the statistical studies, Delacroix (1977), Davis (1995), and Herb (2005) all find no evidence of the natural resource curse. Most recently, Alexeev and Conrad (2009) find that oil wealth and mineral wealth have *positive* effects on income per capita, when controlling for a number of variables, particularly dummies for East Asia and Latin America. In some cases, especially if the data do not go back to a time before oil was discovered, the reason different studies come to different results is that oil wealth may raise the *level* of per capita income, while reducing or failing to raise the *growth rate* of income (or the end-of-sample level of income, if the equation conditions on initial income).[4]

In some cases the crucial difference is whether "natural resource intensity" is measured by true endowments ("natural resource wealth"), or rather by exports ("natural resource dependence"). The skeptics in several different ways argue that commodity exports are highly endogenous.[5]

On the one hand, basic trade theory readily predicts that a country may show a high mineral share in exports, not necessarily because it has a higher endowment of minerals than other countries (*absolute* advantage) but because it does not have the ability to export manufactures (*comparative* advantage). This is important because it offers an explanation for negative statistical correlations between mineral exports and economic development, an explanation that would invalidate the common inference that minerals cause low growth.

On the other hand, the skeptics also have plenty of examples where successful institutions and industrialization went hand in hand with rapid development of mineral resources. Economic historians have long noted that coal deposits and access to iron ore deposits (two key inputs into steel production) were geographic blessings that helped start the industrial revolutions in England, the vicinity of the lower Rhine, and the American Great Lakes region. Subsequent cases of countries that were able to develop their resource endowments efficiently as part of strong economy-wide growth include: the United States during its pre-war industrialization period[6], Venezuela from the 1920s to the 1970s, Australia since the 1960s, Norway since its oil discoveries of 1969, Chile since adoption of a new mining code in 1983, Peru since a privatization program in 1992, and Brazil since the lifting of restrictions on foreign mining participation in 1995.[7] Examples of countries that were equally well-endowed geologically but that failed to develop their natural resources efficiently include Chile and Australia before World War I and Venezuela since the 1980s.[8]

It is not that countries with oil wealth will necessarily achieve worse performance than those without. Few would advise a country with oil or other natural resources that it would be better off destroying them or refraining from developing them. Oil-rich countries can succeed. The question is how to make best use of the resource. The goal is to achieve the prosperous record of a Norway rather than the disappointments of Nigeria. The same point applies to other precious minerals: the goal is to be a Botswana rather than a Bolivia, a Chile rather than a Congo.

Let us return to a consideration of various channels whereby oil wealth could lead to poor performance. Based on the statistical evidence, we have already largely rejected the hypothesis of a long-term negative trend in world prices, while accepting the hypothesis of high volatility. But we have yet to spell out exactly how high price volatility might lead to slower economic growth. In addition we have yet to consider in detail the hypotheses according to which oil wealth leads to poor institutions –

[1] Røed Larsen (2004). Norway is literally ranked number one out of 182 countries in the Human Development Index. Kuwait, Qatar, and the UAE are also in the top fifth on the list. In terms of real income, Norway is ranked number 5, just behind Qatar and the UAE. For comparison, the US is number 9 in real income, and 13 on the HDI.

[2] Engelbert (2000), Sarraf and Jimanji (2001), Acemoglu, Johnson, and Robinson (2003) and Iimi (2006) are among those noting Botswana's conspicuous escape from the Resource Curse of its neighbors.

[3] Most African countries grew more strongly in the years 2000-10 than previously, in part due to rising mineral prices (Beny and Cook, 2009). But countries like the Congo and Chad remain in the bottom 5 per cent of countries in the Human Development Index. Oil-rich Nigeria ranks 142nd out of 169. (*Human Development Report*, 2010.)

[4] See Rodriguez and Sachs (1999) and Alexeev and Conrad (2009).

[5] Maloney (2002) and Wright and Czelusta (2003, 2004, 2006). Even recorded reserves, the most common measure of endowments, are somewhat endogenous as well, since they reflect discoveries, which in turn respond to both world prices and the productivity of the exploration industry, global and local.

[6] David and Wright (1997).

[7] Wright and Czelusta (2003, pp. 4-7, 12-13, 18-22).

[8] Hausmann (2003, p.246): "Venezuela's growth collapse took place after 60 years of expansion, fueled by oil. If oil explains slow growth, what explains the previous fast growth?"

including military conflict and authoritarianism – which in turn might lead to poor economic performance.

Mork *et al.* (1994) show that for seven Organization for Economic Cooperation and Development (OECD) members an increase in oil prices has a negative effect on the GDP of all the countries, except Norway, which is an oil exporter. Zind (2001) analyses the relationship between some economic sectors of member states of the Cooperative Council of Persian Gulf and fluctuations of oil prices. He considers the years 1972–1980 as a period of increasing oil prices and 1981–1995 as a period of decreasing prices. The results of analyses of variance show that during the period of decreasing oil revenues sectors that depend mainly on government subsidies grow less and their shares in GDP decrease; other sectors with less dependence on government (e.g. services, commercial and transportation) subsidies, however, grow more and their shares in GDP increase. Eltony (2002), in his study, investigates the response of macroeconomic variables of Kuwait to fluctuations of global oil prices. The results show that there is causality from oil prices to macroeconomic variables. This result corresponds to what is expected for an oil exporting country (in which the ownership of all resources belongs to the government). Jimenez Rodriguez and Sanchez (2004), in their study of some OECD countries, found that for oil importers increase in oil price have a negative impact in the short run (except Japan in which the impact is positive) and oil shocks result in higher inflation and long-term interest rates in all countries (except Germany). Anashasy *et al.* (2005) studied the relationship between oil prices and government income, economic growth, consumption and investment. They discuss that the dependence of the Venezuelan economy on oil prices has risen and that this greater dependence has occurred along with lower growth in the agricultural and non-oil industries. The results show that oil price fluctuations have a negative impact on the productivity of the Venezuelan economy and that this country suffers from 'resource curse'. Alotaibi (2006) estimates the non-linear relationship between oil price fluctuations and economic growth of the countries of Cooperative Council of Persian Gulf by analysing the negative and positive oil price shocks and finds that the impact of decreasing oil prices on economic growth is more intense than that of increasing oil prices.

Colgan (2011) argues that in fact the net political effect of oil varies dramatically depending on the nature of the petrostate. It shows that oil income, when combined with revolutionary governments in petrostates, generates strong incentives for foreign policy aggression and international conflict. The aggressiveness of petro-revolutionary states is shown to have consequences in both military and economic spheres of international relations. Militarily, the aggressiveness of this type of state leads to a high rate of armed conflicts. Economically, the aggressiveness of petro-revolutionary states shapes global oil markets and international economic relations. The argument is tested using statistical analysis of international conflicts and economic sanctions. The policy implications are then considered, focusing on the negative global impacts of dependence on oil consumption.

Frankel (2011) considers six aspects of commodity wealth, each of interest in its own right, but each also a channel that some have suggested could lead to sub-standard economic performance. They are: long-term trends in world commodity prices, volatility, crowding out of manufacturing, civil war, poor institutions, and the Dutch Disease. he concludes with a consideration of promising ideas for institutions that could help a country that is rich in, say, oil overcome the pitfalls of the Curse and achieve good economic performance. They include indexation of oil contracts, hedging of export proceeds, denomination of debt in terms of oil, Chile-style fiscal rules, a monetary target that emphasizes product prices, transparent commodity funds, and lump-sum distribution.

3. Model Specification

We have used the Ram (1986) model as following:

$$\dot{Y}_t = \beta_0 + \beta_1 (\frac{I_t}{Y_t}) + \beta_2 g_{L_t} + \beta_3 g_{G_t} (\frac{G_t}{Y_t}) + e_t \qquad (1)$$

Regression (1) shows that the variables which affect economic growth ($\dot{Y}$) include the investment rate ($\frac{I}{Y}$), growth of labor force (g_{L_t}), and the multiplication effects of government expenditure growth (g_{G_t}) times government size (G/Y).

We modify this model for entrance the oil revenue in this model. Oil revenue is one of the most important parts of government revenues in Iran, so we assume that the government expenditure is equal to tax revenues and oil revenues in Iran or

$$G = T + Oil \qquad (2)$$

Where G is total government expenditure, T is total tax revenues and Oil is oil revenues. So we modify equation (1) to following model:

$$\dot{Y}_t = \beta_0 + \beta_1(\frac{I_t}{Y_t}) + \beta_2 g_{L_t} + \beta_3 g_{T_t}(\frac{T_t}{Y_t}) + \beta_4 g_{Oil_t}(\frac{Oil_t}{Y_t}) + e_t \qquad (3)$$

where g_{T_t} is tax revenue growth, $(\frac{T_t}{Y_t})$ is the share of tax revenue in GDP, g_{Oil_t} is oil revenue growth and $(\frac{Oil_t}{Y_t})$ is the share of oil revenue in GDP. In addition, we identify the multiplication effects through the sign of β_3. This indicates that the government sector has a reciprocal effect on economic growth through two ways: one is the direct contribution of the government sector and the other is the indirect effect through the non-government sector (externality effect).

Regression (3) is a traditional linear economic growth model, but we alter the linear model into the two regime TAR model of Hansen (1996, 2000). The model can be shown as follows:

$$\begin{cases} \dot{Y}_t = \delta_{10} + \delta_{11}(\frac{I_t}{Y_t}) + \delta_{12} g_{L_t} + \delta_{13} g_{T_t}(\frac{T_t}{Y_t}) + \delta_{14} g_{Oil_t}(\frac{Oil_t}{Y_t}) + e_t & if \quad q_t \le \gamma \\ \dot{Y}_t = \delta_{20} + \delta_{21}(\frac{I_t}{Y_t}) + \delta_{22} g_{L_t} + \delta_{23} g_{T_t}(\frac{T_t}{Y_t}) + \delta_{24} g_{Oil_t}(\frac{Oil_t}{Y_t}) + e_t & if \quad q_t > \gamma \end{cases} \qquad (4)$$

Or as one nonlinear regression such as:

$$\dot{Y}_t = \left(\delta_{10} + \delta_{11}(\frac{I_t}{Y_t}) + \delta_{12} g_{L_t} + \delta_{13} g_{T_t}(\frac{T_t}{Y_t}) + \delta_{14} g_{Oil_t}(\frac{Oil_t}{Y_t})\right) I[q_t \le \gamma]$$
$$+ \left(\delta_{20} + \delta_{21}(\frac{I_t}{Y_t}) + \delta_{22} g_{L_t} + \delta_{23} g_{T_t}(\frac{T_t}{Y_t}) + \delta_{24} g_{Oil_t}(\frac{Oil_t}{Y_t})\right) I[q_t > \gamma] + e_t \qquad (5)$$

The threshold value γ can be found by estimating the regression (3) through finding the minimum Error Sum of Squared in a re-order threshold variable. The threshold variable can be set by the exogenous variables out of the theoretical model. In this paper we set "the share of oil revenue in GDP" as the threshold variable. We can also apply the statistic coming from the threshold variable. For instance, we adopt the heteroskedasticity-consistent Lagrange multiplier (LM) of Hansen (1996) to test the null hypothesis of the linear assumption.

Once the estimator can be found, we then start with the statistical test, but the test procedure of Eq. (5) is different from the traditional test. Under the null hypothesis of no threshold effect, the threshold parameters will be unidentified. This will cause the traditional test statistic in a large sample distribution to not belong to the χ^2 distribution, but rather to a non-standard and non-similar distribution which is affected by nuisance parameters. This will cause the critical value of the distribution to not be estimated through simulation. In order to overcome the difficulty, Hansen (1996) uses a statistic of his

own large sample distribution function to transfer and calculate the asymptotic p-value of a large sample. Under the null hypothesis, the distribution of the p-value statistic is uniform, and this kind of transformation can be calculated through bootstrap. The null hypothesis to test Eq. (5) is as follows:

$$H_0: \delta_{1i} = \delta_{2i};\ \ i = 1, 2, 3. \qquad (6)$$

If H_0 is not rejected then the relationships between economic growth and the share of oil revenue in GDP would be the linear regression as the regression (3). This means there exists no threshold effect. Otherwise, if H_0 hypothesis is rejected, it means that there exist different effects between the two regimes of δ_{1i} and δ_{2i}. The F-test statistics is as follows:

$$F = \frac{RSS_0 - RSS_1(\hat{\gamma})}{\hat{\sigma}^2} \qquad (7)$$

In which RSS_0 and RSS_1 are the residual sum of squares under the null hypothesis and the alternative, respectively.

4. Data Description

The resent socio-economic history of Iran has been subject to the past and political-strategic volatility of the region. Iran has not experienced a relatively free market economy due to the share of oil revenue at large. We have intended to use the annual data from 1959 to 2008 available on the Website database of the Central Bank of Iran (CBI).[9]

5. Empirical Results

This paper uses Hansen (2000) threshold regression model to study whether a non-linear relationship between "the share of oil revenue in GDP" and "economic growth" exists in Iran. As Table 1 shows, we adopt Hansen (2000) advice to use the bootstrapping model. While the threshold variable is “oil revenues divided by GDP”, we find that F-statistic is (17.75), which is significant at 1% level. The threshold value is 0.021, and this means that the threshold exists.

Table 1- Threshold Tests By Bootstrapping Method

Threshold Variables	Value
F_1 value of one threshold test	**17.75**
Threshold regime(%)	**0.00**

After making sure that the oil revenues have the threshold effect and achieve the threshold regimes, we analyze the non-linear oil revenues effects and discuss how the oil revenues affects the economic growth in different threshold regimes.

Table 2- Economic Growth and The Share of Oil Revenues in GDP

Variables	coefficient	p-value
Threshold value (%)	**0.021**	**0.00**
Interception	**-0.18**	**0.00**
I/ Y	**0.45**	**0.00**
(g_{oil})(oil share of GDP) for OIL share of GDP ≤0.021	**5.35**	**0.05**
(g_{oil})(oil share of GDP) for OIL share of GDP >0.021	**-5.35**	**0.05**
R^2	**0.54**	

As table 2 shows, while “Oil revenues divided by GDP” is the threshold variable, oil revenues in small oil revenues regime (the threshold value is less than 0.021) in two-regime model have a positive effect

[9] . the web site of central bank of Iran is : www.cbi.ir

on economic growth, but when the oil revenue is large (the threshold value is larger than 0.021), oil revenue and economic growth have a significantly negative relationship. Thus, we can make sure that the non-linear situation exists in Iran. Moreover, the investment ratio also has a significantly positive impact on economic growth concerning both of the two regimes.

Analysis Dutch Disease:

The phenomenon arises when a strong, but perhaps temporary, upward swing in the world price of the export commodity causes:

- a large real appreciation in the currency (taking the form of nominal currency appreciation if the country has a floating exchange rate or the form of money inflows and inflation if the country has a fixed exchange rate);
- an increase in spending (especially by the government, which increases spending in response to the increased availability of tax receipts or royalties –discussed below);
- an increase in the price of nontraded goods (goods and services such as housing that are not internationally traded), relative to traded goods (manufactures and other internationally traded goods other than the export commodity),
- a resultant shift of labor and land out of non-export-commodity traded goods (pulled by the more attractive returns in the export commodity and in non-traded goods and services), and
- a possible current account deficit (thereby incurring international debt that may be difficult to service when the commodity boom ends).

When the crowded-out non-commodity tradable goods are in the manufacturing sector, the feared effect is deindustrialization. In a real trade model, the reallocation of resources across tradable sectors, e.g., from manufactures to oil, may be inevitable regardless of macroeconomics. But the movement into non-traded goods is macroeconomic in origin.

What makes the Dutch Disease a "disease?" One interpretation, particularly relevant if the complete cycle is not adequately foreseen, is that the process is all painfully reversed when the world price of the export commodity goes back down. A second interpretation is that, even if the perceived longevity of the increase in world price turns out to be accurate, the crowding out of non-commodity exports is undesirable because the manufacturing sector has externalities for long-run growth, as in van Wijnbergen (1984) and Matsuyama (1992). But the latter view is just another name for the Natural Resource Curse; it has nothing to do with cyclical fluctuations per se.

The Dutch Disease can arise from sources other than a rise in the commodity price. Other examples arise from commodity booms due to the discovery of new deposits or some other expansion in supply -- leading to a trade surplus via exports or to a capital account surplus via inward investment to develop the new resource. In addition, the term is also used by analogy for other sorts of inflows such as the receipt of transfers or a stabilization-induced capital inflow. In all cases, the result is real appreciation and a shift into nontradables, and away from (non-booming) tradables. Again, the real appreciation takes the form of a nominal appreciation if the exchange rate is flexible, and inflation if the exchange rate is fixed.

Volatility in developing countries arises both from foreign shocks, such as the fluctuations in the price of the export commodity discussed above, and also from domestic macroeconomic and political instability. Although most developing countries in the 1990s brought under control the chronic runaway budget deficits, money creation, and inflation, that they experienced in the preceding two decades, many are still subject to monetary and fiscal policy that is procyclical rather than countercyclical: they tend to be expansionary in booms and contractionary in recessions, thereby exacerbating the magnitudes of the swings. Ideally the aim should be to moderate them – to achieve the countercyclical pattern that the models and textbooks of the decades following the Great Depression originally hoped discretionary policy would accomplish. At a minimum macroeconomic policy should not be procyclical. That it so often is can be attributed to populist political economy.

That developing countries tend to experience larger cyclical fluctuations than industrialized countries is only partly attributable to commodities. It is also in part due to the role of factors that "should" moderate the cycle, but in practice seldom operate that way: procyclical capital flows, procyclical monetary and fiscal policy, and the related Dutch Disease. If anything, they tend to exacerbate booms and busts instead of moderating them. The hope that improved policies or institutions might reduce this procyclicality makes this one of the most potentially fruitful avenues of research in emerging market macroeconomics.

According to the theory of intertemporal optimization, countries should borrow during temporary downturns, to sustain consumption and investment, and should repay or accumulate net foreign assets

during temporary upturns. In practice, it does not always work this way. Capital flows are more often procyclical than countercyclical. Most theories to explain this involve imperfections in capital markets, such as asymmetric information or the need for collateral.

As developing countries evolve more market-oriented financial systems, the capital inflows during the boom phase show up increasingly in prices for land and buildings, and in prices of financial assets. Prices of equities and bonds (or the reciprocal, the interest rate) reflect the extent of speculative enthusiasm, sometimes useful for predicting which countries are vulnerable to crises in the future.

In the commodity and emerging market boom of 2003-2011, net capital flows typically went to countries with current account surpluses, especially Asians and commodity producers in the Middle East and Latin America, where they showed up in record accumulation of foreign exchange reserves. This was in contrast to the two previous cycles, 1975-1981 and 1990-97, when the capital flows to developing countries largely went to finance current account deficits.

One interpretation of procyclical capital flows is that they result from procyclical fiscal policy: when governments increase spending in booms, some of the deficit is financed by borrowing from abroad. When the governments are forced to cut spending in downturns, it is to repay some of the excessive debt that they incurred during the upturn. Another interpretation of procyclical capital flows to developing countries is that they pertain especially to exporters of agricultural and mineral commodities. We consider procyclical fiscal policy in the next sub-section, and return to the commodity cycle (Dutch disease) in the one after.

Many authors have documented that fiscal policy tends to be procyclical in developing countries, especially in comparison with industrialized countries. Most studies look at the procyclicality of government spending, because tax receipts are particularly endogenous with respect to the business cycle. An important cause of procyclical spending is precisely that government receipts from taxes or royalties rise in booms, and the government cannot resist the temptation or political pressure to increase spending proportionately, or more than proportionately.

Procyclicality is especially pronounced in countries that possess natural resources and where income from those resources tends to dominate the business cycle. Cuddington (1989) and Arezki, Hamilton and Kazimov (2011) show the correlation between commodity booms and spending booms.

Two large budget items that account for much of the increased spending from oil booms are investment projects and the government wage bill. Regarding the first budget item, investment in infrastructure can have large long-term pay-off if it is well designed; too often in practice, however, it takes the form of white elephant projects, which are stranded without funds for completion or maintenance, when the oil price goes back down (Gelb, 1986). Regarding the second budget item, Medas and Zakharova (2009) point out that oil windfalls have often been spent on higher public sector wages. They can also go to increasing the number of workers employed by the government. Either way, they raise the total public sector wage bill, which is hard to reverse when oil prices go back down. Figures 2 and 3 plot the public sector wage bill for two oil producers against primary product prices over the preceding three years: Iran and Indonesia. There is a clear positive relationship. That the relationship is strong with a three-year lag illustrates the problem: oil prices may have fallen over three years, but public sector wages cannot easily be cut nor workers laid off.

Figure 2: Iran's Government Wage Bill Is Influenced by Oil Prices Over Preceding 3 Years (1974, 1977-1997.)

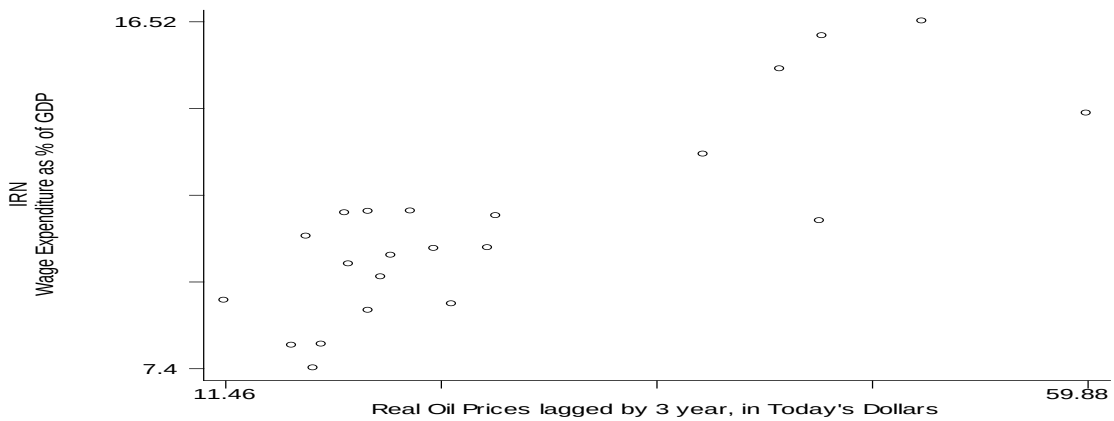
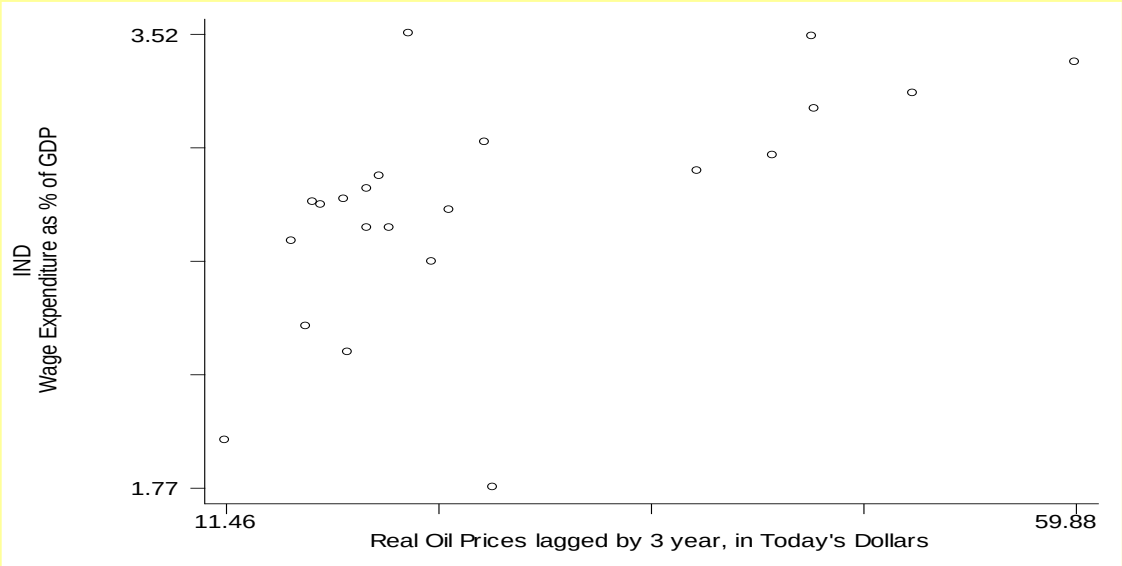


Fig. 3: Indonesia's Government Wage Bill Is Influenced by Oil Prices Over Preceding 3 Years (1974, 1977-97)



6. conclusion

The purpose of this paper is to study the mechanism in which oil revenues affects the Iranian economy and the impact of oil shocks on the Iranian economy using a threshold regression model.
By estimating the model in two distinct regimes of high and low oil revenues, the non-linear approach shows the effects of oil revenues on economic growth more precisely in each regime. We can summarize the results of estimating model as follows:
1. The hypothesis of linear model against non-linear model and the existence of a threshold value is rejected. In other words, threshold model can explain the effects of oil revenues on Iranian economic growth more precisely.
2. In regimes of low oil revenues (where the share of oil revenue in GDP less than 0.021), oil revenue has a positive impact on economic growth, while in regimes of high oil revenues (where the share of oil revenue is greater than 0.021), the effect of oil revenue on economic growth is negative. Thus, the resource curse hypothesis in periods of high oil revenues is accepted for the Iranian economy. Therefore the optimum oil revenue divided by GDP in Iran is 0.02.
3. While investment ratio has the greatest effect on economic activity in regimes of low oil revenues, the effect of this variable in regimes of high oil revenues is not significant.
Civil projects in periods of high oil revenues are likely to have lower productivity, leading to more rent seeking.
Therefore, we conclude that the response of economic growth to different the share of oil revenues is non-linear. According to the asymmetric effect of oil revenues in two regimes, while an excessive rise in oil revenues and covering the estimated threshold, in addition to inefficient management of these revenues along with institutional and structural problems of the Iranian economy in absorbing high oil revenues, counters the positive effects of higher oil revenues on economic activities.

References

Acemoglu, Daron, Simon Johnson, and James Robinson, 2003, "An African Success: Botswana," in In Search of Prosperity, edited by Dani Rodrik. Analytic Narratives in Economic Growth (Princeton: Princeton University Press).
Acemoglu, Daron, Simon Johnson, James Robinson, 2001, "Colonial Origins of Comparative Development: An Empirical Investigation," American Economic Review 91, no. 5, 1369-1401.

Acemoglu, Daron, Simon Johnson, James Robinson, 2002, "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution," Quarterly Journal of Economics 117(4), 1231-1294.
Acemoglu, Daron, Simon Johnson, James Robinson, and Yunyong Thaicharoen, 2003, "Institutional Causes, Macroeconomic Symptoms: Volatility, Crises and Growth," Journal of Monetary Economics (Elsevier), vol. 50(1), pages 49-123, January.
Alexeev, Michael, and Robert Conrad, 2009, "The Elusive Curse of Oil," Review of Economics and Statistics, 91, no. 3, 586-98.
Alotaibi, B., 2006. Oil price fluctuation and the Gulf Cooperation Council (GCC) countries, 1960–2004. May 2006.
Anashasy, E.-A. *et al.*, 2005. Evidence on the Role of Oil Prices in Venezuela's Economics Performance (1950–2001). Working Paper. University of Washington.
Arezki, Rabah, Kirk Hamilton and Kazim Kazimov, 2011, "Resource Windfalls, Macroeconomic Stability and Growth: The Role of Political Institutions," (International Monetary Fund: Washington DC), May.
Beny, Laura, and Lisa Cook, 2009, "Metals or Management? Explaining Africa's Recent Economic Growth Performance," American Economic Review, 99, no. 2, May, 268-274.
Colgan, J., 2011. Oil and resource-backed aggression. Energy Policy, 2011, vol. 39, issue 3, pages 1669-1676.
Cuddington, John, 1989, "Commodity Export Booms in Developing Countries," World Bank Research Observer 4, 143-165.
Davis, Graham. 1995. "Learning to Love the Dutch Disease: Evidence from the Mineral Economies," World Development 23: 1765-79.
Davis, Jeffrey, Rolando Ossowski, and Annalisa Fedelino, editors, 2003, Fiscal Policy Formulation and Implementation in Oil-Producing Countries (IMF: Washington DC).
Davis, Jeffrey, Rolando Ossowski, James Daniel, and Steven Barnett, 2001a, "Oil Funds: Problems Posing as Solutions?" Finance and Development 38, no.4 (IMF, Washington DC).
Davis, Jeffrey, Rolando Ossowski, James Daniel, and Steven Barnett, 2001b, "Stabilization and savings funds for nonrenewable resources: Experience and fiscal policy implications," Occasional Paper 205 (International Monetary Fund: Washington DC). And in Davis, et al, 2003.
Delacroix, Jacques. 1977. "The Export of Raw Materials and Economic Growth: A Cross-National Study." American Sociological Review 42: 795-808.
Eltony, M.N., 2002. Oil Price Fluctuations and Their Impact on the Macroeconomic Variables of Kuwait: A Case Study Using a VAR Model. API-Working Paper Series 9908. Information Center, 2002, Arab Planning Institute, Kuwait.
Frankel, Jeffrey A. 2010. The Natural Resource Curse: A Survey. HKS Faculty Research Working Paper Series, RWP10-005, John F. Kennedy School of Government, Harvard University.
Gelb, Alan, 1986, "Adjustment to Windfall Gains: A Comparative Analysis of Oil-Exporting Countries," in "Natural Resources and the Macroeconomy: A Theoretical Framework," in J.Peter Neary and van Sweder Wijnbergen, eds., Natural Resources and the Macroeconomy (MIT Press: Cambridge), 54-93.
Hansen, B., 2000. Sample splitting and threshold estimation. *Econometrica* **68**, 575–603.
Hausmann, Ricardo, 2003, "Venezuela's Growth Implosion: A Neo-classical Story?"
Hausmann, Ricardo, and Roberto Rigobon, 2003, "An Alternative Interpretation of the 'Resource Curse': Theory and Policy Implications," in Fiscal Policy Formulation and Implementation in Oil-Producing Countries, edited by Jeffrey Davis (International Monetary Fund: Washington, DC), p 12-44.
Hausmann, Ricardo, Bailey Klinger and Jose Lopez-Calix, 2009, "Export Diversification in Algeria," World Bank, MNSED, April.
Hausmann, Ricardo, Bailey Klinger and Robert Lawrence, 2008, "Examining Beneficiation," CID Working Paper No. 162, Harvard University, May.
Herb, Michael, 2005, "No Representation without Taxation? Rents, Development and Democracy," Comparative Politics 37, no. 3, 297-317.
Iimi, Atsushi, 2006, "Did Botswana Escape from the Resource Curse?" IMF Working Paper No. 06/138, June.
in In Search of Prosperity: Analytic Narratives on Economic Growth, edited by Dani Rodrik (Princeton University Press).

Jimenez Rodriguez, R. and Sanchez, M., 2004. Oil price shocks and real GDP growth empirical evidence for some OECD cuntries. Working Paper No. 362 May.
Kaldor, M., Karl, T.L. and Y. Said, 2007, Oil Wars (Pluto Press), edited by M. Kaldor, T.L. Karl and Y. Said.
Maloney, William, 2002, "Missed Opportunities: Innovation, Natural Resources and Growth in Latin America," Economia 3, no. 1, pp. 111-169.
Matsuyama, Kiminori, 1992, "Agricultural Productivity, Comparative Advantage, and Economic Growth," Journal of Economic Theory 58, December, 317-334.
Mork, K., Olsen, O. and Mysen, T., 1994. Macroeconomic responses to oil price increases and decreases in seven OECD countries. *Energy Journal* **15**, 4, 19–35.
Ram, R. (1986), "Government size and economic growth; A new framework and some evidence from cross section and time-series data", American Economic Review, 76(1),191-203.

Røed Larsen, Erling, 2004, Escaping the Resource Curse and the Dutch Disease? When and Why Norway Caught up with and Forged ahead of Its Neighbors," Discussion Papers No. 377, May, Statistics Norway, Research Department.
Ross, Michael, 1999, "The Political Economy of the Resource Curse," World Politics 51, 297-322.
Ross, Michael, 2001, "Does Oil Hinder Democracy?" World Politics 53, no.3, 325-61.
Ross, Michael, 2006, "A Closer Look at Oil, Diamonds, and Civil War," Annual Review of Political Science 9, 265-300.
Ross, Michael, 2007, "How Mineral-Rich States Can Reduce Inequality," Chapter 9 in Escaping the Resource Curse, edited by M.Humphreys, J.Sachs and J.Stiglitz (Columbia University Press: NY), pp.236-255.
Rosser, Andrew, 2007, "Escaping the Resource Curse: The Case of Indonesia." Journal of Contemporary Asia, Vol. 37, No. 1, pp. 38-58.
Sachs, Jeffrey, 2007, "How to Handle the Macroeconomics of Oil Wealth," Ch. 7 in Escaping the Resource Curse, edited by M.Humphreys, J.Sachs and J.Stiglitz (Columbia University Press: NY), pp.173-193.
Sachs, Jeffrey, and Andrew Warner, 1995, "Natural Resource Abundance and Economic Growth," in G. Meier and J. Rauch, eds., Leading Issues in Economic Development, New York: Oxford University Press. NBER WP 5398.
Sachs, Jeffrey, and Andrew Warner, 2001, "The Curse of Natural Resources," European Economic Review (Elsevier), vol. 45(4-6), pages 827-838, May.
Sala-I-Martin, Xavier, and Arvind Subramanian, 2003, "Addressing the Natural Resource Curse: An Illustration from Nigeria." IMF Working Paper WP/03/139.
Sarraf, Maria, and Moortaza Jiwanji, October 2001, "Beating the Resource Curse: The Case of Botswana." Environmental Economics Series Paper No. 83.
Smith, Benjamin, 2004, "Oil Wealth and Regime Survival in the Developing World, 1960-1999," American Journal of Political Science 48(2), 232-246.
Smith, Benjamin, 2007, Hard Times in the Land of Plenty: Oil Politics in Iran and Indonesia (Cornell University Press: Ithaca NY).
van Wijnbergen, Sweder, 1984, "The 'Dutch Disease': A Disease After All?" Economic Journal 94: 41-55.
Wright, Gavin, and Jesse Czelusta, 2003, "Mineral Resources and Economic Development," Conference on Sector Reform in Latin America, Stanford Center for International Development Nov. 13-15.
Wright, Gavin, and Jesse Czelusta, 2004, "The Myth of the Resource Curse," Challenge 47 (March-April).
Wright, Gavin, and Jesse Czelusta, 2006, "Resource-Based Growth Past and Present," in Daniel Lederman and William Maloney, editors, Neither Curse nor Destiny: Natural Resources and Development (Stanford University Press and World Bank Publication).
Zind, R., 2001. The response of the Arabian Gulf economics to the changes in world oil prices. *METU Studies in Development* **28**, 1–2, 235–255.