Iranian Economic Review 2021, 25(2): 279-292
DOI: 10.22059/ier.2020.74559

RESEARCH PAPER

Threshold Effects of Oil Revenues on Iran's Growth Regimes: A Hybrid Threshold Markov Switching Model

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Received: 06 July 2019, Revised: 27 August 2019, Accepted: 12 September 2019

Abstract
One of the significant issues studied in the oil-exporting countries has been to identify the relationship between oil and economic growth, and the nature of the relationship has been important for the economic policymakers of these countries. This study aims to investigate the effect of oil revenues on Iran's economic growth over the period 1971-2017. For this purpose, the threshold effects of oil revenues on economic growth regimes are modeled using a hybrid threshold Markov switching model. The results from the model estimation indicate that oil revenue has a nonlinear and threshold effect on Iran's economic growth regimes in which as long as oil revenues have a share less than 16.3% in GDP, oil revenues have a positive effect on growth but after exceeding this threshold, oil rents had a negative and significant effect on economic growth. The results also imply that Iran's economic growth has two regimes, namely the high-growth regime and the low-growth regime, in which the fluctuations in the high-growth regime are more than that in the low-growth regime.
Keywords: Oil Rents, Economic Growth, Hybrid Threshold Markov Switching Model.
JEL Classification: Q30, O47, O53, C24.

Introduction

The abundance of natural resources in some countries has had different and sometimes adverse effects on the process of the country's economic development. In traditional theories, the abundance of natural resources as a productive input can expedite the process of economic growth. In some countries, such as the United States, Norway, and Canada, these resources have accelerated economic growth. However, for many other countries, this is not the case, and not only this privilege has not contributed to the economic growth and development, but also in some cases has led to retardation in this process (Gylfason, 2001). In response to the question of why some countries with the abundance of the natural resource have not been able to pursue economic development and suffer from many economic problems, the resource curse hypothesis has arisen. According to this hypothesis, the dependence on revenues from the export of natural resources may lead to the strengthening of renting processes, the government's financial independence from the domestic economy, rising government expenditures, weakening democracy, severe fluctuations and instability, lack of transparency, and government inefficiency. Some other problems also may arise such as disregarding the improvement in the quality of human capital, the inefficient allocation of oil rents and the destruction of institutions in these societies, leading to the weak economic performance of these countries (Zamanzadeh and Alhoseini, 2012; Karimi, 2015).

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Economic growth is one of the most important economic issues in every society, so that development, in some sense, is interpreted as a long-term, continuous economic growth. So, one critical problem in oil-exporting countries is to identify the impact of oil and oil revenues on economic growth. From the econometric point of view, although many studies have been conducted on resource curse and economic growth, these studies have deficiencies that the present study attempts to resolve the shortcomings. For example, an important aspect of the resource curse is the effect of oil revenues on economic growth, which in some studies a nonlinear and threshold relationship between oil revenues and economic growth is observed (see for example Mehrara and Maki Nayeri, 2009). However, the possibility of a two-regime economic growth has not been taken into account in studying the threshold model. Two-regime variables such as economic growth arise for reasons such as economic recession and prosperity, the execution of various economic policies, the occurrence of various shocks in demand or supply in the economy, and other natural, social, and political events, as well as technological and institutional changes. Therefore, because of the dynamics of economic developments and the successive changes in economic variables over time and the transformation of different economic situations such as boom and bust cycles, it is necessary to incorporate two-regime dependent variables into the model to achieve more accurate model in the real world. Therefore, previous studies may be affected by a specification error because of this weakness. Therefore, one can use a model combining Markov switching and threshold regression models to achieve more accurate modeling of real-world situations and to obtain unbiased estimates. Specifically, the dependent variable in studying the impact of oil on economic growth is two-regime; and on the other hand, the effect of oil revenues as an exogenous variable has a threshold effect on economic growth. Therefore, a threshold Markov switching model can simultaneously investigate the threshold effect of oil revenues on economic growth regimes. This approach has not been applied in previous studies, so the present study aims to address this lack.

The paper has been organized as follows. The next section reviews the existing literature and provides the theoretical framework. The model and econometrics method is presented in Section3. The results are exhibited in Section4. Section5 presents concluding remarks and recommendations.

Theoretical Framework and Literature Review

Theoretical Framework

Resource curse often refers to a phenomenon in which countries with the abundance of natural resources such as oil or other resources, experience lower economic growth than other countries (Frankel, 2010). This term was first applied by Auty (1993), but its concept had previously been discussed in several papers. For instance, Gelb (1988), Van Wignbergen (1984), Krugman (1987), and Matsuyama (1992) and some others had discussed the concept of resource with reference to the Dutch disease. The history of the resource curse dates back to centuries ago, when for example Spain, in the 16th and 17th centuries, lose its vast wealth obtained from the sources of the newly discovered American continent in luxuries and wars and could not use these vast resources for economic development in the country (Zamanzadeh and Al-Husseini, 2012).

The resource curse hypothesis may be divided into three approaches. The first one, i.e., the political economy approach, deals with the destructive impact of oil rents on institutional quality and economic, political, and social structures, which leads to the development and fortification of renting processes rather than production processes in the economy. The second approach also addresses the transmission of the volatility of natural resource markets, such as oil, to the domestic economy and discusses the impact of fluctuations in natural resource revenues on government budgets, investment, and economic growth. The third approach also deals with the Dutch disease in which oil rents undermine the balance of exchangeable and non-exchangeable parts of the economy by fostering the non-exchangeable part (such as the service sector) and the relative depreciation of the exchangeable part (industry and agriculture) and ultimately weaken the economic growth process (Mehrara et al., 2011).

According to the resource curse hypothesis, the dependence of the economy on revenues from the export of natural resources produces impacts such as rent-seeking of powerful and influential groups in trying to obtain a greater share of natural resource rents. In addition, this property may result in the spread of economic corruption, the reduction of productive economic activity caused by Dutch disease, the insignificant impact of human capital on economic growth due to the lack of attention to the quality of education and the lack of transparency and efficiency of the government (Karimi, 2015; Nademi and Sedaghat Kalmarzi, 2018).

Also, rents from the export of natural resources may affect economic growth (Nademi and Zobeiri, 2017) through various paths such as the reduction of physical and human capital accumulation (Philippot, 2010; Blanco and Grier, 2012), productivity decline (Vernon and Kulys 2013), weakening governance (Busse and Groning, 2013; Bowland, 2012), increasing inequality (Buccellato and Alessandriani, 2009; Mallaye et al., 2015; Nademi, 2018).

Rents from export of natural resources also leads to the creation of rents in the economic system by fostering the limited access order in the economy, so that the rental distribution of revenues from the export of natural resources among powerful and influential groups yield to controlling violence at least temporarily through increased motivations to keep the existing order. Violence does not occur until the distribution of rents between powerful and influential groups changes. However, if the distribution pattern of rents is disturbed, the violence may happen. Although the distribution of natural resource rents, on the one hand, leads to the consolidation of security in the society, the cost of fostering the limited access order with natural resources rents is the loss of economic efficiency and restricting the production process and economic growth. One of these inefficiencies is the financial independence of the government from the private sector. More clearly, in a context where the government provides its expenditures from exogenous rents, i.e., the sale of natural resources such as oil, it feels no need for tax revenues, and so the tax system in such economies is very weak and inefficient. Weakening the tax system, as a nexus between the public sector and the private sector, will disrupt the state's economy from the private sector economy, and in this context, the government naturally does not have sufficient motivation to fortify the tax system and tax transparency. On the other hand, the process of democracy and governance is also enfeebled by the poor responsibility of the government to the private sector because a state that earns its revenue from the sale of natural wealth does not oblige itself to respond about the expenses of oil rents. Consequently, the lack of economic transparency and the spread of corruption and bad governance will be the inevitable outcome of such an economy. The government gives itself authority for the development and tries to expedite the process of state-driven development through centralized planning and a hasty increase in spending, but this process often leads to the expansion of government size and inefficiency of government spending.

Literature Review

Numerous internal and external studies have been conducted on the relationship between oil and economic growth that are listed in the following tables. None of the researches has employed the threshold Markov switching method. Therefore, the main contribution of the present study is to present a new hybrid threshold Markov switching model.

Table 1: International Studies on the Relationship between Oil and Economic Growth

Study	Subject	Studied region and time period	Econometric approach	Results
Berument et al. (2010)	The impact of oil price shocks on economic growth	MENA countries (1971-2004)	VAR	The positive impact of oil price shocks on the outputs in some countries, including Iran and the UAE, and insignificant effect on the outputs of some other countries, including Egypt and Morocco
Alexeev and Chih (2017)	The impact of oil price shocks on economic growth	US (states level) (1987-2014)	Panel and Spatial Panel	The positive impact of oil price shocks on economic growth only in states with a high value of the economic freedom index
Antonakakis et al. (2017)	Oil dependence, quality of political institutions and economic growth	76 countries (1980-2012)	Panel VAR	The resource curse hypothesis is confirmed for developing economies and medium-high income countries, and oil has been a negative impact on economic growth
Ftiti et al. (2014)	Oil shocks and economic growth	OPEC countries (2000-2010)	Evolutionary co-spectral analysis	Different patterns are observed in co-movements between oil and economic growth, depending on the studied horizons.
Bastianin et al. (2017)	Oil supply shocks and economic growth	Countries in the Mediterranean region (1975-2015)	OLS	The negative effects of oil supply shocks increase in oil-importing countries and insignificant effect on oil-exporting ones
Wesseh and Lin (2018)	Oil price shocks, exchange rate fluctuations and economic growth	Liberia (1995-2015)	VAR	Positive impact of oil price increase on economic growth

Table 2: Domestic Studies on the Relationship between Oil and Economic Growth

Study	Subject	Studied region and time period	Econometric approach	Results
Abrishami and Mohseni (2003)	The impact of oil price shocks on economic growth	Iran (1966-1996)	Johansen Co-integration test	Oil export volatility has not affected GDP in the long run, but the impact appears in the short run.
Ebrahimi et al. (2008)	The mechanisms of oil revenues impact on economic growth	Oil-exporting countries (1990-2004)	Panel data model	Negative impact of oil revenues on economic growth
Behbudi et al. (2009)	The effect of oil price volatility on GDP	Iran (1987-2005)	VAR	Oil price has positively affected GDP, and oil price volatility has negatively affected GDP

Study	Subject	Studied region and time period	Econometric approach	Results
				in the long run.
Jahadi and Elmi (2011)	Oil price shocks and economic growth	OPEC countries (1970-2008)	VAR	The most dependence on oil is observed in the UAE and Iran, and the least dependence is observed in Indonesia and Ecuador.
Samadi et al. (2013)	Effect of permanent and transitory volatility of oil prices on macroeconomic variables including investment, output and unemployment	Iran (1981-2007)	Component GARCH and VAR	Permanent volatility of oil prices have led to a decline in investment and output and an increase in unemployment, and its effect on all three variables in permanent.
Mehrara (2014)	Oil revenues and economic growth based on endogenous structural breaks	Iran (1959-2010)	Gregory-Hansen co-integration test	Oil revenues have a negative impact on economic growth in the long run. In the short run, the response of economic growth to oil shocks is asymmetric and more intense for decreasing shocks of oil prices.
Esmaeili Razi et al. (2015)	Impact of oil revenue shocks and uncertainty caused by exchange rate fluctuations on growth in agriculture sector	Iran (1974-2012)	SVAR	Negative shocks of oil revenues have a positive impact on growth in the agriculture sector, and the positive shocks of oil revenues have a negative impact on growth in the agriculture sector.
Samadi et al. (2018)	Asymmetric effects of oil price shocks on the interest rate and economic growth	Iran (1999-2014)	VAR	Oil price shocks in both the high and low volatility regimes have different and asymmetric effects on interest rates and economic growth. The oil prices shock in the high-volatility regime, at the start, leads to a more intense decline in the economic growth compared with the increase in the economic growth in low volatility regime.

Econometric Approach

This research uses the descriptive-correlational research design and applies econometric methods and inferential statistics to test the hypotheses.

According to historical arguments, if a process such as economic growth has changed in the past, then it is possible to repeat those changes in the future. This phenomenon should be taken into account in analyses and predictions. Also, regime change should not be considered as a predictable and certain problem, but it is a random and exogenous variable.

Consider S_t as a random variable taking only integer values. Assume the probability that S_t equals a specific value j depends only on its corresponding value in the previous period:

$$P\{S_t = j / S_{t-1} = i, S_{t-2} = k, \ldots\} = P\{S_t = j / S_{t-1} = i\} = P_{ij} \tag{1}$$

Such a process is described as a Markov chain with n regimes:

$$P = \begin{bmatrix} P_{11} & P_{21} \ldots P_{n1} \\ P_{12} & P_{22} \quad P_{n2} \\ . & \\ . & \\ P_{1n} & P_{2n} \ldots P_{nn} \end{bmatrix} \tag{2}$$

In the probability matrix P, the P_{ij} element represents the probability of the occurrence of the regime j after the regime i. For example, P_{12} represents the probability of change from regime 1 to regime 2, which, in the economic growth context, can be interpreted as the transition from the recession to the boom or vice versa.

An important feature of the regime-switching models is the possibility that some or all of the model parameters switch in different regimes according to a Markov process. This process is controlled by the state variable S_t. The underlying logic for this modeling is to have a combination of distributions with different characteristics. These distributions give the current value of the variable. It is assumed that the state variable follows a first-order Markov chain with the following transition matrix:

$$\mathrm{P} = \begin{bmatrix} \mathrm{p}_{11} & \mathrm{p}_{21} \\ \mathrm{p}_{12} & \mathrm{p}_{22} \end{bmatrix} = \begin{bmatrix} \mathrm{p} & 1-\mathrm{q} \\ 1-\mathrm{p} & \mathrm{q} \end{bmatrix} \tag{3}$$

where p_{ij} represents the probability of switching from state i at time $t-1$ to state j at time t.

$$\Pr(\mathrm{s_t} = \mathrm{j} | \mathrm{s_{t-1}} = \mathrm{i}) = \mathrm{p_{ij}} \tag{4}$$

For convenience, only two regimes are considered. The ergodic probability (which is a non-conditional probability) with the state $S_t = 1$ is specified as follows:

$$\pi_1 = \frac{1-q}{2-p-q} \tag{5}$$

If the process is in period t in the ith regime, the transition probabilities after m periods are as follows:

$$\begin{bmatrix} P\{S_{t+m} = 1 / S_t = i\} = P_{i1} \\ P\{S_{t+m} = 2 / S_t = i\} = P_{i2} \\ P\{S_{t+m} = n / S_t = i\} = P_{in} \end{bmatrix} = P^m e_i \tag{6}$$

where e_i stands for the ith column in the identity matrix I_n. This expression shows that the transition probabilities after m periods for the Markov chain can be obtained by multiplying P by itself m times. Clearly, the probability that starting with the ith regime the jth regime appears after m periods, i.e., $P\{S_{t+m} = j / S_t = i\}$, appears in the jth row of the matrix P^m (Marcucci, 2005; Klaassen, 2002; Gray, 1996).

Generally, the Threshold Markov switching model can be expressed as follows:

$$Growth_t|\zeta_{t-1} \sim \begin{cases} f\left(\theta_t^{(1)}\right) p_{1,t} \\ f\left(\theta_t^{(2)}\right)(1 - p_{1,t}) \end{cases} \tag{7}$$

Where $f(.)$ is one of the possible conditional distributions, assumed to have a normal distribution, student's t, or generalized error distribution. Here, $\theta_t^{(i)}$ denotes the parameters vector in regime i, which determine the distribution, $p_{1,t} = \Pr[s_t = 1|\zeta_{t-1}]$ is the predicted probability, and ζ_{t-1} represents the information set in time $t - 1$.

The vector of variable parameters over time can be decomposed into two parts:

$$\theta_t^{(i)} = \left(\mu_t^{(i)}, \nu_t^{(i)}\right) \tag{8}$$

where $\mu_t^{(i)} \equiv E(Growth_t|\zeta_{t-1})$ is the conditional mean and $\nu_t^{(i)}$ is the shape parameter of the conditional distribution.

Threshold Markov switching consists of four elements, namely conditional mean, threshold variable, regime process, and conditional distribution. The conditional mean equation here is modeled as follow:

$$Growth_t^i = \beta_0^i + \beta_1 oil_t + \alpha X_t + Z(oil_t \geq \gamma) * \beta_2 oil_t + \varepsilon_t^i \tag{9}$$

$$Z(oil_t \geq \gamma) = \begin{cases} 1 \; if \; oil_t \geq \gamma \\ 0 \; if \; oil_t < \gamma \end{cases} \tag{10}$$

where $Growth_t^i$ is the economic growth, and the superscript i stands for the regime, taking values 1 and 2 regarding the recession and boom periods of economic growth. The variable oil_t denotes the ratio of oil revenue to GDP. The coefficient β_1 reflects the impact of oil_t on economic growth regimes before the threshold γ (in low oil revenue regime), and β_2 plus β_1 reflects the impact of oil_t on economic growth regimes after the threshold γ (in high oil revenue regime). The variable X_t shows the controlling variables affecting economic growth, including labor force growth, gross capital stock growth, and secondary school enrolment ratio (human capital). The function $Z(oil_t \geq \gamma)$ is an indicator function taking only two values 0 or 1 according to equation (10). Finally, ε_t is a process with mean 0 and variance 1.

Therefore, the threshold Markov switching models assume two regimes of dependent variable which this assumption will be missed in the threshold regression model. On the other hand, this hybrid model assumes the threshold impact of the explanatory variable on the dependent variable which this effect will be missed in the Markov switching model. So, the hybrid model of threshold Markov switching model which includes both dependent and independent regime-switching has more advantage than threshold or Markov switching models.

In the Markov regime switching literature, the prediction probability $p_{1,t}$ is an essential part for the maximum likelihood estimation. The probability of being in the first regime at time t with the information given at time $t - 1$ is specified as follows:

$$p_{1,t} = Pr[s_t = 1|\zeta_{t-1}] =$$
$$(1-q)\left[\frac{f(growth_{t-1}|s_{t-1}=2)(1-p_{1,t-1})}{f(growth_{t-1}|s_{t-1}=1)p_{1,t-1} + f(growth_{t-1}|s_{t-1}=2)(1-p_{1,t-1})}\right] +$$
$$p\left[\frac{f(growth_{t-1}|s_{t-1}=1)p_{1,t-1}}{f(growth_{t-1}|s_{t-1}=1)p_{1,t-1}+f(growth_{t-1}|s_{t-1}=2)(1-p_{1,t-1})}\right] \quad (11)$$

where p and q are the transition probabilities in equation (3), and $f(.)$ is the conditional distribution of economic growth in equation (7).

Hence, the log-likelihood function is as follows:

$$l = \sum_{t=1}^{T} log\left[p_{1,t}f(growth_t|s_t = 1) + \left(1 - p_{1,t}\right)f(growth_t|s_t = 2)\right] \quad (12)$$

where $f(growth_t|s_t = 1)$ is the conditional distribution of the economic growth given that the regime i has already occurred at time t. The conditional mean of the economic growth, as defined in equation (9), is entered in equation (12), and the economic growth is assumed to have a normal distribution. Therefore, there is also a threshold variable in the conditional mean equation, and, the function in equation (12) is maximized with numerical methods for different values of the threshold variable along with other initial values for the parameters to estimate the maximum likelihood. The values of the threshold variable and other parameters that maximize the likelihood function (12) are chosen as the estimates of the parameters. After estimating the threshold using Hansen's bootstrapping method, the hypothesis that the threshold variable is zero is tested. If the threshold variable is significant, Hansen's likelihood ratio test (1992) is used to examine the significance of economic growth regimes. If the tests of the two-regime model and the threshold significance test validate the Threshold Markov switching model, we can analyze the model. In case that any of the tests is not significant, either the model should be estimated as a threshold model, or it should be estimated as a switching Markov model.

Finally, for maximization the likelihood function, we have used the Broyden, Fletcher, Goldfarb, Shanno (BFGS) optimization algorithm.

Empirical Results

Iran's economic data for the period of 1971-2017, collected through the sources from the Central Bank of the Islamic Republic of Iran and the data bank of the World Bank (WDI), has been used to estimate the model. It is necessary to examine the reliability of the variables before estimating the model. The results of the unit root test for each of the variables are presented in Table 1.

Table 3: Results of Augmented Dickey-Fuller (ADF) and Zivot and Andrews Tests

Variable	Augmented Dickey-Fuller (ADF) p-value	Zivot and Andrews p-value
Labor force growth	0.15	0.00
Gross capital stock growth	0.00	0.03
Economic growth	0.00	0.00
The first lag of economic growth	0.00	0.01
Share of oil revenues from GDP	0.14	0.00
Secondary school enrolment ratio (human capital)	0.07	0.00

Source: Research finding.

The results in Table 3 for the reliability tests show that the variables including labor force growth, the share of oil revenues from GDP, and the secondary school enrolment ratio are not reliable at a significance level of 5%. However, regarding the existence of several structural breaks such as revolution, war, oil shocks, and international sanctions, to ensure the accuracy of the reliability test, the unit root test was performed through the Zivot-Andrews test that enables us to consider structural breaks, and the results indicate the reliability of variables. Therefore, it is possible to estimate the model with conventional methods and the threshold and Markov switching models are appropriate for incorporating the structural breaks. For this purpose, the Threshold Markov switching model was estimated whose results are presented in Table 4.

Table 4: Estimation Results

Variable	Coefficient	P- Value
Intercept in Regime 1	29.27	0.00
Intercept in Regime 2	29.21	0.00
Logarithm of Standard of Deviation in Regime 1	-2.59	0.00
Logarithm of Standard of Deviation in Regime 2	2.27	0.00
Oil Revenue before Threshold Value of 16.3%	4.37	0.00
Oil Revenue after Threshold Value of 16.3%	-8.20	0.00
The first lag of Economic Growth	0.24	0.00
Labor force growth	-661.25	0.00
Gross capital stock growth	0.24	0.00
Secondary school enrolment ratio (human capital)	-0.22	0.00
Serial Correlation LM Test (P-Value)	0.79	
Heteroskedasticity ARCH Test (P-Value)	0.96	

Source: Research finding.

The results of the model estimation are briefly described here.

Economic growth in Iran has two regimes, namely high-growth and low-growth regimes. The high-growth regime has less variance than the low-growth regime. In addition, the transition probability matrix between high- and low-growth regimes is as follows:

$$\begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} = \begin{bmatrix} 0.30 & 0.70 \\ 0.30 & 0.70 \end{bmatrix}$$

where p_{11} represents the probability of staying in the high-growth regime, which is 0.30. In contrast, p_{22}, which is 0.70, shows the probability of staying in the low-growth regime, which has a substantial difference with the probability of staying in a high-growth regime, suggesting higher sustainability of low growth. Further, the probability of transition from the high-growth regime to low-growth regime, i.e., p_{12}, has a relatively high value of 0.70, and the probability of transition from the low-growth regime to the high-growth regime, i.e., p_{21}, is 0.30, indicating a temporary high-growth regime and quick transition of the economy from a high-growth regime to a low-growth regime. The staying length in a high-growth regime is 1.42 periods (years), and the corresponding length in a low-growth regime is 3.39 periods (years).

Figure 1 shows the smoothed conditional distribution of staying in the high-growth and low-growth regimes, showing how the transition between the high-growth and low-growth regimes occurs.

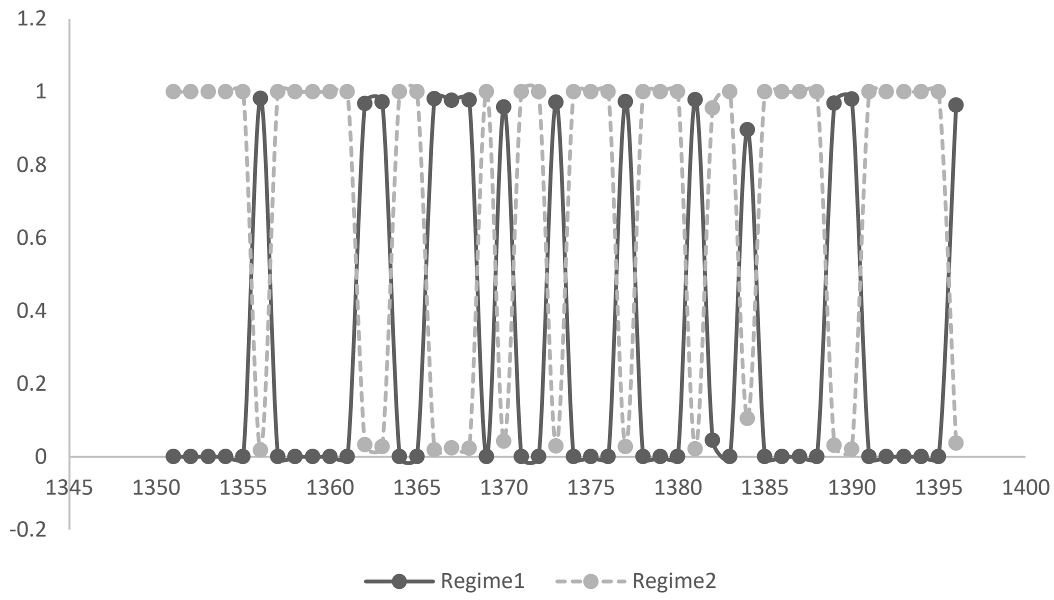

Figure 1: The Smoothed Conditional Distribution for the High-growth Regime (Regime1) and Low-growth Regime (Regime2)
Source: Research finding.

Here, it is assumed that the variable economic growth follows to regimes, one of which has specified with a high mean and the other has specified with a low mean. However, to ensure that two regimes exist in the research model, we should apply the Hansen's likelihood ratio test (Hansen, 1992). In this test, the null hypothesis of linearity is tested against the hypothesis of two regimes. The results are presented in Table 3.

Table 4: Results of Hansen's Likelihood Ratio (LR) Test

Test statistics	p-value	Result
120.68	0.00	The null hypothesis is rejected; the two-regime economic growth is confirmed.

Source: Research finding.

The results of the Hansen's likelihood ratio test for the research model indicate that the null hypothesis is rejected at the significance level of 5%, and the presence of two-regime economic growth has been confirmed in Iran's economy. Therefore, using this test, we can ensure that the model of economic growth can be estimated by Markov switching method with two regimes.

The share of oil revenues from GDP has had a nonlinear and threshold effect on economic growth so that as long as the share of oil revenues in GDP is less than 16.3%, oil revenues have had a positive effect on economic growth, but its effect on economic growth has been negative and significant after exceeding the threshold. The test of equality between the coefficient of oil revenues before and after the threshold was performed to investigate the significance of the threshold value based on the method proposed by Hansen (1996; 2000).

Table 5: Results of the Test of the Equality of Coefficients before and after the Threshold

Test statistics	p-value	Result
385.44	0.00	The null hypothesis of the equality of coefficients before and after the threshold is rejected; the threshold is significant.

Source: Research finding.

The results in Table 6 show the difference in the coefficients of oil revenue on economic growth before and after the threshold value of 16.3%, which indicates the significance of the threshold estimated. Therefore, oil revenues in the low oil revenues regime have a positive effect on economic growth, since oil revenues, on the one hand, lead to an increase in production through the import of capital goods and intermediaries, and, on the other hand, it can boost production and supply-side through government's development budget and investment in infrastructure. Also, the development of the oil sector will directly increase the GDP by increasing oil revenues as the main sector of Iran's economy.

The first lag of economic growth has a positive and significant effect on economic growth, which implies the dynamics of the economic growth model and also reflects the switching nature of the business cycles. The capital stock growth has also had a positive and significant effect on economic growth, which is consistent with economic growth theories.

Labor force growth and secondary school enrollment ratio as an indicator of human capital have had a negative and significant impact on economic growth. Putting together the high rate of unemployment among the trained people in Iran along with the phenomenon of brain drain or the migration of trained forces to developed countries, it is found that the labor market has not been successful in attracting trained labor force due to the rentier economy characteristics and the government-based nature of the Iranian economy. Accordingly, the unemployment of trained forces and the emigration of human capital from the country has been a negative factor in economic growth.

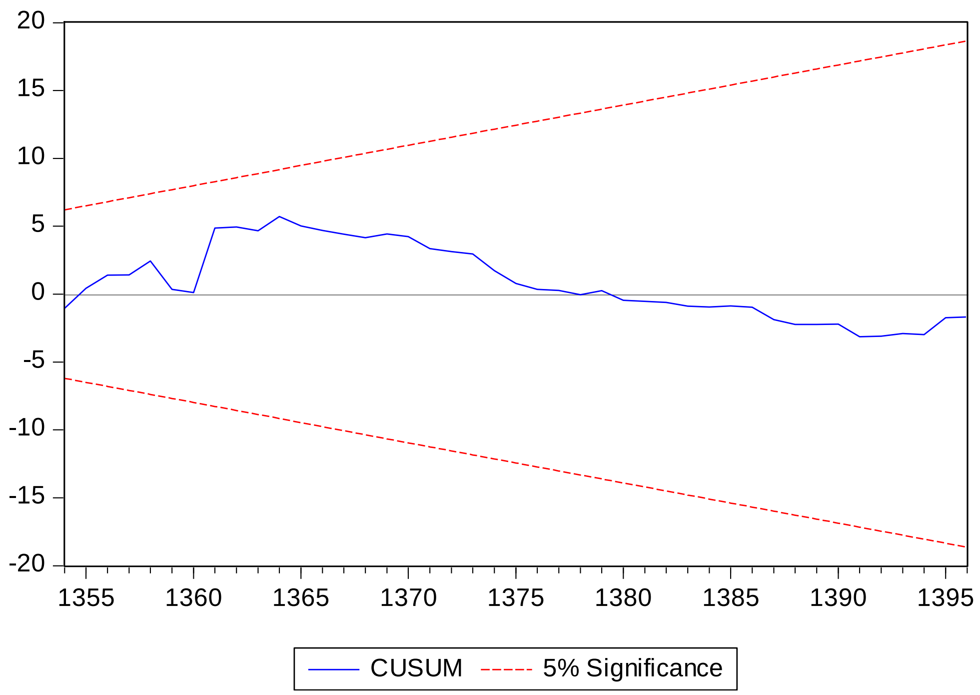

Figure 2. CUSUM Test
Source: Research finding.

In Table 4, the diagnostics test including serial correlation LM test and heteroskedasticity ARCH test indicate no serial correlation and homoskedasticity in error term, respectively. Also, in Figure 2, the stability test of CUSUM test indicates the stability of parameters in the model.

Conclusion and Policy Implications

The impact of oil rents on economic growth has received a great deal of attention among researchers and policymakers of oil-exporting countries, and many scholars have conducted extensive studies in this area. However, previous studies in this area have had deficits that this article has tried to cover one of these deficiencies as well as to perform another review of this important relationship in terms of econometric modeling. The gap existed in previous studies is the lack of attention to modeling economic growth as two-regime as well as considering the effects of oil rents on economic growth. Here, these two cases have been simultaneously included in the modeling of the impact of oil rents on economic growth. For this purpose, a hybrid Threshold Markov switching model has been used to investigate the nonlinear effect of oil revenues on Iran's economic growth over the period 1971-2017. The results of the model estimation confirmed the presence of two regimes of economic growth along with the threshold effect of oil rents on economic growth regimes in Iran's economy. In other words, economic growth in Iran has two regimes, namely high-growth regimes and low-growth regimes, in which the high-growth regime has less variance and less sustainability, and the low-growth regime has more variance and higher sustainability. Also, as long as oil revenue has a share less than 16.3% in GDP, it has a positive effect on economic growth, but after exceeding this threshold, oil revenue had a negative and significant effect on economic growth. This threshold effect is consistent with the findings of the study of Mehrara and Maki Nayeri (2009). Further, the rest of results indicate the positive impact of the first lag of economic growth and the gross capital stock growth on economic growth, while the labor force growth and the growth of secondary school enrolment ratio have had a negative and significant effect on the economic growth. As a reason for this negative effect, we may refer to the widespread unemployment and lack of potential in the market for labor attraction.

According to the results of the study, it is suggested that the government take into account the threshold level of 16.3% in the share of oil revenues in GDP so that the economic growth trend is not interrupted.

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