Oil and money in analyzing the impact of Oil Prices on Inflation, Growth, and Money

Petróleo y el dinero en el análisis del impacto de los precios del petróleo en la inflación, el crecimiento y el dinero

Mohammad Rezaie Narimisa*
Ministry of Petroleum - Iran
mrn43000@gmail.com

Noor Ezlin Ahmad Basri**
National University of Malaysia - Malaysia
neab8693@gmail.com

Ramezanali Shayanrad***
European Regional Academy - Armenia
shayanrad57@hotmail.com

ABSTRACT

In this research, with the proposed model of Kou and Peron (2007), the structural impacts of the Iranian economy due to the exogenous price of oil, with regard to production variables, inflation and volume of money as dependent and endogenous variables during the study period from April 1961 to March 2017 were investigated. The result was that five structural impacts were identified in September 1973, August 1979, August 1990, August 1994, and June 2006. The highest coefficient of oil price impact on production, inflation and growth of money was in the first and fifth regimes, respectively. Also, the highest period of oil price impact on production, inflation and growth of money was in the fourth, second and fifth regimes, respectively.

Keywords: structural impacts, Kou and Peron pattern, Middle East economy, inflation, growth

RESUMEN

En esta investigación, con el modelo propuesto de Kou y Peron (2007), los impactos estructurales de la economía iraní se deben al precio exógeno del petróleo, con respecto a las variables de producción, la inflación y el volumen de dinero como variables dependientes y endógenas durante el estudio. Período de abril de 1961 a marzo de 2017 fueron investigados. El resultado fue que se identificaron cinco impactos estructurales en septiembre de 1973, agosto de 1979, agosto de 1990, agosto de 1994 y junio de 2006. El coeficiente más alto del impacto del precio del petróleo en la producción, la inflación y el crecimiento del dinero se registró en los regímenes primero y quinto. respectivamente. Además, el período más alto del impacto del precio del petróleo en la producción, la inflación y el crecimiento del dinero se registró en los regímenes cuarto, segundo y quinto, respectivamente.

Palabras clave: impactos estructurales, patrón de Kou y Peron, economía de Oriente Medio, inflación, crecimiento

*Ministry of Petroleum, National Iranian Oil Refining & Distribution Company, Oil Refining Industries Development Company, Tehran, Iran (Corresponding author)
**Professor of National University of Malaysia (UKM), Department of Civil & Structural Engineering, Faculty of Engineering & Built Environment, Malaysia
***Ph.D. Student of Management, International Marking, Faculty of Management and Economics, European Regional Academy, Yerevan, Armenia

Recibido: 08/01/2019 Aceptado: 01/03/2019

Introduction

The export of crude oil for many years has led to the dependence of the economies of oil countries on foreign exchange earnings from the sale of this natural material. As all economic activities, including the activities of industry, agriculture and services sectors, have directly and indirectly linked to the export of this product. Also, given the exuberance of oil prices, the economies of oil-producing countries are particularly sensitive to oil price shocks (Auty, 1993). Due to the complete lack of central bank autonomy in oil-rich countries, monetary policy is usually influenced by financial policies, and as analyzed by (Berument, 2010), oil, money, inflation, and production have complex tensions in these countries (Burdidge, 1984), in most oil exporting countries, rising incomes have not been the result of technological progress, but more because of rising incomes This is due to the export of oil. The resource curse phenomenon, introduced by Auty in 1993, refers to the inverse relationship between the abundance of natural resources and economic growth and development (Bai, 1998) also argue that. In the oil-rich countries, 80 to 90 percent of the export earnings and 40 to 50 percent of the state's annual budget are made up of oil revenues. The main source of grants and subsidies is oil revenues, and the proceeds from exporting crude oil indirectly affect other economic activities Also, energy economics researchers from oil-rich countries agree on the existence of Dutch Disease in this economy (Cashin, 2014). So, any structural impetus and defeat in oil prices will affect its related factors, including government budget, general level of prices, volume of money and economic growth. In this research, the zero test hypotheses are that "due to the exorbitant price of oil, there was no structural failure in the Iranian economy." In this study, given the importance of oil prices in financing the Iranian economy and the exogenous nature of its changes, Structural impacts on the Iranian economy caused by changes in oil prices will be identified (Chapra, 2009). Then, the effect of oil price changes on the variables of inflation, economic growth and money will be calculated after each momentum. Finally, after reviewing the identified structural cycles, policy recommendations are presented (Carrion, 2009).

Methodology

Qu & Perron (2007) provided a method for determining structural breakpoints and estimating parameters in different regimes (Ftiti, 2010). The Kou and Peron method are based on a self-healing model vector 2, with dependent variables and several explanatory variables as a regressor. The general form of the model under consideration, which has n equation and t observation, is in the form of relation:

(1)

$$y_t = (I \otimes \acute{z}_t) S \beta_j + u_t$$

In which the vector y is the dominant variables of the pattern. So that:

(2)

Yt = (Y1t,…, Ynt)

I is a dimensional matrix nq. q the number of referrals and in relation (1), z is the regressor matrix.

(3)

$z\_t=(z_{1t},\ldots, z_{qt})'$

The matrix S is the transformation matrix in a model with dimensions nq × p, and p is the number of parameters. The transformation matrix means that all matrix elements contain zero and one numbers. This matrix, in accordance with the estimation method (vector autoregression, apparently unrelated regression, panel data), contains zero or one numbers Kou and Peron, 2007 (Farzanegan, 2009). The number of structural failures of the system is displayed with m. The failure times with the vector T = (T, ..., T) are displayed.

u in relation (1) has a mean zero and the covariance matrix is Σ_i for $T_{j-1} \leq t \leq T_j$.

In the regression mode itself, we can write (1) as (4):

(4)

$$y_t = \acute{x}_t \beta_j + \varepsilon_t$$

In which the relation (5) holds. In (5) r, is the number of endogenous variables.

(5)

$$X_t' = [\, I_r \times (1, Y_{1,t-k}, \ldots, Y_{r,t-k})]$$

To estimate the structural failure points, we need to estimate relation (6).

(6)

$$\{\check{T}_1,\ldots,\check{T}_m, \beta, \Sigma\} = \arg\max\, (T_1,\ldots T_m, \beta, \Sigma)\ r1r\Omega$$

Where r1rΩ is limited to logarithmic truth and is bound relation 7.

(7)

$$r1r\Omega = 1og\,(LR\Omega) + \lambda' g\,(\beta, vec\Sigma)$$

Relation 7: Optimization of the Gaussian right-longitudinal ratio is the relation 4 according to the g(β,vec∑) constraint. The ratio Lr_Ω is the form of relation 8.

(8)

$$LR\Omega = \frac{\pi_{j=1}^{m+1}\ \pi_{t=Tj-1^{+1}}^{T_j}\ f(Y_t \quad X_t\ ; \beta_j \Sigma_j)}{\pi_{j=1}^{m+1}\ \pi_{t=T_{j-1}^0+1}^{T_j^0}\ f(\,Y_t \quad X_t\ ; \beta_j^0 \Sigma j_j^0)}$$

This is in the relation 8:

(9)

$$f(Y_t \mid X_t\ ; \beta_j \Sigma_j) = 2\pi^{-\frac{n}{2}} \left|\Sigma_j\right|^{-\frac{1}{2}} \cdot \exp\{-\tfrac{1}{2}\ [y_t - x_t' \beta_j'] \Sigma_j^{-1} [y_t - x_t' \beta_j]\}$$

After the creation of the main function, the test of the zero hypothesis, “the absence of structural failure," is performed against the non-zero hypothesis "an uncertain number of failures". The test by Qu and Peron (2007) is named for the "double maximum test". Test statistic for non-uniform values a_i=1,i =1,…,M With WDmaxLR_T(M) is shown and is calculated in the form of relation (10).

WDmaxLR_T(M)=max≤kM [aks up LRTk,pb, nbd, nbo, ε]
(10)

Bai & Perron, first introduced the critical values of these statistics. The strategy for determining the number of failures is whether there was at least one failure. The algorithmic process of the model is such that if the double hypothesis test is not approved, then the number of failures based on the sequential test SEQ_T {1+ 1} must be decided, In which the zero hypothesis of the l-failure is tested against the non-zero hypothesis (l + 1) of failure, and its statistic is in the form of (11). SEQ_T {1+ 1}= max1≤j≤1+1 (11)

supφεŋj, ε1RT,1,T,T_j-1, φ,T_j,T1-1rT(T1,…T1) which is in relation (11), ŋj,ε ,as relation (12),

ŋj,ε={φ;$Ť_{j-1}$+($Ť_j$- $Ť_{j-1}$) ε ≤ φ ≤ $Ť_j$ - +($Ť_j$- $Ť_{j-1}$) ε } (12)

In relation (11), 1RT is likelihood ratio of relation (7), ($Ť_j$, …, $Ť_1$) division of failures (in case of failure l). The SEQ_T (1+ 1) logarithmic process continues until the optimal number of failures is determined and the zero hypothesis is confirmed. Up to this stage, by the proposed method Qu & Perron (2007), impulses (t), identification, and structural regimes will be determined.

Long-term coefficients and impact period

In the next step, the following self-regression model will be estimated for each structural regime determined in the previous step. (13)

ΔlogGDP_t=α_1+ $\beta_{1i}$$\Delta$log$GDP_{t-1}$+i=1kδli$\Delta$log$CPl_{t-1}$+i=lkθli$\Delta$log$M_{t-1}$+i=0

kϒliΔlogOIL_{t-1}+uli

(14)

ΔlogCPI_t= α_2+=l β_{2i} ΔlogGDP_{tt-i}+i= i=1kδ2iΔlogCPl_{t-i}+i=1kθ2iΔlogM_{t-i}+i=0

kϒ2iΔlogOIL_{t-1}+u2i

(15)

ΔlogM_t= α_3+ β $_{3i}$$\Delta$log$GDP_{t-1}$+i=1kδ3i$\Delta$log$CPl_{t-i}$+i= lkθ3i$\Delta$log$M_{t-1}$+i=0

kϒ3iΔlogOIL_{t-1}+u3i

In the above equations, logGDP is the logarithm of GDP, logCPI is the logarithm of the consumer price index, logM logarithm of liquidity, logOIL, the logarithm of the oil price and eventually u disrupted. In the set of equations (13) to (15), oil prices are considered as an exogenous variable. From a theoretical point of view, it can be argued that oil prices are set outside the domestic economy and then enter the country after depositing income in international accounts and interbank settlements, and then, of course, they will turn into the Rial to influence the domestic economy. This delay process is usually interrupted by the model. In relations (13) through (15), if the time series of the variables are mana, the surface variable (without (Δ and, alternatively, the differential variable (with Δ) will be used. Finally, for the estimation of the long-run coefficients, the self-regression equations given in the form of the matrix of relation (16) are expressed:

$$(I - \; T \varnothing_1 L^i)Y_t = \alpha + \; (\Gamma_i L^i)X_t + U_t \qquad (16)$$

In relation (16):

(17)

$$Y_t = \begin{pmatrix} \Delta logGDP_t \\ \Delta logCPl_t \\ \Delta logM_t \end{pmatrix}, X_t \; \Delta logOIL_t \;, \quad \emptyset_1 = \begin{pmatrix} B_{1i} & \delta_{1i} & \theta_{1i} \\ \beta_{2i} & \delta_{2i} & \theta_{2i} \\ B_{3i} & \delta_{3i} & \theta_{3i} \end{pmatrix}$$

$$\Gamma_i = \begin{pmatrix} \Upsilon_{1i} \\ \Upsilon_{2i} \\ \Upsilon_{3i} \end{pmatrix}$$

Then: $A(L)Y_t = \alpha + B(L)X_t + U_t$

where in: $A(L)=(I_3 - \sum_{i=1}^{k} \emptyset_i \, L^i)$, $B(L)= \sum_{i=1}^{k} \emptyset_i \, L^i \, \Gamma_i L^i$

So: $Y_t = A(L)^{-1} \; \alpha + A(L)^{-1} \; B(L)X_t + A(L)^{-1} \; U_t$

If: $A(L)^{-1} B(L)$ As a long-term coefficient (LM)2 defined:

$$A(L)^{-1} B(L) = \; (I_3 -)^{-1} , \qquad (18)$$

For triple dependent variables, we have relations (19) to (21).

$$LM_{gdpgrowth} = \frac{\sum_{i=1}^{k} \gamma_{1i}}{1-\sum_{i=1}^{k} \beta_{1i} - \sum_{i=1}^{k} \delta_{1i} - \sum_{i=1}^{k} \theta_{1i}} \qquad (19)$$

$$LM_{cpigrowth} = \frac{\sum_{i=1}^{k} \gamma_{2i}}{1-\sum_{i=1}^{k} \beta_{2i} - \sum_{i=1}^{k} \delta_{2i} - \sum_{i=1}^{k} \theta_{2i}} \qquad (20)$$

$$LM_{cpigrowth} = \frac{\sum_{i=1}^{k} \gamma_{3i}}{1-\sum_{i=1}^{k} \beta_{3i} - \sum_{i=1}^{k} \delta_{3i} - \sum_{i=1}^{k} \theta_{3i}} \qquad (21)$$

The dynamic coefficient of the oil price impact on the three indicators of economic growth, inflation, and money growth is estimated by establishing a dynamic relationship between the coefficients of the different periods. To calculate the dynamic coefficient 1 and estimate the duration of the effect of oil price growth on the dependent variables studied, according to Gomez-Loscos et al. (2011), the following relationships were used:

$$dm_{1\ \varphi} = \gamma_{0\ \varphi} \quad (22)$$

$$dm_{1\ \varphi} = \gamma_{0\ \varphi} + (\beta\varphi\gamma) \quad (23)$$

$$dm_{1\ \varphi} = \gamma_{0\ \varphi} +^{+} 3, \ldots, h \quad (24)$$

In which, dm is the dynamic coefficient of the period of influence, the index φ represents the type of variable, the index ω of time and *h* the long-term horizon. The effect of the impact period is the significant effect of long-term oil price growth on a dependent variable in the set of relations (22) to (24). In other words, the dynamic relation (24) tends to zero as time goes on. Until one season, its impact will no longer be meaningful. From the beginning of the effect time to zero, dm ωφ is defined as the duration of the effect period.

Results

Due to limited access to monthly GDP statistics, GDP data was converted into monthly data by Econometric Views software. Also, due to the unavailability of monthly liquidity figures, the general size of the basic definition of money (total banknotes, banknotes and bank deposits) was used as an indicator of the amount of money. Consumer price index (retail) was also considered as a general indicator of prices. The Qu & Perron (2007) algorithm proposed by GaussView10 software, and the estimation of long-run coefficients and impact period, was implemented by MattBlack software 2014 with bootstrap technique. In the first step, the variance of the research variables in their logarithmic form was determined by Carrion-i-Silvestre et al, (2009) was tested. According to table 1, the test statistic indicates that the zero hypothesis (the root of the unit) of all variables (except the volume of money) is not rejected, and the zero hypothesis is rejected for the first-order difference of all the research variables. Therefore, the first-order difference of variables was used in the model. In order to identify the momentum of oil in the model, the proposed model of Qu & Perron (2007) algorithm was used. The Akaic Critical Point Statistical Index was calculated by Kurozumi & Tuvandorj (2011), and the number of interruptions was selected as the optimal interruption. Previously, conventional statistics were used to determine the optimal lags of the Akaca and Schwarz-Busin. After determining the number of optimum interruptions, according to (11), the hypothesis of non-failure was found in the test model. According to table 2, the maximum value of double was equal to 709.30, which is significant at 99% level, which indicates that the hypothesis is not approved (No failure).

Table 1. Single root test Carrion-i-Silvestre et al. (2009)

Variable at the level of the statistic	**Oil price**	**General price level**	**Production**	**Money**
Dickey Fuller's (1979) Revised Statistics (MADF)	-2/61	-3/58	-2/82	-4/26
M-Class Ng and Peron (2001) Modified Statistics (MMZT)	-2/64	-3/5	-2/98	-3/88
Critical point (α=%5)	-3/85	-3/62	-3/85	-3/85

Variable first order differential statistics	**Oil price**	**General price level**	**Production**	**Money**
Dickey Fuller's (1979) Revised Statistics (MADF)	-15/22	-9/87	-9/72	-3/9
M-Class Ng and Peron (2001) Modified Statistics (MMZT)	-11/03	-8/51	-8/66	-3/86
Critical point (α=%5)	-3/81	-3/81	-3/73	-3/44

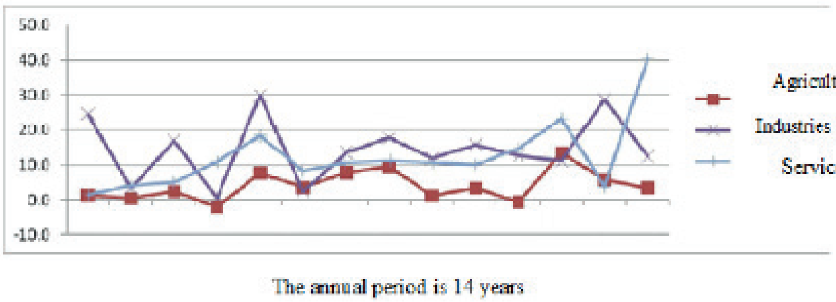
Table 2. Algorithm process Identify the number of breakpoints

Sequential test Seq (1+1| 1)				Maximum double	
Seq(5|4)	Seq(4|3)	Seq(5|4)	Seq(4|3)	Seq(5|4)	
30/64	28/107	30/64	28/107	30/64	The statistics
26/37	25/91	26/37	25/91	26/37	Critical Value (99%)

Table 3. Detected failure points

Break point	03	05	03	05	06
95% confidence interval	06- 04	02- 08	10- 06	05- 01	06- 01

Chart 1. Growth of GDP in non-oil sectors of the economy of the 14-year period



BIBLIOGRAPHIC REFERENCES

Auty, R. M. (1993). Sustaining Development in Mineral Economies: The London Resource Curse Thesis, Routledge.

Bai, J. & Perron, P. (1998). "Estimating and Testing Linear Models with Multiple Structural Changes". Econometrica, 66 (1), 47–78.

Berument, M. H., Ceylan, N. B. & Dogan, N. (2010). "The Impact of Oil Price Shocks on the Economic Growth of Selected MENA Countries". The Energy Journal, 31(1), 149-176.

Burbidge, J. & Harrison, A. (1984). "Testing for the Effects of Oil-Price Rises Using Vector Autoregression". International Economic Review, 25, 459–484.

Cashin, P., Mohaddes, K., Raissi, M. &, Raissi, M. (2014). "The Differential Effects of Oil Demand and Supply Shocks on the Global Economy". Energy Economics, 44(3), 113-134.

Carrion-i-Silvestre, J. L., Kim, D. & Perron, P. (2009). "GLS-Based Unit Root Tests with Multiple Structural Breaks both under the Null and the Alternative Hypotheses". Econometric Theory, 25, 1754-1792.

Chapra, M. U. (2009). "The Global Financial Crisis". Center for Islamic Area Studies at Kyoto University (KIAS). Kyoto University Publication.

Corden, W.M. & Neary, J. P. (1982). "Booming Sector and De- Industrialization in a Small Open Economy". The Economic Journal, 92, 825-848.

Farzanegan, M. R. & Markwardt, G. (2009). "The Effects of Oil Price Shocks on the Iranian Economy". Energy Economics, 31, 134-151.

Ftiti, Z. (2010). "The Macroeconomic Performance of the Inflation Targeting Policy: An Approach Based on the Evolutionary co-Spectral Analysis (Extension for the Case of a Multivariate Process)". Economic Modelling, 27, 468-476.