A survey of the role of speculation in determination and volatilities of crude oil price

Ahmad Rouhi
Department of Management, Buin Zahra Branch, Islamic Azad University, Buin Zahra, Iran

Mir Taher Pour Partovi
Department of Management, Buin Zahra Branch, Islamic Azad University, Buin Zahra, Iran

Rzea Shaban Nejad
Department of Management, Buin Zahra Branch, Islamic Azad University, Buin Zahra, Iran

Abstract
This study aimed to evaluate the role of speculation in volatilities of crude oil price. Today, oil market has encountered analysts with serious challenges in analysis of changes of oil price and its reasons. They considered the issue in terms of structural change, periodical behavior and speculation. These challenges are associated to the change of effect of fundamental factors on oil price. Based on the studies, effective factors on crude oil price, the structural factors of market are important and the role of speculators is not considered in this regard. In this study, based on the new role of speculators in crude oil price valuation in Iran namely in management science, the data of study are regarding real statistics of relevant variables. After data collection and their summary, at first the stationarity of data is evaluated and then by econometric models, the model coefficients are estimated. The applied models in this study are ARCH and GARCH model and the results showed that speculation had major role beside political factors, demand and supply in valuation of crude oil price in international markets. IN other words, the role of speculation is much emphasized.

Keywords: Speculation, International markets, Crude oil price, Economic growth, OPEC.
1. Introduction

In the study of the behavior of effective factors on oil market and oil economy, searching the variable or variables explaining the relationship between market sector with real sector of oil market, is of great importance. Oil markets as one of the most important principles of economy can supply resources for real sector of economy. The efficiency of oil market can lead to optimal allocation of rare resources to economic activities. Optimal allocation of resources leads to optimality of saving, investment and national economy growth about to potential capacities of economy. Some economists believe that energy markets have key role in economic growth and development. They believe that difference of quantity and quality of services presented by energy market can reflect an important part of difference in growth rate among countries.

Oil price in all countries including Iran is affected by various factors. Most of the factors are as the result of economic relations. Most of effective economic factors on oil price are analyzed and this issue is considered in most studies. Some factors are effective on oil price outside of economic and economic relations field. These activities can create volatilities in price and affect the economy of country.

The analysts believing in speculation consider price increase as speculation behavior in stock market and believe in creating price bubble and this is due to the lack of support of fundamental factors of high prices. In current conditions, the excess capacity of OPEC is at minimum and their storage in 2005 was maximum compared to the past five years and future contracts were at optimal conditions. Thus, conditions for speculation are provided. With the price increase, supply is not increased rapidly to avoid price increase. Low price elasticity of oil demand in short and mid-term can not reduce demand and price increase is possible.

Statement of problem

If oil market condition is investigated, oil supply is increased in non-OPEC countries and oil demand growth is stopped and negative in industrial countries due to economic crisis. In the past month, the increase of supply of non-OPEC countries was more than that of world demand. The world price of crude oil is determined by supply and demand condition as economic factors and other factors are effective via supply and demand. For example, the considerable role of speculation and low role of military factors have reduced or increased crude oil supply and prices are increased or decreased. In this regard, politics of industrial countries is effective on supply and demand of crude oil market. Beside these issues, companies and people have direct and indirect role. It is worth to mention that in future year, most predictions showed that the non-OPEC supply increase was more than increase of world demand and by the increasing role, speculation was increased. One of the economic problems of OPEC member countries was economic dependence of these countries on crude oil export and the experts always stated that these countries should only be independent from oil revenue as oil and gas can change economy and geopolitics of energy and by increase or decrease of oil global price for oil dependent countries can be loser. This losing is probable. Based on the above explanations as crude oil price is effective as exogenous on Iran economy, it is required that effective factors on crude oil price changes can be investigated. The present study is aimed to evaluate the role of speculation in volatilities of crude oil price.
1- Scientific purpose
- Evaluation of effective factors on crude oil price in the world
- Determine the role of speculators in crude oil price volatilities in the world

2- Study hypotheses
1- Speculation is effective on crude oil price
2- Oil price in the past period was effective on oil price

3- Study method (study procedure)

This study is descriptive in terms of method (in terms of data collection) and is applied in terms of purpose.

2. Data Analysis and Findings of the Research
For data collection in this study, library resources (book, paper, journals, etc.) and internet and statistics by organization producing crude oil OPEC and BP are used. The applied data of this study are real data as crude oil price and speculation trade regarding crude oil and their stationarity is evaluated by tests as unit root test to avoid fake models.
In this study, internet, library method is used for data collection as books, thesis, different local and international journals.

2-2 Study scope
- The time scope is during 2005 to the end of 2014 for 10 years.
- The subject scope is in positive researches.
- The place scope of present study is crude oil market around the world.

2-3 Study population, sampling method and sample size
The study population is the one being investigated and study findings are generalized to it. The study population is a group of people or objects common in study attributes or goal and subject are associated.
The study population is data of crude oil price and other independent variables of model.
The study sample is a selected group of study population with the attributes of study population to generalize the results to it.
In this study, for sampling, the real methods of study data of different countries producing oil are used.

3. Study variables and conceptual model
In this study, real data are used, after data collection; at first the stationarity of data is investigated using relevant tests as unit root. Then, the model is estimated. In this study, Hamilton model framework is used. The applied math model in this study is as follows:

\[ chgp_t = \alpha + \beta_1 swap_t + \beta_2 m_t + \beta_3 hed_t + \beta_4 pl_t + \varepsilon \]

In the above model, the first variable is the volume of demand of crude oil in the world (by brokers), second variable is economic growth in the world or applied money in this regard,
third variable is speculation in oil market and fourth variable is crude oil price in the past period, \( \Sigma \) is disturbance term.

**Test results**

- Stationarity tests

<table>
<thead>
<tr>
<th>Result</th>
<th>Significance</th>
<th>Statistics</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary</td>
<td>0.0004</td>
<td>-3.389</td>
<td>Oil price</td>
</tr>
<tr>
<td>Stationary</td>
<td>0.000</td>
<td>-8.18667</td>
<td>Speculation volume in oil market</td>
</tr>
<tr>
<td>Stationary</td>
<td>0.00036</td>
<td>-2.68605</td>
<td>Crude oil price in the past period</td>
</tr>
</tbody>
</table>

Null hypothesis in the above test is based on non-stationarity of study variables and the hypotheses are:

H0: The variable is non-stationary.

H1: The variable is stationary.

To reject H0, significance level is less than 0.05.

Based on stationarity of all variables, we can make econometric estimations.

- Chu tests (F-Limer’s)

<table>
<thead>
<tr>
<th>Result</th>
<th>Significance</th>
<th>Statistics</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using data panel</td>
<td>0.000</td>
<td>88.21053</td>
<td>1</td>
</tr>
</tbody>
</table>

In Limer test (Chu), H0, H1 are defined as follows:

H0: Using panel data is not suitable.

H1: Using panel data is suitable.

To reject H0 and support panel data, significance level should be less than 0.05.

Based on significance level in the above Table, using panel data is suitable.

- Hausman test

<table>
<thead>
<tr>
<th>Significance</th>
<th>Degree of freedom</th>
<th>Statistics</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000</td>
<td>1</td>
<td>0.000</td>
<td>1</td>
</tr>
</tbody>
</table>

Hausman test is performed using chi-square distribution. As the chi-square statistics in Hausman test for regression model of this thesis is zero, Hausman test can not distinguish between using fixed or random effects and another criterion should be used in this regard. To do this, the model is estimated with random effects and then the ability of random effects in explanation of the relationship between model variables is evaluated.

In the below Table, the ability of random effects model is summarized.
Table 4- The estimation of random effects for regressions model

<table>
<thead>
<tr>
<th>Model</th>
<th>Rho</th>
<th>Effects Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using fixed model</td>
<td>1</td>
<td>Cross-section random</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0000</td>
<td>Idiosyncratic random</td>
</tr>
</tbody>
</table>

As shown in the above Table, fixed effects can explain the changes of models and fixed effects should be used for model estimation.

The estimation of different models is estimated by fixed effects.

Table 5- The results of model estimation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-statistics</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>55.30679</td>
<td>11.34331</td>
<td>0.000</td>
</tr>
<tr>
<td>The volume of demand of crude oil in the world</td>
<td>-2.67e-7</td>
<td>-10.17864</td>
<td>0.000</td>
</tr>
<tr>
<td>Economic growth in the world or applied money</td>
<td>3.55e-8</td>
<td>8.871902</td>
<td>0.000</td>
</tr>
<tr>
<td>Speculation volume in oil market</td>
<td>1.177896</td>
<td>-11.72452</td>
<td>0.000</td>
</tr>
<tr>
<td>Crude oil price in the past period</td>
<td>0.337796</td>
<td>6.271228</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Adjusted coefficient of determination: 0.985025

Coefficient of determination: 0.986787

- Durbin–Watson test

In Durbin–Watson statistics 1, there is a test statistics to evaluate the auto-correlation (relationship between values as separated with time lag) among the residuals in regression analysis. This statistics is ranging 0-4 and its acceptance threshold is as follows:

Value 2 for this statistics indicates non-auto correlation and it is good state in main hypotheses of residuals in regression analysis. Value lower than 2 is positive serial correlation (type of serial correlation in which positive residual for an observation increases the positivity chance of other residuals and vice versa) and value more than 2 shows negative serial correlation statistics among residuals. It is worth to mention that if test statistics is less than 1 or higher than 3, it is warning for positive or negative correlation between the residuals.

Its formula is as follows n which rank 1 lag is used:

\[ d = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2} \]

Where, \( e_t \) is \( t \)th residual in regression equation and \( T \) is total observations.

Table 6- The main features of estimation
Here, an analysis of hypotheses is presented. Regarding speculation and its effect on oil price is supported. Speculation in all stages and any type of trade is effective on oil price. Speculation creates the conditions in which competition is made for oil purchase or any other goods and it affects the prices directly.

### 4-1 Study recommendations

Based on the findings of study, some recommendations in two separate sections are presented:

#### 4-1-1 Recommendations of hypotheses results

Based on the results of hypotheses of this study, speculation is effective on oil price. One of the ways to control oil price is focusing on speculation factor in oil market. We can not control all macro-economic variables but by focusing on some factors as speculation and crude oil demand around the world, we can control oil price as improvement of oil market can increase economic capability in the country. The attempt to reduce oil-dependence economy to avoid the increase of economy being affected by oil price impulse (e.g. East Asia countries). The effort to organize brokerage in oil and energy to avoid speculation

#### 4-1-2 Recommendation for further studies

To use the results of study and clarification of the relationship between macro-economic variables on oil price, it is recommended to consider the following items:

- The comparison of the effect of speculation on oil price in Iran and neighboring countries
- It is recommended that the present study be performed separately for all energy carriers as gas.
- The evaluation of the effect of exchange rate and gold price on oil price at the same time with the evaluation of the effect of speculation
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