The analysis of effect of oil shocks on Stock Price Index in Iran

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Abstract
The present research is intended to study the effect of oil shocks on stock price index in Iran. For this purpose, the appropriate model has been analyzed by means of seasonal data (1997-2011) and Vector Auto-Regression (VAR) technique and Vector Error Correction Model (VECM) method. The results of long run cointegration equation indicated that by assuming other fixed conditions, the positive shock variable has positive effect and also the negative shock variable has negative effect on total stock price index at Tehran Stock and Exchange Organization (TSEO). The results of Impulse Response Functions (IRFs) showed that a sudden variable or shock up to one unit increase in standard deviation in variables of positive oil shock has small but stable effect on stock price index while a sudden variable or shock with one unit increase in standard deviation in negative oil shock variables and also its fluctuation has more effect on stock price index. Similarly, analysis of variance for stock price index indicated that over the time and after stock price index, oil price and exchange rate play the highest role in variation of stock price index. The positive and negative oil shocks have more effect on short term on stock price index than in long run.

Keywords: Positive and Negative Oil Shock, Stock Price Index, Vector Autoregressive Model.
1- Introduction

According to prevalent economic theories, rising of oil price totally leads to reduction in stock prices. The variations in oil price inversely affects on real production. For instance, if oil prices are increased whereas oil is considered usually as production factors in economy thus production costs are increased and real production and thus returns for the enterprises, which are active in Bourse (stock market), will be reduced. But with exacerbation of corporate activity outlook, the price of its stock is also reduced in the market. Likewise, variations in stock markets may be used to predict variations in oil price since fluctuations in stock market reflect the status and efficiency of financial markets.

Essentially, the relationship among stock market with oil price in oil exporting and importing countries is different from each other. In importing countries, oil is considered as one of the production factors and as it mentioned above, rising of oil price causes falling prices in stock market. Thus, it is expected in oil importing countries that oil price to have reverse effect on stock market. But the conditions are different in oil exporting countries. Rather than assuming as one of production factors in oil exporting countries, its exportation and sale are one of the important sources of national incomes. Therefore, rising of oil price causes increase in national revenues and it is expected that stock market to grow with rising income and probably increased returns for enterprises. Thus, the expected effect of oil price on stock market is direct and positive.

In exporting countries, rising oil price may cause creating and increasing phenomenon of inflation and reduction of stock price. The oil exporting countries have oil- dependent economies and oil revenues belong to governments in these countries. Lack of political and economic development in these countries causes the governments to enter money of oil sale to do development and populist activities in order to satisfy the people. Entering money, which is acquired from natural resources like oil, in economy and its subsequent rising liquidity, causes creating phenomenon of inflation. Briefly, under inflationary conditions, investors are more reluctant to stock market with rational and certain return so they invest in parallel markets. This mechanism will lead to reduced value in stock market.

In an essay, Ratti & Hasan (2013) explored the effect of oil shocks on efficiency and fluctuations in some sectors at Australian Stock market by means of daily data during period (2000-2010) by the aid of Generalized Auto-Regressive Conditional Heteroskedactisity (GARCH). The results of that study signified that rising oil price fluctuations causes noticeable reduction in stock return for five sectors (including energy and materials sectors) and remarkable increase of efficiency in financial sector. In a survey, Sunil et al (2011) examined the effect of oil price shocks totally on stock market level with focus on Developed Countries. The findings of this study have shown and confirmed that oil price fluctuations have asymmetric effect on stock market return (efficiency) throughout the country as well as in industry sector. Mohamed et al (2010) in their investigation studied the response from stock market to oil price shocks in Gulf Cooperation Countries (GCCs). The results of this study suggested that oil price changes have significant effect on
efficiency of stock market in Qatar, Oman, Saudi Arabia, and United Arab Emirate (UAE). Moreover, there is non-linear relationship between stock markets with oil prices in these countries.

2- Model interpretation

With respect to research backgrounds and the conducted studies inside and outside the country and by adjustment of this status with economic conditions in Iran, the following model is employed to examine the effect of oil price shock on stock price index:

\[
LTEPLX_t = \alpha_0 + \alpha_1 LPSHOK_t + \alpha_2 LPSHOK_t + \alpha_3 LPO_t + \\
\alpha_4 LRER_t + \alpha_5 LIP_t + \alpha_6 LEX_t + \alpha_7 LM_t + \epsilon_t
\]

LTEPLX: Stock price index
LPSHOK: Positive oil price shocks
LNSHOK: Negative oil price shocks
LO: Oil price
LRER: Interest rate
LIP: Industrial production
LEX: Real exchange rate
LM: Liquidity value
\(\epsilon\): Error Correction Component

In this study, the variable of stock price index will be employed as dependent variable and also other variables of this model are utilized as independent variables.

3- Research empirical results

3-1- Johansen cointegration test

Johansen cointegration test includes application of maximum likelihood technique for estimation of long run equilibrium relations. In other words, with respect to constraints caused by employing method of sum of least squares in estimation of long run relation, the maximum likelihood estimation technique is used. If there is more than one long run equilibrium relation \((r>1)\), the sum of least squares technique could not interpret it and it does not present compatible estimations from cointegration vectors. In Johansen test, initially the Eigen Values derived from solving the equations are acquired and we witness normalization of this system to achieve long run (cointegration) equations. The quantity of
long run relations is determined by trace tests and maximum Eigen values, which are presented by software in table at Johansen test.

Table (1) indicates that there are minimally two and maximally six long run equilibrium equations in the current model and therefore it requires using Vector Error Correction Model (VECM). Table (2) also confirms widely results of Table (1) in detail.

Table (1): The results of ordinal likelihood and Johansen cointegration test

<table>
<thead>
<tr>
<th>Data Trend:</th>
<th>None</th>
<th>None</th>
<th>Linear</th>
<th>Linear</th>
<th>Quadratic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of test</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Effect test</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Maximum Eigen Values test</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Table (2): The results of cointegration test with assuming linear detrended model with intercept

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigen Value</th>
<th>Trace</th>
<th>Critical value 5%</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.294177</td>
<td>159.6216</td>
<td>159.5297</td>
<td>0.0494</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.250000</td>
<td>129.3116</td>
<td>125.6154</td>
<td>0.0292</td>
</tr>
<tr>
<td>At most 2 *</td>
<td>0.249526</td>
<td>104.2833</td>
<td>95.75366</td>
<td>0.0114</td>
</tr>
<tr>
<td>At most 3 *</td>
<td>0.235732</td>
<td>79.30989</td>
<td>69.81889</td>
<td>0.0072</td>
</tr>
<tr>
<td>At most 4 *</td>
<td>0.220892</td>
<td>55.92107</td>
<td>47.85613</td>
<td>0.0073</td>
</tr>
<tr>
<td>At most 5 *</td>
<td>0.193587</td>
<td>34.20543</td>
<td>29.79707</td>
<td>0.0146</td>
</tr>
<tr>
<td>At most 6</td>
<td>0.149648</td>
<td>15.48662</td>
<td>15.49471</td>
<td>0.0501</td>
</tr>
<tr>
<td>At most 7</td>
<td>0.015776</td>
<td>1.383488</td>
<td>3.841466</td>
<td>0.2395</td>
</tr>
</tbody>
</table>

Source: Results of research

The results of Table (2) indicated that with assuming linear relations, the presence of only one long run equilibrium relationship between research variables is rejected. Thus with respect to the existing non-linear relations among variables of the model, the VECM Model should be utilized to define this model and the results should be generalized to the relations in iterative autoregressive model by the aid of E-views software. It should be noted that conducting Granger causality analysis is not useful and thus necessary because of non-linearity of relations among variables of the model.

3-2- Estimation of error correction model

Cointegration vectors indicate the long run equilibrium and or long run relationship. To make sure of this point that the internal mechanism of governing structures over the
discussed variable can correct imbalance in short term so that moving to long run equilibrium is guaranteed, a dynamic model should be explored in short term. Error Correction Models do this task.

3-2-1- Model long run cointegration relationship

The results of estimation of long run cointegration relationship are given in Table (3).

Table (3): The results of long run cointegration relationship

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Statistics t</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTEPLX</td>
<td>1.000000</td>
<td></td>
</tr>
<tr>
<td>LPShok</td>
<td>2.283957</td>
<td>2.21858</td>
</tr>
<tr>
<td>LNShok</td>
<td>-5.593060</td>
<td>-1.47489</td>
</tr>
<tr>
<td>LPO</td>
<td>1.254773</td>
<td>2.63045</td>
</tr>
<tr>
<td>LRER</td>
<td>3.790067</td>
<td>2.80260</td>
</tr>
<tr>
<td>LIP</td>
<td>3.782743</td>
<td>1.98941</td>
</tr>
<tr>
<td>LEX</td>
<td>4.016335</td>
<td>3.46849</td>
</tr>
<tr>
<td>LLm</td>
<td>3.694605</td>
<td>2.93794</td>
</tr>
<tr>
<td>C</td>
<td>-142.4451</td>
<td></td>
</tr>
</tbody>
</table>

The results of long run relation show that given fixing other conditions, the elasticity of total stock price index is 2.283957 compared to positive oil price shock. In other words, if positive shock is increased one unit in long run, total stock price index will be increased 2.283957 percent and as a result the elasticity of total stock price index is -5.593060 compared to negative oil price index and elasticity of total stock price index is 1.254773 in respective of oil price, and total stock price index is 3.790067 with respect to interest rate, elasticity of total stock price index is 3.782743 in relation to industrial products, and elasticity of total stock price index is 4.016335 for exchange rate, and also elasticity of total stock price index will be 3.694605 with respect to volume of money.

As a result, it can be implied that negative oil price shock has the maximum effect on total stock price index while the oil price has the minimum effect on total stock price index. The given results signify this fact that negative oil price shock has the negative effect on oil price in the long run and all of the rest abovementioned variables have positive effect on total stock price index.

3-2-2- The results of short term relationships

In this section, the short term relationships among variables are expressed. Given that we have eight endogenous variables and number of optimal pause is four, the coefficient of error correction sentence is proposed in Table (4).

Table (4): Results of short term relationships (Error Correction Model)
To interpret the results, this point should be noticed that in estimation of this method and basically in estimation of equations coordinates, coefficients, explanatory percentage of parameters of model have not the same importance as single-equation methods. The coefficient of error correction sentence showed that about 25% of imbalance error is corrected in any phase.

$R^2$ interpretation: The results of this model show that 52.9% of changes in total stock price index have been explained in Tehran Stock and Exchange Organization (TSEO) by the given model.

3-3- Impulse Response Functions (IRFs):

Impulse response functions interpret endogenous variables of system in relation to the exerted shocks on sentences of the model. We examine the effect of standard deviation from variable shock criterion on other variables.

Table (5): TEPIX response to shock in other variables

<table>
<thead>
<tr>
<th>Period</th>
<th>LPSHOK</th>
<th>LNSHOK</th>
<th>LPO</th>
<th>LRER</th>
<th>LIP</th>
<th>LEX</th>
<th>LLM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0.000000 0</td>
<td>0.000000 0</td>
<td>0.000000 0</td>
<td>0.000000 0</td>
<td>0.000000 0</td>
<td>0.000000 0</td>
<td>0.000000 0</td>
<td>0.000000 0</td>
</tr>
<tr>
<td>2 0.010375 5</td>
<td>0.009973 -</td>
<td>0.010868 -</td>
<td>0.011638 -</td>
<td>0.010875 -</td>
<td>0.021778 -</td>
<td>0.023922 -</td>
<td></td>
</tr>
<tr>
<td>3 0.008761 7</td>
<td>0.007738 -</td>
<td>0.014421 -</td>
<td>0.017025 -</td>
<td>0.015755 -</td>
<td>0.030917 -</td>
<td>0.028779 -</td>
<td></td>
</tr>
<tr>
<td>4 0.005427 9</td>
<td>0.002140 -</td>
<td>0.017056 -</td>
<td>0.019911 -</td>
<td>0.019405 -</td>
<td>0.033040 -</td>
<td>0.030836 -</td>
<td></td>
</tr>
</tbody>
</table>
Table (7) shows TEPIX response to standard deviation of shock in logarithm of the variables including LPSHOK, LNSHOCK, LPO, LRER, LIP, LEX, and LLM. In other words, it indicates that if a shock or sudden change creates standard deviation in positive oil price shock and also negative shock in oil revenue, oil price, interest rate, exchange rate, volume of circulation money so how much its effect is on total stock price index at TSEO Organization in the next period.

The second column in Table (5) indicates that a sudden change or shock in standard deviation for positive shock price variable that is ineffective at first phase (first season) but in the second phase (second season) it increases total stock price index at TSEO Organization to 0.010375 units and this effect will be positive and in reducing trend and it is negative in periods 5-8 and then it is positive again.

Third column in Table (5) shows the effect of the exerted shock on total stock price index by variable of negative shock from oil price. If negative oil price shock increases one unit, this has no effect in first phase and it has negative effect on total stock price index of Tehran stock and exchange organization (TSEO) up to -0.010868 in second period. The results derived from impulse response functions (IRFs) show that this shock affects negatively on total stock price index from the second phase and later on.
The sixth column of Table (5) is related to the effect of exerted shock to total stock price index by variable of industrial products. If price of industrial products increases 1 unit in standard deviation it lacks effect in first period and it will affect negatively of total stock price index of TSEO up to -0.010875 at second phase. The given results from impulse response functions indicate that the effect of this shock will be negative on total stock price index from second phase and next periods.

The seventh column in Table (5) is attributed to the effect of exerted shock to total stock price index by variable of exchange rate. If price of exchange rate is increased up to 1 unit in standard deviation it is ineffective in the first period but it will affect negatively up to -0.021778 on total stock price index of TSEO. The acquired results from impulse response functions show that the effect of this shock is negative on total stock price index from second phase and later.

Eighth column of Table (5) is related to the effect of shock that was exerted on total stock price index by variable of monetary volume. If the monetary volume is increased with 1 unit in standard deviation it will affect negatively on total stock price index of TSEO up to 0.023992. The results derived from impulse response functions indicate that this shock will affect negatively on total stock price index from second period and later.

Generally, the shocks resulting from all of aforesaid variables on total stock price index in Tehran Stock and Exchange Organization (TSEO) are small but stable.

4- Conclusion and suggestions

The results of long run cointegration equation indicated that with assuming other fixed conditions, the positive oil shock variable affected total stock price index of TSEO positively while the negative oil shock variable had negative effect on this index in TSEO. The results derived from impulse response functions showed that a sudden change or shock up to one unit in standard deviation in positive oil shock variables has small but stable effect on stock price index while a sudden change or shock up to one unit of standard deviation have further effect on negative oil shock variables and at the same time its fluctuation is greater in stock price index. Similarly, conduction ANOVA on stock price index indicated that over the time and after variable of stock price index, oil price and exchange rate play the greater role in variation of stock exchange index. The positive and negative oil shocks have the further effect on stock price index in short term period than in long run.

Hence, with respect to abovementioned results, the hypotheses of “there is significant relationship among oil price shock and stock price index in short term” and “there is significant relationship among oil price shock with stock price index in long run” were approved.

Likewise, with respect to results of long run cointegration equation the variable of oil price shock has the maximum effect on stock price index. Thus, in long run effect of oil price
shock is greater on stock price index than positive effect of oil price shock. But by considering the results, ANOVA showed that over the time and after variable of stock price index per se, the variables of oil price and exchange rate have the greater role and oil price shock and industrial products have the minimum role in variation of stock price index. The positive effect of oil shock on stock price index in short term is greater than negative effect of oil price shock in long run.

With respect to results of research and negative and significant effects of oil price shock on stock price index, the paramount suggestion for taking policy in this survey is to strengthen capital market in the country, control and monitoring of fluctuations in capital and stock market (as possible) in order to improve production and economic growth.
References


