Shale Oil Revolution Impact on Crude Oil Prices- Have We Overestimated?

Abstract

A popular view is that the slump of crude oil prices since mid 2014 is triggered by shale oil revolution. This paper reviews that opinion, by developing a dynamic OLS model to measure the potential effect of US shale production among other variables, as, industrial production, Geopolitical tensions and supply surplus. Second step is to employ (VECM) model and impulse response analysis to explore to what extent expansions in shale oil production may harm world imports of crude oil. Results show that shale oil production hasn't affect crude oil prices, while geopolitical tensions was the main stimulator for price surge till mid 2014, while supply surplus and OPEC's shifting toward defending market share has driven price to slump. On the other hand, results show that a potential positive shock in oil importers production of shale oil would cause a significant impact on world's imports. This demonstrate that remaining crude oil prices at very low prices below the marginal costs of new producers, may preserve crude oil exporters from losing their markets, unless world total demand rush to higher levels.

Introduction

Crude Oil is one of the most important commodities in the world; thereby behavior of its prices is the focus of attention for producers, consumers and financial investors. Volatility and shocks are the main Characteristics of crude oil markets, Thus it is essential for policy-makers to specify the origins of shocks and predict its probable persistence to adopt suitable actions toward minimizing crude oil price shocks negative impacts on different economic variables.

Crude oil prices had experienced two opposite shocks during 2008, when prices touched 140$/bbl in July then dropped to less than 40$/bbl due to the international financial crisis and its consequences on global economic growth. In return, OPEC countries succeeded in rebounding prices by cutting production to balance demand, which had fully recovered within two years, pushing prices above
75$/bbl during 2010 and 100$/bbl since 2011. Nevertheless, after three years of stable high prices, downturn path has started again since July 2014 till now, in response to an oversupplied market resulted from shale oil production revolution and OPEC’s deviation from price targeting to market share protecting.

Analyzing price path during 2010-2015 indicates some contradictions concerning the relationship between shale oil increasing production and crude oil prices. U.S. was considered as the world’s largest importer of crude oil with a share exceeding 20% of world imports, equivalent to 9.5 mmbbl/d, no long until shale oil revolution has raised, enabling U.S. to reduce its dependence on imported crude oil.

As illustrated in figure 1, U.S shale oil production has grown significantly by nearly 4 mmbbl/d during last five years. Although approximately two third of total U.S. shale oil production increment occurred during 2011-2013, accompanied by a sharp fall in the U.S. oil imports to around 6.2 mmb/d, annual crude oil average prices steadied above 100$/bbl, in addition, prices surged 10% to 112$/bbl during June 2014 compared to 102$/bbl in January, while shale oil production raised by 14% and resulted in a cut down in U.S. imports by 11%. On the contrary, crude oil prices suffered from sharp and accelerated Falling since the second half of 2014 up till now, although increasing imports from other countries which slightly exceeded declines in US imports. Analyzing the impact of shale oil developments and its reflections on crude oil prices requires to take in consideration movements in other variables, which have a potential impact on crude prices as, develops in economic growth, uncertainty surrounding market's supply due to geopolitical tensions ,and exporting countries' targets and policies.

![Figure1](source: EIA Data, Monthly Drilling Report)
The aim of this paper is to discover whether there is a real impact from US shale oil production on crude oil prices, or not. In addition it seeks to assess the expected influence of potential growth in domestic production of conventional and unconventional oil on world imports for consumption, taking in account other factors may affect world demand for crude oil as, industrial growth, inventory levels, and crude prices. The focus will be on imports for consumption rather than total imports, to exclude the impact of storage demand, which is usually stimulated by external factors, as it is driven by precaution and speculation motives, which mostly don't affect consumption demand.

Achieving the first aim will depend on Dynamic OLS model introduced by (Stock and Watson,1993) to determine the impacts of four variables, namely, industrial production growth, Geopolitical tensions, Shale oil production ,and supply surplus, on crude oil prices during the period 2009-2015, while achieving the second aim of this paper will depend on Vector Error Correction Model, introduced by (Engle and Granger,1987), to assess factors affecting world's imports for consumption, by estimating the impact of four factors, namely, industrial production, domestic production of oil, inventories, and crude oil prices, besides, an impulse response function will be applied to estimate the accumulated effect of a potential shock in each variable.

This paper will be organized as follow; first section will be a literature review, second section will present the econometric methodology for both proposed models, third section will explain empirical results, and finally, the concluding remarks.

**Literature Review**

Few number of studies tackle this subject, the most significant may be (Baumeister and Kilian, 2015) study, they show that more than half of the decline in the price of oil was predicted in real times as of June 2014, they attributed it to the cumulative effects of adverse demand shocks, while the remaining decline was explained due to supply shocks associated with an unexpectedly weakling economy. (Manescu and Nuno,2015), employ a general equilibrium model of the world oil market and concluded that most of expected increase in US oil supply due to the shale oil revolution has already been incorporated into prices, and referred the collapse in oil prices in the second half of 2014 to positive unanticipated supply shocks.
(Kilian, 2015), clarifies that shale oil producers remain competitive even at the current much lower price of oil, but it is likely to be more of a temporary reprieve for another decade than a permanent solutions. (Alquist and Guenette, 2014), show that changes in U.S. oil production alone is not expected to have a large impact on global oil prices. (Arezki and Blanchard, 2014), pointed out that the co-movement of crude oil prices and metal prices is a react to global slowdown activity, however, metals declining prices were less substantially than oil.

Econometric Methodology

The objective of this paper is to discover main determinants of crude oil price fluctuations during the period (2009-2015), and then it will seek to estimate determinants of world crude oil imports for consumption, as follow:

1- Determinants of crude oil prices

This model aims to examine the role of four determinants, namely, Industrial production, Supply surplus, Geopolitical events, and shale oil production, that might have affected crude oil prices during the period 01-2009 to11-2015, using monthly data for the variables mentioned below.

1-1 Data Description:

- Crude oil prices (OP): represents the dependant variable, and will be calculated as average monthly prices for benchmarks data listed in WB commodity price data.
- OECD industrial production index (IN): an index comprise indices of industrial production for total industry, manufacturing, energy and crude petroleum, for the 34 OECD member countries.
- Geopolitical tensions (GT): Although this variable exhibits qualitative rather than quantitative characteristics, following the methodology proposed by (Vakhshouri,2012), may allow to measure the effect of geopolitical tensions on crude prices through its impact on either physical or financial markets' participants expectations about potential supply shortage triggered by these events. Uncertainty about supplies from an exporting country suffering from political tensions ,or from a threatened oil trade transit point as strait of
Hormuz, will be used as a proxy variable for geopolitical tensions which may affect crude oil market. This proxy will be calculated as follow:

\[ GT_i = (TX/WX) \cdot P \cdot T \]

Where: GT: a specified geopolitical event occurred through month i.
TX: threatened exports due to a specified GT.
WX: world total exports
P: the influence rank of the GT\(_i\) on supply security as proposed by (Vakhshouri,2012).
T: the duration of a specified GT in days.

Geopolitical events will be collected from Reuters news archive, threatened exports are the regular crude oil exports from the tensioning country derived from EIA annual data, ranks of GT's influence will be derived from (Vakhshouri,2012) as follow:

<table>
<thead>
<tr>
<th>Event</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political instability</td>
<td>0.39</td>
</tr>
<tr>
<td>Sanctions</td>
<td>0.29</td>
</tr>
<tr>
<td>Threats to energy transportation</td>
<td>0.10</td>
</tr>
<tr>
<td>Underinvestment</td>
<td>0.22</td>
</tr>
</tbody>
</table>

- Shale oil Production (SH): monthly data for shale oil production in US will be collected from EIA Drilling Productivity Report.

- Supply Surplus (SS): calculating this variable will be based on the following equation:  
  \[ SS = OS + NS - WC \]

Where: SS: supply surplus 
OS: OPEC's supply
NS: non-OPEC's supply
WC: world consumption

Data source for these variables is EIA Short-Term Energy Outlook.

1-2 Model Specification:
Dynamic OLS model developed by Stock and Watson(1993), is a procedure allows for variable integrated of higher orders, as well as, tackling the problem of simulating amongst the regressors, and accounting for the dynamic of the relationship within a temporal and causal framework.
Estimation of the proposed model will be based on the following equation:

\[ \text{OP}_t = B_0 + BX + \sum_{j=-q}^{P} d\Delta x_{t-j} + U_t \]

Where: \( \text{OP}_t \) : dependant variable (crude oil prices)
\( B \): cointegrating vector
\( X \): matrix of explanatory factors
\( P \): Lag length \( q \): lead length

2- Determinants of world crude oil imports for consumption:

This model will examine the impact of four variables, namely, industrial production, crude oil inventories, oil domestic production in importing countries, and crude prices, on the dependant variable, world crude oil imports for consumption, during the period 01-2009 to 05-2015, due to the latest available data for inventories, using OECD monthly data for each variable as a proxy for the world data, due to lack of data for other importing countries.

2-1 Data Description:

- Crude oil imports for consumption (MC): assuming that the whole domestic production of crude oil in importing countries is directed to domestic consumption, while crude oil imports are directed to fill excess domestic demand gap, besides building up strategic and commercial inventories, crude oil imports for consumption could be calculated as following:

\[ \text{MC} = \text{TM} - \text{PI} \]

Where: \( \text{MC} \): OECD crude oil imports for consumption
\( \text{TM} \): OECD total imports of crude oil
\( \text{PI} \): OECD positive change in crude oil inventories

Data for each variable will be collected from EIA data stream, excluding data for net exporting countries.

- Industrial production Index(IN): similar to the aforementioned in previous model.
- Crude oil inventories(ST): will be collected from EIA data stream
• Domestic crude oil production (DP): including both conventional and unconventional sources of oil.
• Crude oil prices (OP): will be calculated as average monthly prices for benchmarks data listed in WB commodity price data.

2-2 Model Specifications:
Vector Error Correction Model (VECM) will be applied to estimate the coefficients of the following model's equation:

\[ \ln M_c = \alpha + \sum_{i=1}^{P} S_i \ln Y_{t-i} + \varepsilon_t \]

Where: \( M_c \): crude oil imports for consumption
\( P \): optimal lag length
\( S_i \): coefficients matrix
\( \varepsilon_t \): error term

Results

First model results:
Before applying DOLS model to determine the aforesaid factor's impact on crude oil prices, it is necessary to check existence of long-run equilibrium relationship between variables, through testing for integration and cointegration, as follow:

1. Stationary test: It determines whether a given time series contains a unit root or not. Two types of tests are used in this study, Augmented Dickey Fuller (ADF) test, and Philips-Perron test. Null hypothesis of both tests is the presence of unit root, indicating that time series is not stationary, and vice versa. Eviews output for both tests show that all OP, ID, SS,SH variables are stationary at first difference, while GT is stationary at level.

2. Cointegration test: Due to the fact that variables have different integration orders, applying ARDL cointegration frame work based on the bound testing procedure will be used, after selecting optimal lag length, as follow:
   - Lag length selection:

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-1884.135</td>
<td>NA</td>
<td>5.35e+15</td>
<td>53.24323</td>
<td>53.43444</td>
<td>53.31927</td>
</tr>
<tr>
<td>1</td>
<td>-1424.966</td>
<td>827.7965*</td>
<td>3.57e+10*</td>
<td>41.32299*</td>
<td>42.66148*</td>
<td>41.85527*</td>
</tr>
</tbody>
</table>

* indicates lag order selected by the criterion
Eviews output for lag length selection after including 6 lags, that 1 lag length is the optimal due to all applied criterions.

- cointegration test:
  According to ARDL cointegration frame work, a long-run equilibrium relationship exists between variables, if F statistics obtained from wald test is greater than the I(1) bound F critical value.

  Wald Test:
  Equation: WALD_TEST

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>124.0914</td>
<td>(5, 68)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Chi-square</td>
<td>620.4571</td>
<td>5</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Fcritical's value at 0.01 significance level: I(0)=3.74    I(1)= 5.06
  Critical values source: Pesaran et al.,(2001), Table CI(iii).P.300

Results show that alternative hypothesis can't be rejected, which confirms the existence of cointegration relationship among variables.

3. Testing for structural break: Time series of dependant variable (crude oil price) shows a potential structural break, refer to exporter's policy change towards protecting market share rather than targeting prices, since OPEC's meeting in nov.2014. This break in dependant time series may influence estimation's accuracy, so it is important to check whether there is a break or not using Chow test, to take a suitable decision regarding add a dummy variable to the model, to reflect this break.

1Chow Breakpoint Test: 2014M11
Null Hypothesis: No breaks at specified breakpoints

Equation Sample: 2009M01 2015M11

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Prob. F(5,73)</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>24.05439</td>
<td>Prob. F(5,73)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>80.81203</td>
<td>Prob. Chi-Square(5)</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

-F-critical value at 0.01 significant level = 9.20

Results of Chow breakpoint test, ensures rejecting the no break null hypothesis, thus adding a dummy variable to model equation is assumed to improve model estimations.
### 4- Coefficients estimation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>1.663724</td>
<td>0.592797</td>
<td>2.806564</td>
<td>0.0073</td>
</tr>
<tr>
<td>GT</td>
<td>10.19529</td>
<td>4.940606</td>
<td>2.050071</td>
<td>0.0460</td>
</tr>
<tr>
<td>SH</td>
<td>-4.67E-06</td>
<td>2.20E-06</td>
<td>-2.117784</td>
<td>0.0395</td>
</tr>
<tr>
<td>SS</td>
<td>-6.638204</td>
<td>2.543210</td>
<td>-2.610167</td>
<td>0.0121</td>
</tr>
<tr>
<td>DUMMY</td>
<td>-23.74910</td>
<td>11.35113</td>
<td>-2.092223</td>
<td>0.0418</td>
</tr>
<tr>
<td>C</td>
<td>-73.15274</td>
<td>55.86758</td>
<td>-1.309395</td>
<td>0.1968</td>
</tr>
</tbody>
</table>

R-squared    0.936680  Mean dependent var  89.08100
Adjusted R-squared  0.896264  S.D. dependent var  19.94833
S.E. of regression  6.424982  Sum squared resid  1940.179

Testing for residual stationarity shows stationary residual series at level at 0.01 significance level. In addition, testing for stability based on cumulative sum of recursive residuals method confirms the model stability, residual normal distribution is realized due to Jarque-Bera test.

**Comments on estimation results**

- Industrial production index is the most significant variable in the estimated model, however, it has a moderate positive effect on crude prices through the sample period, equivalent to $1.66/bbl for each added point.

- Geopolitical tensions impact on crude prices is the highest impact, compared with the other three variables impacts. Estimations show that every geopolitical event supposed to disrupt one million barrel of the world daily exports and lasts for a whole month, may increase crude oil monthly average price with $10.19/bbl. It implies that even markets haven't suffered from supply shortage due to a specific geopolitical tension, crude prices may rise thanks to increasingly attitude among consumers toward inventories accumulating, as well as, a portion of increments may stem from speculation activity in crude oil futures market. Besides, the quality of the disrupted crude may play a role in determining the influence extend, because filling market demand gap with lower quality crudes may seemingly balance market demand, although it will not be able to fully compensate supply disruptions from high quality crude, thus it may induce up pressures on Benchmark crudes' prices.
- In the absence of geopolitical tensions tangible effect, and stable growth, a one million bbl/day of supply surplus is assumed to negatively affect monthly average price by $6.63/bbl, while shifting in oil exporter's policy toward defending their market share, has a probable negative impact exceeds threefold surplus's impact on price. This result may be explained in the light of a potential shift in supply curve to the right.

- US shale oil production has a negligible influence on crude oil prices, although an obvious negative effect on US imports. Half of total growth in shale oil production had occurred during 2011 to 2013, while oil market was suffering from serial of supply shortage and increasing storage demand. On the other hand, during the period between second half of 2014 to the end of 2015, supply surplus and opec's policy shift was the main stimulator for price decline path.

Second model results

Before applying VECM model to determine the previously mentioned factor's impact on OECD crude oil imports for consumption, it is necessary to check existence of long-run equilibrium relationship between variables, through testing for integration and cointegration, as follow:

1- Stationary test: Results of both ADF and PP tests show that all variables are non stationary at level, but stationary at first difference, which imply to use Johansen cointegration approach in the next step.

2- Cointegration test: Before testing for cointegration, optimal lag length should be selected:

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>562.5290</td>
<td>NA</td>
<td>8.31e-14</td>
<td>-15.92940</td>
<td>-15.76879</td>
<td>-15.86561</td>
</tr>
<tr>
<td>1</td>
<td>948.0806</td>
<td>705.0086</td>
<td>2.80e-18*</td>
<td>-26.23087*</td>
<td>-25.26723*</td>
<td>-25.84810*</td>
</tr>
<tr>
<td>3</td>
<td>989.2779</td>
<td>34.20136</td>
<td>3.74e-18</td>
<td>-25.97937</td>
<td>-23.40966</td>
<td>-24.95865</td>
</tr>
</tbody>
</table>

* indicates lag order selected by the criterion
Results show that 1 lag length is the optimal delay for this model. To check the presence of long-run relationships between variables according to this approach depends on two types of tests, Trace Test, and Max-Eigen Value Test:

Unrestricted Cointegration Rank Test (Trace)

<table>
<thead>
<tr>
<th>Hypothesized</th>
<th>No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td></td>
<td>0.213956</td>
<td>86.54604</td>
<td>69.81889</td>
<td>0.0013</td>
</tr>
<tr>
<td>At most 1</td>
<td></td>
<td>0.108630</td>
<td>44.41620</td>
<td>47.85613</td>
<td>0.1015</td>
</tr>
</tbody>
</table>

* denotes rejection of the hypothesis at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

<table>
<thead>
<tr>
<th>Hypothesized</th>
<th>No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Max-Eigen Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td></td>
<td>0.213956</td>
<td>42.12984</td>
<td>33.87687</td>
<td>0.0042</td>
</tr>
<tr>
<td>At most 1</td>
<td></td>
<td>0.108630</td>
<td>20.12425</td>
<td>27.58434</td>
<td>0.3326</td>
</tr>
</tbody>
</table>

Results of both tests reject the null hypothesis for none long-run relationship between the variables, hence, existence of one cointegration relationship in the model can't be rejected, allowing for estimating VECM model.

3- Coefficients estimation:

<table>
<thead>
<tr>
<th>Cointegrating Eq:</th>
<th>CointEq1</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNMC(-1)</td>
<td>1.000000</td>
</tr>
<tr>
<td>LNIN(-1)</td>
<td>0.235314</td>
</tr>
<tr>
<td></td>
<td>(0.14307)</td>
</tr>
<tr>
<td></td>
<td>[-1.64472]</td>
</tr>
<tr>
<td>LNST(-1)</td>
<td>0.519934</td>
</tr>
<tr>
<td></td>
<td>(0.21952)</td>
</tr>
<tr>
<td></td>
<td>[-2.36851]</td>
</tr>
<tr>
<td>LNOP(-1)</td>
<td>-0.031556</td>
</tr>
<tr>
<td></td>
<td>(0.02161)</td>
</tr>
<tr>
<td></td>
<td>[1.46030]</td>
</tr>
<tr>
<td>LNDP(-1)</td>
<td>-0.632400</td>
</tr>
<tr>
<td></td>
<td>(0.03505)</td>
</tr>
<tr>
<td></td>
<td>[18.0448]</td>
</tr>
<tr>
<td>C</td>
<td>10.67772</td>
</tr>
</tbody>
</table>
Comments on estimation results:

- In long run, OECD's domestic crude oil production significantly affects their external demand for crude oil negatively, that's for every 1% increment in domestic production, a fall by 0.63% in crude oil imports for consumption is expected. This result is supposed to be a warning sign of potential larger effect on the whole world's crude oil imports, if shale oil production expanded- as it represent the most probable source of increments in importer's production of oil- especially in main crude oil importers as China.

- Industrial production has a positive significant impact on imports for consumption, at 0.1 significance level, by 0.23% for every 1% industrial production growth, whereas, it is smaller than the corresponding effect during the period 2003-2007\(^1\), a period characterized by continuous increasing growth and static domestic production of crude oil. Different coefficients estimation between the two samples, may attributed due to the fact that most of the growth in OECD industrial production during 2009-2015, came from US, while Europe and Japan were suffering from economic troubles. On the other hand, US growth had been fueled partly by increasingly domestic shale oil production.

- Inventories have a positive significance impact on imports, which may be partly explained by an external factor, affected the relationship between both variables, as supply side, which dropped prices to low levels, encouraging consumers and governments to accumulate more inventories, rather than drew it, when it reach high levels\(^2\).

Impulse response:

- As illustrated in figure 2, it seems that a 1% positive shock in domestic production of crude oil, may trigger an accumulated negative effect on imports for consumption equivalent to 10.61% by the end of one year.

- As illustrated in figures 3 and 4 ,a positive shock in industrial production equals 1%, may lead to an accumulated positive effects on imports for consumption equals 3.64%, while a 1% negative shock in crude oil prices

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\(^1\) For a similar model applied on the period between 2003-2007, 1% increase in industrial production  has leaded to 1.29% rising in crude oil imports for consumption.

\(^2\) This interpretation may be confirmed if compared with opposite estimation results from a similar model for a period between 2003-2007, as inventories variable has a negative impact on imports for consumption = -0.49% for every 1% increase in inventories level, at a period characterized by rising prices and demand.
may improve imports for consumption with 2% increments by the end of one year.

Conclusions:

The Key question addressed in this paper is whether shale oil production has an impact on crude oil prices. Most of academic literature studied this relation through a model combines economic growth and supply shocks besides shale oil variable. This paper introduced a new variable to reflect geopolitical tensions impact on crude oil market. Results show a reasonable effect of this assembled variable on prices, which points out that crude prices were overestimated during the period 2011-mid2014, in consequence of uncertainty about supply due to geopolitical events surrounding crude oil market. This overestimation ranged between $5.30 to $15.09/bbl, according to the event magnitude.

The inclusion of a dummy variable reflecting a change in OPEC's policy toward protecting market share matters. It added an explanatory power of supply side in explaining recently price collapse, as amounts of supply surplus singly, is not sufficient to drop prices below $35/bbl, as this dummy variable reflect a shift in the supply curve to right side, while supply surplus reflect moving along the curve.

Results clarify that although shale oil production hasn't affect crude oil prices, it has a significant effect on world imports for consumption. Although available data shows that total world oil imports of crude oil haven't been affected by increasing shale oil production, other factors rather than demand for consumption have stimulate storage demand, as uncertainty about supply and enticing low prices, which led the growth in total world imports.

Potential negative impact of shale oil production – or either any alternative equivalent resource- may represent a threat to crude oil exporting countries, that every 1% increase in alternative production in an importing region, may reduce its imports for consumption by 0.62%, as long as demand still unchanged. This imply that maintaining supply surplus and current OPEC's policy may be able to protect its market share. Storage demand would stop absorbing supply surplus when running out of spare storage capcity, at that time exporters would lower supply, but with neutral effect on prices because consumers will drew from inventories, this would ensure preventing other competitors from entering
the market. A significant restriction on this scenario would be exporting countries' ability to bear such lower prices for a long time, as long world demand still stable.

Variables graphs:
supply surplus

LNIMPORTS

LNPRODUCTION
Reference:

- Vakhshouri, S. " MEASURING THE EFFECT OF POLITICAL INSTABILITY IN MIDDLE EAST AND NORTH AFRICA ON GLOBAL ENERGY SECURITY". (2012)
- Salameh, M.," MAJOR GEOPOLITICAL DEVELOPMENTS THAT COULD IMPACT ON OIL SUPPLIES FROM THE ARAB GULF REGION".