The Adjustments in the Oil Market: Cyclical or Structural?

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After trading above $100 dollars/barrel, the oil price started falling sharply in 2014 and reaching low levels of below $30 in January this year.

The 2014 price fall has been sharp, even when compared to previous episodes of sharp price declines in the 1980s, 1990s and most recently in 2008 following the global financial crisis.

Source: EIA, World Bank
Supply-Demand Imbalance and Rising Stocks

EIA Estimates of Implied Stock Change, mb/d

Since 2014, global supplies have been exceeding global consumption and the world has been adding stocks every month with international organizations expecting this to continue for the rest of 2016.

OECD overhang relative to 5yr avg., mb

Crude stocks currently well above the 5-year average; products stocks are also above the 5-year average mainly due to increase in diesel stocks (and more recently gasoline).

Source: EIA, Energy Aspects
Is this Cycle Different?

- At the start of the cycle, wide belief of relatively fast rebalancing and rapid price recovery based on:
  - Non-OPEC supply falling sharply especially in the US (assumptions: US shale most responsive and most fragile part of the supply curve)
  - OPEC cutting supplies to stabilize the market
  - Low oil prices induces a positive shock to the world economy and generate strong demand responses to help absorb the surplus (though with a lag)

- Why did not expectations of faster adjustment materialize? Has there been a fundamental shift in the adjustment process? Is it different this time round?

- Key to answering the question of whether we have entered a world of ‘low oil price for much longer’ / a ‘new global oil order’ or ‘oil prices rising sooner than later’

- Wide macroeconomic implications
The Non-OPEC Investment/Supply Response in a Low Price Environment
The High Oil Price Environment Generated Strong Supply Responses

Shale transformed the oil supply prospects for the US constituting a key supply shock to the rest of the world.

Y/Y change in US Liquid Supply (Crude and NGLs), kbd

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>440</td>
<td>408</td>
<td>983</td>
<td>1,207</td>
<td>1,684</td>
<td>1,085</td>
</tr>
</tbody>
</table>

Y/Y Change in Non-OPEC (EX-US) Oil Supply, mb/d

After few quarters of negative y/y growth, non-OPEC supply outside the US rebounded benefitting from record investments due to the high oil price environment.

Source: EIA, Energy Aspects
US crude oil imports fell to below 7.5 mb/d helping the US improve its trade balance.

Some of the traditional exporters to the US shut from the US market forcing them to divert exports and compete in other markets (mainly Asia).

Source: EIA, Energy Aspects
Deep Cuts in Capex in Response to Fall in Oil Price

Global Capex estimates, $ billion

<table>
<thead>
<tr>
<th>Region</th>
<th>2016E</th>
<th>2015E</th>
<th>2014A</th>
<th>+ / -</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>72.2</td>
<td>114.6</td>
<td>158.1</td>
<td>(42.3)</td>
<td>(36.9%)</td>
</tr>
<tr>
<td>US Independents Intn.</td>
<td>8.5</td>
<td>13.6</td>
<td>21.0</td>
<td>(5.1)</td>
<td>(37.5%)</td>
</tr>
<tr>
<td>Canada</td>
<td>22.4</td>
<td>30.1</td>
<td>36.8</td>
<td>(7.7)</td>
<td>(25.5%)</td>
</tr>
<tr>
<td>Mexico</td>
<td>14.5</td>
<td>18.0</td>
<td>24.6</td>
<td>(3.5)</td>
<td>(19.4%)</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>78.7</td>
<td>96.2</td>
<td>116.9</td>
<td>(17.5)</td>
<td>(18.2%)</td>
</tr>
<tr>
<td>Majors International</td>
<td>77.3</td>
<td>95.7</td>
<td>107.5</td>
<td>(18.4)</td>
<td>(19.3%)</td>
</tr>
<tr>
<td>Russia/FSU</td>
<td>37.9</td>
<td>33.2</td>
<td>43.9</td>
<td>4.6</td>
<td>13.9%</td>
</tr>
<tr>
<td>Latin America</td>
<td>35.7</td>
<td>47.8</td>
<td>53.2</td>
<td>(12.1)</td>
<td>(25.3%)</td>
</tr>
<tr>
<td>Europe</td>
<td>27.6</td>
<td>34.5</td>
<td>45.1</td>
<td>(6.9)</td>
<td>(19.9%)</td>
</tr>
<tr>
<td>Middle East</td>
<td>37.0</td>
<td>39.9</td>
<td>40.7</td>
<td>(2.9)</td>
<td>(7.3%)</td>
</tr>
<tr>
<td>Africa</td>
<td>16.5</td>
<td>20.1</td>
<td>23.0</td>
<td>(3.6)</td>
<td>(17.8%)</td>
</tr>
<tr>
<td>Other</td>
<td>8.0</td>
<td>10.7</td>
<td>10.4</td>
<td>(2.7)</td>
<td>(25.0%)</td>
</tr>
<tr>
<td>International</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>(0.1)</td>
<td>(15.7%)</td>
</tr>
<tr>
<td><strong>Global Capex</strong></td>
<td><strong>436.4</strong></td>
<td><strong>554.4</strong></td>
<td><strong>681.1</strong></td>
<td><strong>(118.0)</strong></td>
<td><strong>(21.3%)</strong></td>
</tr>
</tbody>
</table>

Source: Energy Aspects
But Many Projects Sanctioned in High Oil Price Environment Coming on-line in 2015, 2016 and 2017

More than 2 mb/d of new projects coming online in 2016 sanctioned during the period of $100 + environment

The pipeline of new projects starts slowing down in 2017 but sill close to 2 million b/d and will help offset declines in non-OPEC supply

Source: Energy Aspects
Non-OPEC Supply in Key Areas

Non-OPEC Supply, North America, mb/d

- Canada
- US
- Mexico

2015 2016

Non-OPEC Supply, Latin America, mb/d

- Colombia
- Brazil
- Other

2015 2016

Source: Argus Media
Non-OPEC Supply in Key Areas

Non-OPEC Supply, Asia, mb/d

Non-OPEC Supply, FSU, mb/d

Source: Argus Media
Most of Projections of Supply Growth have Been Revised Downward

Petrobras Production Forecast, mb/d

Canada Production Forecast, mb/d

Some of the key growth centers such as Brazil are feeling the pinch. Brazil has already reduced its capex and revised downward its production target to 2.7 mb/d of liquid production by 2020.

And Canada’s oil production has been revised downward substantially as many projects get postponed or cancelled.

Source: Energy Aspects, Petrobras, Canadian Association of Petroleum Producers
The North Sea Investment and Output Dynamics

Field development plans approved by U.K. regulators (2005-15)

United Kingdom offshore fields' expected peak production volumes

Source: EIA
Decline Rates Accelerating in Some Mature Areas

The decline rates in some of the mature areas such as the UK will accelerate in a low price environment as investment in the high oil price environment fades.

In Mexico large investments are needed to reverse the heavy declines.

Source: Energy Aspects, IEA
The US Shale Supply: A Very Different Investment Cycle

Average lead times between final investment decision and first production for different oil resource types

The investment cycle for US shale is different with the time lag between Final Investment Decision (FID) and first production is a fraction of that for conventional and deep offshore fields.

Source: IEA
Very Different Profiles of Production and Decline Rates

Bakken vs. pre-salt well count
(no of wells)

Sample Well Production Profile

Bakken and pre-salt Brazil achieved similar production growth but the investment profile and the number of wells to achieve that growth fundamentally different

So are the decline rates which are much more prominent in shale wells compared to conventional fields

Source: Energy Aspects, BP
Shocks from Credit Markets Can Impact Production

Cash flow from operations have not been large enough to cover capex with the shortfall increasing in recent years.

The shortfall has been financed by debt (bank loans, bonds); leverage of US shale producers has risen sharply over the years with debt service as a share of operating cash flow reaching high levels.
US Shale has been the Fastest to Respond on the Supply Side

The decline in the rig count in the US has been sharp as US shale producers cut capex and shift strategy from growth maximization to operating within cashflow.

Despite efficiency gains and cutting cost and increase in production from the GOM, y/y growth has been slowing down with the EIA predicting sharp y/y declines in 2016.
Efficiency Gains But Also High-Grading, Lower Cost of Services and Hedging

US shale has proven to be more resilient than originally expected with efficiency improvements and lower costs of services bringing down the the break-even cost.

But part of the improvement is also related to high-grading as rigs moved from non-core area to core areas with higher IP.

Source: Energy Aspects, EIA
Very Different from the Dynamics of non-OPEC Supply in the 1980s

Oil Production Growth, Selected Countries
y/y change, kbd

Oil Production Growth, non-OPEC and FSU
y/y change, kbd

High cost producers such as the North Sea and Mexico with long-term investment cycles led the way but production started slowing down and eventually turned negative in key supply centers.

Strong Non-OPEC supply growth preceding price fall in 1986 but the dynamics within non-OPEC shifting.

Source: BP
The OPEC (non)Response
OPEC has been the major source of supply growth in 2015 with Iraq and Saudi Arabia alone adding more than 1.1 mb/d

In 2016, Iran and Saudi Arabia constitute the major source of uncertainty on the supply side
Saudi Arabia and the Role of the Swing Producer

In 1998, SA reacted by increasing production and did cut output but only after agreement with other OPEC and non-OPEC members has been reached; took long time to forge such an agreement.

Saudi Arabia not willing to cut output unilaterally; shaped by the mid 1980s events when its attempt to protect the price resulted in loss of large volumes of production and market share.

Source: BP, OPEC
Bringing Back Iraq and Iran into the Quota System Challenging

In 2015, Iraq, a low cost producer, has been the major source of supply growth adding more than 650,000 b/d

How much and how fast can Iran increase its export is a major source of uncertainty facing Saudi Arabia and the wider market

Source: Energy Aspects, MEES
US Shale Supply Response Introduces New Set of Uncertainties

Under complete information about shale response in a rising price environment, there is a single and efficient solution to the game. However, due to uncertainty, the players are exposed to significant risk because the optimal strategy and, due to presence of a unique equilibrium under both games, an efficient outcome can only be achieved. But, in practice, it is not clear how the market will initially react to the announcement of an output cut, which would depend on market conditions and whether market participants consider the announcement of a cut as credible. For simplicity, we assume that there is no information available to the players regarding the news. In other words, there is a priori uncertainty induced by US shale oil.

In similar manner, when shale oil supply curve is highly elastic (game 1) there is a dominant strategy for Saudi Arabia. In the short run, when output cuts are successful production cut of its自己的 (see for instance, Fattouh, 2008). This could add a further layer of uncertainty to the game. For simplicity, we assume that there is no information available to the players regarding the news. In other words, there is a priori uncertainty induced by US shale oil.

Under uncertainty about US shale response, it is better off for Saudi Arabia to assume that shale supply curve is elastic and not to cut production (the losses are even larger if other OPEC members don’t cut and US supply proves to be elastic).

### Table 2: Optimum strategy in the short run (falling market)

<table>
<thead>
<tr>
<th>Elastic US supply (game 1)</th>
<th>Inelastic US supply (game 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other-OPEC members cut output</td>
<td>Other-OPEC members cut output</td>
</tr>
<tr>
<td>SA cuts output</td>
<td>-C, -C</td>
</tr>
<tr>
<td>SA does not change output</td>
<td>0, -A</td>
</tr>
</tbody>
</table>

Under uncertainty about US shale response, it is better off for Saudi Arabia to assume that shale supply curve is elastic and not to cut production (the losses are even larger if other OPEC members don’t cut and US supply proves to be elastic).
Producers Pursuing a Market Share Strategy

In the absence of agreement on cuts and the wide range of uncertainties, Saudi Arabia is seeking to maintain market share and to keep exports above 7 mb/d; in winter, exports could jump

Saudi Arabia has succeeded in maintaining its share in key markets in Asia in face of very tough competition

Source: Energy Aspects, EIA
Iraq’s Oil Sector Challenged

Iraqi rig count has halved and the government is facing serious fiscal pressures and security challenges.

Iraqi government has been forced to revise downwards its production target negotiating with oil companies new production plateaus and reducing investment.

Source: Baker Hughes, Barclays
The Demand Response in the Low Price Environment
Oil demand has been stronger than initial expectations in 2015 driven in part by cheaper oil prices.

Sources of demand growth have become more varied with China being an important but not the only engine of oil demand growth.

Source: EIA
Change in the Dynamics of Products Demand

In China, gasoline demand has outperformed that of diesel as the economy continues to rebalance from investment towards consumption.

China’s diesel exports have jumped to a record level as demand growth for diesel slows down and topping refineries given licenses to import crude and export products.

Source: Energy Aspects
In India, gasoline sales have seen a sharp rise almost doubling from the 2009 level and in 2015 India contributed to oil growth demand as much as China (0.3 mb/d)

Personal vehicle ownership in India has been increasing especially for two wheelers

Source: Energy Aspects, OIES
Gasoline demand in the US has been rising benefiting from cheap gasoline at the pump and improvement in job prospects.

Americans are also driving more and for longer distances.

Source: EIA
Oil Prices: Lower for Longer? Or Higher Sooner Than Later?
The Case for Lower Oil Prices For Longer

• High level of crude and products stocks would put a cap on the oil price

• Many sources of supply that could come back to the market (Libya, Iran)

• Cooperation to cut or freeze production not feasible (OPEC no longer functional; on the contrary maxing production and competing for market share)

• Cost deflation structural and efficiency measures would accelerate

• Demand growth will ease (the world of lows + climate change concerns)
  – Short and long-term impacts

• US shale responds fast in a higher oil price environment putting a cap on the oil price
(1) Demand Growth Expected to Weaken as Global Economy Slows Down

Economic growth in different regions continue to be revised downward affecting demand growth

Slowing oil demand growth in most countries and regions particularly Latin America

Source: Oxford Economics, EIA
**Why Has the decline in Oil Price Failed To shock more?**

**Increase in Domestic Energy Prices in SA**

<table>
<thead>
<tr>
<th></th>
<th>Old Price</th>
<th>New Price</th>
<th>Percentage Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas ($/mmbtu)</td>
<td>0.75</td>
<td>1.25</td>
<td>67</td>
</tr>
<tr>
<td>Ethane ($/mmbtu)</td>
<td>0.75</td>
<td>1.75</td>
<td>133</td>
</tr>
<tr>
<td>Gasoline ($/litre) (High Grade)</td>
<td>0.16</td>
<td>0.24</td>
<td>50</td>
</tr>
<tr>
<td>Gasoline ($/litre) (Low Grade)</td>
<td>0.12</td>
<td>0.2</td>
<td>67</td>
</tr>
<tr>
<td>Diesel Transport ($/litre)</td>
<td>0.067</td>
<td>0.12</td>
<td>79</td>
</tr>
<tr>
<td>Diesel Industry ($/Barrel)</td>
<td>9.11</td>
<td>14.1</td>
<td>55</td>
</tr>
<tr>
<td>Arab Light Crude ($/Barrel)</td>
<td>4.24</td>
<td>6.35</td>
<td>50</td>
</tr>
<tr>
<td>Arab Heavy Crude ($/Barrel)</td>
<td>2.67</td>
<td>4.4</td>
<td>65</td>
</tr>
<tr>
<td>Kerosene ($/barrel)</td>
<td>23</td>
<td>25.7</td>
<td>12</td>
</tr>
</tbody>
</table>

Oil exporting countries cutting spending and introducing reforms to rationalize spending

Source: World Bank, APICORP
ST vs LT: The Income Effect Remains Strong Even After Accounting for Improvements in Efficiency

**World Energy Intensity**

- Oil intensity (barrels per millions of 2005 U.S. dollars of GDP)
- Coal intensity (tons per millions of 2005 U.S. dollars of GDP, right scale)

Sources: U.S. Energy Information Administration; World Bank, *World Development Indicators*; and IMF staff calculations.

**Car Ownership and GDP per Capita, 2013**

Sources: International Road Federation, *World Road Statistics*; and IMF staff calculations.

Note: Size of bubble represents population in 2013. Cars per thousand people for India is from 2012.

Oil intensity has fallen sharply in recent years globally

But mitigated by income effects; car ownership is strongly linked to improvements in income

Source: IMF
The period 1994-2014 has seen some of the biggest improvements in global energy intensity. Assuming even faster declines in the world’s energy intensity in the next two decades, energy demand will continue to increase (including oil demand).
In Most Base Cases, Oil Demand Will Continue to Rise

Carbon emissions can be reduced both by improvements in energy intensity and carbon intensity (mainly changing the energy mix).

The Base Case included massive improvements in both; to reach IEA’s 450 scenario, you need even further drastic improvements.
The Case for Higher Oil Prices Sooner Rather Than Later

- Demand will continue to grow at its historical trend in part encouraged by low oil prices.

- Cuts in investment are so deep that they will have big impact on future supplies both inside and outside the US.

- The ability of the US shale supply respond in a higher oil price environment is constrained.

- Geopolitical deterioration and unplanned outages will increase.

- Decline rates in mature fields will accelerate.

- When activity picks up, cost of services will go up.

- Should not exclude the possibility of producers’ agreement on output.
Unplanned Upstream Outages Rising

**Unplanned upstream outages, mb/d**

- **Non-OPEC**
- **OPEC**

**Nigerian Oil Output, mb/d**

Upstream outages have been on the rise in recent months led by countries like Nigeria, Venezuela, Iraq, Colombia, and Libya.

Especially in weak states where dependency on oil revenues is very high.

Source: Energy Aspects, IEA