Fracking, China, and the Geopolitics of Oil

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“My conclusion is that hundred-dollar oil is here to stay.”

1. Fracking

U.S. oil production by source

- lower 48
- Alaska
- offshore
- tight oil
• Assumption 1: production of tight oil would fall quickly without continual new drilling
• Assumption 1: production of tight oil would fall quickly without continual new drilling

• Reality check:
• Assumption 1: production of tight oil would fall quickly without continual new drilling

• Reality check: exactly right
Month-to-month change (1000 barrels/day) in production from legacy tight oil wells

Cumulative lost production April 2015 to Sept 2015 = 1.6 mb/d (source: EIA DPR)
• Assumption 2: if prices fell below $80, drilling rigs would be cut back dramatically
• Assumption 2: if prices fell below $80, drilling rigs would be cut back dramatically

• Reality check:
• Assumption 2: if prices fell below $80, drilling rigs would be cut back dramatically

• Reality check: pretty much right
Number of active drilling rigs in counties associated with U.S. tight oil production

Down 58% July 2014 to July 2015 (source EIA DPR)
• Assumption 3: big drop in legacy production and number of active drilling rigs would mean big drop in U.S. production
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Reality check:
• Assumption 3: big drop in legacy production and number of active drilling rigs would mean big drop in U.S. production

• Reality check: dead wrong!
Monthly U.S. tight oil production

Down 7% April 2015 to Sept 2015 (source EIA DPR)
Drilling productivity (gross added barrels per month per rig) in counties associated with tight oil
• How did they do it?
• Finishing wells faster
Multiple wellheads from single pad

Source: http://www.eia.gov/todayinenergy/detail.cfm?id=7910
Better technology for moving rigs quickly

Source: http://www.eia.gov/todayinenergy/detail.cfm?id=7910
How OXY reduced drilling time per well from 44 days in Jan to 22 days in June

- Multi-well pad, ↓ move time (1.8 days)
- High-res benchmarking (1.5 days)
- Advanced mud system (5.1 days)
- Oxy Drilling Dynamics (8.5 days)
- Curve building optimization (1.2 days)
- Vibration reduction (1.7 days)
- Rig site crew efficiency (2.1 days)

For Delaware Basin Wolfcamp A in Permian
Source: 2015:Q2 conference call
Before-tax losses for major shale oil producers, first half of 2015 (millions of dollars)

- WTI averaged $53/barrel first half of 2015

<table>
<thead>
<tr>
<th>Company</th>
<th>Loss (millions of dollars)</th>
</tr>
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<tbody>
<tr>
<td>Devon</td>
<td>10,103</td>
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<td>EOG</td>
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<td>Pioneer</td>
<td>451</td>
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<td>Whiting</td>
<td>387</td>
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Fracking: Conclusion

• Improving technology can help replace some of the lost production
• But status quo not sustainable at $50/barrel
2. Geopolitics

Sources of growth in world oil production, May 2014 - May 2015

- Total OPEC: 52%
- United States: 37%
- Other: 11%
Distinguish turmoil from deliberate decisions

Sources of growth in OPEC production, May 2014 - May 2015

- Saudi Arabia: 53%
- Iraq: 36%
- Other OPEC: 11%
• Assumption 4: Turmoil in Middle East and North Africa would continue
• Assumption 4: Turmoil in Middle East and North Africa would continue
• Reality check:
• Assumption 4: Turmoil in Middle East and North Africa would continue

• Reality check: true, but they’re pumping more oil anyway!
Iraq production up 2/3 mb/d May 2014 – May 2015
Libyan production up from its lows
Nigeria hanging in there
Iran could see big increase if sanctions lifted
• Assumption 5: Saudi Arabia would never increase production above 10 mb/d
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Reality check:
• Assumption 5: Saudi Arabia would never increase production above 10 mb/d

• Reality check: increased from 9.7 mb/d May 2014 to 10.1 mb/d May 2015
Saudi production up 450,000 b/d May 2014 – May 2015
Geopolitics: conclusion

• There is potential for significant near-term increases from Iran
• But there is also real possibility of significant geopolitical disruptions (Iraq, Libya, Iran, Nigeria, ...)
• Saudi Arabia wants to form impression that it is driving this bus but remains a secondary influence
3. China
• Assumption 6: China’s energy demand would continue its phenomenal growth
• Assumption 6: China’s energy demand would continue its phenomenal growth

• Reality check:
• Assumption 6: China’s energy demand would continue its phenomenal growth
• Reality check: ???
High-frequency correlation between news about China and dollar price of oil

Cumulative percent change in Shanghai Stock Exchange Composite Index (in blue) and United States Oil Fund ETF (in red), March 16 – Sept 11
China’s growth in electricity use has slowed.
China - Synthetic Index - PMI/Markit/Caixin Survey

How to read it: Above 50 the index shows improvement on manufacturing sector activity.

Manufacturing Sector
January 2005 - August 2015

How much of oil price decline can be explained by factors other than oil supply?

• Regression of weekly change in crude oil price on weekly change in copper price, bond yield, and value of dollar (estimated April 2007 to June 2014):

\[ \Delta p_{oil,t} = 0.363 \Delta p_{copper,t} - 1.253 \Delta p_{dollar,t} + 9.442 \Delta r_{10y,t} + \epsilon_t \quad R^2 = 0.33 \]

• Would predict a decline in price of WTI from $105 in June to $69 today on basis of change since June in copper price, value of dollar, and interest rate.

• Suggests weakening global demand also contributed to falling oil prices.
Conclusion

• Will oil production continue to increase from Middle East and North Africa despite geopolitical turmoil?

• ???

• Will China experience a significant economic downturn?

• ???
Conclusion

• But whatever the answers, U.S. tight oil will remain the marginal producer (U.S. production will rise with excess demand, fall with excess supply)

• High marginal cost and rapid decline rates for tight oil put a floor under oil price

• Floor is below $100/barrel

• Floor is above $50/barrel