Changing Oil Market Fundamentals and the Implications for OPEC Strategy

Daniel P. Scheitrum    Amy Myers-Jaffe    Lewis Fulton

University of California-Davis

dpscheitrum@ucdavis.edu

Presentation to IAEE 2016, Bergen, June 21, 2016
Overview

1. Introduction
2. Methodology
3. Oil consumption projections
4. Implications for OPEC
5. Dynamic optimization results
6. Conclusion
Since 1980s, conventional wisdom held “easy oil” would be exhausted first and the world would become increasingly reliant on OPEC oil.

In this scenario:

- OPEC reserves become increasingly valuable
- OPEC benefits from strategically deferring production

Recent events and developments in oil market have led to a departure from the expected scenario.

Shale Boom: Recoverable production in non-OPEC regions is not as scarce as previously believed.
Crude oil demand growth starting to be questioned

- Climate Initiatives
  - Paris Climate Agreement
  - Keep it in the Ground

- Weakening Economic Growth
  - “Risks to the global outlook remain tilted to the downside.” IMF, Jan 2016
  - “Developing economies are catching up ever more slowly.” - Economist, Jun 2016.

- Advances in efficiency upcoming
  - improvement in fuel economy standards
  - improved logistics
Methodology: Part One

First, evaluate sensitivity of oil projection to alternative assumptions
- International Energy Agency’s Mobility Model (MoMo)
- Some underlying assumption may overstate future oil consumption
- Consider alternative demand-reducing scenarios
- Evaluate variability in projected oil consumption
What events could peak demand?

**Hold the catch-up**
Emerging and developing economies

Share of economies whose GDP per person is converging with US level
% of total

Source: World Bank

Source: Economist.com, June 14, 2016
What events could peak demand?

Oil Consumption in Transportation Projection

- Baseline
- Global Growth Reduction 20%
## Projections by scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>% Reduction Relative to Baseline 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td></td>
</tr>
<tr>
<td>25% Reduced Vehicle Saturation</td>
<td>13.48%</td>
</tr>
<tr>
<td>Global Growth Reduction 20%</td>
<td>12.38%</td>
</tr>
<tr>
<td>No China-India Growth</td>
<td>10.38%</td>
</tr>
<tr>
<td>20% Freight Improvement</td>
<td>8.23%</td>
</tr>
<tr>
<td>20% Lower VMT</td>
<td>7.93%</td>
</tr>
<tr>
<td>Global Growth Reduction 10%</td>
<td>6.34%</td>
</tr>
<tr>
<td>No China Growth</td>
<td>5.41%</td>
</tr>
<tr>
<td>10% Lower VMT</td>
<td>3.96%</td>
</tr>
<tr>
<td>10% Freight Improvement</td>
<td>2.91%</td>
</tr>
<tr>
<td>20% Air Efficiency Improvement</td>
<td>2.70%</td>
</tr>
<tr>
<td>10% Air Efficiency Improvement</td>
<td>1.35%</td>
</tr>
<tr>
<td>Shipping Efficiency Improvement</td>
<td>0.85%</td>
</tr>
<tr>
<td><strong>All Above</strong></td>
<td><strong>33.91%</strong></td>
</tr>
</tbody>
</table>
Oil projections: single scenario and combination

Range of Oil Projection Scenarios

Baseline

"Kitchen Sink"

million bbl/day

Oil consumption projections

Oil projections: sensitivity to VMT assumptions

Oil Consumption Sensitivity to VMT

- Baseline
- 30% Higher VMT
- 50% Lower VMT

million bbl/day

0 10 20 30 40 50 60 70 80 90 100

Large variation in car ownership rates
ASEAN and developing nations large source of growth

Oil Demand Projection: ASEAN

Business as Usual:
ASEAN countries
Second, results of our oil projections inform a model of OPEC strategy:

- Solve for optimal OPEC production path in the face of a perfectly competitive fringe
- Adjust parameters to allow for **negative oil demand growth**
Start with a model Cartel-Fringe (Salant 1976)

- **OPEC** operating as a perfectly **cohesive cartel**
- A **perfectly competitive fringe** of **non-OPEC** producers
- OPEC reserves > fringe reserves
- OPEC marginal costs < fringe marginal costs
Static model: OPEC vs Fringe

- Cartel faces residual demand curve (dashed) while fringe is active.
- Cartel faces entire demand curve (solid) while fringe is absent.
Dynamic Optimization: OPEC vs Fringe

- Price
- Stock
- Quantity

Cartel w/ Fringe vs Cartel Alone
Dynamic Optimization: Declining consumption outlook

Student Version of MATLAB

Constant Demand

Falling Demand

Changing Oil Market

June 21, 2016
Conclusion

- Great uncertainty

- Commonly available projections could be overestimating

- Perception of consumption outlook materially affects production today
Future Work

- How will policy interventions (i.e. Paris Agreement) affect our projection
- Extend dynamic model OPEC extraction: How can a decreasing demand outlook impact exploration and investment?
The End
Dynamic Optimization: Increased Fringe reserves

- Price
  - Year vs. Price
  - Low Fringe Reserves: Black line
  - High Fringe Reserves: Blue line

- Stock
  - Year vs. Stock
  - Low Fringe Reserves: Black line
  - High Fringe Reserves: Blue line

- Quantity
  - Year vs. Quantity
  - Low Fringe Reserves: Black line
  - High Fringe Reserves: Blue line

LEGEND
- Low Fringe Reserves: Black line
- High Fringe Reserves: Blue line