An aerial photograph of an oil field, showing a dense network of roads, pipelines, and numerous small structures, likely wellheads or pumpjacks, scattered across a hilly, brownish landscape. The terrain is rugged with visible erosion patterns.

# Fracking, China, and the Geopolitics of Oil

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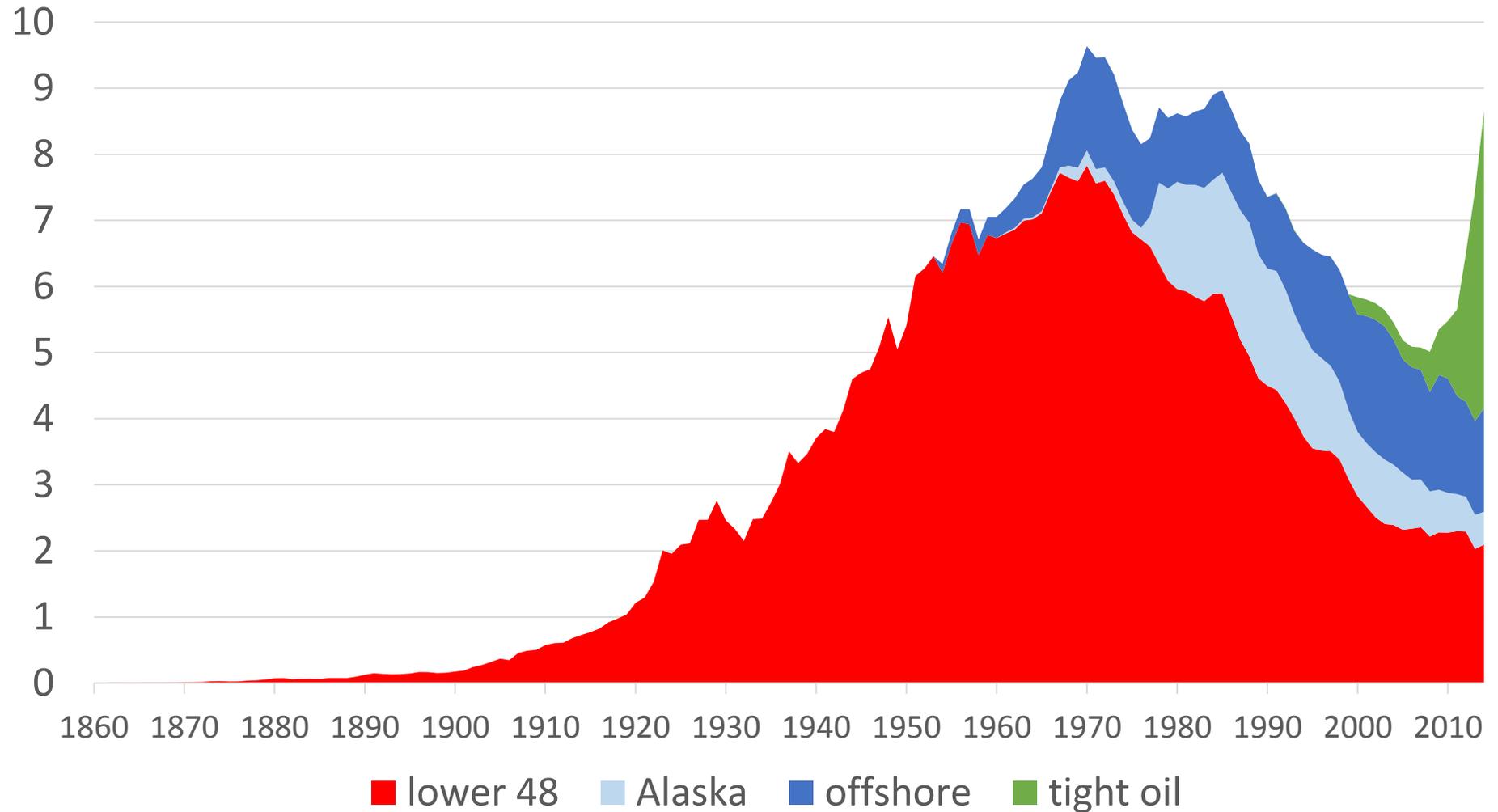
# Fracking, China, and the Geopolitics of Oil

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

*James D. Hamilton, “The Changing Face of World Oil Markets,” July 20, 2014*

# 1. Fracking

U.S. oil production by source

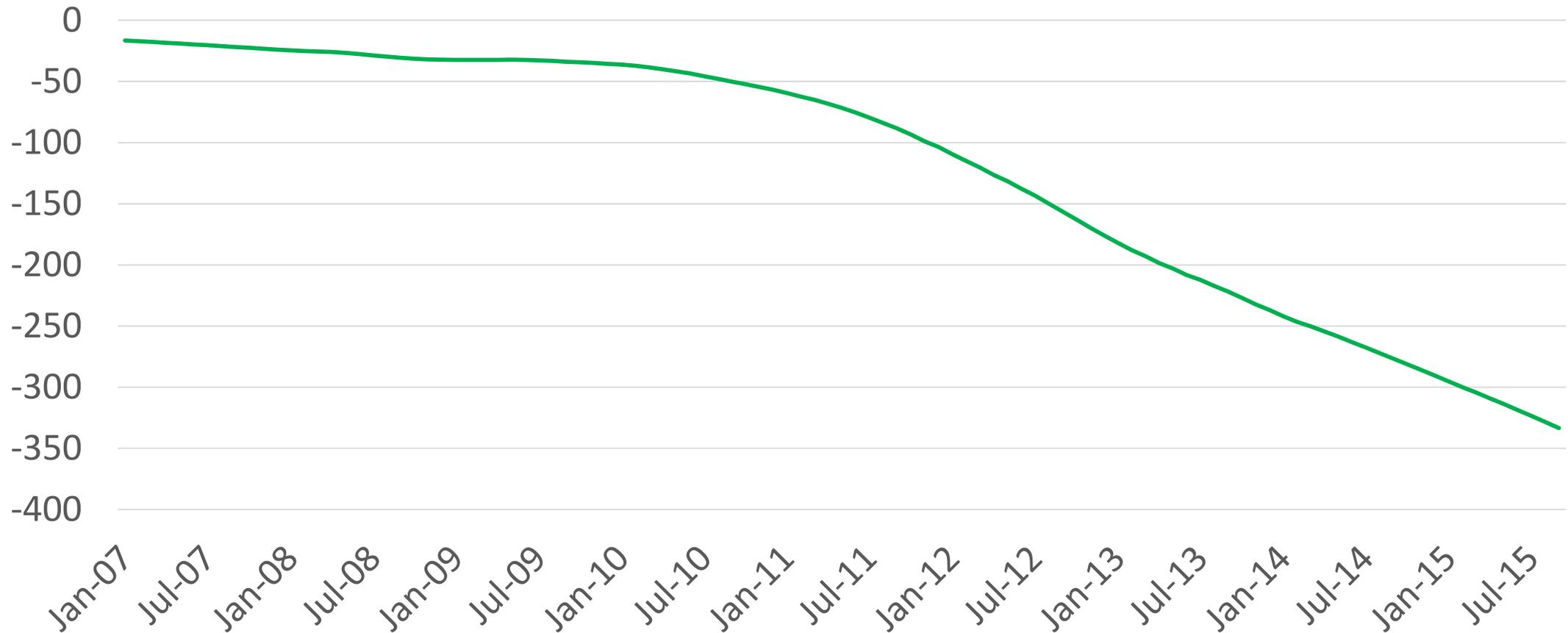


- Assumption 1: production of tight oil would fall quickly without continual new drilling

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- Reality check:

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- Reality check: **exactly right**

# Month-to-month change (1000 barrels/day) in production from legacy tight oil wells



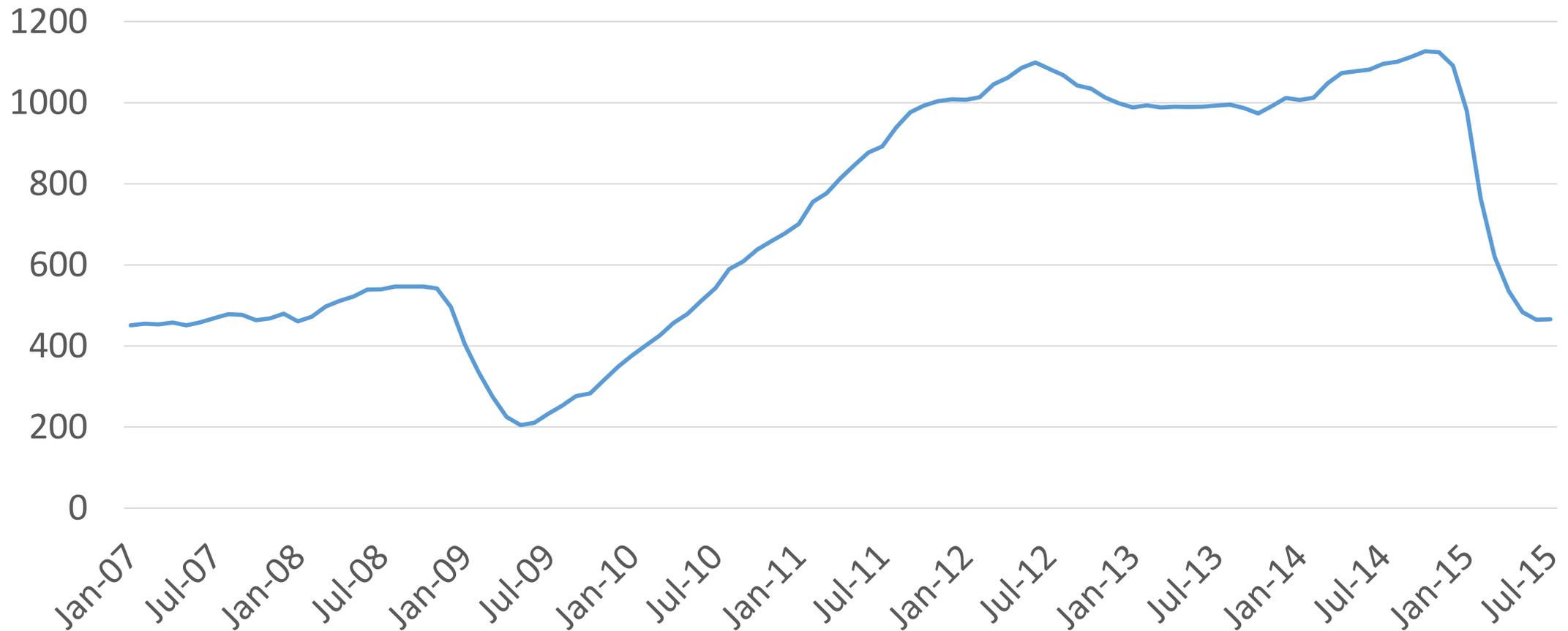
Cumulative lost production April 2015 to Sept 2015 = 1.6 mb/d (source: EIA DPR)

- Assumption 2: if prices fell below \$80, drilling rigs would be cut back dramatically

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- Reality check:

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- Reality check: **pretty much right**

# Number of active drilling rigs in counties associated with U.S. tight oil production



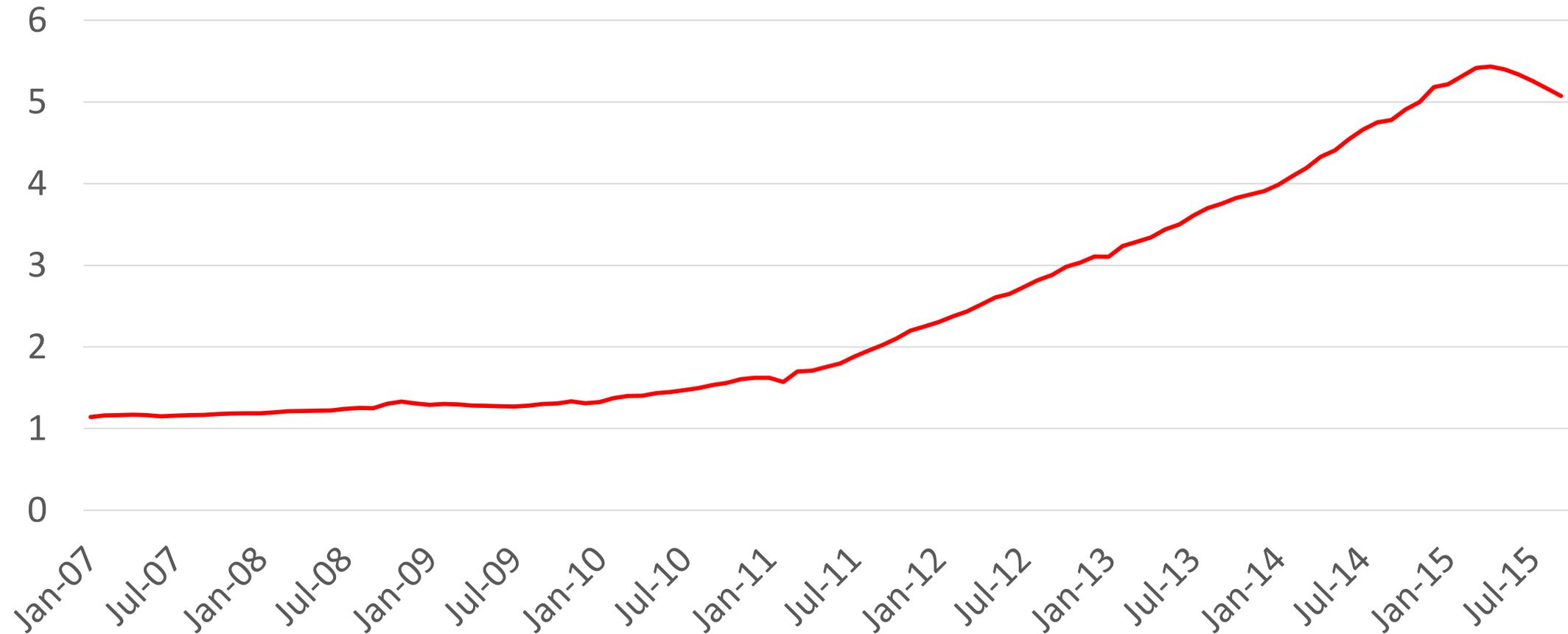
Down 58% July 2014 to July 2015 (source EIA DPR)

- 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:

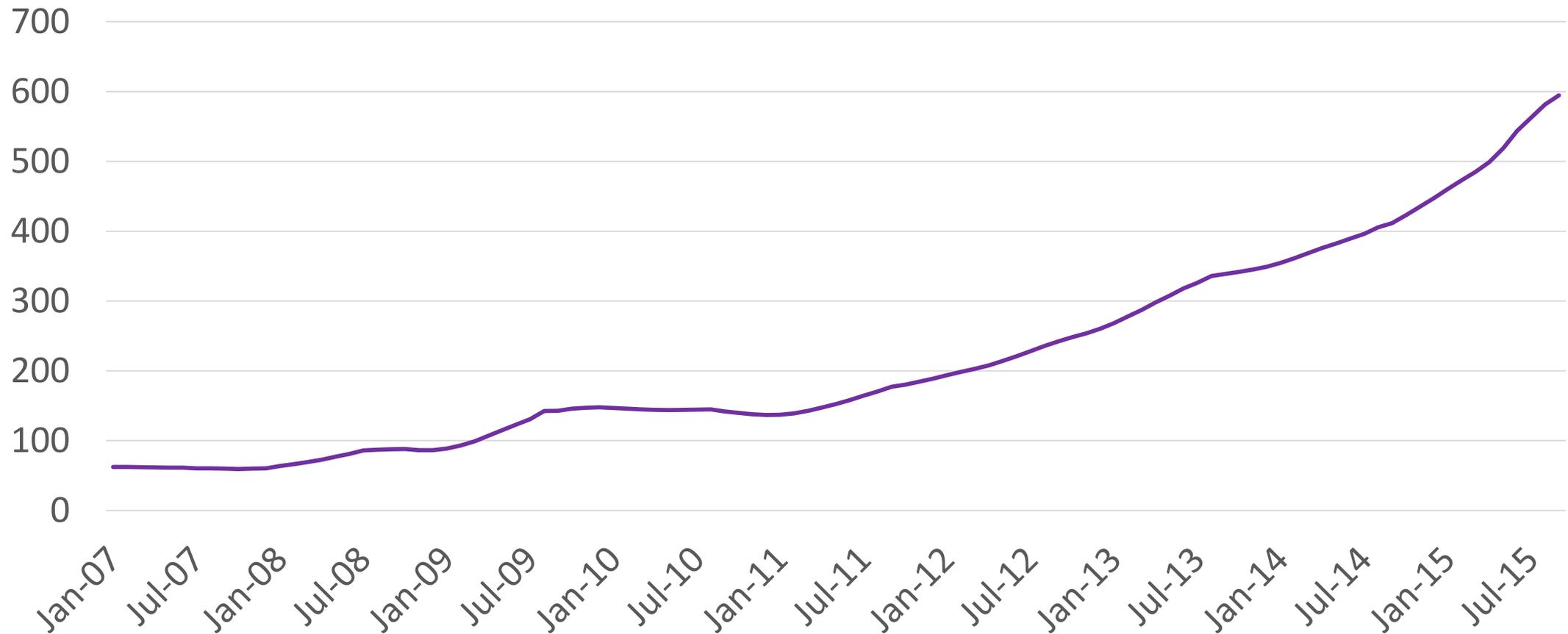
- Assumption 3: big drop in legacy production and number of active drilling rigs would mean big drop in U.S. production
- Reality check: **dead wrong!**

# Monthly U.S. tight oil production



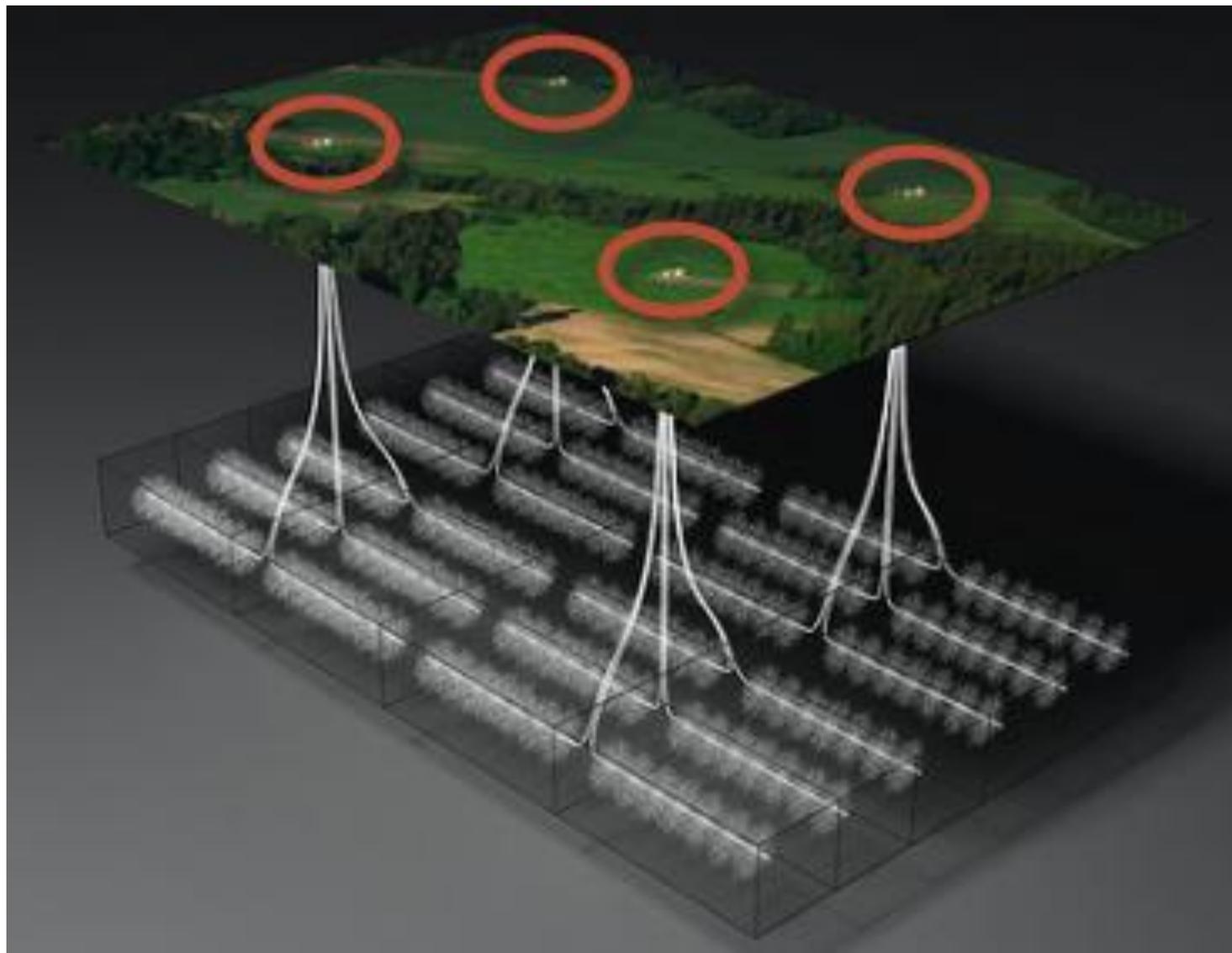
Down 7% April 2015 to Sept 2015 (source EIA DPR)

# 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

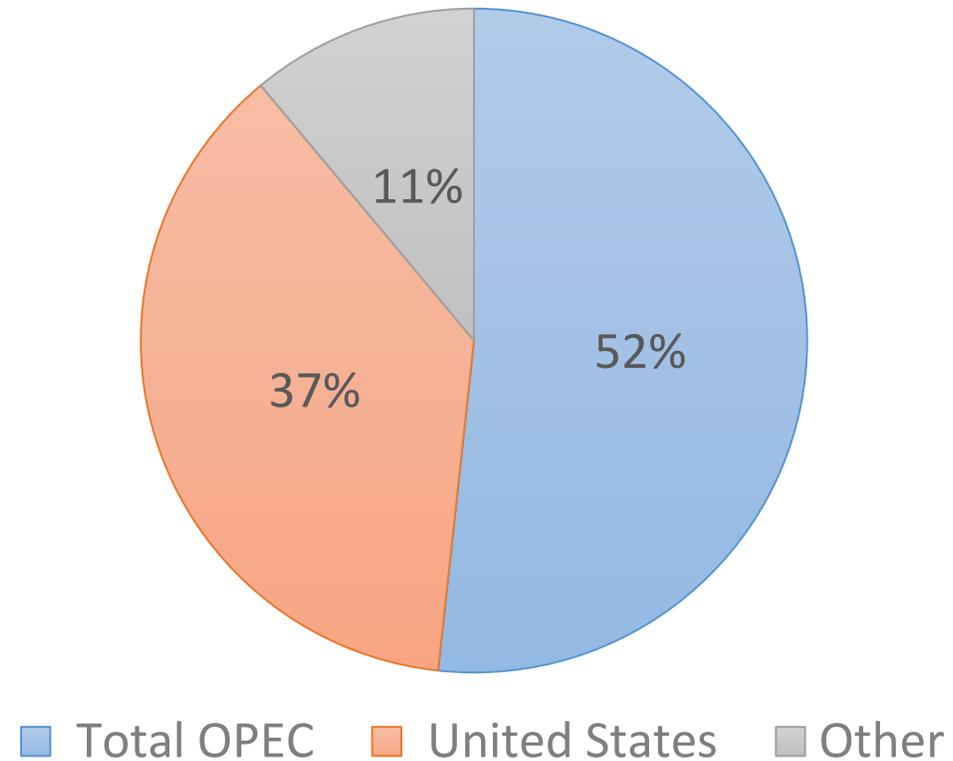
Devon	10,103
EOG	247
Pioneer	451
Whiting	387

# Fracking: Conclusion

- Improving technology can help replace some of the lost production
- But status quo not sustainable at \$50/barrel

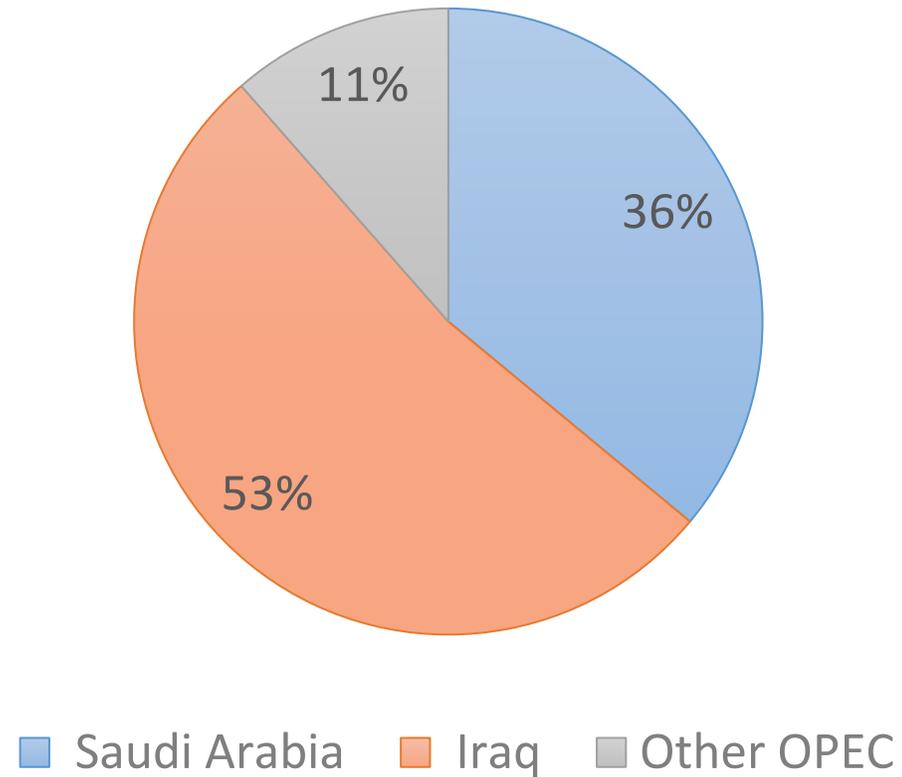
## 2. Geopolitics

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



# Distinguish turmoil from deliberate decisions

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

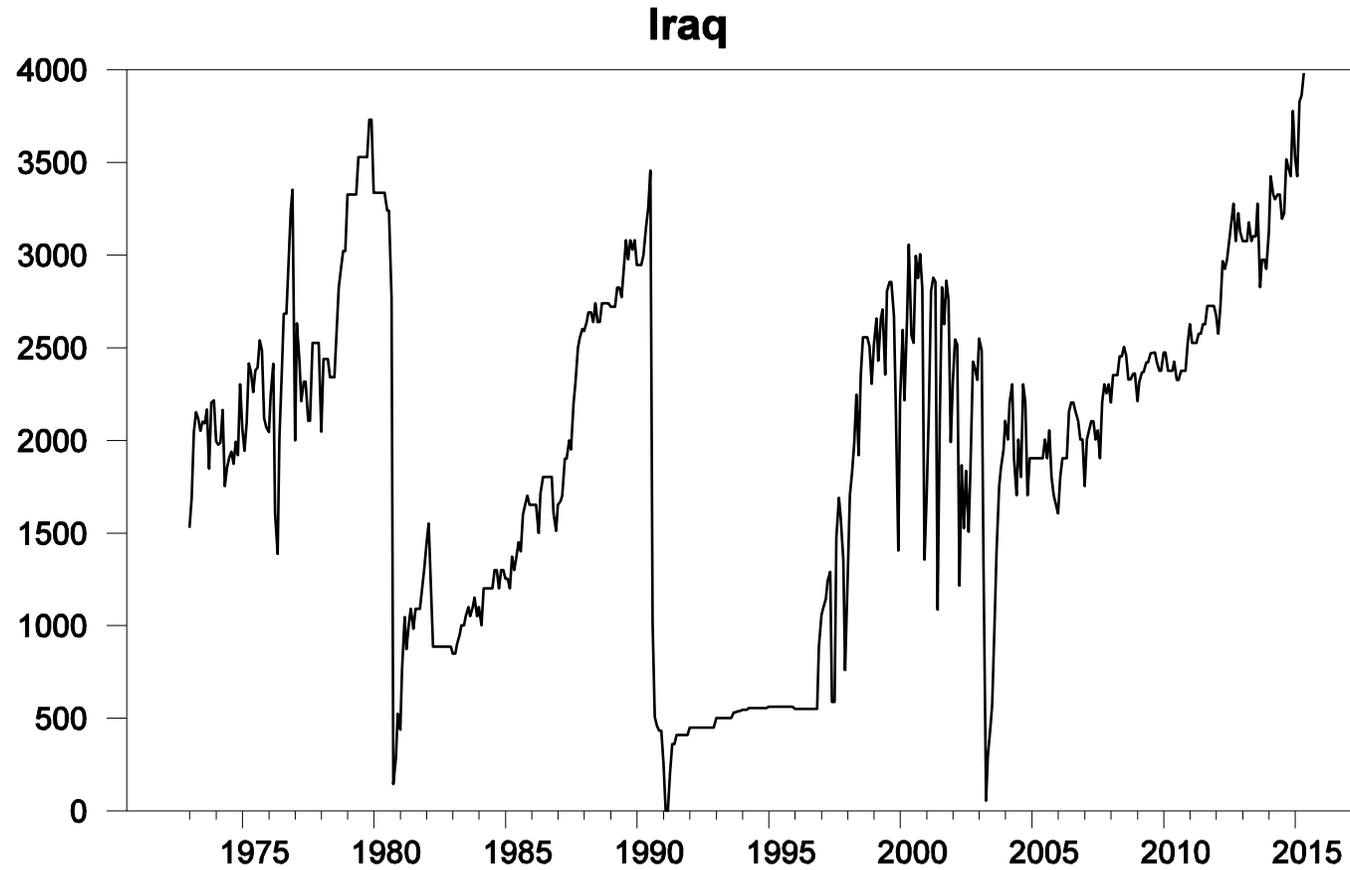


- Assumption 4: Turmoil in Middle East and North Africa would continue

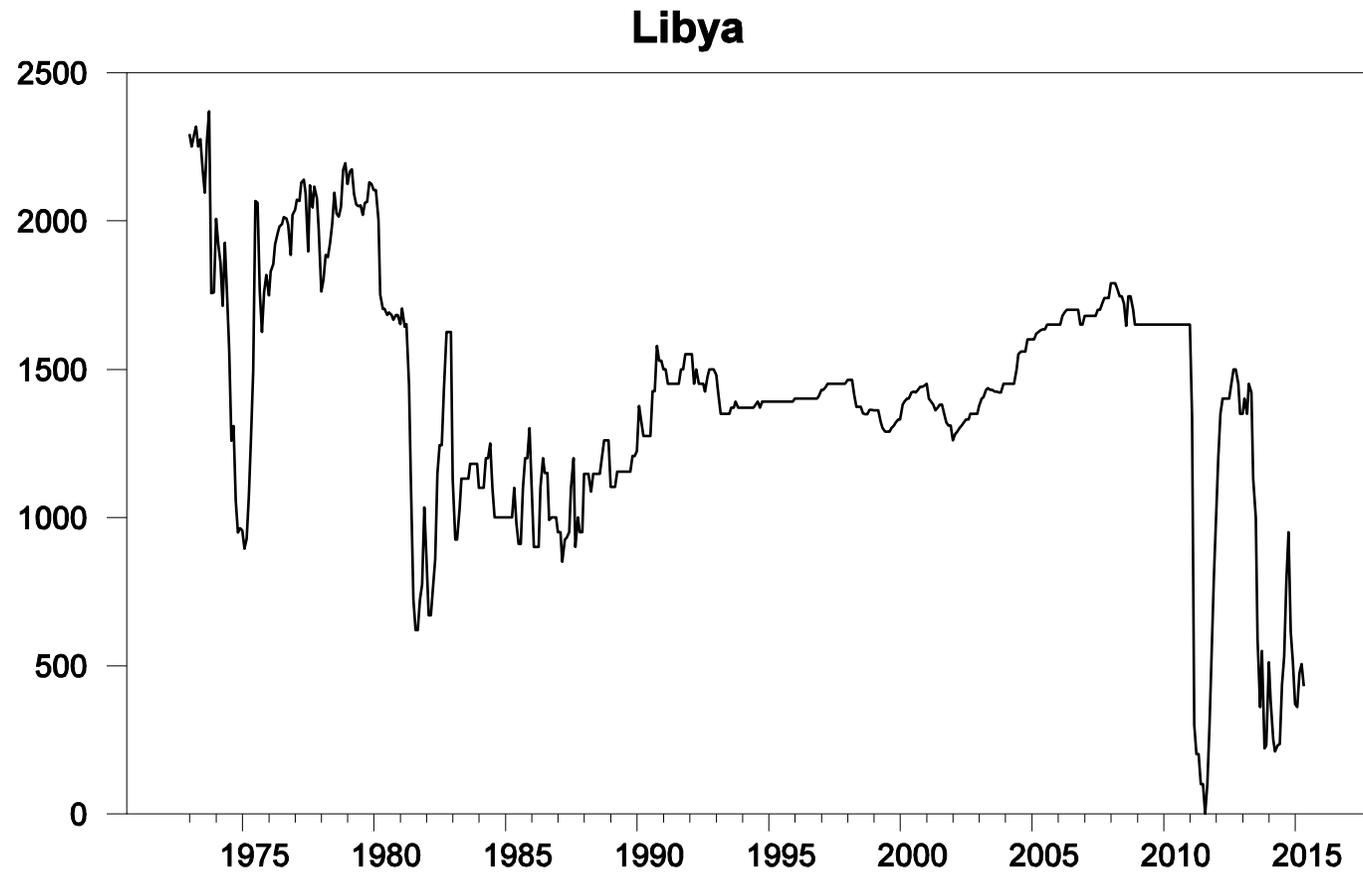
- Assumption 4: Turmoil in Middle East and North Africa would continue
- Reality check:

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- Reality check: **true, but they're pumping more oil anyway!**

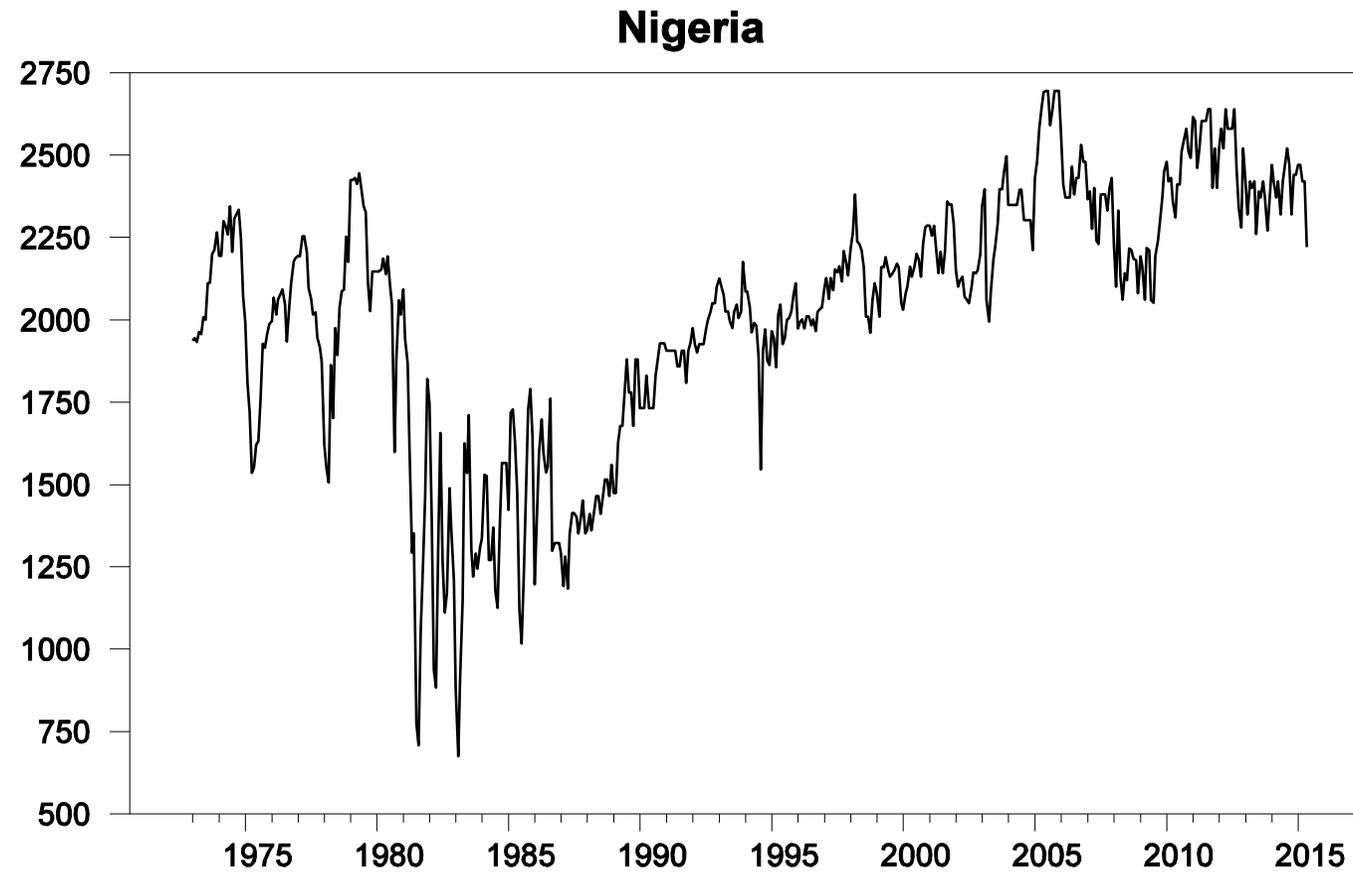
# Iraq production up 2/3 mb/d May 2014 – May 2015



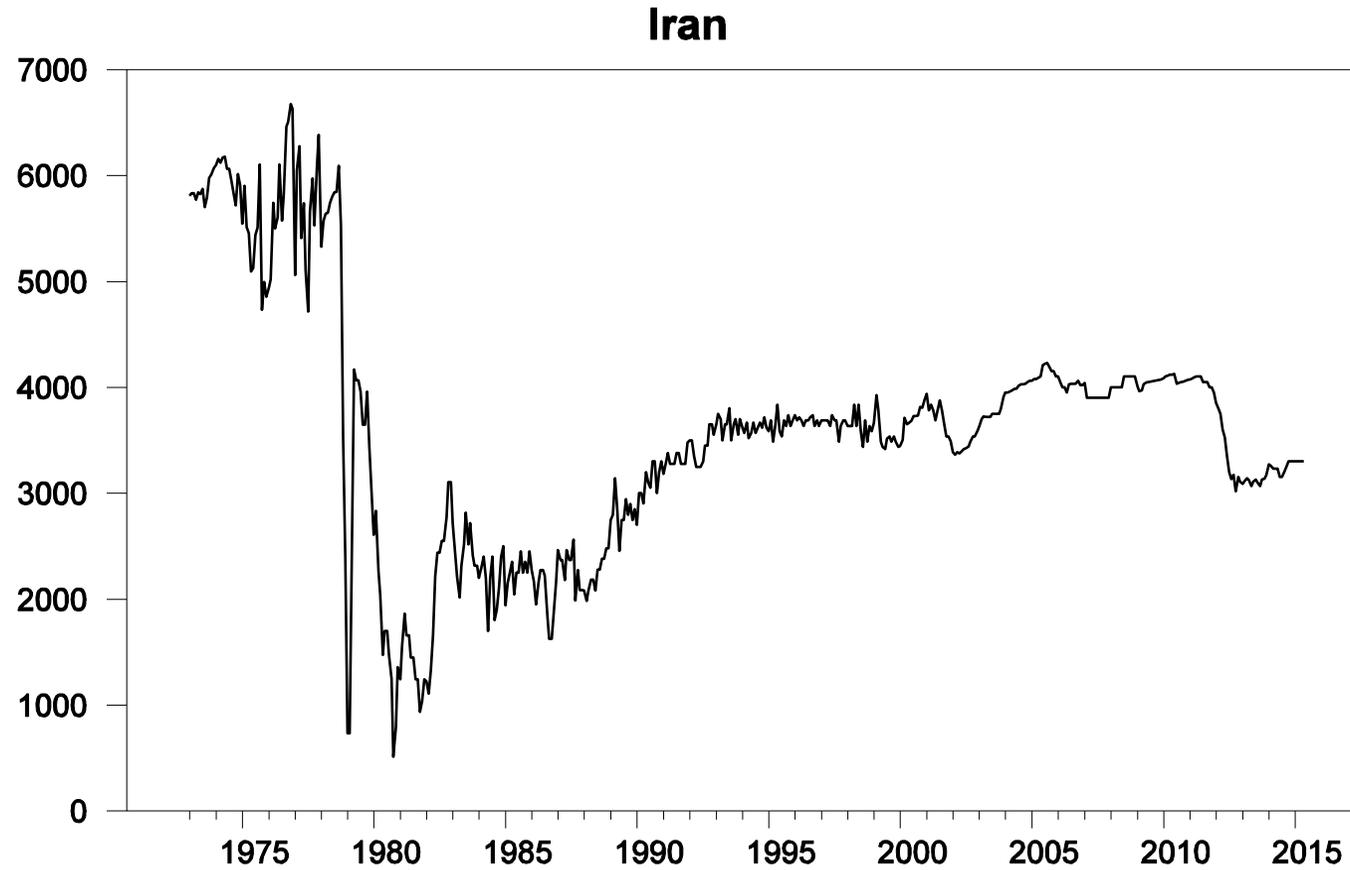
# Libyan production up from its lows



# Nigeria hanging in there



# Iran could see big increase if sanctions lifted

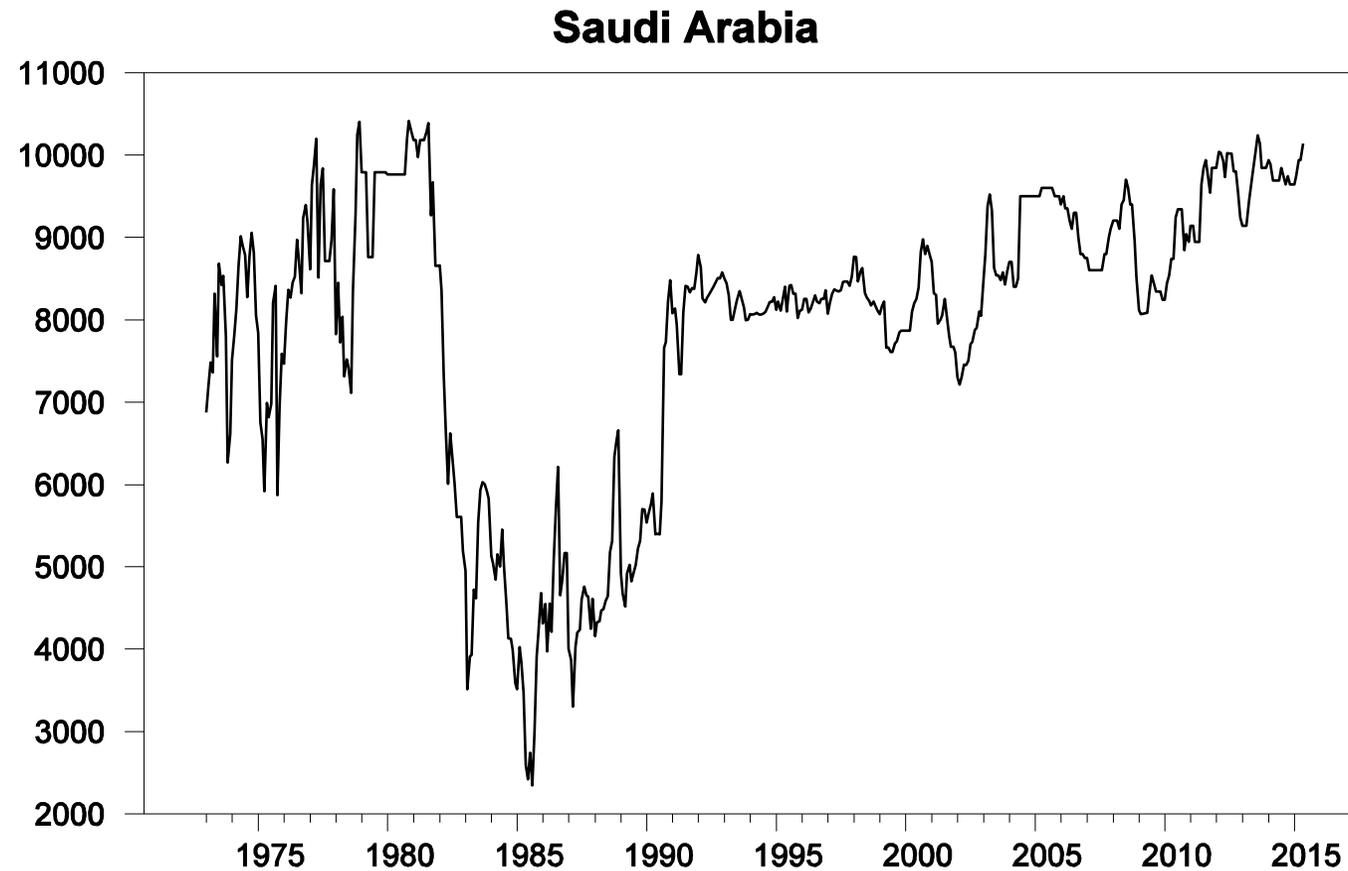


- Assumption 5: Saudi Arabia would never increase production above 10 mb/d

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- Reality check:

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- 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

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- Reality check:

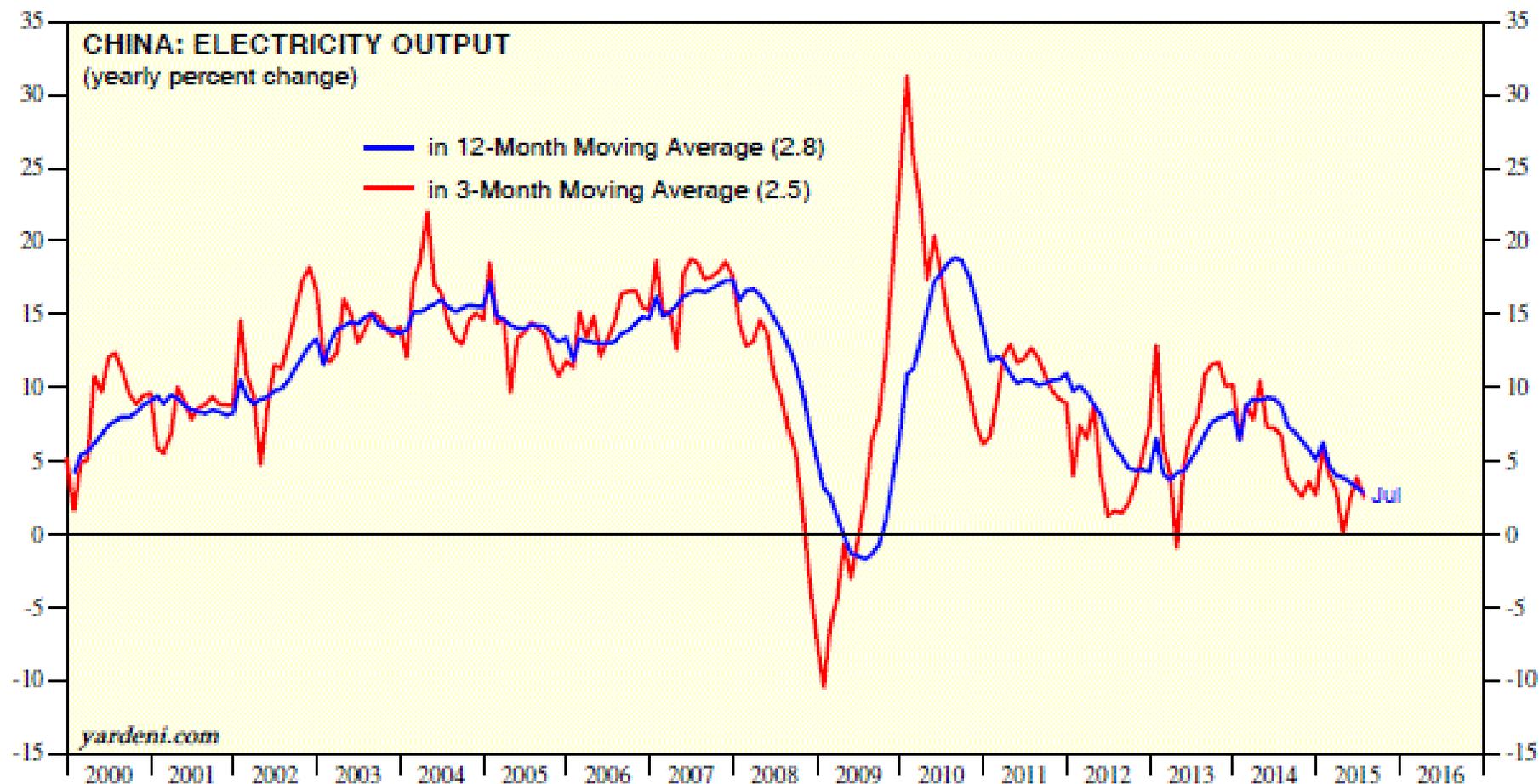
- Assumption 6: China's energy demand would continue its phenomenal growth
- Reality check: ???

# High-frequency correlation between news about China and dollar price of oil



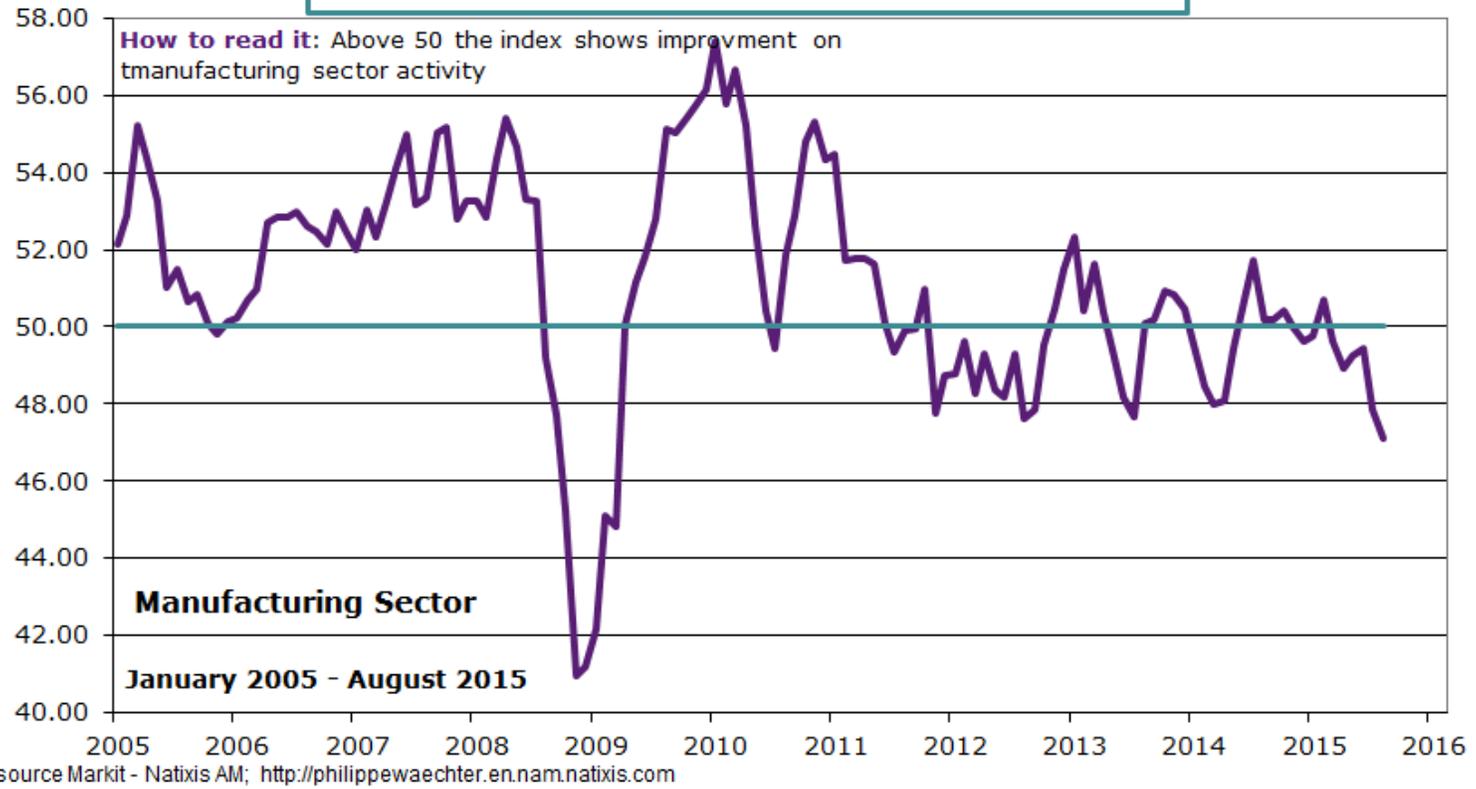
Cumulative percent change in Shanghai Stock Exchange Composite Index (in blue) and United States Oil Fund ETF (in red), March 16 – Sept 11

# China's growth in electricity use has slowed



Source: Haver Analytics and China National Bureau of Statistics.

### China - Synthetic Index - PMI/Markit/Caixin Survey



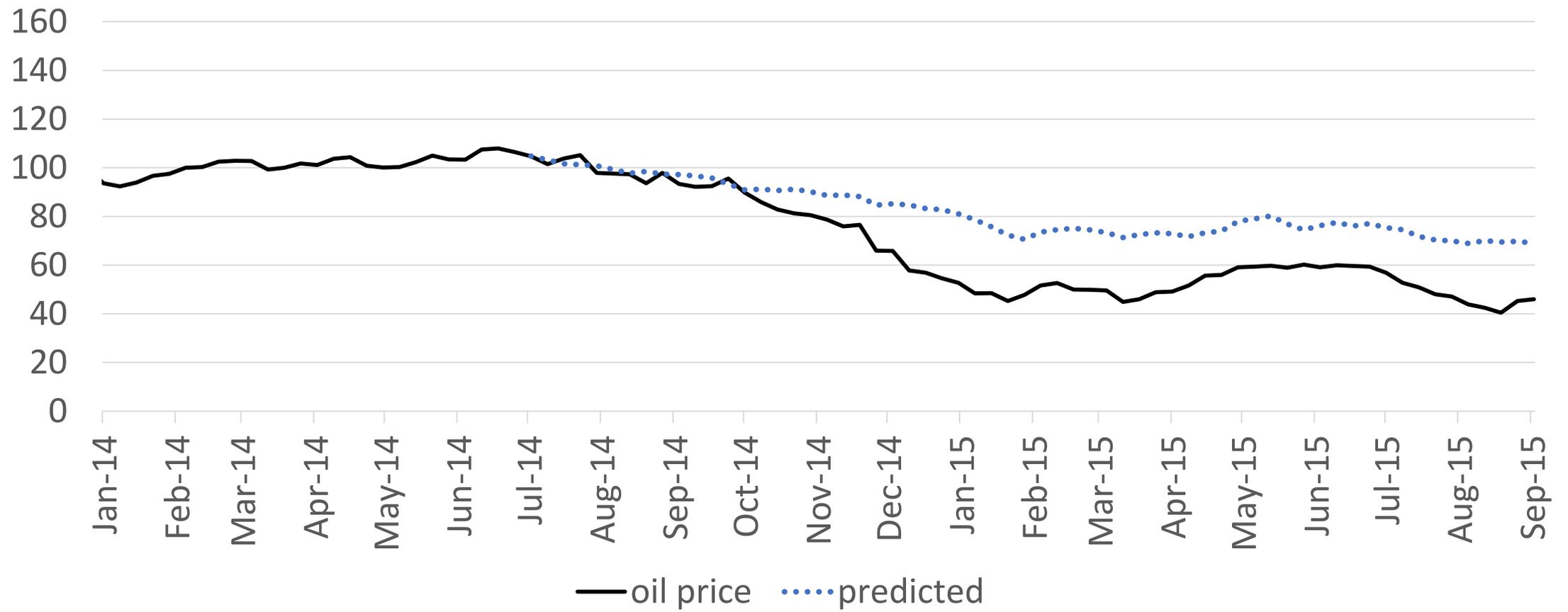
# How much of oil price decline can be explained by factors other than oil supply?

- 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):

$$\Delta p_{oil,t} = 0.363 \Delta p_{copper,t} - 1.253 \Delta p_{dollar,t} + 9.442 \Delta r_{10y,t} + \hat{\epsilon}_t \quad R^2 = 0.33$$

(3.40)                      (4.44)                      (2.84)

- 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