

The Impact of the U.S Fracking Boom on the Price of Oil and on Arab Oil Producers

Lutz Kilian
University of Michigan
CEPR

Background

- Shale oil production became possible because of technological innovation (horizontal drilling, hydraulic fracturing (fracking), microseismic imaging).
- The rapid expansion of U.S. shale oil production was stimulated by the high price of conventional crude oil after 2003, which made this new technology competitive.
- Since then efficiency gains in shale oil production have lowered its cost, allowing continued production at much lower oil prices.
- Because the price of oil has remained low since 2015, shale oil producers are experiencing increased operating losses and financial stress.

The Role of Refineries

- Crude oil is being consumed by refineries that turn crude oil into refined products such as gasoline, diesel, heating oil, jet fuel and heavy fuel oil.
- Not all refineries are alike. Their technical configuration determines which type of crude oil they can process.
- Changing an existing configuration is costly.

The Refining Industry in Transition

A few years ago, the global refining industry expected a growing shortage of light sweet crude oil worldwide:

1. Refiners along the Texas Gulf Coast invested in new technology that allowed them to become the world leader in processing heavier crudes. This allowed them to process lower priced crudes imported from Saudi Arabia, Venezuela and Mexico.
2. Refiners along the East Coast began to shut down existing refineries for light sweet crude oil in anticipation of a growing shortage of light sweet crude oil.

The Glut That No One Saw Coming

After 2010 shale oil was shipped in ever increasing quantities from the interior of the country to the U.S. oil market hub in Cushing, OK.

- The refiners most naturally suited to taking advantage of this opportunity were the East Coast refiners.

Because traditionally these refiners supplied the central United States with refined products produced from imported light sweet crudes, however, the infrastructure required to move the shale oil from the interior of the country to those refineries was lacking.

- Likewise, it proved difficult for Texas refineries to absorb the shale oil in part because of the lack of a pipeline infrastructure to Texas and in part because many of the Texas refineries were not well-equipped to process light sweet crude.

The Fragmentation of the Market for Crude Oil

- The local excess supply of light sweet crude oil put downward pressure on the U.S. price of oil, as measured by the WTI benchmark.
- This local glut coincided with high demand for imported light sweet crude along the East Coast, causing the WTI price to decline relative to the Brent oil price benchmark.
- Exporting this crude oil was precluded by transportation bottlenecks and by the U.S. crude oil export ban.

Key Market Responses

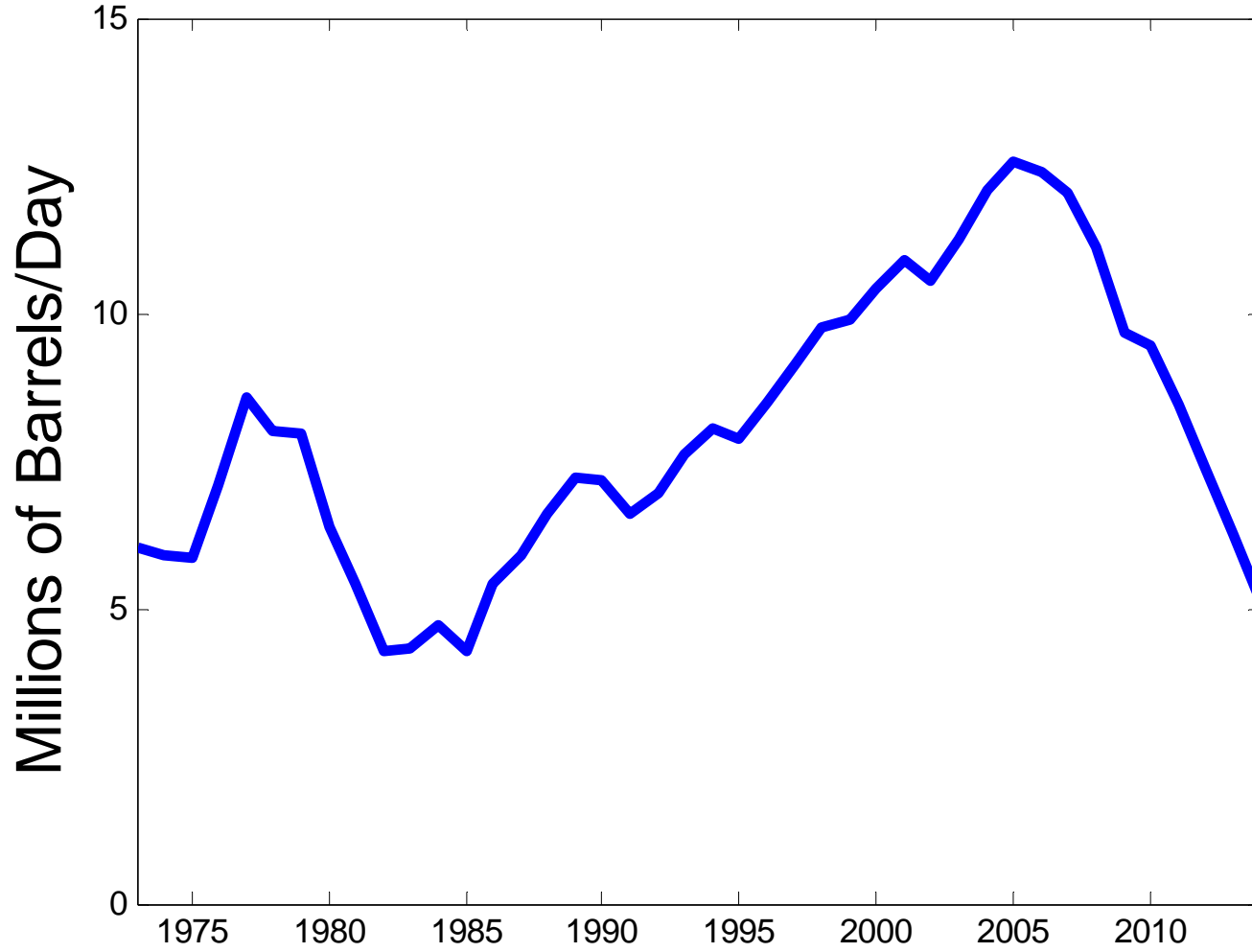
1. Pipeline reversals (especially in 2013 in Texas) and new pipeline construction (especially in 2014 in Texas)
 2. Increased oil shipping by rail and barges (especially to East Coast).
- ⇒ Over time more of the shale oil is reaching U.S. refiners along the Gulf Coast and the East Coast.

The Role of Trade in Refined Products

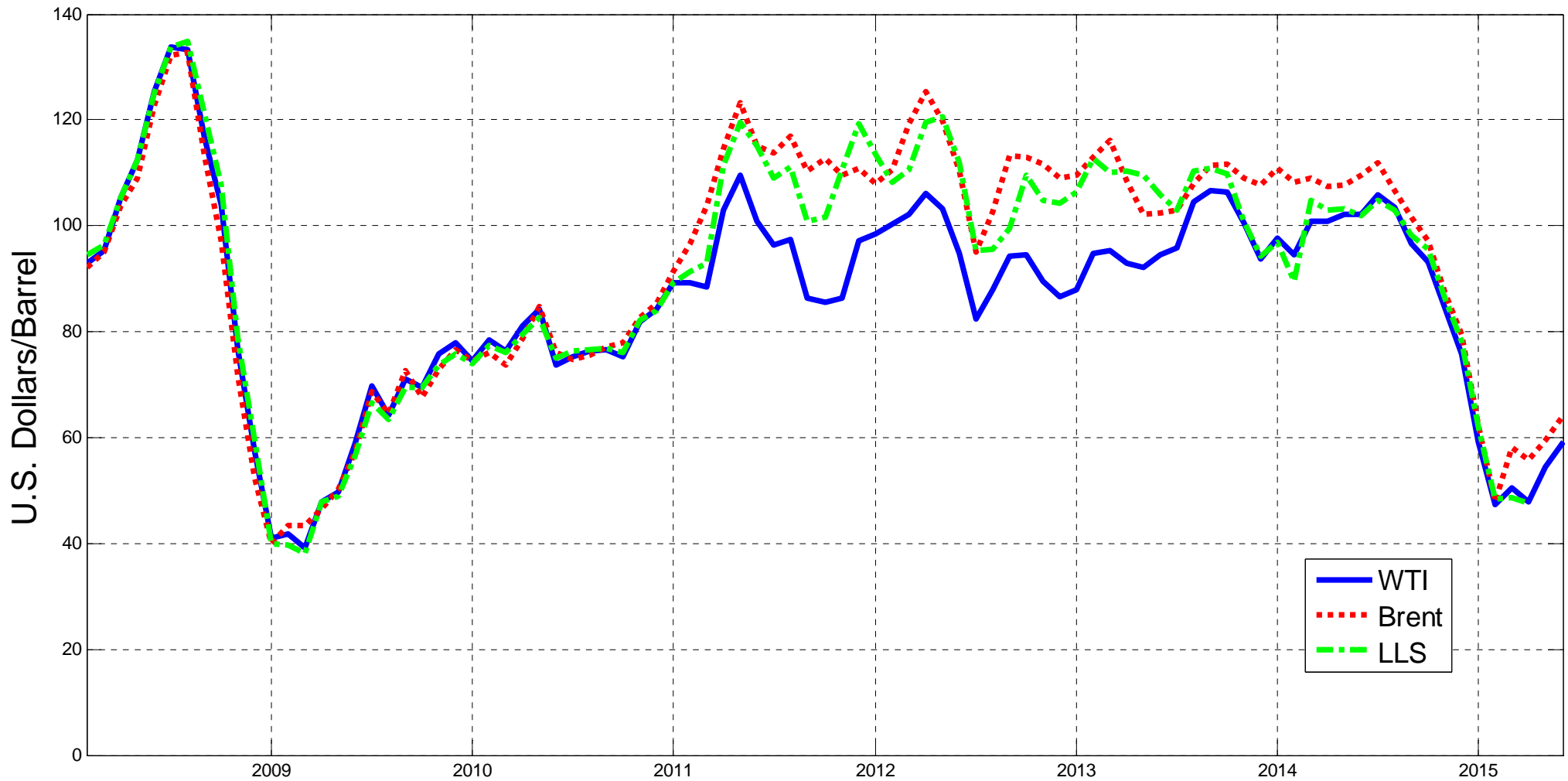
U.S. refiners substituted exports in refined products such as gasoline or diesel for exports of the raw product crude oil. U.S. refiners have competitive advantage due to access to low-cost oil.

- By shipping these refined products to Latin America and Europe, the effective demand for crude oil in those regions declines.
- At the same time, imports of crude oil to the United States have dwindled mainly at the expense of African crudes along the East Coast and at the expense of Mexican and Venezuelan crudes along the Gulf Coast.
 - ⇒ This is the mechanism by which shale oil affected the global price of oil, proxied by the Brent price of oil.

U.S. Petroleum Net Imports, 1973-2014

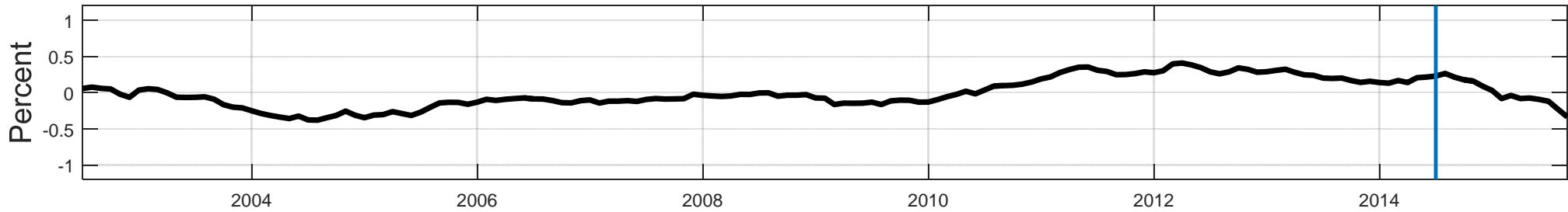


Monthly Spot Prices of Crude Oil, 2008.1- 2015.5

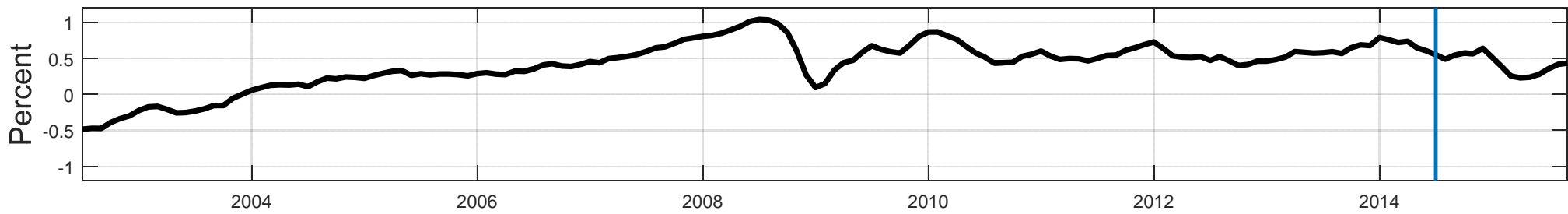


What Caused the Decline in Oil Prices in 2014?

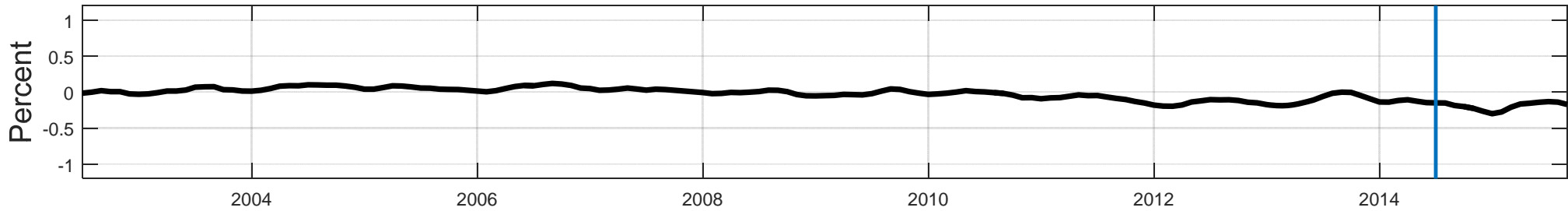
Cumulative Effect of Flow Supply Shock on Real Price of Crude Oil



Cumulative Effect of Flow Demand Shock on Real Price of Crude Oil



Cumulative Effect of Speculative Demand Shock on Real Price of Crude Oil



How Much of the Decline in Brent Prices Was Caused by Shale Oil?

Counterfactual:

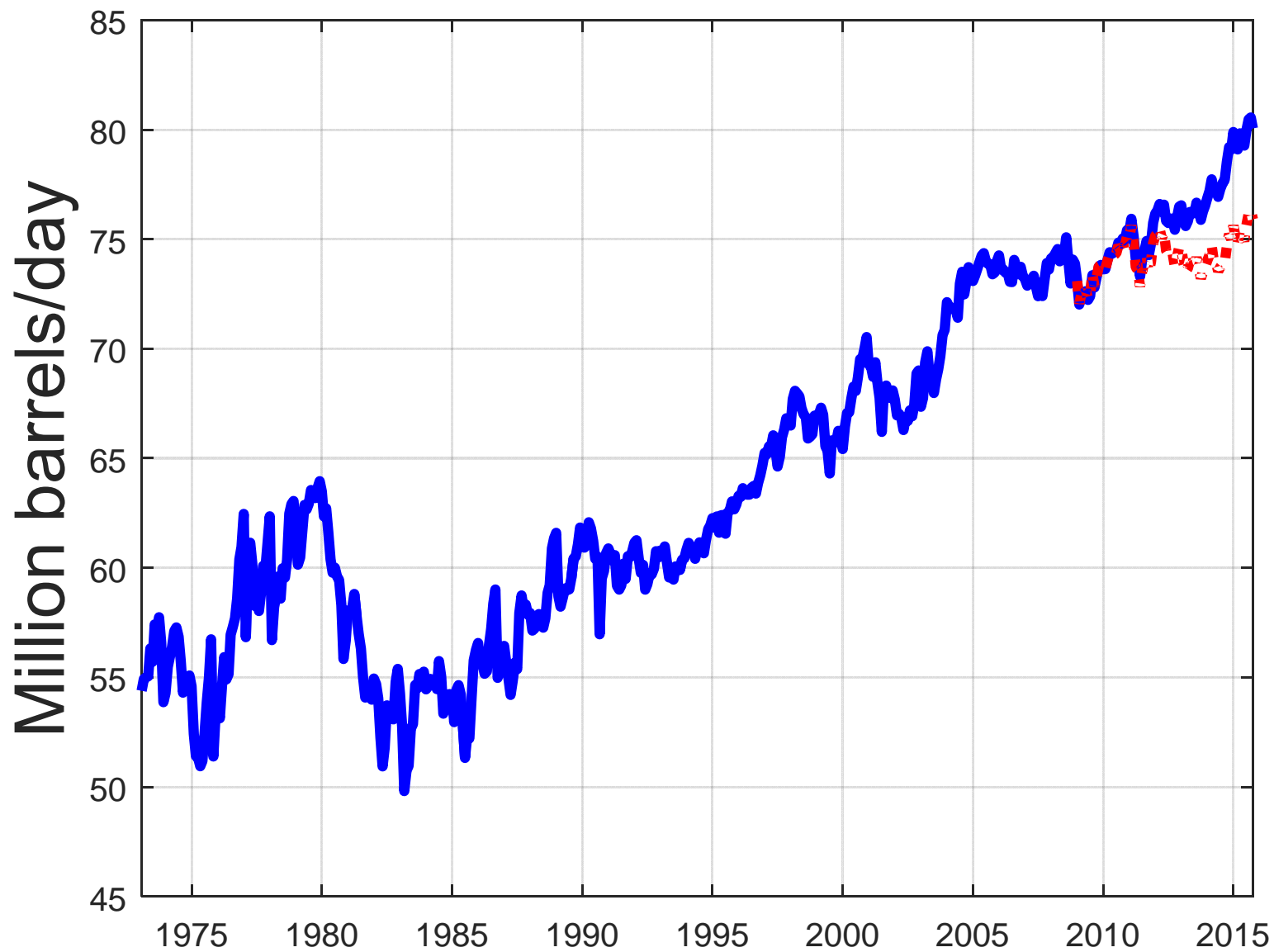
How different would the price of crude oil have been, if the U.S. fracking boom had never happened?

Step 1: Construct counterfactual level of world oil production.

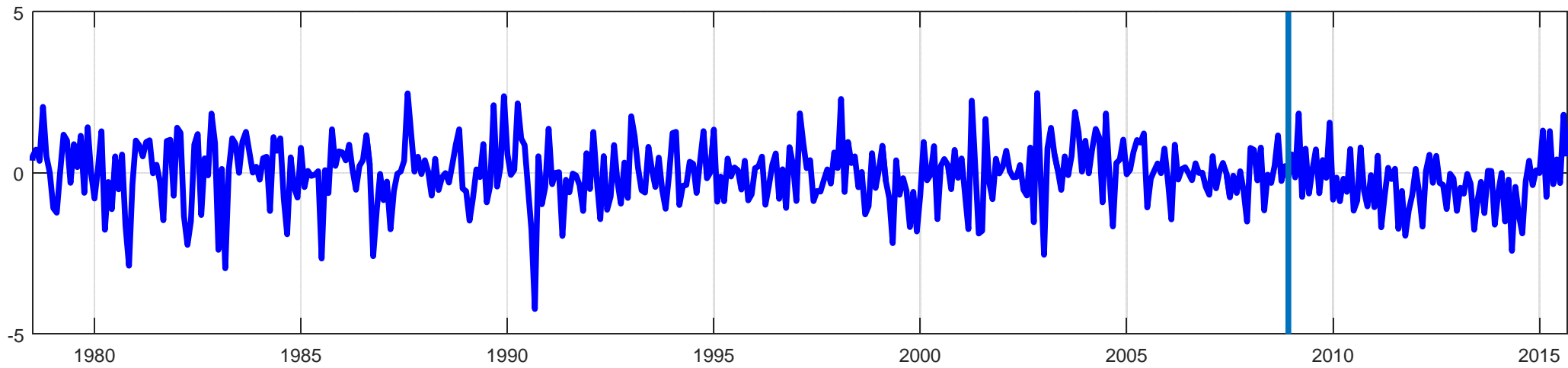
Step 2: Use structural oil market model (Kilian and Lee 2014):

Given the counterfactual path of global oil production, infer the sequence of flow supply shocks required to produce this path of oil production after November 2008, holding constant the remaining structural shocks in the model.

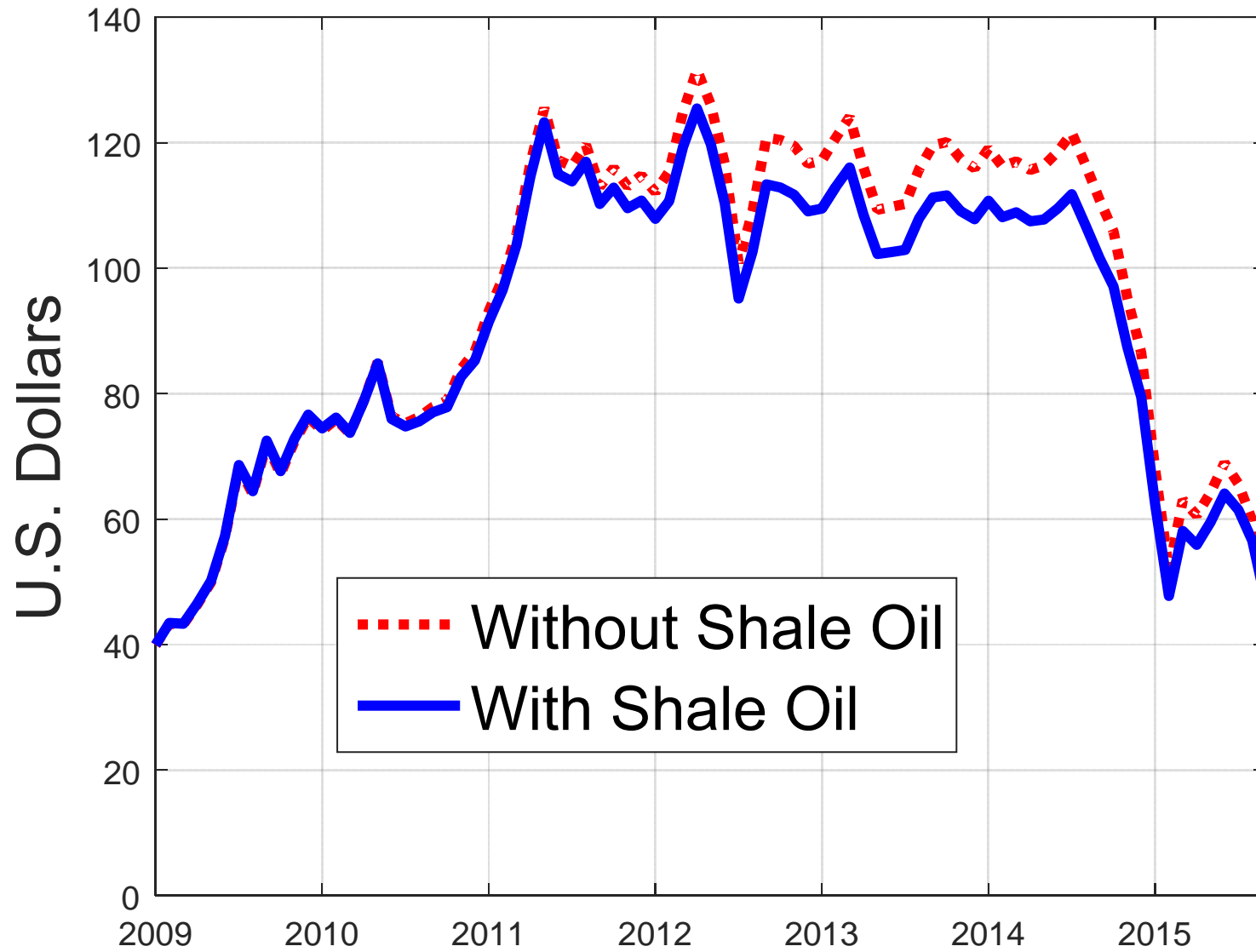
Counterfactual for World Oil Production in the Absence of the U.S. Fracking Boom



Sequence of Flow Supply Shocks Required to Implement the Counterfactual



The Impact of Shale Oil Production on the Brent Price of Crude Oil



Conclusion

- Press reports put the reduction in Saudi foreign exchange reserves between mid-2014 and August 2015 near \$90 billion.
- This estimate is considerably larger than the loss in oil revenue over the same period that is attributable to the fracking boom. The latter we estimated to be about \$24 billion.
- In the absence of the fracking boom, the reduction in Saudi foreign exchange reserves since mid-2014 would have been about two thirds of the actual decline.
- The remainder reflects higher crude oil production elsewhere in the world, shifts in oil price expectations affecting demand for oil stocks, and the effects of a slowing global economy.

Saudi Policy Options

At the current rate, one would expect the Saudi foreign exchange reserves to be exhausted by early 2020.

External borrowing or fiscal retrenchment or both?

Key questions for Saudi Arabia:

1. How resilient will U.S. and Canadian oil producers be?
2. How about state-controlled oil producers (Russia, Iran, Iraq)?
3. How soon will oil production elsewhere run out (UK, Norway)?
4. How soon will the global economy recover?
5. Coordinated supply cuts? (Russia, Saudi Arabia, Venezuela)