How the Shale Oil Revolution and U.S. Oil Infrastructure Have Shaped the Evolution of U.S. Oil and Fuel Prices in Recent Years

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Putting U.S. Shale Oil Production in Perspective

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U.S. Crude Oil Imports: 7.3 mbd
U.S. Crude Oil Production: 8.2 mbd
… of which U.S. Shale Oil Production: \( \approx 3.5 \) mbd
2014 EIA Outlook for U.S. Crude Oil Production

U.S. maximum production level of 9.6 million barrels per day in 1970
Two Concerns with these Projections

● They reflect estimates of shale oil reserves that are not necessarily reliable:

Example:
The EIA just reduced its estimate of Monterey shale oil reserves from 15.4 million to 0.6 million barrels.

This implies a 64% reduction in previously estimated U.S. shale oil reserves.

● In adding up barrels of crude oil, we ignore differences in the oil’s density (light to heavy) and sulfur content (sweet to sour).
A Fragmented Oil Market

- Traditionally, the U.S. has specialized in refining mid-grade crude oil from Mexico and Venezuela along the Gulf of Mexico as well as refining higher-grade crude along the East coast.

- In recent years two new grades of crude oil entered the U.S. market:
  1. Heavy Western Canadian crudes extracted from oil sands.
  2. Ultra-light sweet shale oil from Bakken and Eagle Ford.

- Many U.S. refineries were already operating at capacity.

- Other U.S. refineries were not set up to process this type of crude oil (or the transportation capacity was lacking to ship the oil where it was needed), resulting in excess supply and falling oil prices at both ends of the quality spectrum.

Operable refinery locations and capacity volumes as of January 1, 2012

PADD 1: East Coast

PADD 2: Midwest

PADD 3: Gulf Coast

PADD 4: Rocky Mountain

PADD 5: West Coast

oil refinery capacity
thousand barrels per day

- 250 and above
- 110 to 250
- 50 to 110
- less than 50
The Role of Crude Oil Exports

This disequilibrium might have been resolved by exporting crude oil. This did not happen for several reasons:

- European refiners are used to processing light sweet crude oil and hence have no use for heavy Canadian crude oil or ultra-light shale oil.
- Exporting Canadian heavy crude oil to Asia would have required pipelines to the Pacific; exports from the Gulf of Mexico to Asia are not cost-effective.
- At the same time, U.S. law prohibits the export of domestically produced crude oil, so neither conventional U.S. oil nor shale oil could be exported.
- In any case, the transportation capacity would not have sufficed for large-scale oil exports from the Gulf coast.
The Role of Transportation Infrastructure

One domestic response has been to blend heavy and ultra-light crude in the right proportion to mimic mid-grade crude oil.

- Such blends, however, can be processed by existing refineries along the Gulf coast only to the extent that the oil can be transported there by rail or by pipeline. That’s a problem.

- Insufficient refining and transportation capacity caused even the price of light sweet WTI crude oil to drop below the world price after 2010 due to excess supply in Cushing. Only the opening of a pipeline to the Gulf increased the effective demand for crude oil and raised the WTI oil price.

The future evolution of the U.S. oil price is closely tied to that of the U.S. oil refinery and transportation infrastructure. There is little investment in pipeline infrastructure. Refineries favor rail cars. Their market power allows them to squeeze oil producers.
The Role of the Refining Infrastructure

- Another response has been to build new refineries in the proximity of shale oil fields that supply high-end products such as diesel to the local economy and feedstock for other refineries.
  - In addition to reopening old plants, three new refineries are under construction in Texas, North Dakota and Utah.
  - These refineries all process under 50,000 barrels a day and their product must transported by truck or rail.
  - These operations cannot be scaled up for three reasons:
    1. Lack of transportation infrastructure
    2. Environmental regulations
    3. Concerns that the U.S. export ban on crude may be lifted.
- There also has been some expansion of capacity for processing heavy crude oil along the Gulf coast (but not on the East coast), but this does not address the transportation bottlenecks.
Implications for the U.S. Price of Gasoline

Going forward, U.S. oil is likely to trade at a discount. This does not mean that U.S. gasoline prices will fall, however:

● To the extent that the marginal gallon of fuel in the Midwest is still imported from coastal locations, fuel produced in the Midwest from low-cost domestic oil will cost the same as fuel produced from high-cost imported crude oil (Borenstein & Kellogg 2014).

● To the extent that fuel produced in the Midwest may be exported, refiners will charge the same fuel price that they can sell at in world markets.
Macroeconomic Implications for the U.S. Economy

Oil price shocks matter for U.S. real GDP mainly for two reasons:

1. If the price of imported crude oil (and hence the price of domestic fuel) increases, wealth is being transferred abroad. Higher fuel costs act as a tax on the U.S. economy.

- Given that net crude oil imports will decline with increased shale oil production, this tax and its recessionary effect will diminish.

- Moreover, the increased export of refined products will improve the terms of trade compared to the past.

- This does not mean that there is no redistribution of wealth from higher U.S. fuel costs, but that more of this redistribution occurs domestically and that its effect is less clear.
EIA Projections of Net Petroleum Imports

U.S. Petroleum Net Imports, 1950-2040

Source: EIA
2. Oil price shocks also may matter for real GDP through their effect on the relative price of fuels.

- Given that gasoline and diesel prices closely mirror world market prices, firms and consumer face the same change in relative fuel prices as they would have traditionally.

Hence, the effect of an oil price shock in global markets on the relative price of fuel remains unchanged.

- Recent research, however, suggests that changes in the relative price of fuel are not as quantitatively important for the U.S. economy as traditionally thought (see Kilian and Vigfusson 2011, 2013, 2014).
Does Shale Oil Have a Stimulating Effect on the Domestic Economy?

- No stimulating effect on spending or production through lower fuel prices.

- Lower oil prices, but higher gasoline prices involve a transfer from oil producers to oil refiners. This means that owners of stocks of refining companies benefit.

- The local economy near shale oil fields benefits (Montana/North Dakota, Texas, Colorado/Utah).

\[\Rightarrow\] Overall, the effects on the aggregate U.S. economy are likely to be small. This is in contrast to low-price shale gas, access to which benefits the petrochemical industry, for example.
Conclusions

- There remains much uncertainty about the persistence and scope of the shale oil boom.
- Shale oil will not cause an expansion in the U.S. economy. At best it may ameliorate the recessionary effects of global oil price shocks somewhat.
- The evolution of the U.S. price of oil is inextricably tied to the development of the U.S. refining, pipeline and rail infrastructure.
- Modelling these connections will become increasingly important for understanding and forecasting the evolution of the U.S. price of oil.
- It will be less important for understanding and forecasting U.S. retail fuel prices, which are likely to remain tied to global markets.