**The US Shale Oil Boom, the Oil Export Ban and the Economy: A General Equilibrium Analysis**

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## Overview

A boom in U.S. shale oil production has dramatically changed the nation’s energy landscape in a few short years. Since 2010, the U.S. has increased its oil production by 4 million barrels per day and imports of crude oil have fallen by 20 percent. The ample supplies of crude oil from the U.S. were a factor in the collapse of oil prices in 2014.

An important facet of the shale boom is that the crude oil produced from shale plays is predominantly light crude. While refineries can process different types of oil, they are imperfect substitutes for each other as refining inputs. There is also specialization across countries in terms of what types of oil are processed. In particular, compared to the rest of the world, the U.S. refining sector processes a relatively large amount of heavy crude oil as a proportion of U.S. refining capacity.

As a result, the large and unexpected increase in U.S. light oil production led to many questions about the ability of the U.S. refining sector to process the new supplies of oil. This issue was particularly relevant until the end of 2015 because of the U.S. export ban on crude oil, a policy that had been put in place after the 1973 oil embargo. This policy had the potential to distort outcomes in the oil and refining sectors, and potentially the broader economy, given the potential mis-match between the type of oil produced and U.S. refiners’ ability to process it.

## Methodology

With these issues in mind, we investigate the impact of the shale oil boom and the U.S. crude oil export ban on the oil and refining sectors, as well as the broader economy, through the lens of a dynamic stochastic general equilibrium model (DSGE).

In our model, the world economy consists of two countries, the U.S. and the rest of the world (ROW). Both countries produce oil, a non-oil good and refined petroleum products. Oil comes in three types, light, medium and heavy, and they are imperfect substitutes as inputs into the refining process. We calibrate our model to match a variety of macroeconomic and oil market data, and take into account important differences in the refining sectors of the U.S. and the rest of the world. To the best of our knowledge, our model is the first of this type to include a refining sector, different types of crude oil and to model the U.S. crude export ban.

In our model experiment, we assume the U.S. is hit with a series of positive productivity shocks that increase light crude oil production by the same amount that occurred from 2010 to 2015. We track the impact of the shock on the prices and output of the three types of oil, refinery inputs, refinery production, oil imports, product exports, fuel prices and GDP, among others, in both the U.S. and the ROW. We first do this for a case where free trade is allowed for all goods, including crude oil. We then use our model to investigate the distortionary effects of the U.S. crude export ban by assuming that oil cannot be exported from the U.S.

## Results

Our model predicts that the shale production boom causes light oil prices to fall by more than ten percent. Light oil prices also fall relative to other types of crude oil. The increased production backs out a significant portion of imported light crude oil, and leads U.S. refiners to process more light oil at the expense of other types, particularly medium crude. Fuel prices fall and U.S. GDP increases by a modest amount. These features are consistent with the data.

We then introduce the export ban into the model. We find that the distortions from the policy primarily affect the price of light oil in the U.S. and refining sectors in both the U.S. and the rest of the world. The price of light oil becomes artificially low in the U.S., both relative to light crude outside the U.S. and to other grades of oil. This provides a cost advantage to the U.S. refining sector. As a result, the U.S. processes more light oil than it would otherwise, and gains market share at the expense of the rest of the world. We find that the impact of the ban on refined fuel prices is negligible, as trade in refined petroleum products are unaffected by the crude oil export ban. Similarly, the impact on GDP is small, as the upstream and downstream sectors are relatively minor components of U.S. GDP.

Our model predicts that the export ban was binding from 2013 to 2015. We investigate whether the data are in agreement with this assessment. To do so, we look at the behavior of U.S. crude imports and several other variables to see if they behave as our model predicts they should if the export ban was a constraint on exporting crude. We find that the data are consistent with the model predictions.

**Conclusion**

## In this paper, we examine the boom in U.S. shale oil production and its impact on the oil and refined products market and the overall macroeconomy using a two-country, open-economy trade model where countries produce crude oil, refined fuel products and a non-oil good. We also analyze the effects of an oil export ban in the U.S., which had been in effect for decades until it was lifted in December 2015.

## Consistent with the data, our model predicts that the boom should back out significant amounts of imported light crude oil, lead to a ramp up in the use of light crude by U.S. refiners and crowd out the use of medium crude oil. Our model also predicts that the export ban was a binding constraint from 2013 to 2015. The distortions generated by the ban were primarily concentrated in the oil and refining sectors. Had the production boom been larger, the impacts could have been more widespread.

## The ban has since been removed and this has enabled energy markets to become more efficient by allowing the U.S. to export light crude oil. Indeed, exports of crude oil have continued to increase since the end of 2015, despite the fact that production has fallen somewhat. The removal of the ban has become increasingly important in recent months given the return to strong production growth in the U.S. shale patch.