

# A Macroeconomic Analysis of Lifting the U.S. Crude Export Ban

Nida Cakir Melek, FRB Kansas City, 816-283-7759, [nida.CakirMelek@kc.frb.org](mailto:nida.CakirMelek@kc.frb.org)

Michael Plante, FRB Dallas, 214-922-5179, [mplante@dal.frb.org](mailto:mplante@dal.frb.org)

Mine Yücel, FRB Dallas, 214-922-5160, [mine.k.yucel@dal.frb.org](mailto:mine.k.yucel@dal.frb.org)

## Overview

Rapidly expanding 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. Although the U.S. has one of the largest refining capacities in the world, it is mostly for non-light crudes. Only 37% of this capacity is for light sweet crude. Hence, the increase of "light" crude oil from shale may have resulted in a mismatch in light inputs and heavier refining capacity.

Refineries can process different types of oil, but the different oils are imperfect substitutes for each other as refinery inputs. There is also specialization of refinery capacity across countries. In particular, the U.S. refining sector processes a relatively large amount of heavy crude oil as a proportion of U.S. refining capacity vis-a-vis the rest of the world. As a result, the large and unexpected increase in U.S. light oil production led to lower domestic light oil prices, higher U.S. refined product supply and exports, and backed out light crude oil imports. 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.

With these issues in mind, we investigate the impact of the shale oil boom on the upstream and downstream energy industry and the broader economy using a dynamic stochastic general equilibrium (DSGE) model. We then use our model to investigate the distortionary effects of the U.S. crude export ban.

Our model fits into the DSGE literature focused on oil, which includes works such as Backus and Crucini (2000), Leduc and Sill (2007), Bodenstein et. al. (2011), Nakov and Nuno (2013), and Plante (2014). Our work also has connections with the international real business cycle literature, see for example Backus et al. (1992), Backus et al. (1994), Crucini and Kahn (1996). To the best of our knowledge, our paper is the first to model the refining sector in a general equilibrium DSGE model, as well as the first to introduce a distinction between different types of oil.

There are several recent papers analyzing the U.S. shale oil boom and its effects on global oil prices, the global economy and the energy industry (for example, see Manescu and Nuno (2015), Mohaddes and Raissi (2016), Walls and Zheng (2016), Kang et. al. (2016) and Kilian (2016, 2017)). There is also a large body of non-academic literature discussing the impact of a U.S. crude oil free trade policy by national and international organizations. These studies are typically qualitative in nature or rely on simple models in order to evaluate the impact. More academic analysis can be found in Brown et. al (2014), Vidas et. al. (2014), Medlock et. al (2015), Langer et.al., (2016), Farrokhi (2016).

## Methods

We investigate the impact of the shale oil boom and the lifting of the U.S. crude oil export ban on the upstream and downstream energy industry and the broader economy through the lens of a DSGE model. 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.

In our model experiments, we first assume the U.S. is hit with a series of positive productivity shocks that increase light crude oil production, similar to the shale oil boom. We track the impact of the 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 then use our model to investigate the distortionary effects of the U.S. crude export ban.

## Results

Our model predicts that the shale production boom causes light oil prices to fall, 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. In addition, 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. When the ban binds, 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., which 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.

## 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. A large increase in U.S. light crude production can cause the ban to become a binding constraint, making the price of light oil in the U.S. artificially low. We find that this introduces significant distortions in the refinery sector, with the U.S. producing an inefficiently high amount of refined fuel products vis-a-vis the rest of the world. The impact of the ban on fuel prices is negligible, however, as free trade in those products prevents the ban from having any major impacts on their prices.

The decline in oil production in 2015 likely reduced the initial impact of the removal of the export ban, although it enabled energy markets to become more efficient. If reinstated, an export ban would likely be binding given the return of strong oil production growth in the U.S.