

# Working Paper Executive Summary

## Decomposing Crude Price Differentials: Domestic Shipping Constraints or the Crude Oil Export Ban?

Mark Agerton, Rice University, Center for Energy Studies, James A Baker III Institute for Public Policy, [magerton@rice.edu](mailto:magerton@rice.edu)

Gregory B. Upton, Jr., Louisiana State University, Center for Energy Studies, [gupton3@lsu.edu](mailto:gupton3@lsu.edu)

### Motivation

In 1975, United States President Gerald Ford signed the Energy Policy and Conservation Act (EPCA), which prohibited the export of domestically produced crude oil and created the Strategic Petroleum Reserve. Signed shortly after the OPEC oil embargo of 1973-74 and during a time when many feared the arrival of “peak oil,” the ban was designed to keep domestic crude in the U.S. and enhance domestic energy security. For many years, the crude export ban,—hereafter referred to as the “export ban” or more simply “the ban,”—had little bite: declining domestic crude oil production and increasing domestic demand meant that the U.S. imported ever more crude oil.

In the late 2000s after many years of declining U.S. crude oil production, the combination of horizontal drilling and hydraulic fracturing techniques enabled companies to produce oil and gas from geological formations that had been, heretofore, uneconomic. This technological innovation sparked a renaissance in U.S. crude oil production, which began rising after years of decline. By the end of 2014, U.S. production had reached levels not seen since the 1970s.

As U.S. crude oil production rose, price differentials between domestic and international crudes grew to unprecedented levels. At its peak, the most widely cited U.S. crude benchmark, West Texas Intermediate (WTI), was trading at more than a \$25 discount to the international benchmark, Brent crude. This differential was unheard-of: WTI had consistently traded at a slight premium to Brent for decades. The large differential spurred a robust debate over what was causing domestic crudes to sell at such a steep discount to their foreign counterparts and whether the unusual discount could be eliminated by removing the export ban.

### Overview

We empirically investigate the degree to which this discount was due to a constraint on external trade (the ban) or internal trade (pipeline congestion). If the constraint was internal, then the opportunity to arbitrage spatial differences in price would have led to new pipeline construction and the elimination of the discount without any new legislation. However, if the discount was due to a mis-match of refining capacity with new U.S. crude supplies, then an earlier lifting of the export ban might have raised domestic wellhead prices for oil producers, increasing their profitability, and mitigating the extent to which domestic refineries had to make significant operational changes to handle this new source of crude.

We begin our analysis by discussing the interactions between oil production, transport, and demand in refining and the export-market: the upstream, midstream, and downstream market segments. We present descriptive evidence that increased shale production led to significant disruption in the midstream sector. The evidence is consistent with the presence—and subsequent relief—of transportation constraints. We use econometric analysis to compare the difference between the price of Brent crude oil (subject to no U.S. constraints) and prices of mid-continent crudes (subject to both pipeline constraints and the ban) with the difference between Brent and coastal crudes (subject only to the ban). Using our estimates, we test for structural breaks in price differentials at discrete points coincident with when the internal and external constraints change. We find that the largest breaks happen for crudes subject to internal constraints (mid-continent crudes), not Gulf Coast crudes subject only to external constraints. Then, we regress price differentials on measures of transportation and refining constraints. We find that transportation constraints have an order of magnitude more explanatory power than refining constraints. Taken together, our results strongly suggest that the export ban was not the main cause of large domestic crude discounts. Instead, the majority of the price differential between WTI and Brent can be explained by internal shipping constraints within the U.S., not the export ban.

## **Conclusions**

In this paper, we investigate two plausible causes for the significant price discount of U.S. crudes during the U.S. “shale boom” and evaluate how much each mattered. Some studies have claimed that the price differential was due to refineries' inability to process light tight oils (LTOs) being produced at record levels from shale plays. These studies postulate that the alleviation of the export ban could have eliminated this price differential. Other studies, though, have associated price differentials with transportation constraints within the U.S. that were gradually alleviated due to pipeline reversals and upgrades. We provide the first statistical decomposition of these differentials into these two competing factors.

Based on pseudo- $R^2$  measures that we calculate, it appears that that around half to three-quarters of the domestic mid-continent crude oil to Brent price differential can be explained by internal pipeline constraints, while only a few percent of the differential can be explained by refineries' inability to absorb the glut of domestic LTOs as captured by PADD-specific average API gravity of inputs to refineries. It is plausible that part of the price differential associated with refineries' inability to absorb domestic LTOs could have been alleviated if the export ban were not to have been in place during the export ban, though it is unlikely that this would have had as large of an effect in the short run compared to relieving pipeline constraints.

## **Policy Conclusions**

There are significant policy implications of this research. First and foremost, results of this research suggest that with or without the crude export ban in place, significant price differentials would have emerged between U.S. and foreign crudes. In particular, we argue that the price differentials between mid-continent and Gulf Coast crudes were mostly associated with transportation bottlenecks within the U.S.

Second, Gulf Coast crudes may have been impacted by the export ban, but the magnitudes of these impacts were likely small and short lived. LLS and HLS did sell at a discount to Brent, but this to a much smaller degree than for mid-continent crudes. Depending on the cost to

ship Gulf Coast crudes abroad, this discount may or may not have justified exporting crudes and incurring higher, international shipping costs.