

A Regionalized or Unified Oil Market: The Price Spread Between Brent and WTI

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Motivations underlying the research

Over the last several years, I have published papers that show arbitrage opportunities largely unify the world oil market and that they can account for much of the price differences among crude oils. Exceptions include crude oils that are especially heavy or originate in nations with poor governance.

But my confidence in these results was limited by the sudden appearance of a large spread in the prices for Brent and WTI, which are two of the world's most important benchmark crude oils. As stated by the Morpheus character in the film *The Matrix*, "You don't know what it is, but it's there, like a splinter in your mind, driving you mad." My splinter, I had to understand why crude oils from nations with relatively transparent governments and similar physical characteristics (both light and sweet), suddenly seemed to be priced by regionalized markets.

This sudden separation in price also perplexed other researchers. They posited several possible explanations; the shale oil boom, imports from Canada, building inventories, the lifting of the US ban on crude oil exports, changes in transportation infrastructure, declining production of crude oils that make-up Brent, the collapse of Libyan production, and even exchange rates.

But these efforts did not satisfy my curiosity. Often, authors examined only a subset of possible explanations, which raised the specter of omitted variable bias. In others, authors ignored the nonstationary nature of the data, which raised the possibility that the statistical results were spurious. Finally, many analyses implicitly assumed that the spread was caused by a sudden change in an explanatory variable and so looked for a change-point in the price spread, rather than focusing on the factors that influenced the price of Brent and WTI.

Research performed

Here, I try to solve these shorting-coming by estimating two cointegrating vector autoregression (CVAR) models for the price of Brent and WTI and analyzing their residuals to identify periods when the model fails in a statistically significant manner. A univariate model specifies only the price of Brent and WTI. This model likely suffers from omitted variable bias and so its residual should identify periods when the long- and short-term relations between the two prices change in a statistically significant fashion. The second CVAR model contains all possible explanatory variables. If this expanded CVAR model includes the relevant variables, the residuals should not contain any structural changes and the long- and short-run relations should quantify the factors that open and close the price spread.

After an initial period (1987-2010) when the price spread between Brent and WTI remains relatively constant, their prices move separately during three periods. Starting in 2011, the price spread expands suddenly. This spread narrows starting in 2014. But in 2017, the price spread widens again. The CVAR models identify the likely causes for the two later periods. In 2014, the price spread shrinks because investments in transportation infrastructure increase the flow of crude oil from the mid-continent to Texas. Expanding the market for WTI raises its price. The price spread expands when the US lifts the ban on exporting crude oil. The price of WTI falls because the existing infrastructure forces exporters to load their cargos onto smaller, higher cost vessels and introducing new customers to the physical characteristics of WTI forces exporters to offer price discounts.

Conversely, the CVAR models do not clearly identify the causes for and the timing of the increase in the price spread between Brent and WTI that starts in 2011. Results suggest that increasing imports

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of crude oil from Canada, rising production of crude oil from hydraulic fracturing, expanding inventories, and declining production of crude oil from the North Sea raise the price of Brent relative to WTI. But their effects are small and gradual compared to the sharp and large increase in the price of Brent relative to WTI. And so a small splinter remains for further investigation.

Finally, the CVAR models are consistent with a speculative bubble in the world oil market between 2007 and 2009. During this period, the residuals for price of WTI and Brent fail in a statistically significant fashion in both the univariable and expanded CVAR model. Failures in both models suggest that market fundamentals do not account for prices, which is the definition of a speculative bubble.

Main conclusions

Taken together, the results presented here add nuance to the debate about whether the world oil market is unified or regionalized. Rather than an either or, I argue that a feedback loop moves the world oil market between phases when it is unified or regionalized. Innovations, such as hydraulic fracturing change the local balance between supply and demand. If these changes are sufficiently large, they can regionalize local prices, which can enlarge price spreads. These larger spreads create opportunities for arbitrage. Sometimes these opportunities are limited by bottlenecks, such as transportation infrastructure. Over time, these bottlenecks spur new investments. And once the opportunities for arbitrage are realized, price differences are reduced, and world oil market moves towards unification.

But the return towards a unified market does not imply a return to the status quo ante. Technical changes that tend to regionalize the market and the new investments that are used to arbitrage the resultant price differences change the point of reference used to arbitrage the price spread. These changes likely create a new equilibrium as represented by a new set of price spreads.