Closer to One GreatPool? Evidence from Structural Breaks in Oil Price Differentials

Michael Plante[a], Grant Strickler[b]

Crude oil can vary significantly in some key physical properties, making them imperfect substitutes for each other and leading to the existence of price differentials among crude oils. These price differentials are important for many oil market participants. For refiners, they can affect profitability and influence investment decisions about specific equipment that could improve the profitability of processing lower grades of crude. Oil producers and fiscal authorities are concerned about these differentials because of the impacts they can have on revenues earned from producing or taxing certain types of oil. Finally, for academics, analysts and others interested in understanding the upstream and downstream oil markets, these differentials provide important signals about how supply and demand conditions change over time for one type of crude relative to others.

This paper investigates how the size of these quality-driven price differentials has changed over time. More specifically, we consider if these differentials have experienced permanent shifts, or structural breaks, in their average values. This research is motivated by the simple observation that in the data many differentials between high and low-quality crude oils appear to have become significantly smaller and less volatile since 2008.

We use a statistical test to formally document that price differentials between different grades of crude oil have become smaller over time. In particular, we show that many experienced a major structural break around the time of the Great Recession. Specifically, 25 out of 27 possible differentials in our daily price data, and 38 out of 42 cases when using monthly data. We then use these tests to investigate whether oil price differentials between crudes of the same quality experienced a similar set of breaks, which would suggest a broader change in the oil market not necessarily connected to crude quality. Overall, we do not find any evidence for such breaks.

As part of the paper, we document several fundamental, long-lasting changes in the oil market that we believe are consistent with the pattern of small differentials. One is the fact that the global refining sector has become increasingly complex over time, as upgrading capacity additions have increased the ability of the sector to transform lower-grade crude oil into high-valued petroleum products. The other is the shale boom, which has unexpectedly increased the relative supply of light crude oil, reducing, on the margin, the need for such complex refineries. This narrowing of the differentials has occurred despite the fact that increasingly stringent environmental regulations and a persistent decline in the use of residual fuel oil should be pushing them apart.

a Corresponding author. Federal Reserve Bank of Dallas, 2200 N Pearl St., Dallas, TX 75201. E-mail: Michael.plante@dal.frb.org

b Federal Reserve Bank of Dallas, 2200 N Pearl St., Dallas, TX 75201.

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