**WTI-Brent spread and the value of refining firms**

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## Overview

The varying difference in price of West Texas Intermediate (WTI) and European Brent crude (Brent) oil has drawn the attention of investors, regulators and policy makers over the past few years. As both commodities deliver in essence the some consumer benefit, the economic theory of substitution suggests that the prices for these should converge to some equilibrium (ignoring transportation costs). The past six years has, however, witnessed large fluctuations in the spread of these two commodity prices, ranging from –$27.00 to +$5.00.

One of the key factors driving this spread is the limited storage in Cushing, Oklahoma ([Büyükşahin *et al.* 2013](#_ENREF_1)) – a key supply basin for US crude. Uniquely situated to exploit this opportunity are the U.S. based oil refiners. While their final product (heating oil, unleaded gasoline & diesel) is fungible with those of foreign refiners, they have two readily available inputs to draw on – locally sourced WTI or imported Brent. If equity markets are efficient then when WTI is trading at a material discount to Brent, US refiners should experience periods of elevated profitability, which in turn should be reflected in higher refiner equity returns. Further, the International Energy Agency (IEA) reported that 16 major European refineries will be shut down in 2014 as these refiners are acquiring crude oil based on the price of the generally more expensive Brent crude oil.

This paper examines the relation between the WTI-Brent spread and the value of US oil refining firms. We use the S&P 500 Oil Refining and Marketing Index (SP5SOGR) as a proxy for value of these firms and analyse the effects of the WTI-Brent spread while controlling for other explanatory factors including, Mid-West ending stocks levels, the crack spread, and macro-factors including interest rate, exchange rate (US/Euro) and general equity market returns.

## Methods

The weekly time series data for each Friday is collected via numerous sources from the first week of January 2006 to the third week of December 2013. The WTI and Brent crude oil price data (closest to maturity futures contract) are obtained from Bloomberg. Midwest ending stock level data (PADD2 district) are obtained from the U.S. Energy Information Administration website (EIA). It should be noted that Cushing stock level data is included in Midwest stock data. Interest rate, exchange rate and equity market returns are obtained from Thompson Reuters Datastream. The S&P 500 return is used as a proxy for general equity market returns. The four weeks U.S. treasury bill provies a proxy for interest rate. The USD/Euro exchange rate is included to capture exchange rate effects. Consistent with the literature we include the crack spread as an output and profitability measure for refinery firms ([Dunne & Mu 2010](#_ENREF_2)).

In this study, we rely on regression analysis to examine the relation between equity returns of oil refinery firms in U.S. and WTI-Brent spread. Following the standard practice in the literature ([Fattouh 2010](#_ENREF_3)), the WTI-Brent price differential (spread) is defined as:

WTIBrent Spread= LN(WTI)-LN(Brent). (1)

 The regression model used for analysis is as follows:

 $REF\_{t}=α+βRMKT\_{t}+ηWTIBrentSpread\_{t}+θINTRATE\_{t}+ϕUS/Euro\_{t}+γCrackSpread\_{t}+ε\_{it}$ (2)

Where the dependent variable is the return on the S&P 500 refining and marketing index. $RMKT\_{t} $refers to S&P 500 market return.

To further explore the relations that exist among our variables, we used a six variable vector auto-regression(VAR). In VAR framework, each variable is expressed as function of the lagged values of variables included in the model. Further, [Toda and Yamamoto (1995](#_ENREF_5)) propose a lag augmented VAR model which is robust to integrated and co-integration features of the data and is a superior measure of testing as it avoids pre-test problems. Nevertheless, we also report results from three different unit root tests to check whether the return data are stationary. In addition, a Lagrange multiplier test is been used to test for serial correlation in the VAR residuals. Our lag augmented VAR model ([Toda & Yamamoto 1995](#_ENREF_5)) to used to examine the empirical relations that exist between our variables. This procedure has been used previously to explore the relation between the stock prices of alternative energy companies and oil prices ([Henriques & Sadorsky 2008](#_ENREF_4)).

## Results

Over the eight year period (2006-13) our regression analysis finds there is a significant and material relationship between the WTI-Brent spread and the value of U.S. refiners. For the full period, we find that a 1% decline in the spread lead to a 0.07% increase in the refining and marketing equity index per week which leads to a 4% return per annum. This provides empirical evidence to support the argument, that US refiners are indeed more highly valued when the spread is lower. This negative relationship between the value of the US refiners and the spread appears to have started in 2008, and has remained in place during both the GFC period and during the Cushing supply glut that took place post 2010. Specifically, we do not find evidence of this prior to 2008.

We also find there is a significant and material relationship between the crack spread and the value of U.S. refiners. The coefficient of 0.05% suggests that a 1% increase in the crack spread results in a 0.05% increase in the refiner’s share price and this is statistically significant at 5% level. Given that the crack spread is a measure of refining margin, and in turn profitability, the result is in-line with expectations. Moreover, it provides a direct point of comparison with the WTI-Brent spread result and shows the WTI-Brent spread has a larger impact on US refiners. When considering the other control variables, only equity market returns are found to be significant. The coefficients for Mid-West stock level, U.S interest rates and exchange rate (US/Euro) are not statistically significant over the period as a whole, or before and after 2008.

In our time-series analysis we construct a six variable vector auto-regression model (VAR) to explore the relations that exist between variables. Our results show that WTI-Brent spread, interest rate, exchange rate (USD-EUR) and crack spread each individually Granger cause the stock prices of refining firms. Consistent with our economic rationale, it is also found that past movements of Midwest Crude oil stock level explains WTI-Brent Spread movements.

## Conclusions

The persistent supply imbalance and transportation frictions from mid-west crude producers have to a degree fractured the notion of a global oil price. These constraints on storage and transportation capacity have in turn created price differentials that are economically significant. Our focus on a key actor in the energy value chain, the U.S. based refiners, shows they are indeed positioned to profit from this imbalance and this is reflected in refiner equity returns. As such, market participants seeking to profit from future changes in the WTI-Brent spread could trade on these views via U.S. refiners, either through direct equity positions or index tracking ETFs.

An important contribution of this study is the evidence supportive of market efficiency in a refining industry equity market. Previous studies find evidence of real options in refining industry ([Dunne & Mu 2010](#_ENREF_2)). This current study utilizes the price differentials between WTI and Brent prices to present evidence of a positive market reaction to increased profitability of refinery firms. A possible extension of this study is to use techniques sucha as impulse response function to identify the response of refining and marketing index equity returns to a shock in WTI Brent spread or crack spread.

## References

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