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A Special Note Regarding the Recent Decline in the Price of Crude-Oil

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I. Overview

Since closing at a price of \$115.06 on June 19th, Brent crude-oil prices declined \$45.99 or 36.9%. Over the same period, WTI prices declined \$41.42 or 32.4%. This special issue of “Message from the Markets” is designed to analyze the results and better understand their dimensions.

II. Brent and WTI

As noted above, the two primary oil futures contracts behaved similarly. For many purposes, Brent is currently the relevant benchmark, but of course some domestic producers are tied to WTI.

The charts below display the spread between Brent and WTI, which has narrowed from \$14.95 on 1/13/14 to a current value of \$3.11.

FIG1. WTI vs Brent Historical Prices



Source: Bloomberg, Guzman Energy

FIG2. WTI vs Brent Price Spread



Source: Bloomberg, Guzman Energy

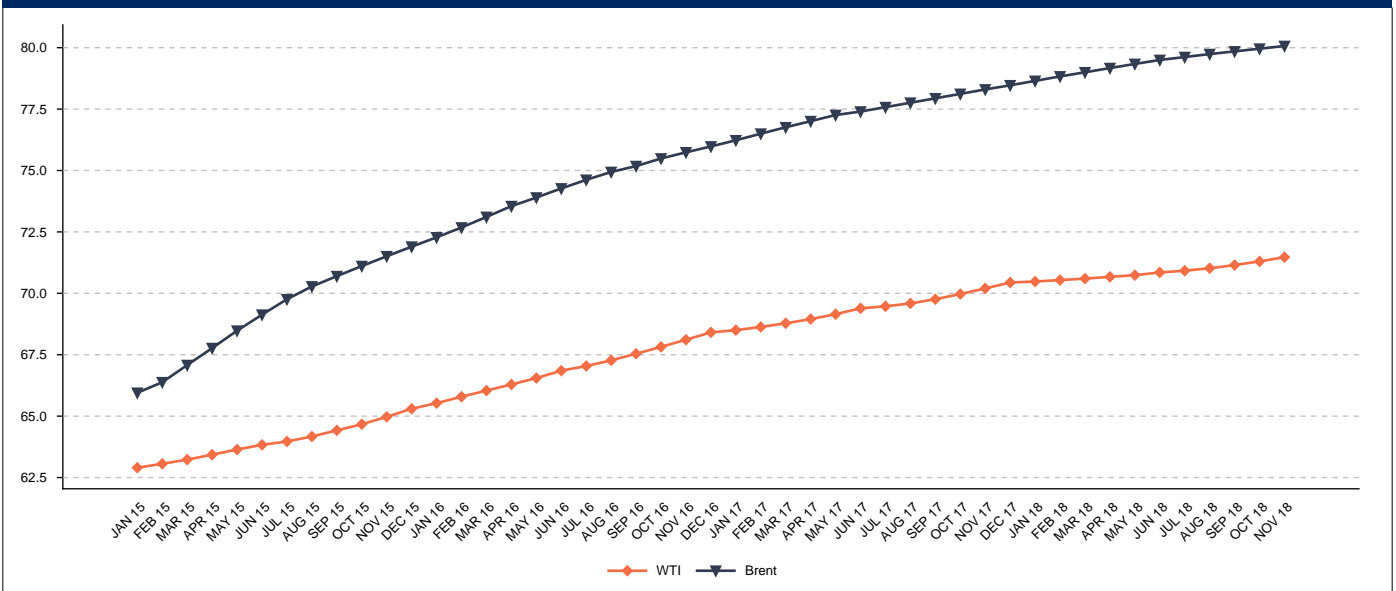
BRENT AND WTI

By way of explanation, the U.S. Energy Information Administration justifies this compression of the difference between the two contracts:

“More recently, expansions in U.S. crude oil infrastructure have eased the downward pressure on the price of WTI. Since mid-2012, significant pipeline takeaway capacity has been added at Cushing, enabling crude oil to flow to and from the trading hub more easily. Other pipeline and rail projects have also been completed, making it possible to move barrels from production areas, such as Texas and North Dakota, to refinery centers without passing through the hub. Even U.S. East Coast refineries, which historically have relied on Brent crude oil and Brent-like crudes, can now access U.S. light sweet crude oil. U.S. crude that moves by rail is replacing Brent crude oil and Brent-like crude oil imports into the U.S. East Coast, putting downward pressure on the price of Brent crude oil and narrowing the differential versus WTI crude oil.”

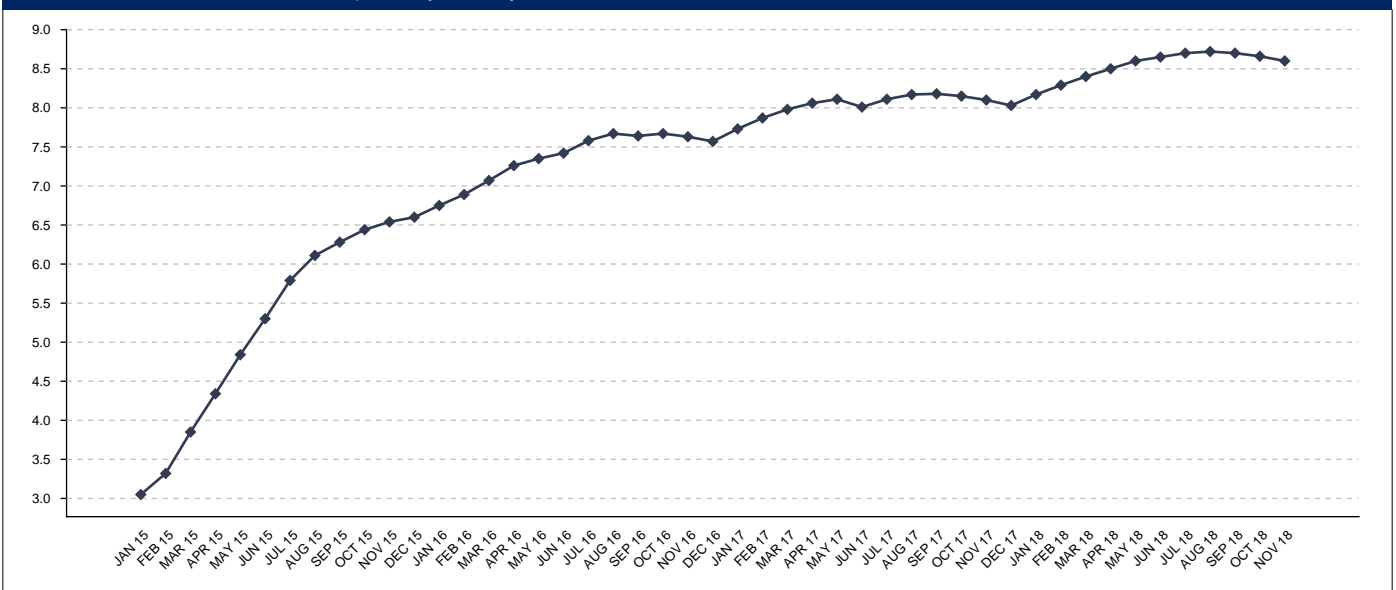
Longer-term, however, the market’s clear expectation is that the spread will gradually widen back up to the \$10 range. This can be seen below from the cross-sectional snapshot simultaneously displaying the two futures curves. The lower chart is the difference at increasingly distant maturities between Brent and WTI.

FIG3. WTI vs Brent Futures Price by Maturity



Source: Bloomberg, Guzman Energy

FIG4. WTI vs Brent Futures Price Spread by Maturity



Source: Bloomberg, Guzman Energy

OIL PRICES

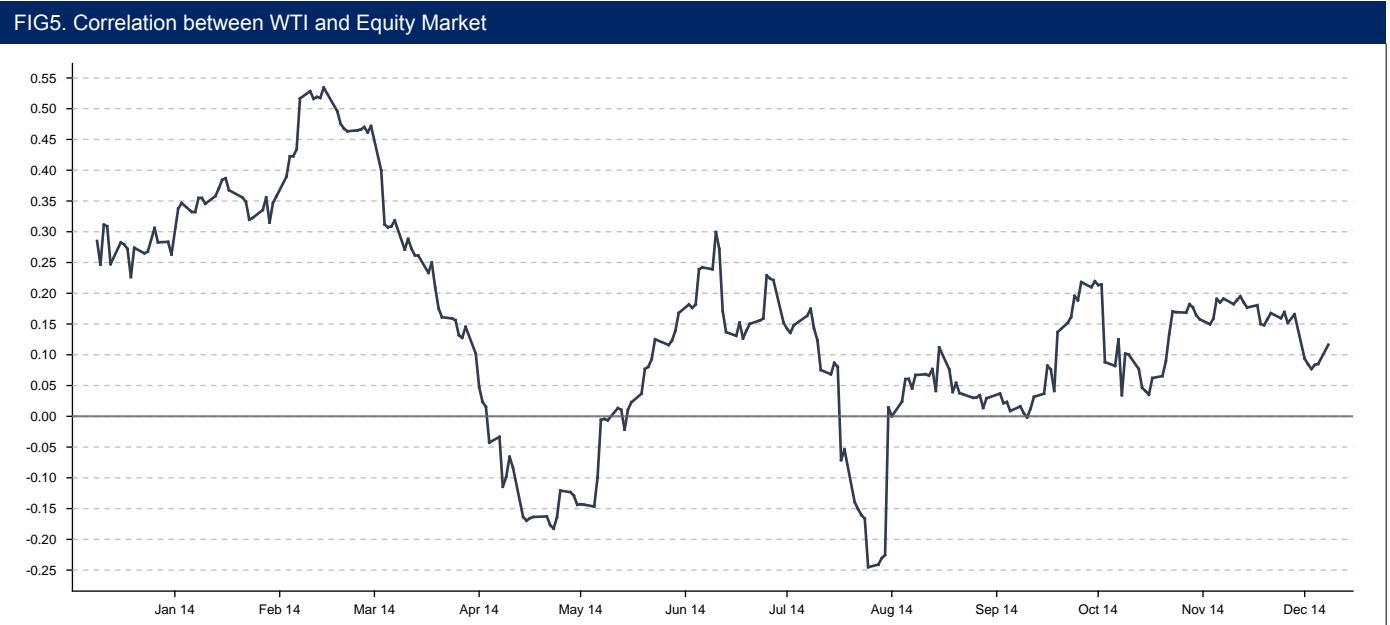
III. Whither Oil Prices?

We have some indications from the markets as to the next move in oil prices. The first comes from the slope of the futures curve as currently perceived. As can be seen from Figure 3 above, the WTI and Brent curves are currently in contango, with longer-dated futures trading above the spot price. *The point about this shape of the curve is that it is dramatically different from the backwardation the curve evidenced as late as May 2014.*

To give this shape of the curve context, consider the last time markets were in this form. Perhaps the first comparison may be drawn with the 12/19/08 (for WTI) or 12/24/08 (for Brent) curves: These were the two dates at which oil prices bottomed out during the Great Recession. There are two conclusions from such a comparison:

1. Then and now, the oil curves were in contango, a clear demonstration prices are unusually low. Thus, while we can and are heading lower in oil prices, the market is signaling that this is unusual. (Roughly 65% of the time the markets are backwardated, whereby the slope of the curve is negative.)
2. Unsurprisingly, the slope was far more pronounced in Dec. 2008 than it is at this time.

The second indicator comes from the relationship between oil prices and equity markets. Although stock-market values have generally increased during this recent time of declining oil prices, the correlation(SPX, Oil Prices) is marginally positive (0.0845) as seen in Figure 5 below.



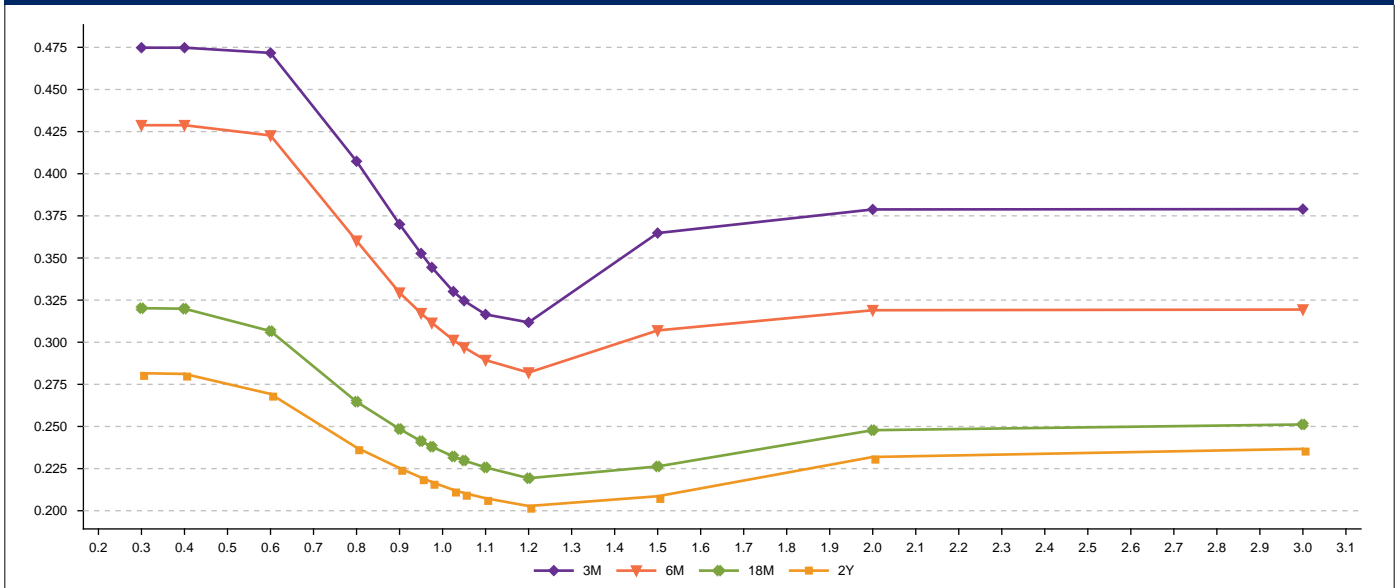
Source: Bloomberg, Guzman Energy

Typically, that correlation is negative during times of geopolitical crises, when prices are elevated due to concern regarding the arrival of supplies to consuming markets. When correlations are positive, as they are at this time, the intuition of the Capital Asset Pricing (CAPM) is interpreted as implying expected prices in the future will be above their current futures prices. These futures prices, in turn, as Figure 5 indicate, are in turn higher than current spot prices.

VOLATILITY SMILES

In contrast to the previous, there is one prevailing indicator that the markets are concerned with a possible further crash in oil prices. To see this last, consider the volatility skew in WTI futures options:

FIG6. Volatility Smiles of Crude Oil



Source: Bloomberg, Guzman Energy

The volatility skew is defined as the futures options' implied volatility using the Black (1976) option-pricing model. In the Figure 6 above, the implied volatilities for options with moneyness (strike price divided by futures price) $K/F < 1$ are greater than the volatilities for those options with $K/F > 1$. This reflects option traders' concerns that there may be rapid large moves to the downside which they would be unable to Delta-hedge and thus seek protection by pricing them at a higher implied volatility.

OVX VALUES / REFINING SPREAD

IV. OVX Values

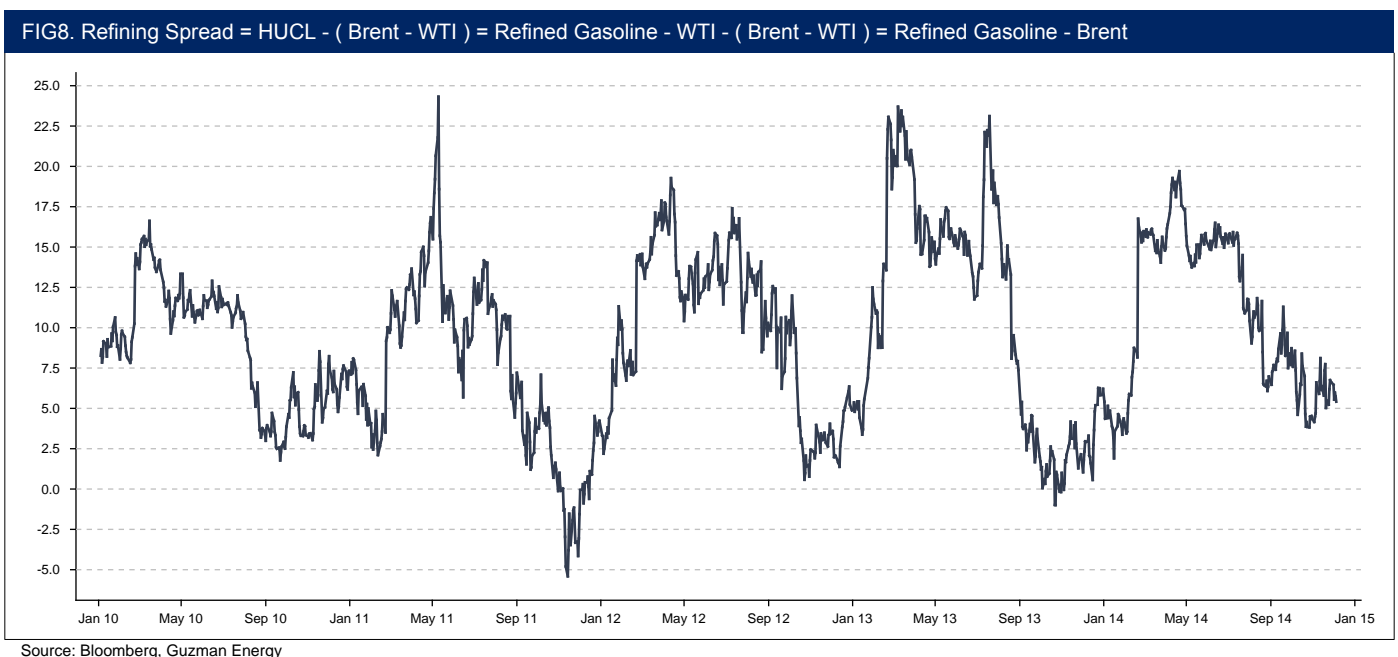
Quite analogously to the equity market's VIX index, the OVX represents the 30-day implied vol on WTI futures options:



As usually happens during times of dramatic changes (up or down) in oil prices, the OVX 30-day oil implied volatility has more than doubled from its recent low of 16.5% on 8/27/14 to a current value of 35.4%. Thus, there is far more uncertainty as to where prices are going.

V. Refining Spread

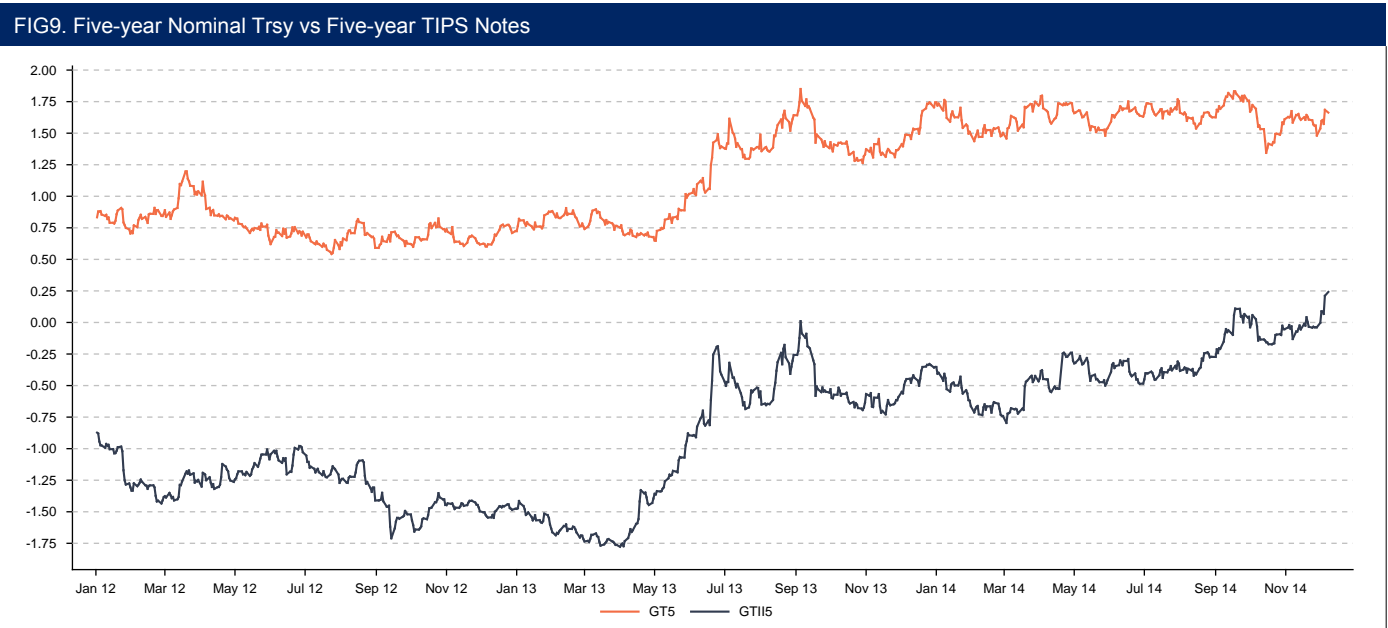
The refining spread, measured as the per bbl difference between NY gasoline and WTI, has narrowed from as high as \$26.52 in April to a current \$8.817 (subtract \$3.11 for an even-smaller refining spread when measured relative to Brent). Thus, refiners are being squeezed by the drop in prices.



IMPLICATIONS FOR INFLATION

VI. Implications for Inflation

With respect to implications for CPI inflation, consider the implied break-even inflation rate, which we define as the difference between the five-year nominal Treasury and five-year TIPS notes.¹



As can be seen from Figure 10 above, the break-even inflation rate has narrowed from an annualized inflation rate (over the next 5 years) of 214 b.p. in July to a current value of 147 b.p. The market is expecting lower oil prices to make their way into consumer prices and have the beneficial effect of reducing CPI. Looking at the 10-yr. maturity, we observe a similar decline at the 10-yr. level from 230 b.p. to 176 b.p.

¹ The term "break-even inflation" refers to that rate of inflation which would equate the rates of return on the nominal and real (TIPS) bonds over the maturity for which it is defined. Note it is erroneous to refer to this as the market's "expected rate of inflation," as there may well be a risk-premium associated with inflation uncertainty.

IMPLICATIONS FOR INFLATION

We have also considered the extent by which we can relate the decline in CPI inflation to oil prices. To see this impact, define:

FIVEYR_t = Break-even inflation for the next five years (nominal 5-yr. Treasury yield – real 5 yr. TIPS yield) at date t

CL60_t = WTI oil-futures contract with a maturity of five yrs. at date t

Delta FIVEYR_t = FIVEYR_t – FIVEYR_{t-1} = Change in FIVEYR_t between t-1 and t (i.e., 1 wk or 1 day)

% CL60_t = (CL60_t – CL60_{t-1}) / CL60_{t-1} = Percentage change in FIVEYR_t between t-1 and t (1 wk or 1 day)

Now consider two regressions over the past seven months, early May 2014 – early Dec. 2014. Using daily and weekly data, regress the change in break-even inflation Delta FIVEYR_t on the percentage change in 5-yr. oil-futures % CL60_t:

$$\text{Delta FIVEYR}_t = a + b * \% \text{ CL60}_t$$

In this regression, we are interested primarily in the slope b and the explanatory power (R-squared):

| Parameter Value | Daily Data | Weekly Data |
|------------------------|------------|-------------|
| Number of Observations | 151 | 31 |
| Intercept a | -0.00276 | -0.00128 |
| Slope b | 1.193 | 1.868 |
| R-Squared | 13.2% | 29.3% |
| Correlation | 0.363 | 0.541 |

Note: Correlation is simply the square-root of R-squared.

From the above table, we conclude:

- 1. The explanatory power of the regression – the degree to which we can attribute the break-even rate inflation changes to oil-price deflation – is moderate: 13.2% using daily data, 29.3% using weekly data. We conclude lower oil prices were not the only factor affecting break-even inflation during this period. Others could include U.S. and global economy (including Chinese economy), Fed monetary action, etc.*
- 2. While we certainly expect the regressions' slopes to be positive (and they are), perhaps surprisingly the point estimates of b (1.19 daily and 1.87 weekly) are greater than 1, though in neither case are they statistically different from 1.0.*

NATURAL GAS

VII. Natural Gas Prices

A number of investors have inquired as to whether there are spillover effects from the crude to the natural gas markets. We explore this in two ways.

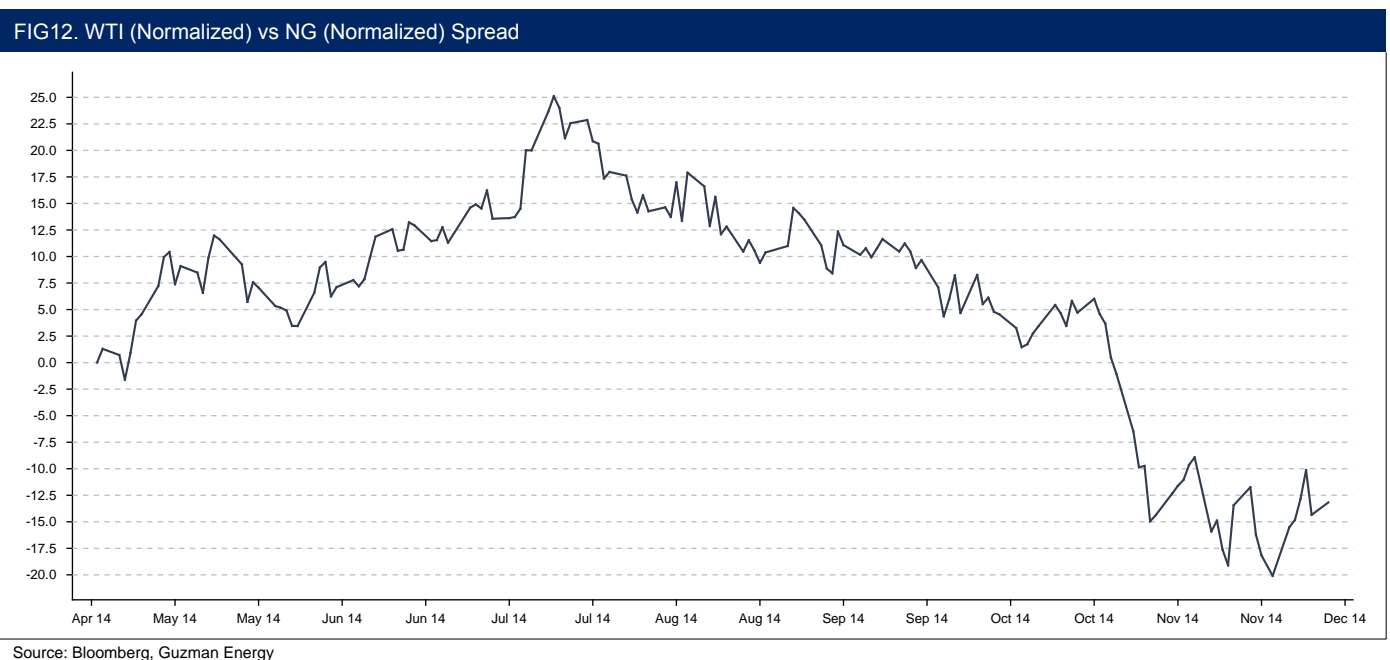
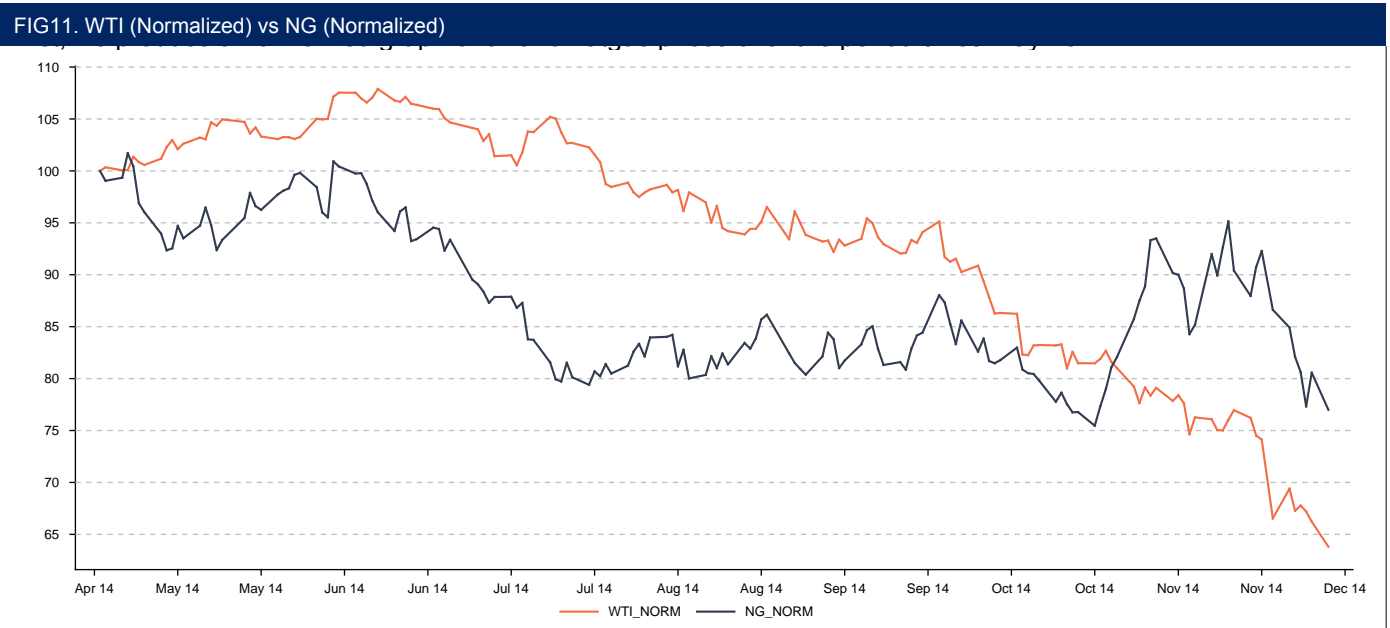


Figure 12 above shows oil prices surged 25% relative to natgas prices earlier this year, but because of their recent decline are now 14% below their relative 5/1/14 value.

NATURAL GAS

The second way we explore this issue is to consider a moving 45-day correlation of oil and natgas prices.

FIG13. Correlation between WTI and NG



Source: Bloomberg, Guzman Energy

The alternating sign of the correlation between spot oil and natgas prices since 5/1/14 make it difficult to see an obvious pattern. Rather, it is more likely natgas prices are driven primarily by short-term weather effects, esp. as we turn into the 2014 – 2015 winter season.

VIII. Conclusion

The recent decline in Brent and WTI prices has been precipitous and sharp. While it is hazardous to describe when and at what price the trough of this decline might occur, the market's contango slope and positive correlation with equity markets indicate the market see this decline as unusual and appear to display an expectation of reversion to higher prices than are observed at this time.

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