



WTI: Quarterly Update: A Fundamentals Analysis

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Companion to Spring Webinar on WTI

- **Review background highlights during the course of this presentation**
- **Review and update information on pipeline flows between the US Gulf and Midcontinent as well as storage capacity at Cushing, OK**
- **Provide new analysis on price responsiveness to fundamentals: historical, including recent history**
 - Especially focused on relationship between the forward curve and inventory levels
 - Looked at major benchmarks WTI and Brent

Physical Connectivity

US Midcontinent and US Gulf Markets

- **Seaway Flows: YTD, the average has been 170,000 barrels/day; July was over 200,000 barrels per day**
- **Other flows from the US Gulf: unofficially 700-750,000 barrels per day this summer**
- **Canadian Flows to Midcontinent well over 1 million barrels per day**
- **Even stronger connecting flows than previously**
- **Storage Capacity at Cushing Approaching 50 million barrels – significant excess capacity**

Analysis of Impacts of Fundamentals

- **Examine impact of inventory levels on forward price curve**
- **Specifically the impact on the difference between:**
 - Dated Brent and 1-Month Forward Brent Futures
 - 1-Month Forward WTI Futures and 2-Months Forward WTI Futures
 - 1-Month Forward Brent Futures and 2-Months Forward Brent Futures
- **(Also examined impacts between 1-month forward and 3-months forward, but no additional insights.)**

Analysis of Impacts of Fundamentals...cont.

- **Inventories**
 - OECD “Days Supply”
 - US Crude Oil Inventories (barrels)
- **OECD data are monthly**
 - End-of-Month
 - Preliminary available 6 weeks after End-of-Month
 - Revisions published 10 weeks and 14 weeks after End-of-Month
- **US data are weekly – as of previous Friday**

Goals of Analysis

- **First and Foremost: an important relationship to measure and understand**
- **Second: Further address sentiments that may linger regarding role of WTI**
 - “Isolationists” Sentiments– Factually refuted on infrastructure alone
 - “Speculationists” Sentiments– Fraught with internal inconsistencies that render it self-refuting
- **Third: Amplification and evaluation of previously proposed explanation that WTI is driven by fundamentals while Dated Brent is driven more by commercial activity and less by fundamentals – “Fundamentalists”**

Test Parameters

- **Monthly Observations**
End-of-Month – January 2005 through May 2009
- **Performed two tests for each dependent variable**
 - (Dated Brent) – (1-Month Forward Brent Futures)
 - (1-Month Forward Brent Futures) – (2-months Forward Brent Futures)
 - (1-Month Forward WTI Futures) – (2-months Forward WTI Futures)
 - Essentially measuring changes in “curvature” of near term forward curve.
- **Independent Variable**
 - OECD inventories above “low” range of 5-year average of maximums and minimums expressed in terms of days supply
 - US crude oil inventories above “low” range of “normal” inventory levels.
 - “Normal” represents an average range calculated by the US DOE Energy Information Administration.
 - The analysis between “low” and “high” was essentially identical when applied to US inventory data.
 - Essentially, measuring “excess” inventory levels.

Comment on Causality

- **“Tests” are structured such that causality is implied to run from change in “excess” inventories to “curvature” in forward curve.**
- **Could the causality run in the reverse direction?**
 - Since OECD Data are end-of-month, not publicly announced until 6-14 weeks later, and the prices are end-of-month, this is feasible.
- **Note that also performed weekly analysis for US inventory data where price impacts are measured firmly after the public release of data. For monthly US, most (if not all) are after public release.**
 - Results were significant for weekly but weaker than for monthly.
- **Based on timing of data release, this analysis favors interpretation that causality runs from “excess” inventories to curvature.**

Results for OECD “Excess” Days Supply

- **Closeness of “fit” (R^2): Evidence of impact**
 - Weakest for Dated Brent component – $R^2 = .101$
 - Modest but stronger for WTI and Brent futures;
 - WTI $R^2 = .168$; Brent $R^2 = .215$
- **“t” statistics significant for each coefficient:**
 - (Dated Brent) – (1st-Month Brent Futures): About 98% Confidence Level
 - WTI Futures: Greater than 99% Confidence Level
 - Brent Futures: Greater than 99% Confidence Level
- **Qualification: Constants statistically not-significant for each**

Results for US Crude Oil Inventories

- **Closeness of “fit” (R^2): Evidence of impact strong for WTI, modest for Brent futures, very weak for Dated Brent**
 - Dated Brent component $R^2 = .042$; Brent futures $R^2 = .163$
 - WTI $R^2 = .335$
- **“t” statistics for coefficients significant for futures but not Dated Brent:**
 - (Dated Brent) – (1st-Month Brent Futures): About 86% Confidence Level
 - WTI Futures: Well-Above 99% Confidence Level
 - Brent Futures: Greater than 99% Confidence Level
- **Qualification: Constants statistically not-significant for each**

Interpretation of Results

- **Unambiguous indications that WTI is responsive to fundamentals– both OECD and US; more responsive to US as it should be.**
- **Brent Futures are responsive to fundamentals; more responsive to OECD as it should be.**
- **Dated Brent weakly responsive to OECD; indicative of influence of non-fundamentals factors.**
- **Further Comment on WTI and Brent Futures:**
 - Recall that “constants” in all regressions were statistically insignificant.
 - Further tested

Interpretation of Results continued

- **Further Comment on WTI and Brent Futures:**
 - Recall that “constants” in all regressions were statistically insignificant.
 - Further tested impacts of “excess” OECD on WTI and Brent Futures by “forcing” the “constants” to be zero– this enables a level comparison of strength of responsiveness as measured by respective coefficients.
 - Coefficient for WTI = $-.19785$
 - Coefficient for Brent = $-.15503$
- **The fit of the regression line to the observations is less snug for WTI, but the responsiveness is stronger. Results were similar for regressions applied to US “excess” inventories.**

Other Related Results

- Tested using weekly data as well as using outright US inventory levels
- In general, weekly data supported monthly findings—statistically significant but the R^2 s were lower.
- Similarly, over the entire time frame, monthly outright US inventories significantly impacted curvature of WTI futures— R^2 equal to .268; lower than when based on “excess” inventories.
- Also, examined impact from early December 2008 through Mid-May 2009. Weekly US inventories impact on WTI futures curvature. Not enough monthly observations. $R^2 = .273$; constant and coefficient each significant with confidence level greater than 99%.

Conclusion

WTI is Responsive to Fundamentals

- Midcontinent and US Gulf markets are integrated
- WTI is responsive to international fundamentals
- WTI is responsive to US fundamentals
- US is an integral part of international market