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HIGH CRUDE OIL PRICES – A STUDY ON MIDSTREAM AND DOWNSTREAM DEMAND INFLUENCE ON PRICES

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Overview

The full chain of oil products from crude oil to refined products is traded in at least three segmented but linked markets. The first market is one between crude oil producers and the crude oil refiners. The second one is the non-physical product crude oil market such as hedging and speculation market. The third one is the refined product market in which refiners interact with the end-users. The demand in the first and second markets constitutes midstream demand while the demand in the third market is called the downstream demand.

Within a demand-supply framework, an increase in demand, ceteris paribus will cause prices to rise. Yet, typical attribution of recent crude oil price spikes (since September 2003) to the increase in *consumer demand* for refined products is valid only if crude oil demand is derived from demand for refined products. Indeed, the assumption is contestable as various researches have shown price causation from crude oil to refined products instead, thus suggesting a non-derived demand market structure (Asche, Gjolberg and Volker, 2003; Adrangi, Chatrath, Raffiee and Ripple; Gjolberg and Johnsen, 1999). Yet, other studies have shown price causation from refined products to crude oil instead (Lanza et al., 2005; Girma and Paulson, 1999). Therefore it is insightful to investigate the above, using a multivariate framework, which captures all elements of the sub-markets. Furthermore, by estimating models for three geographical regions – America, Europe and Singapore; nuances in oil market structure across geographies are examined.

Methods

A market framework that has elements of crude oil prices, speculative demand, refiners' demand and gasoline prices is estimated. A lack of theoretical consensus regarding exogeneity in the oil market necessitates a Vector Autoregressive (VAR) approach to model the proposed framework. In addition, as the representative time-series for economic variables across all three geographical models are $I(1)$, cointegration is tested and Vector Error Correction Models (VECM) are estimated. The four investigated economic variables are: 1) Crude oil prices 2) Refiners demand 3) Speculative demand 4) Gasoline prices (to proxy downstream demand); the above variables are differentiated across geographies – America, Europe and Singapore. The time-series used for the respective regional models as follows:[1]

America – WTI Prices, USA Crude-run, Non-commercial COT, USA average gasoline prices

Europe – Brent Prices, European Crude-run, Non-commercial COT, Europe gasoline prices

Singapore – Weighted Asian Prices, Singapore Crude-run, Non-commercial COT, Singapore gasoline prices

To test for price causation, weak exogeneity tests are conducted. In addition, nuances in market behavior are examine via innovation accounting – impulse response and variance decomposition.

[1] Please see full paper for detailed explanation and adjustments (where applicable) for the various variables/time-series.

Results

For all three regional models, one cointegration relation is found. Table 1 summarizes the findings for the weak exogeniety test and innovation accounting across all three regional models.

Table 1: Cross-comparison of Market Structure

Features / Tests	America	Europe	Singapore
Weak Exogeneity	*WTI Price, Refiners' Crude-run*	*Brent Price*	*Asia Basket Crude Price, Speculative Activity*
Impulse Response *, **	Variables with similar response path within America Model: *WTI, Speculative Activity*	Variables with similar response path within Europe Model: *Brent, Speculative Activity*	Variables with similar response path within Singapore Model: *NA*
	Similar response path across all 3 models: *Speculative Activity*	Similar response path across all 3 models: *Speculative Activity*	Similar response path across all 3 models: *Speculative Activity*
	Time take for variables to return to a steady path: *Below 10 weeks*	Time take for variables to return to a steady path: *10 – 25 weeks*	Time take for variables to return to a steady path: *20 – 30 weeks*
	Price Increase of Gasoline: *High*	Price Increase of Gasoline: *High*	Price Increase of Gasoline: *Low*
Variance Decomposition **	Contribution to Crude Oil Price Volatility: *Speculative Demand – 10%* *Other Variables – Negligible*	Contribution to Crude Oil Price Volatility: *Gasoline price – 4%* *Other Variables – 1% to 2%*	Contribution to Crude Oil Price Volatility: *Gasoline price – 40%* *Speculative Demand – 18%* *Refiners' Throughput – 2%*

* Based on one standard deviation positive shock to crude oil prices

** Cholesky order of crude oil prices, speculative demand, gasoline prices and refiners' crude-run

Conclusions

This paper models oil market structure using a multivariate framework that takes into account midstream market forces, namely speculative demand and refiner's demand. As there is cointegration amongst the variables for each regional model, respective VECM is estimated. Tests on market structure are conducted to determine the direction of price causation – if it originated upstream from crude oil prices or downstream from gasoline prices. This is examined across three regional models – America, Europe and Asia. There are certainly nuances in market structure amognst the three models, with behaviour in America and Europe more similar than in Singapore. Differences aside, weak exogeneity across all three models is valid for crude oil prices, lending further support to the argument that in the oil market, price causation originates upstream from crude oil.

Selected References

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