

Volatility Spillovers Across Petroleum Markets

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Research on the interdependencies observed on financial and commodities markets has led to analyzing not only returns and volatility, but their spillovers as well. The global financial and economic crisis, sharp fluctuations in commodity prices, the rapid financialization of petroleum commodities, and tight oil production from shale formations have prompted a fresh surge of interest in how the dynamic links among commodities work. In this paper we focus on petroleum commodities and analyze volatility spillovers across petroleum markets. In doing so we differentiate between spillovers due to negative and positive returns (negative and positive spillovers), as asymmetry has been proven to play an important role in many economic and financial issues related to our analysis.

Our motivation to study volatility spillovers across petroleum markets is grounded in several issues that are relevant for investors, regulators, and facility operators. Since volatility serves as a proxy measure of risk, substantial changes in volatility and related spillovers across markets are able to negatively impact risk-averse investors. Hence, knowledge of volatility spillover dynamics has important implications for investors and financial institutions in terms of portfolio construction and risk management as these spillovers and their direction may greatly affect portfolio diversification and insurance against risk. Further, volatility spillovers are closely associated with market co-movements and this phenomenon becomes quite pronounced during crisis events when financial market volatility usually increases sharply and spills across markets. Analyzing and measuring volatility spillovers also enables “early warning systems” for dormant crises and mapping the development of existing crises. A knowledge of volatility spillovers then becomes a segment of information useful for regulators, operators, and policy makers that may lead to the introduction of regulatory and institutional rules to reduce the cross-market impact of excessive price movements.

Petroleum-based commodities form an asset class where spillovers historically play a prominent role given the importance of these commodities for the economy and economic development and the fact that shocks’ transmissions into oil prices significantly affect the U.S. and global economy. However, the research on volatility spillovers among petroleum commodities is rather limited and the asymmetric aspect of spillovers is not adequately explored yet. In our paper we improve the current methodology and are able to quantify negative and positive asymmetries in spillovers, including their directions and magnitudes over time.

We show that volatility spillovers began to rise from the early 2000s and substantially increased after 2008. At the same time volatility spillovers became less volatile. The increase in volatility spillovers correlates with the progressive financialization of petroleum commodities after 2002. After 2008 the degree of (negative and positive) asymmetries markedly declined and negative and positive shocks exhibit quantitatively similar effects on volatility spillovers. Finally, an analysis of directional spillovers reveals that no commodity dominates other commodities in terms of spillover transmission in general, and asymmetries in directional spillovers decline after the financial crisis. Thus, the results of directional spillovers are in line with those of total spillovers and resonate with economic relationships among petroleum commodities.

Our results also form grounds for some less-than-orthodox implications. Our findings defy a common belief that a financial crisis should prompt spillovers to be more volatile. We provide evidence of just the opposite: spillovers from price developments in 2008 and later are less volatile than before the 2007–2008 financial crisis. Further, we show that the occurrence of negative volatility spillovers correlates with low levels of crude oil inventories in the U.S. and often with world events that hamper crude oil supply. Negative spillovers frequently indicate the extent of real or potential crude oil unavailability.

Finally, a decline in asymmetries in volatility spillovers after 2008 correlates with the ongoing financialization of commodities and the advent of tight oil exploration and production in the U.S. The extent of financialization reached impressive levels in 2008 and financial crisis had a substantial immediate impact on financial and commodities markets. In this respect, the emergence of the crude oil supply due to the U.S. tight oil production since 2008 might represent a factor beneficial to lower asymmetries. The key reason is that the advent of the U.S. tight oil decreased the oil market vulnerability to supply shocks when compared to the past.