

Managing Energy Price Risk using Futures Contracts: A Comparative Analysis

Executive Summary

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Energy risk management through hedging has been the subject of increased focus in recent years given the importance of energy to the global economy and its increased susceptibility to volatility arising out of political, economic, climate and technological events. This volatility means that energy markets participants are generally exposed to higher levels of risk as compared with other asset classes and therefore require efficient strategies for managing their exposures. However, outside of the benchmark Crude Oils and Natural Gas there has been relatively little work that has focused on the hedging effectiveness of other energy products.

Within this context, this paper seeks to assess energy market volatility and carries out a wide ranging comparison of Optimal Hedge Ratios (OHR's) estimated using futures contracts together with an analysis of their associated efficacy in terms of managing energy price risk. Both constant (Ordinary Least Squares - OLS) as well as time-varying (GARCH) methodologies are employed across both weekly and monthly holding periods. A particular focus of this paper is the application of some of the newer risk metrics such as Value at Risk (VaR) and Expected Shortfall to evaluate hedging performance. A metric that is based on investor utility is also applied which incorporates both risk and return.

The results from the volatility analysis indicate that there are significant variations in volatility across the different markets with Natural Gas exhibiting the highest levels. Persistence in volatility is also a feature of each of the energy markets even at the monthly frequency with values in the range 62% (Gasoline) to 95% (Gasoil).

The results for the OHR estimations show that the hedge strategies for the various energy assets are quite different even for assets that are considered to be very similar. For example, the constant OHR using weekly data for West Texas Intermediate (WTI) Crude Oil is 1.02 as compared with an OHR for Brent Crude Oil of 0.88. However, at the monthly frequency the differences are markedly smaller.

The findings on hedging performance indicate that futures hedges are generally quite effective when measured in terms of variance reduction, but less effective in terms of reducing downside risk measures such as VaR and Expected Shortfall. Furthermore, there are significant differences in terms of the hedging effectiveness across the different energy assets. Better performance is found for WTI Crude Oil and Heating Oil while the poorest performer in hedging terms is Natural Gas. These differences can be attributed in part to the higher basis risk inherent in Natural Gas hedges. The implication of these findings is that hedging strategies should be tailored to a particular energy product, as a generalised approach is likely to be suboptimal. Furthermore, Natural Gas market participants should be aware of the relatively poor performance of futures hedges in terms of reducing risk. From a policy perspective this is an interesting result as it points to the need to develop hedging products and strategies designed to minimise Natural Gas price volatility.