DISCUSSING LNG PRICING RULE BASED ON PRICE RISK MANAGEMENT

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Overview

Long-term liquefied natural gas (LNG) importing contracts are generally indexed to the crude oil price in the Asian market. Before mid-2014, a high Asian import price and a large regional price divergence were linked to this oil-index price mechanism (IEA, 2014). While greater shale gas production in the United States caused a decline in Henry Hub price, it attracted numerous Asian LNG importers to consider gas hub linked mechanisms. However, because of the unexpected plunge in global oil prices since mid-2014, buyers tend not to break down the oil link in the short term (Sung, 2015). Thus, the decoupling of LNG and oil prices is still an ongoing debate. One of the major motivations for maintaining the oil-index price is that the natural gas price series is much more volatile than the crude oil price series (Morikawa, 2015). However, volatility/risk, if predictable, can be reduced by hedging. Thus, we claim that the predictability of volatility is more important than the size of volatility because that the financial risk associated with unpredictable volatility rather than predictable volatility. Therefore, this article discuss the LNG pricing issues based on the predictability of price risk rather than discussing the size of volatility such as in IEA (2011), Alterman (2012) and Sofyo (2012). The purpose of this study is to investigate the predictability of the price risk for oil and other possible links (Henry Hub and an oil-gas hybrid index). Results of our empirical investigation provide practical implications on financial risk management for LNG traders.

Methods

VaR (Value at Risk) is a widely used measure of financial risk. This study estimates the VaR for three possible LNG pricing mechanisms, including Brent crude oil, Henry-Hub and an oil-gas hybrid (50% Brent and 50% Henry-Hub). Two commonly used VaR models-the Historical simulation (HS) and GARCH models—are applied to calculate the 95% daily VaR. Further, the back-testing is used to access the performance of these simple but popular VaR models. Details of VaR models can be found in Jorion (2007) and backtesting methods are refer to Kupiec (1995), Christoffersen (1998) and Christoffersen et al. (2004)

Results

Two simple but commonly used VaR prediction methods, the historical-simulation method and the GARCH(1,1) model, are applied to estimate 95% daily VaR for each price index. Figure 1. depicts the daily return and time series of the predicted 95% daily VaR for Brent crude oil, Henry Hub and oil-gas hybrid. Brent are less volatile than Henry Hub. We can see that sometimes actual loss exceed predicted loss, these no-hit events are called “VaR violations” in this study.

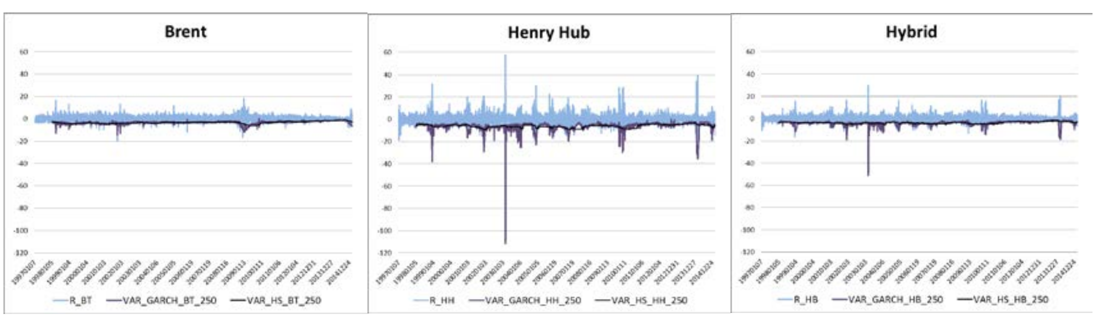

Fig 1. 95% 1 day VaRs for Brent, Henry Hub and oil-gas hybrid

B VaR backtesting results for Brent, Henry Hub, and an oil-gas hybrid are discussed in this subsection. Failure rates and testing results are shown in Table 2. Failure rates (violation rates) are close to 5%, and P-values of Kupiec’s (1995) LRuc test reveal that violation rates are not significantly different from the target in each case. Thus, these two simple but commonly used VaR models appear to capture successfully the risks that they are intended to cover. However, detecting clusters in VaR violations is another important issue, because it implies that an energy company faces repeated severe capital losses during a short time period. Therefore, VaR violations should ideally be i.i.d when the VaR model works well, which means that the violations should spread evenly over time.

The ACD coefficients α, estimated from Brent violation durations are very significant. The coefficient α of Henry Hub and an oil-gas hybrid's violation duration, based on the GARCH model, do not reject the null of independent violation durations. Either the first-order Markov tests or the duration-based test indicates that a simple GARCH model captures the price risk well for Henry Hub and an oil-gas hybrid. In other words, predicting the price risk for LNG is easier if the LNG price links to Henry Hub or to an oil-gas hybrid, rather than to Brent crude oil.

Table 1. The back-testing results

Price Index	Brent	Brent	Henry Hub	**Henry Hub**	Hybrid	**Hybrid**
VaR Method	HS	GARCH	HS	**GARCH**	HS	**GARCH**
Failure Rate	0.056	0.053	0.053	**0.045**	0.053	**0.048**
LR_{uc}	1.215	0.427	0.267	**0.942**	0.427	**0.163**
	(0.270)	(0.514)	(0.605)	**(0.332)**	(0.514)	**(0.686)**
First-Order Markov Tests						
LR_{ind}	1.878	0.840	16.311	**1.803**	12.456	**0.775**
	(0.171)	(0.359)	(0.000)	**(0.179)**	(0.000)	**(0.379)**
LR_{cc}	3.092	1.267	16.579	**2.745**	12.882	**0.938**
	(0.213)	(0.531)	(0.000)	**(0.253)**	(0.002)	**(0.626)**
Duration-Based Tests						
Q_1	11.140	12.985	1.006	**0.550**	3.445	**0.493**
	(0.001)	(0.000)	(0.316)	**(0.458)**	(0.063)	**(0.483)**
Q5	12.469	16.678	4.308	**7.731**	10.443	**3.240**
	(0.029)	(0.005)	(0.506)	**(0.172)**	(0.064)	**(0.663)**
Ceof. in EACD (1,0)	0.316	0.291	0.117	**0.032**	0.171	**0.051**
	(0.000)	(0.002)	(0.029)	**(0.705)**	(0.012)	**(0.434)**

Note: p-values are reported in parentheses.

Conclusions

Based on this study's empirical evidence, we find that Brent returns are less volatile, but its VaRs are more difficult to predict, compared with Henry Hub or an oil-gas hybrid. The predictability of risk is more crucial than its size, because the expected price risk can be managed or hedged, which could provide extra motivation for LNG producers to break the oil-link pricing rule. Several lead energy analysts (e.g., IEA and the World Bank) write that low oil prices offer policymakers a golden opportunity to reform. Therefore, we claim that the reform should include the LNG pricing mechanism. More volatility should not be the major reason for refusing to move to a gas-linked or an oil-gas hybrid-linked pricing mechanism.

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