BRENT OIL VS TTF GAS PRICES – A TALE OF TWO VOLATILITIES

By Julien Mathonniere
MARKET INSIGHT

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Price volatility is a good indicator of market dynamics for any investor willing to take exposure in energy commodities, especially as prices are characterised by unpredictable shocks and fast-changing drivers. Unlike the gas market, fluctuations in crude oil volatility do not point so much to actual changes in supply and demand than to the wider market sentiment. Volatility does not move in sync on both markets, suggesting that what prompts it on the gas market is somehow different from what flares it up on the crude oil market. ICIS takes a look at Brent oil and TTF gas prices to understand what their changes reflect and why they seem to be tracking different patterns. In particular, gas volatility seems to be a better reflection of actual, physical disruptions than crude volatility. This, together with a more flexible gas market, has allowed implied volatility benchmarks to gain more traction as a decision-making tool in gas trading.

Energy commodities are characterised by unpredictable shocks and often-changing determinants, including sharp moves in prices and inventory levels. Prices change direction quickly and very frequently over time.

For crude oil, the adoption of market pricing and crude benchmarks in the mid-1980s has compounded those fluctuations. Likewise, for natural gas, the effective liberalisation of European markets from 2006 and the development of hub trading have contributed to cast gas prices adrift.

Unlike the gas market, however, volatility fluctuations in the oil market do not point so much to actual changes in supply and demand fundamentals (although they sometimes can) than to the perception, real or imagined, of such changes and hence, to wider market sentiment.

Variations in spot prices, futures prices and inventory levels are affected by fluctuations in volatility. For this reason, volatility measures remain an objective risk benchmark for any investor willing to take exposure in the crude oil or gas market.

Besides being a good indicator of short-term market dynamics, price volatility remains a key determinant of contingent claims, in particular opportunities to invest in additional production capacity.

The intuition is that gas markets may be more attuned to volatility changes than oil markets, and more prompt to respond to it.

Market participants generally use two widely recognised measures of price uncertainty: historical or realised.

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HISTORICAL VOLATILITY (HV) OF FRONT-MONTH BRENT CRUDE OIL AND TTF GAS FUTURES

Source: ICIS Heren, ICE Europe
volatility, and implied volatility. They differ in their outlook. Historical volatility measures how prices have changed in the past and is calculated from the daily price movements of a specific commodity. The wider the price dispersion, the higher the volatility.

Implied volatility, on the contrary, is forward looking and uses option prices to measure how participants think prices will vary in the future until expiration of the option.

In the standard Black-Scholes pricing formula (see on page 4), option prices are a function of their strike price, the underlying commodity price, the option time to expiry, the risk-free rate of interest and volatility. Hence, a level of volatility can be ‘implied’ from the other variables in the formula.

With a number of long-term gas contracts still indexed to Brent crude, the relationship between those two commodities usually starts to transpire at the back end of the gas forward curve, that is, beyond six months. Yet, two clearly different patterns emerge when comparing implied volatilities for the front-month Brent crude oil and for the TTF gas options markets between November 2016 and August 2018.

The TTF gas implied volatility curve has roughly tracked sharp variations in supply and demand. In January 2017, a prolonged cold snap across a large part of Europe boosted gas demand and prices. Storage withdrawals were much higher than a year earlier, prompting concerns of tighter supply towards the end of the winter.

The spike was eventually offset when such fears did not materialise later in the spring. Interestingly though, the so-called ‘Beast from the East’ from 24 February to 4 March 2018 also prompted a spike of volatility, but a delayed one.

The reason is that the market did not anticipate the widespread and unusually low temperatures, hence volatility remained low as the season moved slowly into spring. However, the spike came later when again, market fears crystallised over possible supply shortage following massive unplanned withdrawals.

Hence, volatility spikes on the gas market tend to coincide with the winter season or with clearly identified physical disruptions, while those on the crude oil market seem far less conspicuous and more random, with a crude volatility curve tracking a downtrend throughout 2017, followed by a slight uptrend until about mid-July 2018.

The first trend is mostly the reflection of OPEC’s supply deal, which assuaged the markets and reduced volatility. The second trend from February 2018 is in line with several geopolitical events that occurred one after the other, rather than significant changes in the supply and demand balance.

The uncertainty on OPEC’s response to supply shortages (Venezuela, Iran), followed by the trade spat between the US and China, and then by the start of effective sanctions against Iran have gradually snowballed into higher volatility.

What the set of graphical evidence hence shows is that volatility does not move in sync on the oil and gas markets, suggesting that what prompts volatility on the gas market is somehow different from what flares it up on the crude oil market.

“Spikes of volatility can relate to the gas storage story. Certain countries like the UK are very low on storage, which makes the market a bit nervous. Also, the renewables output has an effect. All those conditions on the physical market can add up to create the perfect

Source: ICE Europe
storm”, Georgi Slavov, head of research at brokerage firm Marex Spectron, told ICIS.

Compared with those rather well understood and tightly tracked parameters, crude oil volatility does not seem to respond to clear determinants.

“Oil is very different. The reaction is very muted, notably because it is overlaid by the noise from OPEC ministers’ statements”, said Slavov.

As a result, beyond immediate information on option trading and price expectations, crude oil volatility conveys little information as to where fundamentals may be headed. The crude oil market lacks the flexible assets of the gas market to fully exploit the benefits of tracking volatility.

Volatility is a key driver of value in European energy portfolios because the gas market offers that degree of flexibility that the crude market lacks, notably in terms of customer supply contracts, gas swing contracts or storage capacity.

Unlike oil, many contracts in the natural gas markets incorporate some flexibility-of-­fundamentals options, known as ‘swing’ or ‘take-or-pay’ options. For example, a swing gas option contract will stipulate the minimum and maximum volume of gas an option holder can buy per month, how much that will cost (strike price) and how many times during the month the option holder can change (swing) the daily quantity of energy purchased.

In theory, volatility should affect the marginal value of storage through the marginal convenience yield, that is, the cost or benefit of hoarding one extra unit of physical oil or gas. When price volatility increases, demand for storage also rises as a way to smooth out physical delivery.

Hence, higher volatility can lead to build-ups in inventory (precautionary oil or gas storage injections) and impart some bullishness to short-term prices.

Volatility would also affect the marginal cost of production by increasing an option’s premium, that is, the price to pay to buy and hold that option until expiry. Oil and gas producers hold real options. A real option is a choice made available to a decision maker with respect to investment opportunities.

In the oil and gas industry, the option to develop a field and/or increase production is similar to a call option. The producer has the option to invest the development costs and receive the value of the oil and gas reserves, or to forfeit that. Inversely, the ability to abandon or sell a property for a producer is the equivalent of a put option.

The option strike price is equal to the marginal cost of production and the payoff to the price of the commodity. The total marginal cost includes the opportunity cost of exercising the firm’s real option now rather than later, that is, the decision to expand production rather than waiting for new price information.

An increase in price volatility will raise the value of this option and the associated opportunity cost. If the opportunity cost of producing the commodity now rises, there is a risk that less profitable, low-margin producers may decide to reduce their production.

Financial investors like banks and hedge funds often favour option-traded derivatives on mature markets with sufficient liquidity and transparency, mostly because of the flexibility they give. The European gas option market is still relatively young compared to its crude oil counterpart, and gas options have only started to trade recently, essentially on the most liquid UK NBP and Dutch

Source:
ICIS, ICE Europe

IMPLIED VOLATILITY OF TTF GAS AT-THE-MONEY FRONT-MONTH CALL OPTIONS VS REALISED FRONT-MONTH TTF PRICES

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The Black-Scholes formula

The formula shown below is a compound of several variables including:

- the current underlying price
- the options strike price
- the option time until expiration, expressed as a percentage of a year
- the implied volatility
- the risk-free interest rate

\[ C = SN(d_1) - Ke^{-rt}N(d_2) \]

\[ d_1 = \frac{\ln \left( \frac{S}{K} \right) + \left( \frac{r}{\sigma^2/2} \right) t}{\sigma \sqrt{t}} \]

\[ d_2 = d_1 - \sigma \sqrt{t} \]

- \( C \) = call option premium
- \( S \) = current underlying commodity price
- \( N \) = cumulative normal standard deviation
- \( K \) = option strike price
- \( e \) = natural exponent term
- \( r \) = risk-free rate of interest
- \( t \) = time until option expiry
- \( \ln \) = natural log
- \( \sigma \) = standard deviation (volatility)

The model is essentially divided into two parts:

- The left-hand side part, \( SN(d_1) \), multiplies the price by the change in the call premium in relation to a change in the underlying price. This part of the formula shows the expected benefit of purchasing the underlying outright.
- The second, right-hand side part, \( Ke^{-rt}(d_2) \), provides the current value of paying the exercise price upon expiration (for a European style option that can be exercised only on expiration day).

The value of the option is calculated by taking the difference between the two parts, as shown in the equation.

TTF markets. The NBP exchange options accounted for 12.5% of its total exchange volumes and the TTF 6% of the total exchange traded volumes in 2015.

Dutch fast-cycle storage operator EnergyStock started to publish a volatility dashboard in 2015, and comprising historical volatility indices and based on ICIS assessments. ICE Europe also publishes implied volatility data for the NBP and TTF hubs, as well as large gas options brokers like Marex Spectron.

Implied volatility benchmarks are more recent in the gas market than in the crude oil market, but they seem to have gained more traction as a decision-making tool in gas trading.

"It is certainly the case for consumers, and [energy] utilities will be keen to monitor volatility closely on a day-to-day basis", said Slavov. "They are sophisticated players on the market, and they seem able to extract information from it and act upon it."

Trading on volatility signals has its shortcomings, though, whether for crude oil or for gas. Past levels of volatility are weak predictors of future volatility levels. And changes in volatility are not predicted by market variables such as spot prices, inventory levels or convenience yields either, even if they will eventually influence all of those.

Volatility remain largely exogenous. Wide fluctuations in gas or crude spot prices may not prompt any movement of implied volatility, reflecting unchanged views on longer-term risk in those markets, as illustrated above by the 'Beast from the East' example.

Jumps in implied volatility for specific contract maturities tend to come from sharp changes in underlying option prices. Higher TTF price volatility is often associated with winter and peaks in gas prices.

Brent offers a different picture, with instruments like the CBOE’s crude OVX – launched in 2008 – being used mostly to gauge market sentiment. However, investors not
directly involved in options trading may not internalise the broader issues underlying its daily movements.

Unlike Brent-priced crudes, where different grade qualities fetch different refining yields and are hence not substitutable, gas has no such problem and offers a lot more flexibility on the supply side.

Therefore, gas traders may be keener to benchmark their positions and investment strategies against volatility reading than crude investors. Spikes of volatility in the gas market will erode away if traders identify and take advantage of arbitrage opportunities across particular gas contracts, especially on a liquid market like the TTF. Such effects are far less likely to materialise on the crude volatility curve.

ABOUT THE AUTHOR

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Julien Mathonniere is the global crude oil deputy editor for ICIS Energy. A trained petroleum economist from the University of Aberdeen (UK) with a strong background in energy finance, he loves crunching data, running models and drawing curves to bring complex energy-related topics into shape, find hard evidence, and prop up sound market analysis. Julien covers various regions for ICIS, including Asia-Pacific, Arab Gulf, CIS, Mediterranean, west Africa, and North Sea. He is also involved in training and public speaking inside and outside of the company and occasionally writes for the Financial Times on crude oil-related subjects.