Eric Fishhaut explores the current state of volatility within the US natural gas market and outlines how hedging with 'strips' can be used to secure long-term prices that are variable, but known

Dealing with a volatile gas market

★ The price of natural gas in the US going into this winter has retreated substantially from last year's surge due to hurricane impact, but the underlying factors that lead to price spikes and price volatility remain. Demand continues to increase, while traditional supply sources of natural gas are declining in productivity and production costs are increasing. As volatility has grown, trade within the natural gas markets has attracted an increasing number of financial entities, which arguably has added to the price volatility.

All factors considered, it would be difficult to conclude anything other than that natural gas prices will remain relatively high, and highly volatile, over the long-term.

With a limited gap between production and consumption in the US, natural gas prices react quickly to changes in key market factors such as weather and storage levels. The delicate supply/demand balance certainly impacts short-term price volatility, due to both anticipation and reality.

Factors to consider

Weather is the single most important element driving demand for natural gas in the US. Cold winter temperatures result in greater consumption by residential customers and hot summer weather causes greater consumption by electric generators. Market price sensitivity to temperature has increased over the last few years as industrial consumption that is not weather driven has decreased as a reaction to high prices. Industrial customers have relocated or closed plants, as well as cut back on production, as prices have increased from under $3 per thousand cubic feet in the 1990s to an average of nearly $9 in 2006.

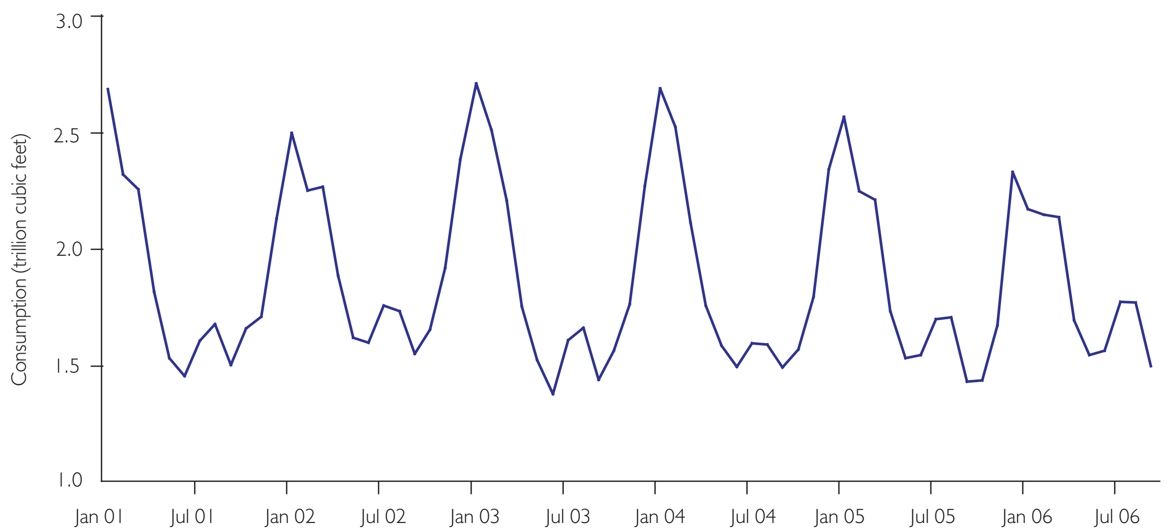
Following severe market disruption in 2005 caused by Hurricane Katrina, prices have settled somewhat. Most experts, including the US Energy Information Administration (EIA), are predicting level prices and little chance of a retreat. Interestingly, total consumption has levelled off and, in fact, declined since 2000, when new highs were reached.

Natural gas storage facilities are used to help production keep up during the high-demand months in winter. The closely watched weekly-storage reports drive market prices. Levels are typically drawn down in response to cold weather demand and then built up again prior to the next heating season. In the crude market, the US Strategic Petroleum Reserve stores a sizeable amount of oil that can be released in times of tight supply or very high oil prices. The natural gas market lacks an equivalent protection, as current storage capacity for natural gas offers only a small cushion against colder-than-normal weather or supply disruptions.

The energy markets generally exhibit high volatility as they respond to complex and unpredictable factors, and unlike financial products, ultimately must be delivered to meet demand. And highly volatile markets tend to attract speculators, in addition to regulation changes that have made it possible for a broader group of financial companies to partake. Sizeable profits earned by the likes of Morgan Stanley and Goldman Sachs have drawn countless other banks and hedge funds to the energy markets.

Volatility

Examining volatility, we first look at the historical trend of spot market Henry Hub natural gas prices on a monthly basis going back to the early 1990s. We can see substantial price spikes in December 2000 and January 2003 that clearly stand out and are then eclipsed in October 2005. However, the balance of the chart appears comparatively tame (as seen in figure 2). But in reality, many of the 'lesser' price spikes during the 1990s represent doublings or more in price and day-to-day price swings of greater than 1% have been common. In other words, short-term natural gas prices have been



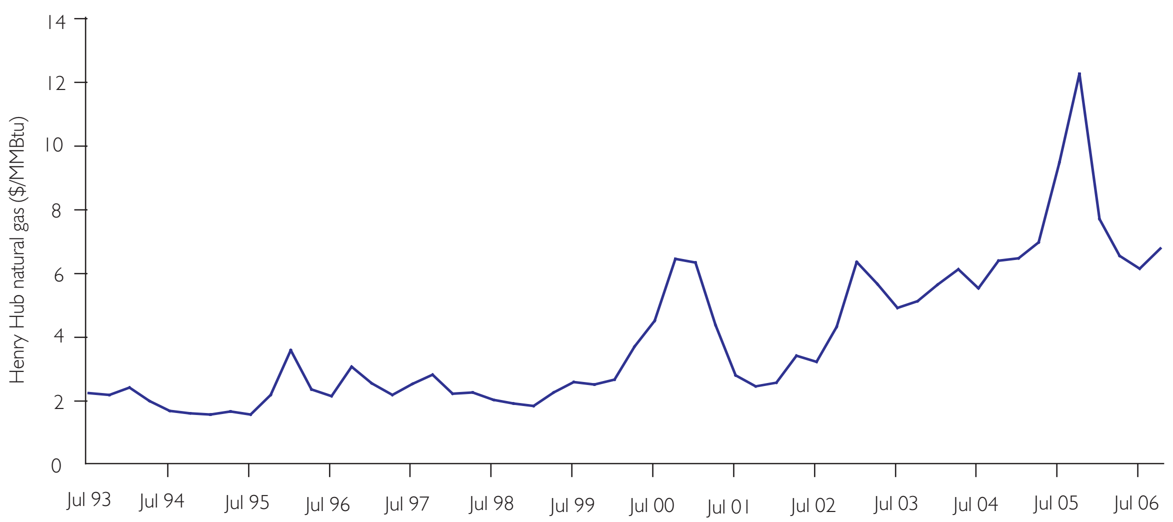
F1. US natural gas consumption

The seasonality of natural gas consumption is clear in this study while the downward trend over the past few years may be somewhat surprising *Source: EIA via GlobalView*

volatile since deregulation and the inception of futures trading in this market.

The natural gas market exhibits price volatility at the second highest level of all traded commodities. According to EIA studies, only the wholesale electricity market has greater volatility – this market is in a realm quite apart from any other commodity due to a number of drivers, including a lack of storage and the fact it is partly driven by the natural gas market. By comparison, crude oil volatility, on average, displays less than 40% of that seen for natural gas.

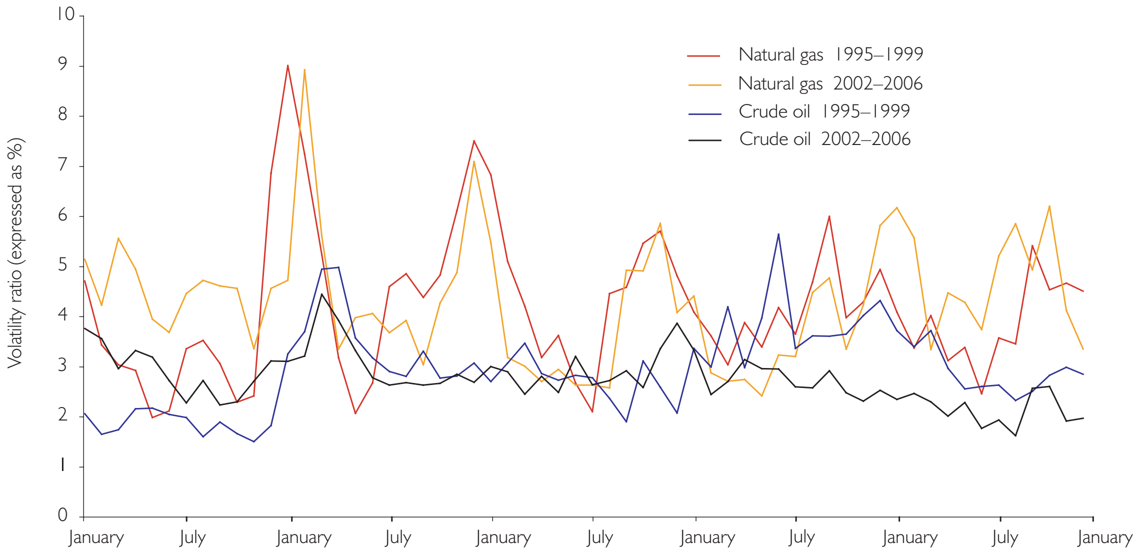
Conventional wisdom would say that at the same time prices have more than tripled, volatility has grown in lockstep. However, another calculation yields a different



F2. US natural gas spot prices

The long-term pattern for US natural gas spot price shows an upward trend in this decade along with strong volatility

Source: Natural Gas Intelligence via GlobalView



F3. Natural gas volatility ratio

The volatility ratio measures volatility in relative terms. Some interesting patterns emerge in the comparison of recent and historic periods of natural gas volatility vs that of crude oil *Source: NYMEX via GlobalView*

perspective; volatility ratio is a measure of volatility or maximum price fluctuation presented in relative terms, and is used as a standard technical analysis study. Unlike volatility, it is not affected by the actual level of prices. Volatility ratio is the difference between the highest high and the lowest low for a given time interval, divided by the lowest low for the same interval. Figure 3 compares the volatility ratio of natural gas against that of crude oil during the last five years and the final five years of the 1990s.

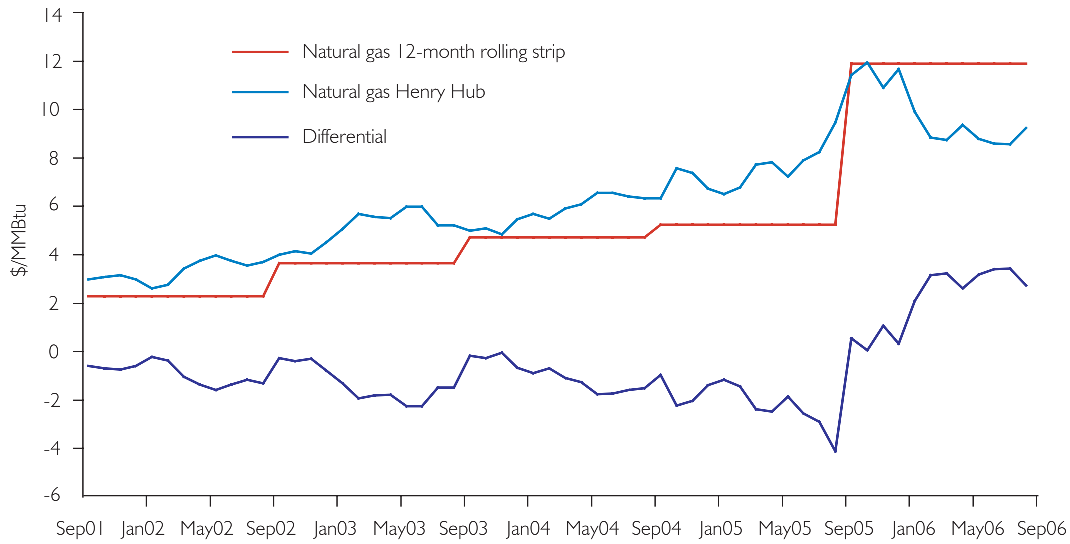
There is evidence not only that the volatility ratio is in the same range for each commodity, but also that a remarkable correlation exists between these two periods for natural gas. While the average ratio for natural gas during has grown from 4.15% to 4.27% in the comparison, crude oil has actually fallen from 2.92% to 2.73%.

Having identified historical trends in gas price volatility, what can analysis provide as far as future volatility trends – will it maintain steady or potentially increase further? The current market can provide some valuable information on market perception and the future outlook. Using observed options premiums in the market and options pricing formulas combined with a suitable calculation tool, we can derive the implied volatility. Implied volatility can be simply defined as the market's forecast of future price volatility. That at least shows the likely outer bands of highs and lows for the market in the near to mid-term.

Hedging with strips

Large natural gas consumers concerned with prices will seek long-term stability in pricing and minimise or avoid volatility. Many will use physical hedges that include long-term fixed-price gas supply contracts and natural gas storage. At the same time, many are likely to utilise a strategy of financial hedges (futures, forwards, swaps, options on futures, or some combination or derivation thereof) in order to reduce natural gas price risk. When hedging with futures, forwards, or swaps, the long-term consumer locks in a natural gas price in advance, thereby eliminating exposure to both rising and falling gas prices.

Nymex natural gas futures are actively traded, enabling buyers and sellers to lock in a known price, in any or all months, up to six years into the future. However, in practice, liquidity drops in the contracts more than 12–18 months out, making trading more difficult. Using 'strips' is a simple strategy commonly used to secure long-term prices that are variable, but known. The purchaser will buy contracts for delivery in each of the months for the duration of the period for which they desire price stability. The price is then locked for the period in question. However, this method introduces the risk that prices may in fact be lower at times during the period and the actual purchases will be made above market rates. Nevertheless, this approach actually negates the market volatility and insulates the buyer from both price increases and decreases.



F4. Natural gas strip analysis

Weighing the natural gas futures strip against the spot market price shows a measurable differential in four out of the last five years *Source: NYMEX and Natural Gas Intelligence via GlobalView*

In the over-the-counter markets, forward contracts are traded between individual counterparties (in other words, 'off exchange'). An equivalent strip method can be structured using 'swaps' – an exchange between parties of floating spot market prices for fixed gas prices over a predefined term. Consumers can lock in a fixed price over the duration of the swap agreement to provide a long-term flat cost pattern. Because swaps are bilateral contracts, they have one advantage over futures contracts – swaps can be structured for terms longer than the limited period in which futures contracts are liquid.

We can examine a simple model of using natural gas futures strips, and compare the supply cost over a number of years to a no-hedge approach of paying spot market prices. In this illustration, we will look at the cost of purchasing a twelve-month strip of futures contracts at a given point in autumn, which will provide delivery of a specific gas volume each month over a one-year period. Figure 4 shows a five-year period in monthly increments, starting in autumn 2001. It displays the 12-month strip if purchased at the beginning of September each year, along with the Henry Hub spot price. On the lower section the actual difference is calculated.

In this model, we can quickly evaluate that in each heating season other than the most recent, there is a markedly negative difference that makes the strip price very advantageous. In fact, the cumulative difference within each of the first three years exceeds $12 per contract (10,000 million British thermal units (MMBtu)) or $1 each month. In the 2004–2005 season, the cumulative difference is more than double that amount, while during the 2005–2006 season it is nearly the exact opposite. Of course, that year may easily be considered an anomaly, due to the supply disruptions caused mainly by unusual events such as hurricane damage.

Taking a long-term approach, however, we can see that over the five-year term, savings total over $44 per contract, resulting in an average of nearly $0.75 in each contract month. As an interesting contrast, if we modify the model and purchase the 12-month strip a month later (that is, in October), we find that the average of the differential is only $0.11 per contract month. Likewise, making the purchase earlier in August yields an average differential of only $0.36 per contract month. The evidence tells us that timing of the strip purchase will potentially have tremendous impact on the result.

While this simplistic analysis can only simulate real-world supply acquisition, it helps provide some insight into market behaviour. It suggests some fundamental approaches – that don't need to be overly complex – to minimise potential risks from price volatility. As ever, the better our understanding of the market, the more prepared we can be to offset its inherent volatility – especially in the case of natural gas. ER

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