on investment using a swaption.

With the high volatility of oil and gas prices, a swaption is often used to assure the company acquiring reserves that prices on the date of closing will yield an anticipated level of profit. The acquiring company would pay a premium to ensure that at least the same fixed price was obtainable on the date of closing as was on the date of the negotiated agreement.

At closing, if the fixed price for the particular term of the swap is lower than the fixed price when the acquisition was negotiated, the company would exercise the swaption, thereby receiving the fixed price established when the acquisition was negotiated. However, if the fixed price were higher for the period at closing, the company would not exercise the swaption. It would instead hedge the new reserves at the higher fixed price, locking in a larger profit margin on the acquisition.

To complete the hedging strategy, a company may treat acquisition hedges separate from equity hedges. Once acquisition hedges roll off, however, this production can then be merged into the equity hedging program. ❐

Support the oil and gas industry.

Hedging Is An Option For Producers

By Cynthia A. Kase

When deciding whether or not to hedge basis, a number of critical issues must be decided. First, we must determine whether or not our exposure may be hedged in the futures at all. A number of exposures do not lend themselves to futures hedging.

Second, even if we are able to hedge our exposure with futures, we must determine whether or not we wish to take on the risk associated in doing so. Finally, we must decide whether the index or basis price is attractive–on a stand-alone basis–to warrant hedging the basis.

If we are hedging an exposure based on an index (i.e., Houston Ship Channel, Northern California Border, etc.) we must first determine whether or not it is feasible to hedge such exposure, settling on other than the index specifically involved, for example Kansas City Gas or New York Mercantile Exchange Henry Hub Gas.

There are two major considerations ensuring that such a hedge is feasible. First, we need to make sure that we have a reasonable correlation between the hedge instrument and the underlying exposure. The minimum correlation sought is usually assumed to be an R-squared of 0.8.

If we do not have a reasonable correlation then we do not have an efficient hedge. In the extreme example, we would not want to hedge natural gas with pork bellies. We would not hedge Northern California Border with NYMEX Henry Hub for similar reasons–the two price bases do not move in concert with one another.

Table 1 shows correlations between Kansas City Gas and NYMEX gas in various locations. If we hedge Appalachian Gas with either contract, we are out of luck because the R-squared does not meet the 0.8 criteria. We do not have an efficient hedge, because the correlation is not high enough.

The other issue is that we do not qualify for hedge accounting with the U.S. Internal Revenue Service. So, even if relatively low hedge efficiency doesn't matter, the firm may be disqualified from counting the financial transaction as a hedge when it comes to tax time.

The implication is that any benefits or costs on what has been considered a hedge will be considered capital gain or capital loss for tax purposes. If the firm's capital losses are too high–even though its own chief financial officer is satisfied with the overall performance of the hedge–it is limited to a net $3,000 in what it can write off as a loss against the firm's capital gains.

Correlation Important

In any case, even not considering the tax implications, a hedge involving a financial instrument that does not correlate with the underlying exposure will leave us with the possibility of a poorly performing hedge. So, the number one item in the hedge basis question is correlation (Figure 1).

A correlation should be run over a 30- to 36-month period for all strategic hedges. In the short run, if placing a hedge for a very brief period, or based on daily, swing or spot indices, run a regression over the past 30-36 business days as well. A regression analysis may be easily done on any spreadsheet program such as Excel or Lotus (Figure 2).

The second element in this process is to determine what the best instrument is, and to concentrate most of one's hedges in that instrument. For example, Table 1 shows that Houston-Katy gas correlates with both Henry Hub and NYMEX. However, there is a much better correlation with NYMEX. In the second case, Oklahoma, there is a much better correlation

TABLE 1

Price Correlations (In Term Of R-SQ)

Region	NYMEX	KCBT
West Waha	0.74	0.97
Houston-Katy	0.84	0.97
Louisiana	0.99	0.77
Oklahoma	0.77	0.96
Rockies	0.57	0.83
East Texas	0.93	0.90
Appalachia	0.79	0.49

FIGURE 1

Typical Regression Chart

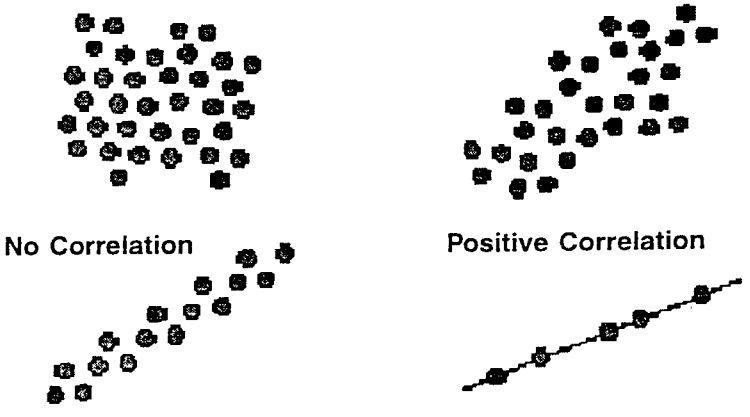

FIGURE 2

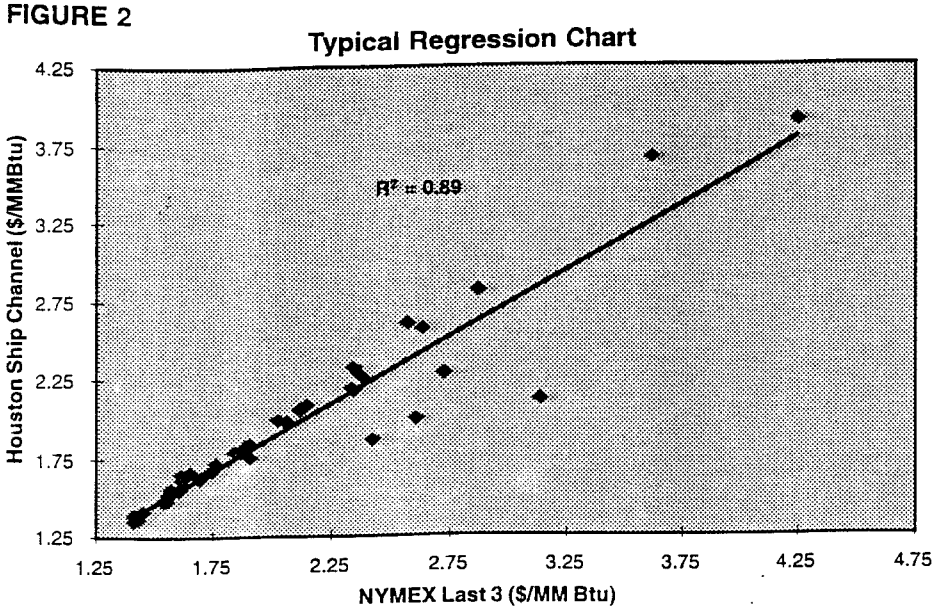

TABLE 2

Houston Ship Channel Rankings: Price And Basis Versus NYMEX

	Price	Basis
100%	$3.90	$.049
97.5%	3.62	.038
95%	2.79	.031
90%	2.52	-.004
85%	2.29	-.021
80%	2.27	-.028
75%	2.19	-.039
70%	2.14	-.042
65%	2.09	-.050
60%	2.05	-.052
55%	1.99	-.056
50%	1.86	-.058
45%	1.83	-.061
40%	1.78	-.065
35%	1.73	-.068
30%	1.67	-.074
25%	1.64	-.077
20%	1.58	-.139
15%	1.53	-.152
10%	1.48	-.379
5%	1.39	-.573
2.5%	1.37	-.645

with Kansas City, thus the tendency is to lean more heavily on NYMEX hedges in case one than on Kansas City hedges in case two.

Another consideration in the decision whether or not to hedge basis is how much risk we have in our position if we do not hedge. The method used by industry to determine risk is to assume a two standard deviation move, called a 2σ, against the portfolio. This means that at that level (two standard deviations in a painful direction), we have only a 2.5-percent chance the level will be worse.

Volatility in its most simplistic form can be thought of as a one standard deviation expected move in price on an annualized basis.

If we wish, we can do a 'back of the envelope' calculation to estimate what our risk is over the term or holding period of the risk. First, volatility has a square-root relationship with time. Therefore we know what the volatility is on a particular spread. One can determine this by asking a market maker, dealer or over-the-counter broker for this information. Once we know the volatility, we simply multiply the percentage volatility by two (for a two standard deviation move), and then correct for time, using the square-root relationship. For example, if we hold basis risk for a month then we have the annualized volatility times two times one over the square root of 12.

Estimating Risk

In a simple example involving Houston Ship Channel (Table 2), we assume that the current basis is 15 cents under, and we are going to hold risk for a month. Volatility is 200 percent, so our risk–the amount we would expect to lose most of the time (97.5 percent)–should be no more than. Risk = 2(standard deviations) x 15 (cents) x 2(hundred percent per year) / (1 year / square-root (12 months) per year) = 17.5 cents. This means our risk is no more than 17.5 cents most of the time (97.5 percent).

Estimating risk on basis can be tricky when basis swings from positive to negative. In these cases, estimating risk on the hedge instrument first (using the preceding technique), then estimating risk on the ratio between the two indices may be substituted.

Another way we can estimate our risk, is to simply look at the 98th percentile if we are consumers, or the second percentile if we are producers to see how bad basis can get in an extreme case.

Sometimes hedgers get hurt on basis even when the hedge instrument has a good correlation with the exposure. As we have seen, the industry standard for estimating risk (two standard deviations) still leaves out 2.5 percent of the observations. Because market prices tend to skew in the direction of the trend, 2.5 percent can be very painful.

Smooth Spikes

Generally, producers hedging by selling financial instruments get hurt the most when underlying prices spike. The financial instrument runs up, while their particular geographic location (index) fails to follow suit. Consumers get hurt when the opposite happens; they have purchased forward, and the financial instrument takes a nosedive, while the commodity in their location remains firm.

Generally, such spikes–either up or down–become more exaggerated as bid week approaches. One simple method of mitigating the risk caused by such spikes is to price the gas on a monthly average basis.

In this case, the price of the physical commodity is determined by the NYMEX monthly average rather than by NYMEX last three days. In this way, even if prices are moving in an adverse direction, the spikes are smoothed to a great degree.

Another method that may be used is to mix the indices with whichever one hedges exposure. For example, if we have a situation such as Louisiana gas, which correlates fairly well with both NYMEX and Kansas City, we would lean toward hedging most of our exposure in the NYMEX, but we would reserve some exposure to be hedged in the Kansas City contract.

The probabilities of the NYMEX and the Kansas City spiking up or spiking down to exactly the same degree at exactly the same time are low. So, we could hedge 60 percent of East Texas gas in NYMEX last three days, 25 percent in NYMEX monthly average, and 15 percent in Kansas City last three days in order to diversify and lower risk.

There could be situations in which we do not wish to lock in the basis because we do not view it as being at a favorable level, but are concerned that it might get worse. For example, a producer hedging Ship Channel at a time when the basis is at -15 cents, may not wish to lock it in, but is concerned that it may move to worse than -60 cents. In this case, the producer would purchase a put option on the basis at the same time that it locks in the underlying. In this example, the producer might buy a -55 put option for 5 cents, to guarantee an all-in price of no less than -60 cents.

Opportunities To Benefit

It always makes sense to hedge basis when the price is right. There are two circumstances in which a hedger would wish to lock in or protect the basis.

The first is when the outright index price is at a statistical extreme. In this case, a hedger would place the hedge that settles on an index as opposed to underlying futures prices.

This would generally be a circumstance when both the basis and the underlying price are attractive. For example, a producer is quoted a price of $2.40 for Houston Ship Channel, six-month strip. The first nearby contract has been above $2.35 only about 10 percent of the time since early 1994. Therefore, the price is not only attractive, the probabilities of the price remaining this high for a full six months is also very low. So, this would be an ideal time for the producer to lock in the entire index (both basis and underlying) in order to achieve a price for gas in the top 10 percent. Similarly, a consumer might wish to hedge the same index below $1.55.

There may be times when the basis itself is very attractive. Often this happens when the underlying price, such as NYMEX or Kansas City price, is not attractive.

An example case was the dislocation in prices between Ship Channel and NYMEX in early 1996. At that point the basis went to historical lows (-$1.01, according to Inside FERC versus NYMEX three-day average, January 1996), as the underlying moved to historical highs.

Considering that the median difference between the NYMEX and Ship Channel is -6 cents and the 20th percentile is -14 cents, this is an ideal hedge. These are two instances in which hedgers would be well off to hedge basis regardless of other considerations. ❐

Coming In November

The Independent Oil & Gas Association of New York held its 1997 annual meeting Sept. 23-24 in Buffalo. See complete convention coverage in the November issue of *The American Oil & Gas Reporter.*

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Cynthia A. Kase is the president of Kase and Company, where she leads a team that provides strategic advice in the form of hedge models, forecasts, risk management planning and education on an ongoing basis to energy companies. A CMT and CTA, Kase, an award-winning market technician, is a chemical engineer who began her trading career after 10 years in refinery and plant design. She became a trader at Chevron the year crude oil futures were introduced, and a derivatives trader for Chemical Bank months after the CFTC permitted the over-the-counter market.