Basis: The Key to Successful Livestock Hedging

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What is Basis?

Basis is probably the most important but least understood concept in hedging. Basis is defined as the difference between a cash market price and a futures market price. A basis may refer to any cash market price compared to any futures market price. For example, the difference between the Guymon, Oklahoma, cash market price for choice slaughter steers in October and the Chicago Mercantile Exchange (CME) live cattle futures market price for October delivery quoted in October is basis. If select and choice steers are selling at Guymon for $75.00 and if the Futures Contract price quotation is $74.00 at the CME, the futures basis for select and choice steers is $1.00. The term **basis** is not restricted to livestock of the quality represented by the futures contract. If the live cattle futures is quoted at $74.00 and mixed select and choice heifers are selling at $72.00 at Guymon, the quality adjusted basis would be -$2.00 for October cash, October futures on select and choice heifers.

Basis may also refer to different delivery times. Cash prices for September may be compared to October futures delivery prices. For example, a hog producer who expects to have hogs available for delivery in September would be interested in the September cash, October futures basis for live hogs. If September cash prices for his hogs are expected to be $2.00 less than October futures quoted in September, the relevant basis estimate for him is -$2.00.

Basis may also be different for different marketing methods and locations. Basis for a given quality of feeder cattle at a given time are likely to be different for Oklahoma City compared to Omaha, Nebraska, Sioux City, Iowa, and Georgia auctions. There may be significant differences between markets that are no more than 50 to 100 miles apart. So it is vitally important to understand that any time the term basis is used, it refers to specific qualities of product at specific market locations at specified delivery dates for cash and futures markets.

Why is Basis Important?

Basis is the key to successful hedging. Basis allows a producer to convert a futures price into a local price. First, basis estimates are essential in making the initial decision to hedge or not to hedge. Second, once the hedge has been placed, it is basis rather than price levels which determines the net result of the hedge. Hedging may be used as a method of forward pricing. The accuracy with which the relevant basis can be estimated determines the accuracy with which hedging can be used to establish a price for livestock before they are available for delivery.

The arithmetic of hedging brings out the importance of basis in the hedging process. Assume that a stocker operator in central Oklahoma is buying stocker calves in October to winter on wheat pasture and sell the following March. The producer wants to establish a price for the 600 pound choice feeder steers that are expected to be sold the following March. Estimated production costs helps establish a pricing objective or "asking price" of $93.00. The producer checks the CME feeder cattle futures and finds March futures quoted at $92.00. March cash-March futures basis for 600 pound choice steers are estimated at $4.00. This implies an expected hedged price of $96.00 compared to the $93.00 asking price, so he decides to hedge. Transactions and price relationships for the hedge are shown in Table 1.

The hedger sells March feeder cattle futures in October to initiate the hedge. The next spring, in early March, March futures are bought, offsetting the previous sale. The producer is thus free to sell his feeder cattle at the local market. Assume that March futures drop from $92.00 in October to $88.00 by early March. The hedger would then make a futures profit of $4.00/cwt. of cattle hedged. However, if the basis estimate is correct, local cash market price for feeder cattle in March will be $4.00 over the level of March futures. The cattle will be sold at the local market for $92.00 which is $4.00 less than the expected hedged price. The futures market profits must be added to the cash market price to realize the expected hedged price of $96.00.

Assume that cash market prices in March had been higher than the expected hedged price, say $99.00 instead of $92.00. The hedging results in this case are shown in Table 2. The October transactions are the same as in Table 1. But if the local feeder cattle price is $99.00 and the basis is accurately anticipated at $4.00, March futures prices will be $95.00. In this case, losses in the futures market of $3.00 offset the higher local cattle price, leaving the hedger again with a realized hedged price of $96.00. If the realized basis is equal to the expected basis, the realized hedged price will be equal to the expected hedged price, regardless of whether market prices at the completion of the hedge are higher or lower than price levels indicated when the hedge was placed.

Table 1. Arithmetic of a Hedge

	Futures Market	Cash Market	Basis
October	Sell March feeder futures at $92.00	Expected hedged price $96.00	Expected $4.00
March	Buy March feeder futures at $88.00 Futures $4.00 profit	Sell feeder cattle at $92.00 Difference $4.00	Realized $4.00 Difference $.00
	Pricing Results Local market price Futures profit Realized hedged price		 $92.00 +4.00 $96.00

Table 2. Arithmetic of a Hedge

	Futures Market	Cash Market	Basis
October	Sell March feeder futures at $92.00	Expected hedged price of $96.00	Expected $4.00
March	Buy March feeder futures at $95.00 Futures $3.00 loss	Sell feeder cattle at $99.00 Difference $3.00	Realized $4.00 Difference $.00
	Pricing Results Local market price Futures loss Realized hedged price		 $99.00 3.00 $96.00

Table 3. Arithmetic of a Hedge

	Futures Market	Cash Market	Basis
October	Sell March feeder futures at $92.00	Expected hedged price $96.00	Expected $4.00
March	Buy March feeder futures at $95.50 Futures $3.50 loss	Sell feeder cattle at $99.00 Difference $3.00	Realized $3.50 Difference $.50
	Pricing Results Local market price Futures loss Realized hedged price		 $99.00 $3.50 $95.50

The previous examples are called "perfect hedges" in that the hedger was able to anticipate perfectly in October the basis that would exist the following March. It is rare when the basis can be perfectly estimated in advance. But basis almost always can be predicted with more accuracy than price predictions. Thus, price uncertainty can be reduced if not eliminated by hedging. For example, in the previous hedging situation, assume that the realized basis was $3.50 rather than the $4.00 expected at the time the hedge was placed. This would imply a futures price of $95.50 compared to a cash price of $99.00 as shown in Table 3. The hedger would lose $3.50 in the futures market which would not quite offset the $3.00 premium of the local market price over the expected hedged price, leaving him with a realized hedged price of $95.50. Note that the realized hedged price will differ from the expected hedged price to the extent that the realized basis differs from the expected basis. This will hold true in all cases. In this case the basis estimate was in error by only $.50, which would probably be considered a reasonably accurate result in most livestock hedging situations. Realistically, hedging establishes a price within some range rather than an exact forward price because the basis is not precisely predictable.

Note that the hedger had to have a basis estimate to make the hedging decision. The basis was added to the futures price before it was compared to the asking price. A producer with different quality of cattle or at a different market location might have had a different basis. A producer who doesn't have a reasonable estimate of the basis that will exist when the hedge is completed does not know whether the hedge is a profit or a loss. If the expected hedge price is not known, the producer is in no position to make a hedging decision.

Once the hedge has been placed, it is the basis rather than price levels which determines the realized price. If the

producer is able to get a higher cash price relative to the futures price (that is, a more favorable basis), a higher price will be realized regardless of whether overall price levels are higher or lower than expected. Likewise, if the basis is weaker than expected, the realized hedged price will be lower than expected. As time approaches to complete the hedge, the producer should begin to carefully monitor local basis. It may pay the hedger to complete a hedge early if a more favorable basis is realized by doing so. On the other hand, waiting until well into the delivery month to complete the hedge may allow an unusually weak basis to come back into line with expectations. A producer should not be concerned with whether prices are rising or falling. Once a commodity is hedged, it is basis trends, not price trends, which will affect profits.

What Determines Livestock Basis?

Basis is the difference between a price in a futures market and a price in the cash market. At any point in time, the basis, like the prices on which it depends, is determined by product quality, location, time of delivery or by some combination of these factors. The cash price for a particular commodity differs among different qualities of that commodity, among different market locations, and among different market times. A futures market price is a price for a particular quality of the traded commodity, to be delivered at a specific location, at a specific time in the future by a specific delivery method. The quality, location, time and delivery method in the cash market are different from the quality, location, time and delivery method in the futures market. So, futures prices typically will be different from the cash prices. That is, the basis will be something other than zero.

As a futures contract delivery date approaches, the futures price and the cash price tend to become equal at par delivery points for product meeting the quality standards specified in the futures contract[1]. The reason for this equality is that on a delivery date, at a par delivery location and for product deliverable on the futures contract, the time, location, and quality characteristics represented by futures market price are identical to time, location and quality characteristics represented by cash market price. If futures market prices were higher than cash market prices, it would be profitable to buy the commodity on the cash market and deliver it through futures contracts. If cash market prices were higher, it would be profitable to buy through the futures market, accept delivery and sell the commodity on the cash market. The potential profit from such transactions (technically defined as arbitrage) insures that the futures and cash prices will approach equality at par delivery points as the futures contract approaches maturity.

The three dimensions of price differentials — market location, time of delivery, and quality of product — make up the basis. Since different markets represent one or more different dimensions of cash price, the basis may be different for each market. Thus, it is important for the hedger to determine local basis before attempting to use futures markets to forward price products.

Cash and futures prices for livestock might be expected to be slightly different even during the delivery month, at par delivery points, for livestock meeting the quality specifications of the futures contract. Livestock that are delivered in fulfillment of a futures contract must be graded and held in sealed pens at an approved stockyard prior to delivery. Thus, there may be costs associated with delivering in fulfillment of a futures contract that do not exist in the normal cash market method of marketing. Cash prices must be lower than futures prices by more than enough to offset these added costs before it will be profitable to buy in the cash market and deliver livestock through the futures market. It is this situation of being able to buy in one market and sell in another that brings cash and futures prices together. Thus, it is not unusual to observe some minor differences between cash and futures prices, even at par delivery points during the contract delivery month. Cash and futures will, however, tend to move up and down together during the delivery month. Thus, the basis or price difference due to added futures delivery costs is predictable.

If a prospective hedger normally sells livestock at any location other than a par delivery point, the appropriate basis estimate will include an estimate of locational price differences. For example, a par delivery point for live beef cattle futures contracts is Amarillo, Texas. A cattle feeder selling cattle in Oklahoma must consider the difference between Amarillo price and local market price to have an accurate estimate of basis. The producer knows that the futures price and the Amarillo cash price for contract quality cattle (quoted during the contract delivery month) will differ by no more than the futures transactions cost. Knowing the normal difference between Amarillo cash prices and local cash prices, the difference between futures prices and local cash prices can then be estimated. The reasons for price differences among different locations are differences in supply relative to demand among locations and costs of moving livestock and/or meat among locations.

The local market price may be for a product of a quality somewhat different from the quality represented by the futures market price. If this is the case, price differences between the futures market and the local market may not only reflect locational differences but may also reflect quality differences. If a producer normally sells livestock of a higher or lower quality than that represented by prices quoted in the futures market, local market basis must be adjusted to fit a particular product. For example, if a cattleman is hedging feeder heifers using the feeder steer contract, the basis might be less favorable by $5.00 or more. The basis estimate should reflect this quality difference.

Livestock basis estimates can be made most accurately only for the delivery month. Seasonal price patterns for livestock are often overshadowed by cyclical and random changes in livestock supplies. However, since contracts are

[1] A par delivery point is a location where commodities may be delivered in fulfillment of futures contracts with no discount subtracted from the quoted contract price.

not traded in all months, it may be necessary for the hedger to estimate bases for non-delivery months. In these cases the contract that matures nearest to but not before the time when the livestock will be available for delivery should be used. The greater potential for error in basis estimates should also be recognized.

Methods of Estimating Basis

There are two methods of estimating basis. One is to analyze the historical price relationship between futures prices and local market prices. The other is to calculate the actual cost of making delivery on a futures contract. In both cases, the hedger is attempting to estimate the price received for livestock relative to a price quoted in the futures market at the time of delivery. The historical price method is by far the most widely applied method of basis calculation. With this method, the hedger compares past local market prices with past futures prices to determine the average size and variability of the difference. The hedger should be sure that the cash and futures prices used are applicable in estimating the basis expected to exist when the hedge is completed.

Basis relationships are largely dependent on cash price relationships between futures delivery points and local markets, since cash and futures prices tend to equalize at par delivery points as contract maturity approaches. Differences in cash prices among markets are determined by patterns of trade among geographic locations and associated costs of transportation. Since trade patterns and transfer costs are relatively stable and predictable from year to year, the futures-cash basis also tends to be stable and predictable. Although basis is generally more predictable than levels of cash prices, this does not imply that there are no significant basis variations. The basis may vary with variations in relative supply and demand, changes in production costs among regions, changes in transportation costs, changing government programs or short-run shortages or surpluses at the local market. Understanding these sources of variation may assist the hedger in successfully completing a hedge.

The second method of basis calculation implies that the hedger at least has the potential for making delivery on the futures contract. The seller has the option concerning time and place of delivery. But, the seller must bear all delivery costs. These costs include insurance, shrinkage, interest, charges, quality discounts, cost of obtaining deliverable quality livestock, and all commission and grading fees. Transportation cost to get the livestock to the delivery point must also be considered.

Actual costs of making delivery depend on the individual situation, but it is not unreasonable to assume that delivery costs amount to $1.00/cwt. or more, excluding transportation costs. The direct cost method of calculating the basis will generally result in a wider basis for the hedger than the historical average of cash and futures prices difference. And as seen previously, the hedger need not make delivery to complete a successful hedge. Thus, it will rarely if ever be advisable for an average hedger to make delivery to fulfill the futures commitment. The large commercial cash brokers typically make deliveries when necessary and thus make hedging feasible without delivery for other hedgers. Livestock not fitting the quality definition of the futures contracts may also be hedged if the basis is appropriately adjusted to reflect this quality difference. For example, heifers may be hedged using a steer contract. Obviously, in such cases delivery is impossible, so the historical price method of basis calculation is the only applicable method in such cases.

An important question in any hedging activity concerns the variability of the basis estimate. Basis for par delivery points for deliverable quality livestock at the time during delivery would be expected to be the most easily estimated. The greater the differences in location, quality and time from that represented by the futures contract, the greater the expected variability. Regardless of the basis calculation method or basis variability, adjusting a futures price for the basis is an absolutely essential step in the hedging process.

Cash Settlement and Feeder Cattle Basis

In 1986, physical delivery of feeder cattle for the feeder cattle futures contract was replaced with cash settlement. At maturity, all feeder cattle contracts are cash settled against a composite index of current cash feeder cattle prices from a wide geographic area instead of being physically delivered and sold at a specific location. Cash settlement is discussed in more detail in OSU Extension Facts 509.

With cash settlement, a producer who chooses to hold a futures position until the contract matures would still be able to sell the cattle in a local cash market. The producer's futures position would be offset by the value of the cash settlement index on the day of expiration. Of course, offsetting the futures position with an opposite futures transaction prior to contract maturity would still be the most common way of removing the futures market obligation. However, the opportunity to arbitrage the futures market against the cash settlement index is what forces the futures and cash markets to come together at contract expiration in the same manner that physical delivery would.

Because of the difference between the cash settlement price index and feeder cattle prices at specific locations, feeder cattle basis relationships changed after cash settlement was implemented. OSU Extension Facts 499 and 500 provide estimates of feeder heifer and steer basis for Oklahoma City since cash settlement began. Conceptually, the use of futures and options and the interpretation of basis is the same with cash settlement as it is with physical delivery. Only the magnitude of the price relationships between specific locations and the feeder futures price was affected by the implementation of cash settlement.

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