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Basis Hedging

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BASIS HEDGING

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Once the concept of the hedge has been learned it becomes clear that the essence of hedging lies in basis trading.

The purpose of this publication is to outline the concept of basis and how it can be used for hedging purposes. It would be helpful indeed, if the reader were first familiar with the concept of hedging such as outlined in EC-314, "How Farmers Use Futures to Reduce Risk." To illustrate the principles and examples used in this text, consideration should be given to utilizing practical workshop exercises such as those contained in "A Workshop Exercise in the Pre-Harvest Hedge," and/or "A Workshop Exercise in Hedging Hogs on the Live Hog Futures Market."

Review *

1. Futures contracts are promises to deliver or accept delivery of a given quantity of a specified commodity at an agreed upon price at some future date in time called an option month.

    a. Most contracts mature about 7 business days prior to the end of the option month.

2. Contracts may be entered into through selling (promising to deliver) or buying (promising to accept delivery) by placing an order with a commodity broker with whom you have established an account (proven financial creditability).

    a. Commitments to deliver made by selling futures are termed "short."

    b. Commitments to buy or accept delivery are termed "long."

3. Contracts which had been sold may be covered (cancelled) by purchasing an offsetting position prior to maturity of the option. **

4. Contracts which had been purchased may be liquidated by selling an offsetting contract. **

Hedging

Hedging offers a way for individual producers to protect themselves against one of the most volatile factors in farm businesses -- that of price change. While use of the hedge cannot guarantee the producer a profit, it can be used to establish a net market value for commodities in advance of their sale. From this standpoint, hedging offers the producer protection from rapidly changing, erratic price movements.

Obviously, the possible net market value or "lock-in price" resulting from the hedge will be different for hedges entered into at various points in time. The "lock-in price" may be relatively high or low for any given contract depending upon when that contract was entered. The price at which futures contracts are trading depends upon a host of economic, technical, and psychological

* See Publication EC-314, How Farmers Use Futures to Reduce Risk.

** While a contract to sell (or buy) may be placed by depositing the required margin (5 to 10 per cent of the value of the contract) with the broker any losses (gains) which are incurred are computed at the actual total rate of loss (gain). Losses may require substantial additional deposits be made with the broker if the account is to be held open.

factors affecting the market. Futures prices can vary considerably over the life of any particular contract option.

Learning to hedge will not guarantee that you can select the "right time" or "highest price" at which to hedge, but it will aid you in this direction as you will become a much more able marketer once you have laid your money "on the line." You will know more about where prices have been, where and why they got to where they are, and where they are likely to go.

In its simplest form, the hedge is undertaken by determining a "lock-in price" that the hedger is willing to accept. By diligently watching the futures market, and careful assessment of the cash market, the hedger determines the appropriate time and number of contracts for which he wants to "lock-in" a price and then (if he is protecting himself against a price decline) sells a futures contract which will mature as near to the time he plans to sell the cash commodity as possible:

Sell July Futures, $1.85/bu., Chicago = "Lock-in Price" *

The above hedge appears simple enough, but most farmers won't want to deliver to Chicago because of costs, risks and timing factors. Besides, if everybody delivered to Chicago, there wouldn't be room. Most farmer hedgers are interested in "locking-in" a price which reflects their local market price levels. How then, does one determine what the "lock-in price" for the commodity will be, if the commodity is to be sold locally at some future date?

Basis

To determine the local "lock-in price" we are likely to receive, we must know the relationship of the futures price (Chicago Board of Trade or Chicago Mercantile Exchange) to the cash price (local elevator, or livestock market) for the time we are intending to turn the hedge (sell cash commodity and cancel the futures commitment). This relationship between the futures price and the cash price is called "basis":

Futures Price - Cash Price = Basis

Basis is nothing more than the difference between the cash and futures price for a given contract at a given point in time. For example, if December corn futures, in mid November were selling for $2.00/bu. and local corn prices were $1.75/bu. that same day, then basis would be $.25 "under December" (cash under futures). *

Basis follows certain somewhat predictable patterns over time and with a knowledge of basis and basis changes, hedgers are able to determine their potential profit from production as well as estimate the likely price they could receive at some future point in time, if they were to hedge.

The most important fundamental principle of basis is that it usually becomes "narrower" as the futures transaction reaches maturity. This means that as the transaction matures, the cash price and the futures price converge. It can easily be seen that if the futures price remained higher than the cash price, immediately prior to contract maturity, a speculator could sell a futures contract and then immediately fulfill that contract by purchasing cash corn at the delivery point (or a warehouse receipt for cash corn) and deliver on his commitment. Thus, the speculator-seller, in this case, would make a profit at the speculator buyers expense. In actual practice the price

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* On any given day there exists a different basis for each "open" futures option. Basis may also be referred to relative to what it has been historically at a given time for a given option, or to what the numerical value of basis is "anticipated" to be at some future time.

spread between cash and the maturing futures would not normally be expected to offer such an opportunity, but when the situation does occur, speculators would be expected to quickly narrow the gap by their trading activities. A futures market that does not normally behave in this manner (narrowing of the basis) cannot be easily used by hedgers. Theoretically, the futures price at the point of delivery would not exceed the cash price by more than the cost of delivering to satisfy contract commitment.

Another major principle of basis is that it usually follows a more definite pattern from year to year than price movements, therefore making basis somewhat predictable. A qualification to this statement is necessary. This principle is generally true for commodities which are storable. Basis, however, is not predictable with any great amount of reliability for nonstorable commodities such as livestock until about 8 or so weeks prior to contract maturity because of the difficulty in predicting forthcoming supplies. *

Since basis patterns are of a recurring nature, it is possible to use basis as a tool in the hedging operation. To use basis, the individual must equip himself with the historical basis patterns in his area or he must begin to record basis patterns for future use.

At this point, it should be pointed out that hedgers do not completely eliminate price risks through hedging, but rather price risk is substantially reduced. While basis is often thought to be more predictable than price, the prediction is still subject to error.

Basis patterns, then, do follow somewhat predictable and identifiable patterns over time. It is for this reason, we want to study and use basis in the hedging operation. A key to successful hedging lies in the accurate estimation of basis at given points in time.

As an example, suppose it is known that on November 15, local basis will be cash, $.24 under December futures. Assume the hedger sells a December futures option in April (pre-harvest hedge) for $1.77/bu. Further, as stated above, assume the hedger knows that local cash prices will be $.24 under futures come November 15, no matter what level November 15 cash and futures prices turn out to be. If the preceding assumption turns out to be true, the November 15 "lock-in price" will be equal to the December option futures price, which can be contracted in April, minus the estimated local basis at the time the hedge is turned (November 15). In this example, the "lock-in" equals $1.77/bu., minus $.24 = $1.53/bu. No matter what the price of cash corn at delivery time, the hedger will receive $1.53/bu. as long as the local basis at the time the hedge is turned (November 15) equals $.24/bu. under December futures:

Sell December Futures @ $1.77/bu.
- $.24 (est. local December basis on Nov. 15) = $1.53/bu. "lock-in"

In the above example it can be seen that the futures market can be used by hedgers to "lock-in" a return. In this example, we have been dealing with what is called the pre-harvest hedge. The hedger attempted to determine what the local basis would be at the time he was planning to sell his cash commodity in order to determine a "lock-in price." The "lock-in" rule is:

* For both storable and non-storables, basis may vary from the "norm" at any given point in time because of both fundamental supply and demand adjustments in the market as well as a host of technical factors. It must be recognized that some over-simplification has been made in this publication to reduce its length and enhance its educational value.

"Lock-in price" = (Price at which the futures is sold) - (estimated closing basis when the hedge is turned)

In the example, the ideal situation is illustrated, that is December basis turned out to be $. 24/bu. under in November, just what this hedger had anticipated it would be, back in April. Of course, this is the hypothetical case for it is unlikely that the hedger would be able to estimate basis quite this close. Even so, in normal years he should be able to estimate basis within a few cents per bushel.

A re-examination of the preceding example will show that had the actual basis turned out to be wider (greater than $. 24/bu.) in November than what the hedger had anticipated, he would have received a somewhat lower net return per bushel. Had basis been narrower than what he anticipated, he would have received a somewhat higher net return.

While futures can be used by hedgers to lock-in a return, the size of the return is a different story. In the example, the hedger might have locked-in a lower or higher price depending upon the level at which he had sold futures in April. It is this ability to assess markets and to enter hedges at logical times that makes the difference between a so-so and a successful hedger. This means studying both cash and futures markets constantly. It means managing your marketing as you manage your production. Following are logical steps to be taken in successful hedging:

1. Constant observation.
2. Reading trade and other related literature.
3. Record keeping.
4. Analyzing.
5. Decision-making.

Charting Basis

Basis is generally peculiar to a given location, and basis patterns vary from one location to another. Local basis is determined by factors such as distance from major markets and transportation which serves that location. * It is, therefore, important that the hedger chart basis in relation to the area in which he markets the commodity.

As was pointed out earlier, basis tends to be repetitive from year to year. Thus, if an individual charts basis, he can then visualize the trends and patterns of the market (both cash and futures).

Basis is relatively simple to chart. Futures prices can be obtained weekly or daily from any newspaper carrying quotes from the Chicago Board of Trade or the Chicago Mercantile Exchange. Cash prices can be obtained from local elevators, livestock markets, newspapers, etc. It is important that cash prices be obtained locally for reasons previous stated. This data can then be easily entered into table form as illustrated in Table 1.

Establishing a Corn Price at Planting Time (Pre-Harvest Hedge)

Assume that it is April and farmer Jones, in considering his financial position, feels it would be advantageous for him to guard himself against a possible relatively low harvest time price during mid November. He decides to hedge a portion of his corn crop by selling December futures. In this case he needs to consult his historical basis records for his local market. He checks his basis charts from previous years and makes a judgment as to what basis is likely to be at harvest time (November) or for the time he is planning to turn the hedge.

* Additional factors which determine the size of basis during a given year and help account for the variation in basis from year to year include: crop size, harvest conditions, storage availability, amount and prices of forward sales, etc.

Table 1. Illustrative, July, December options, basis table

Date	Local Cash	Futures Option		Basis	
		December	July	December	July
	- - - - - dollars per bushel - - - - -				
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
10/23	1.46	1.61	1.75	.15	.29
10/24	1.49	1.63	1.76	.14	.27
10/25	1.49	1.64	1.76	.15	.27
10/26	1.51	1.65	1.77	.14	.26
10/29	1.52	1.64	1.77	.12	.25
10/30	1.54	1.64	1.77	.10	.23
10/31	1.52	1.62	1.73	.10	.21
11/1	1.52	1.61	1.71	.09	.19
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

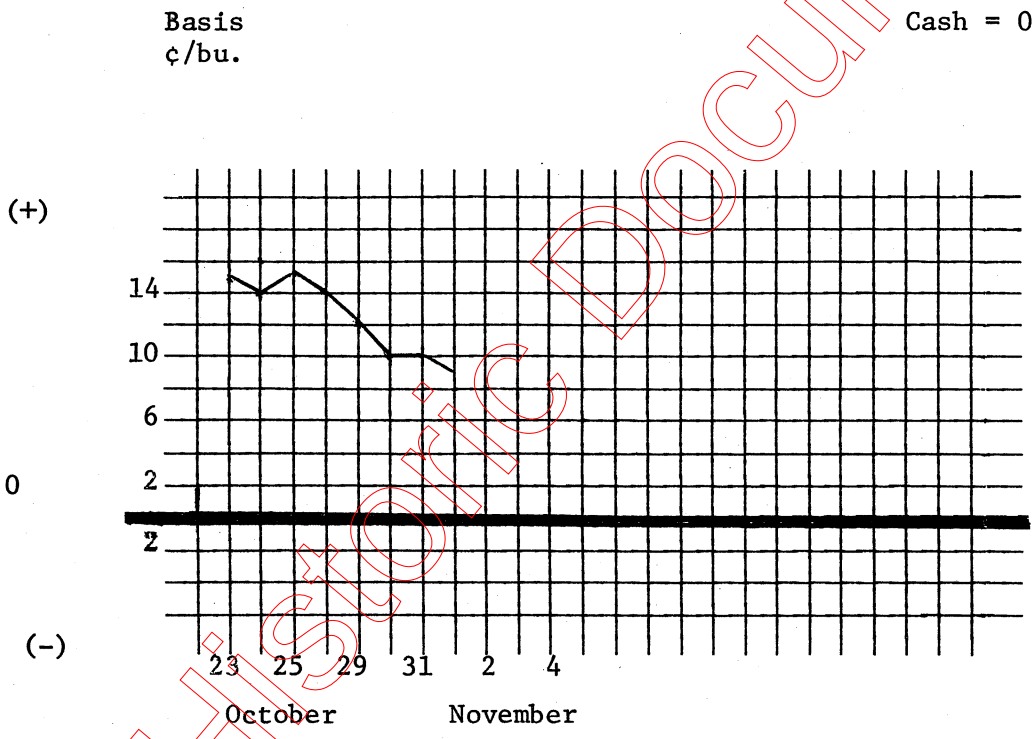

Figure 1. Illustration Showing Plotting of December Basis from Table 1

For purposes of this example, he estimates basis will be $.18 under during mid November for a December contract. If the December futures option price for corn in April were $1.65/bu., farmer Jones' estimated "lock-in" price would be $1.47/bu. when he

sells his grain at harvest; i.e., the "lock-in" = the futures price at which the December option is sold, minus the anticipated basis when the hedge is to be turned:

Date	Cash Market	Futures Market	Basis
April	Est. Mid-November "Lock-in Price" - $1.47	Sell, Dec., $1.65/bu.	Est. Basis (Mid-Nov.) $.18
Mid-Nov.	Sell - $1.35	Buy, Dec., $1.53/bu.	$.18
		+ $ .12	

If the cash price declines to $1.35/bu. during harvest, the futures price would likely be $.18 higher than the cash price if basis were anticipated correctly, as it was in this case. The farmer gains $.12 from the futures transaction. This value added to the cash price received of $1.35/bu. would give the farmer a net of $1.47/bu., which is what he had "locked-in", back in April.

Had the basis turned out to be $.16 when the crop was harvested and sold, the gain in futures would have been $.14 and the net price received would have been $1.49/bu., $.02/bu. over the lock-in price anticipated. If the basis rose, say to $.20, then the gain on futures would have been $.10/bu., and the net price received would have been $1.45/bu., $.02 less than anticipated.

The Storage Hedge

The storage hedge can be accomplished in a manner similar to the pre-harvest hedge. An estimated closing basis can be obtained and this value subtracted from the current futures quotation:

In November	July Futures	$1.70/bu.
(Cash Market $1.35/bu.)	July Est. Basis	.10/bu.
		$1.60/bu. "lock-in"

The "lock-in price" estimate during November, if the hedge were turned in July, is $1.60/bu.

If the cash market were $1.35/bu. during the November previous, the return to storage in the above example, would be an estimated $.25/bu., ($1.60/bu. July "lock-in" - $1.35 cash market the November previous = $.25/bu., return to storage).

The storage hedge may be of use to farmers storing grain. At times the market offers a "carrying charge" (return to storage) which may be of considerable value to farmers storing grain, though it is true that over the years cash market returns from storage have not been highly risky.

Table 2 and Figure 2 illustrate data used in the storage hedge in the example to follow. The figure shows basis data from Table 2. Only 1 year is shown here for simplicity. Remember:

1. If ending basis is to be known -- historical basis records must be kept, so keeping a running basis chart will be invaluable to the hedging process.

2. The basis chart reflects no more than the difference between cash and futures prices over time. It can be kept in a number of ways and this is but one example.

3. While basis tends to be repetitive from year to year, deviation from the "norm" or average should be expected. Where possible, these deviations need to be anticipated in advance. Talk "basis" with knowledgeable individuals and others involved in the hedging process.

Table 2. Illustrative basis table showing data used in the example cited in the section entitled, "Storage Hedge."

Date	Local Cash	Futures Option July	Basis - July
	- - - - dollars per bushel - - - -		
.	.	.	.
.	.	.	.
.	.	.	.
Nov. 1	1.56	1.91	.35
.	.	.	.
.	.	.	.
.	.	.	.
July 10	1.86	1.96	.10
.	.	.	.
.	.	.	.
.	.	.	.

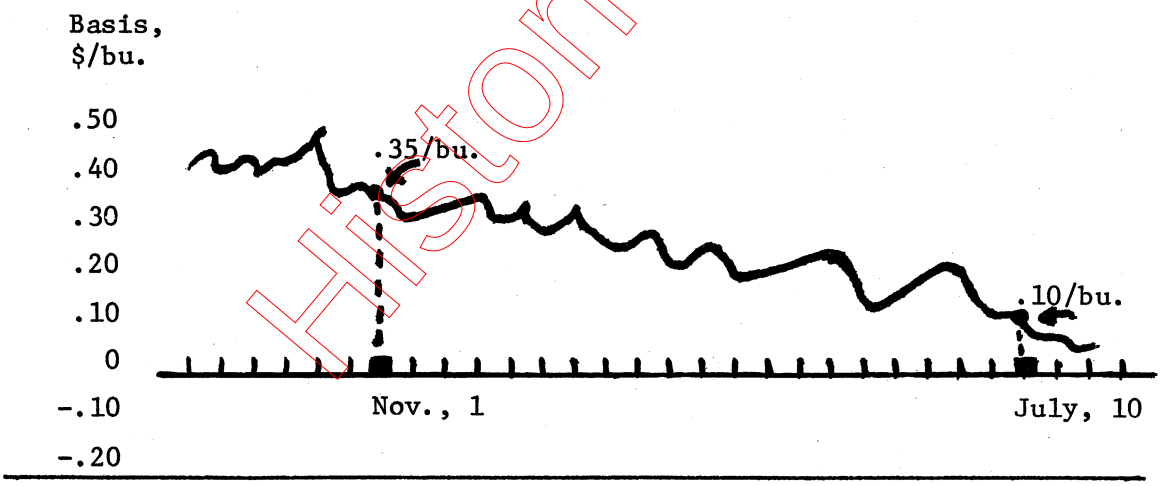

Figure 2. July option basis chart derived from data illustrated in Table 2. Data used in the example cited in the section entitled, "Storage Hedge."

Assume farmer Jones made the decision, on November 1, to store a given quantity of grain for future sale. Let us assume that sale is to be made in late June or early July (July 10) of the following year. Farmer Jones wishes to assure himself of a return to storage. At current cash - futures price relationships, it looks as if such a return is possible. He decides to sell July futures.

From historical basis charts (page 7) it is observed that basis from November to July can be expected to narrow by about 25¢ per bushel (35¢ basis in November minus 10¢ basis in early July). Farmer Jones estimates that if basis, today (November 1) were about $. 35, he would expect basis in early July to be about $. 10/bu.

The local cash grain price on November 1 is $1. 35/bu. He can and does sell July futures at $1. 70/bu. on a current basis of $. 35/bu. He figures his return to storage will be $. 25/bu. (See example below.)

On July 10 farmer Jones finds he is able to sell his cash corn locally for $1. 65/bu. Basis, indeed, does turn out to be $. 10/bu., and therefore the futures price, $1. 75/bu.

Under the above situation, illustrated below, farmer Jones loses $. 05 in the futures market which he subtracts from the price received for the cash commodity, for a net value for his corn of $1. 60/bu.

Using the "lock-in" rule -- back in November he sold futures for $1. 70/bu. and anticipated the July 10 basis to be $. 10/bu. Therefore, on November 1, his anticipated lock-in was $1. 60/bu.

Farmer Jones knew on November 1 the basis was $. 35/bu., and he estimated the July basis to be $. 10/bu. This change in basis, equal to $. 25/bu., would be what he would receive as a return to storage. Indeed, the cash price rose from $1. 35/bu. on November 1 to $1. 65/bu. on July 10 for a $. 30/bu. gain in price, but farmer Jones lost $. 05/bu. in the futures market making his total returns from storage equal to $. 25/bu. In this case, his "insurance" cost him $. 05/bu. (in addition to interest on margin capital and brokerage fees for the "round turn"):

Date	Cash Market	Futures Market	Basis
Nov. 1	$1. 35/bu.	Sell, July, $1. 70/bu.	$. 35/bu.
	Est. July "Lock-in" price - $1. 60/bu.		$. 10/bu. (est. for July 10)
July 10	$1. 65	Buy, July, $1. 75/bu.	$. 10/bu.
		− $. 05	

Basic Hedging Postulates

Following are three basic rules which will always be true in hedging transactions. These rules and why these rules work must be understood by the hedger. Use the preceding examples to test the accuracy of the postulates:

P_1 The change in basis from the time the hedge is entered until the time the hedge is exited (turned) is equal to:

a. Returns from storage (in a storage type of hedge, the cash price alternative at the time the hedge is entered is used for calculating entering basis. Obviously, then any gains made through basis narrowing from entry to exit, are the same as returns from storage).

b. Profits from production. (In a hedge such as the preharvest hedge or a livestock hedge, where the commodity under question is not in storage, the cost of production should be used in calculating the basis when entering the hedge. The resulting change in basis (from entry to exit) will be equal to the profits gained from producing the commodity. That is, the cost of production per unit subtracted from the net returns from sale).

P_2 (Prices at which the futures are sold)- (estimated closing basis) = "lock-in price."

P_3 (Production costs) + (the change in basis [from entry to exit]) = "lock-in price." (See notes a and b in P_1 above.)

Hedging Hogs and/or Cattle *

There are two very basic information needs the hedger should know and understand prior to hedging livestock. These are:

1. Production costs
2. Basis patterns (and lack of patterns).

Once these are known and understood, profit or loss prospects from hedging can be easily estimated.

Theoretically, the difference between futures prices and cash prices narrows to zero as the time to contract termination or maturity shortens. Such a "narrowing of the basis" usually occurs in the hog futures market during the last 8 or 12 weeks prior to contract closing.

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* While hogs are used as an example in this section, the principles and methods used are similar for hedging cattle.

Basis at the par (delivery) market (Peoria) tends to close to plus $. 60 to $. 80/cwt. (futures minus cash equals $. 60 to $. 80/cwt.) If hedgers were to deliver hogs to Peoria on a futures commitment, the cost of delivery (not including transportation and shrink) would be about $. 60/cwt. A study of delivery costs at the prime market (Peoria) disclosed at-market delivery charges as shown in Table 3.

For use by farmers, basis must be localized -- that is the cash price differential between Peoria and their normal market outlet must be calculated.

A summary of basis for the par market, Peoria, and interior Indiana is given in Table 4. The study reflects basis for the last 8 weeks prior to maturity for all contracts during the years 1968-1972. Note, particularly, that basis tends to be smallest during the last few days before contract maturity, and gradually gets larger as the time period to contract maturity gets longer.

Note that basis at the par market tends to be smaller near contract maturity than basis for interior Indiana markets. This is because interior Indiana prices run somewhat under par market (Peoria) prices. We would therefore expect a wider basis.

Note also that both a positive and negative basis is shown. A positive basis reflects the fact that futures prices were at a premium over cash prices. A negative basis reflects the fact that futures prices closed on cash prices from a negative side, i.e., futures prices lower than cash prices. This latter case is much more infrequent than the case of the positive basis. Even when futures prices are below cash prices, early in the life of a contract option, they will often revert to the positive side prior to delivery. Expect in most cases, that basis will be positive, i.e., futures at a premium over cash during the close of futures options in hogs. This is because there is a positive cost to delivery.

Note that basis narrows as the time to contract maturity becomes shorter. This narrow basis is advantageous to the "short" hedger. It results in a higher "lock-in price" (futures price minus the estimated closing basis = estimated lock-in price). The smaller the estimated closing basis, the higher the estimated "lock-in" price (true when futures prices close at a premium to cash prices). This is why, when hedging in livestock options, one should plan to have his hogs ready to market as close to contract maturity as possible.

One additional factor should be mentioned which Table 2 does not illustrate. The variance in the size of basis is much greater the further in time a contract is from maturity. That is, the average Indiana positive basis at 8 weeks prior to contract maturity is shown to be $1.49/cwt. This may vary from less than a dollar to more than 2 or 3 dollars/cwt. Variance in the expected range in basis usually gets smaller as contract maturity is approached.

In the following example an attempt will be made to prove the postulates developed previously in this bulletin:

An Example of a Hog Hedge

Farmer Jones estimates production costs for his hogs to average $28. 00/cwt. He observes that futures are selling for $34. 00/cwt. (This is a futures contract which matures during the month farmer Jones' hogs will be ready for market.) Farmer Jones calculates

an estimated basis using production costs and a futures price as explained in Postulate 1 (b) ($34.00/cwt. futures price - $28.00/cwt. production costs = $6.00/cwt.), $6.00/cwt. entering basis minus $1.00/cwt. estimated closing basis equals a change in basis of $5.00/cwt. This is the estimated profit which would be expected if the hedge were undertaken.

By examining historical basis patterns farmer Jones predicts (estimates) the basis for the time he will be ready to market his hogs and turn his hedge, to be $1.00/cwt.

Diagrammatically:

Date	Cash Market	Futures Market	Basis
Now	$28.00/cwt. prod. costs $33.00/cwt., est. "lock-in" price	Sell, Futures, $34.00/cwt.	$6.00/cwt. $1.00/est. basis when hedge is turned
When hedge is turned and hogs marketed	Sell, cash $31.00/cwt.	Buy, Futures, $32.00/cwt.	$1.00/cwt. actual basis

The preceding example demonstrates:

P_1 (1) Profit = $ 6.00 - $1.00 = $5.00/cwt.

P_2 (2) Lock-in Price = $34.00 - $1.00 = $33.00/cwt.

P_3 (3) Lock-in Price = $28.00 + $5.00 = $33.00/cwt.

Knowledge of the postulated relationships is important to the understanding of the hedging process. Note, in the preceding example that changes in price levels, once the hedge is entered, do not affect the outcome of the hedge, as long as the closing basis is equal to $1.00/cwt.

Specifications for live hog futures contracts traded on the Chicago Mercantile Exchange including grades, weights, and delivery provisions are available from your Broker. Basically, one deliverable contract consists of 30,000 pounds of U. S. 1-3 hogs averaging 200-230 pounds, i.e., about 130-140 hogs. Some deviation from these terms is allowed and any person intending to deliver on an open contract should familiarize himself with complete contract specifications. Trading in live hog futures terminates on the 20th calendar day of the contract month or the business day prior thereto.

Though not covered in the preceding examples, costs of trading include the Broker's commission and interest on margin capital deposited with the Broker. These costs should be accounted for in estimating returns from the hedging operation.

Workshop Exercises

Two workshop exercises covering the pre-harvest hedge for corn or soybeans and the hedging of hogs on the live hog futures market are contained in Extension publications "A Workshop Exercise in the Pre-Harvest Hedge," and "A Workshop Exercise in Hedging on the Live Hog Futures."

Table 3. Estimated delivery charges, hogs, at Peoria, based on study, * of 282 head, average weight 210 pounds

Item	Cost/head
Yardage	$ .50
Feed	.06
Insurance	.05
Commission	.47
Grading	.09
Total/head	$1.17

* Source: Chicago Mercantile Exchange.

Table 4. Average basis (futures prices less cash prices) for all hog contracts, 1968 through 1972, PAR market (Peoria) and interior Indiana (dollars per hundredweight)

		Week								Day			
Market	Basis	8	7	6	5	4	3	2	1	4	2	1	Close
Par	Negative	-1.51	-1.05	- .92	- .82	- .79	- .71	- .50	- .34	- .41	- .11	- .18	- .25
	Positive	1.96	1.75	1.17	1.03	.94	.84	.91	.66	.64	.69	.72	.71
Ind.	Negative	-1.82	-1.51	- .66	- .65	- .53	- .49	- .43	- .33	- .09	- .00	- .00	- .00
	Positive	1.94	1.57	1.35	1.47	1.15	1.06	.86	.76	.79	.95	1.10	.95

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