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Commodity Options as Price Insurance for Pork Producers – Pork Industry Handbook
Michigan State University Cooperative Extension Service
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pork industry handbook

Michigan State University Extension

Commodity Options as Price Insurance for Pork Producers (Key words: Options, Futures, Forward Pricing, Price Risk Management)

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Most pork producers are familiar with insurance. Producers insure buildings against fire, equipment against accidents, and their lives against death or injury. Insurance buyers trade a small but certain loss by paying an insurance premium to guard against the possibility of a large but uncertain loss.

In pork production, one of the greatest risks faced is that of unfavorable price change. Market hog prices have been so uncertain that many times prices expected to be profitable – when decisions were made regarding facility investment, breeding or feeder pig purchases – ended up unprofitable instead. Additional risk also may be incurred on the feeding side as feed price increases and may “wipe away” anticipated profits.

Because of these risks, producers might want to “insure” against unfavorable hog or feed price moves while retaining their ability to profit from favorable price changes. Producers have this opportunity by using the commodity options market.

What is the Commodity Options Market?

The commodity options market is a market in which producers may purchase the opportunity to sell or buy a commodity at a specified price. Purchasers in these options markets have the “opportunity” but not the “obligation” to exercise their agreement. Therefore, the markets are appropriately named “options markets” since they deal in an option, not an obligation.

Just as pork producers may purchase the right from an insurance firm to collect on a policy if their buildings burn, they can purchase the right to sell their commodities at a specific price if prices go below the specified price. A separate market exists to purchase the right to buy com-

modities at a specified price if prices are higher than the specified price.

So there are actually two separate commodity options: one that insures products for sale against price declines and another that insures products purchased against cost increases.

For instance, if one desired to buy the right to sell hogs for no less than \$66/cwt. of carcass, the lean hog options market might provide the opportunity. By paying the market determined premium, one could then collect on the option if prices are below \$66/cwt. when the hogs were actually sold. If prices are higher than \$66/cwt., the hogs are sold for the higher price, and the cost of the premium is absorbed.

While this is a simplified version of the actual way in which producers operate in the options market, the concept is a very simple one. Just as with other types of insurance, by paying a premium, insurance can be purchased against price declines or increases. One would collect on the option (policy) only if the price moves in an unfavorable direction.

The “In’s and “Out’s” of Options – Puts and Calls

As mentioned, there are actually two types of commodity options: a *call option* and a *put option*. The call option gives the holder the right, but not the obligation, to buy the underlying commodity from the option writer at a specified price on or before the option expiration date. The put option gives the holder the right, but not the obligation, to sell the underlying commodity to the option writer at a specified price on or before the commodity expiration date. The call option and the put option are two distinct contracts. A put option is not the opposite side of a call option. Distinguish the two types of options by

remembering that the holder of the put option can choose to "put-it-to-them," that is, sell the product, while the holder of the call option can "call-upon-them" to provide the product.

Buyers and Sellers

In the option market, as in every other market, each transaction requires both a buyer and a seller. The buyer of an option is referred to as an option holder. Holders of options may be either seekers of price insurance or speculators.

The seller of an option is sometimes referred to as an option writer. The seller also may be either a speculator or one who desires partial price protection. Whether one chooses to buy (hold) or sell (write) an option depends primarily upon one's objectives.

Buyers and sellers of lean hog options "meet" on the Chicago Mercantile Exchange. Rather than physically meeting, all transactions are carried out through brokerage firms which act as the buyer and seller representative at the exchange. For this service, the brokerage firm charges a commission. The exchange has no part in the transaction other than to insure its financial integrity. In effect, the exchange offers a place for option buyers and sellers to get together under organized rules of trade.

Strike Price

The "specified" price" in the option is referred to as the exercise price or strike price. This is the price at which the underlying commodity can be exchanged and is fixed for any given option, put or call. There will be several options with different strike prices traded during any period of time. If the price of the underlying commodity changes over time, then additional strike prices may be traded.

Underlying Commodity

The "underlying commodity" for the commodity option is not the commodity itself but rather a futures contract for that commodity. For example, an October lean hog option is an option to obtain an October delivery lean hog futures contract. In this sense, the options are on futures and not on the physical commodity.

Because options have futures contracts as their underlying commodity, each options contract "stands" for the same quantity as the underlying futures contract. Most grain options represent 5,000 bushels of grain and the Soybean Meal option, 100 tons of meal. The lean hog option represents 40,000 pounds of carcass or about 220 head of 245 lb market hogs yielding 74% of hot carcass weight.

Expiration

Futures contracts have a definite predetermined maturity date during the delivery month. Likewise, options have a date at which they mature and expire. The specific date of expiration for the lean hog options and futures contracts is the 10th business day of the contract month. For example, a \$66/cwt. October lean hog put option is an opportunity to sell one lean hog October futures contract at \$66/cwt. This option can be executed by the holder on any business day until it expires. The lean hog futures contract and option expire on the same day. However, most grain options expire prior to their underlying futures

contract. Upon expiration, the option contract becomes worthless.

Option Premiums

The put or call option writer is willing to incur an obligation in return for some compensation. The compensation is called the option premium. Using the insurance analogy, a premium is paid on an insurance policy to gain the coverage it provides. Likewise, an option premium is paid to gain the rights granted in the option. The premium is determined by public outcry and acceptance in an exchange trading pit, and like all commodity prices, it can be expected to change daily.

While the interaction of supply and demand for options will ultimately determine the option premium, two major factors will interact to affect the level of premiums. The first factor is the difference between the strike price of the option and the price of the underlying commodity.

This differential in prices may give the option "intrinsic" value. For example, consider an October lean hog put option with a strike price of \$66/cwt. If the underlying October lean hog futures contract was trading at \$65/cwt., the option could be sold for at least \$1/cwt. Other traders should be willing to purchase the right to sell at \$66 when the market is currently \$65. In this example, the \$1 is said to be the intrinsic value. As long as the market price on the underlying futures contract is below the strike price on a put option, the option has intrinsic value. Of course, the converse of the price relationship is true for a call option. A call option has intrinsic value when the market price is above the strike price.

Any option that has intrinsic value is said to be "in-the-money". An "in-the-money" option has value to others because the market price is below the put or above the call strike price. An option is said to be "out-of-the-money" and has no intrinsic value if the current market price is above the put or below the call strike price. When the market price of the commodity and the strike price are equal, the option is said to be "at-the-money," and will have no intrinsic value.

A second factor that will influence the option premium is the length of time to expiration of the option. Assuming all else is held constant, option premiums usually will decline in value as the time to expiration decreases. This phenomenon reflects the time value of an option. For example, in March the time premium on a \$66 June hog option will be less than the premium on a \$66 August option. The option with a longer time to expiration has a greater probability of moving "in-the-money" than the option with less time. Therefore, it is worth more on that factor alone. The longer the time period, the greater the chance that events will occur that could cause substantial movement in futures prices and change the value of the option. As a result, the option writer requires a greater premium to assume the risk of writing a longer term option.

"Out-of-the-money" options have a value that reflects time value. "In-the-money" options possess both time value and intrinsic value.

Offsetting an Option

The method by which most holders of "in-the-money" options will realize any accrued profit is by resale of the option. This is referred to as "offsetting" an option position.

Options can be offset any time between their purchase and expiration date if the holder so desires. Most option buyers will offset their position rather than exercise the option to avoid losing any remaining time premium and (or) assuming a futures market position and its resultant decisions, margin deposits, and commissions. In most situations, the option can be resold to another trader at a premium at least equivalent to the intrinsic value that results from an "in-the-money" price relationship.

Exercising an Option

Another method by which the holder of an option could realize accrued profit is by "exercising" the option. The decision to exercise an option lies only with the option holder. The opportunity to exercise the option means the option buyer can always get the intrinsic value of the option premium even if there is little or no trading in the option being held, and thus no opportunity to offset the option. It also provides for a means of continuing price protection after the option expires. If the decision is made to exercise, the following procedures are followed. For a put, the holder is assigned a short (sell) position in the futures market equal to the strike price. At the same time, the option writer is assigned a long (buy) futures position at the same price. Both positions are then adjusted to reflect the current settlement price. It is rational to exercise a put option only when the futures market price is below the strike price so that the holder's futures position will show a profit. The futures position of the grantor will show an equivalent loss. At this point, the option contract has been fulfilled and both parties are free to trade their futures contracts as they see fit. For the "price insurance" buyer of the put, this would result in immediately trading out of the futures position or holding it until the hogs were sold or the grain purchased (providing this was before the futures contract matures). Exercising and eventually trading out of the futures does result in an additional brokerage commission.

Evaluating and Using Options Markets

Now that the mechanics of options trading have been explored, it is time to consider two critical questions. (1) What do varying strike prices mean in terms of price insurance? (2) How does a producer actually obtain this insurance?

Evaluating Option Prices Example Lean Hog Option Quotes April Lean Hog Option \$68.10 = April Futures Close		
Settlement		
Strike Prices \$/cwt.	Calls \$/cwt.	Puts \$/cwt.
64.00	4.55	0.50
66.00	3.10	1.00
68.00	1.95	1.85
70.00	1.15	3.02
72.00	0.60	4.45

There are three steps to consider in evaluating options prices. The first step is the selection of the appropriate option contract month. To do this, select the option whose underlying futures will expire closest to, but not before, the time the physical commodity will be sold or purchased. For example, if a group of pigs were to be finished and sold in late March to early April, the April option would be appropriate.

The second step is to select the appropriate type of option. To insure products for sale at a later time against price declines, then the producer would be interested in buying a put (the right to sell). If the producer's motive is to insure future commodity purchases against cost increase (for instance corn needed to feed the hogs), then the purchase of a call (the right to buy) will be needed. To continue our example: if the pork producer wishes to insure prices on hogs that will be sold in late March, then April put option purchases will need to be evaluated.

The third step to consider in evaluating option prices is to calculate the minimum cash selling price (MSP) being offered by the put option selected. For a call option, the maximum buying price (MBP) would need to be calculated. These calculations can be accomplished in five steps.

1. Select a strike price within the option month. For instance, a \$68 April put.

2. Subtract the premium from the strike price for a put or add the premium for a call. For the example quotes, a \$68 April put cost \$1.85/cwt. So the result is \$68.00 - \$1.85 = \$66.15/cwt.

3. Subtract (for a put) or add (for a call) the "opportunity cost" of paying the premium for the period it will be outstanding. For example, if the option premium of \$1.85/cwt. is paid in January and the option is expected to be liquidated by an offsetting resale in late March, an interest cost for the three month period needs to be added. If borrowed funds are used and the interest rate is 12% (for example) then the cost would be 1% per month or 3% for 3 months. The interest cost associated with a \$1.85/cwt. put option premium would be \$0.06/cwt. This leaves a net price of \$66.15 - \$0.06 = \$66.09/cwt.

4. Subtract the commission fee for both buying and offsetting the option. Assume the brokerage firm charges \$100 per round turn for handling each option contract. The per cwt. commission fee would be \$0.25 (\$100 for 40,000 lb). The net price after brokerage cost would be \$66.09 - \$0.25 = \$65.84/cwt.

5. One final adjustment must be made to these prices. The option strike price must be localized to reflect the difference between prices in the local markets where the hogs will be sold or grains purchased and the futures market price. This difference is called basis. The basis may differ greatly between different types of hogs and location of markets. See PIH-19, "Pork Producers and the Futures Markets" for additional discussion on basis and its calculation. A source for historical basis information on market hogs and feed ingredients in most states is the Cooperative Extension Service.

By adjusting the option price for basis, a minimum selling price can now be obtained for a put or a maximum purchase price obtained for a call. For the example, if in late March/early April, the local base carcass prices usually run \$0.50 per cwt. less than the lean hog futures market, then the likely minimum local cash selling price offered by the option can be determined. The minimum local cash price becomes $\$65.84 - \$0.50 = \$65.34$ ¹. The plus references the fact that this is the minimum price expected from a cash sale projected by a purchased put option.

Farmers can buy more or less price insurance by buying options with different strike prices. To determine the minimum selling price suggested by each strike price, just repeat steps 1 through 5. An evaluation of each strike price on the previous example would result in the minimum selling prices in Table 1.

Strike price	Premium	Interest	Commission	Basis	Minimum selling price
Dollars per hundredweight					
64.00	- 0.50	- .02	- 0.25	- 0.50	- 62.73
66.00	- 1.00	- .03	- 0.25	- 0.50	- 64.22
68.00	- 1.85	- .06	- 0.25	- 0.50	- 65.34
70.00	- 3.02	- .09	- 0.25	- 0.50	- 66.14
72.00	- 4.45	- .13	- 0.25	- 0.50	- 66.67

Options Arithmetic: An Example

Once the relevant options prices have been evaluated, the next question is how would the producer go about obtaining a certain level of price insurance. An example will help illustrate the total process. The pork producer who will be selling market hogs in late March checks the options quotes in early January and observes that an April hog option to sell (a put) at \$68/cwt. of carcass can be purchased for \$1.85/cwt. The strike price can be "localized" by subtracting \$.50/cwt. since the local packer's base carcass prices have averaged \$.50/cwt. less than the lean hog futures price during this time. Commission and interest on the premium will be about \$.31/cwt., so the \$68 put would provide an expected minimum selling price of $\$68 - \$1.85(\text{premium}) - \$0.50(\text{basis}) - \$0.31(\text{trading cost})$ or $\$65.34/\text{cwt.}$ of carcass. By comparing the \$68 put option purchase with other pricing alternatives and the cost of production, the pork producer decides that the \$68 put purchase would be an appropri-

¹To convert a carcass price to a live price, multiply by the percentage a live hog is expected to yield as a carcass. A commonly used yield is 74%. Using this conversion, the example MSP of the \$68 lean hog option put is equivalent to $\$48.35 (\$65.34 * .74)$ on a live weight basis. Live hog prices can be converted to a carcass basis by dividing the live price by the yield factor. For example a $\$50.00/\text{cwt.}$ live price is equivalent to a $\$67.57 (\$50/.74)$ carcass price using a 74% yield factor.

ate pricing strategy for 220 of the market hogs to be marketed in late March. The producer's broker is called and advised to purchase one "\$68 April lean hog put at \$1.85." A check for \$840 (400 cwt. X \$1.85/cwt. plus \$100 commission) is sent to the broker.

As April approaches, one of three things will happen. Either prices will stay relatively unchanged, rise above the option strike price making the option worthless, or fall making the producer's option valuable. Remember for a put option, if the current futures price is above the strike price, the option is said to be "out-of-the-money." If futures are below the strike price, it is "in-the-money."

First, assume the April futures market price at the end of March is \$74/cwt. Thus, the option is "out-of-the-money." Since no one is willing to pay for an option to sell at \$68/cwt when they could sell currently for \$74/cwt., the option expires worthless. In this case, the producer will sell the hogs to the local packer and not use the option. Assuming the packer's base carcass price is \$.50/cwt. less than the futures market price, the net base carcass price received by the producer would be $\$73.50/\text{cwt.}$ The net price received by the producer including the option purchase is the $\$73.50/\text{cwt.}$ cash price less the option

Cash Market	Hog Option Market
January 5	
Expect to sell 220 hd. hogs in late March. Expected basis = $-\$.50$ Therefore: Expect minimum selling price of $\$65.34$ (Strike price - premium + basis - trade cost)	Buy a \$68 April lean hog put option for \$1.85 per cwt. premium. Option trade cost of interest and commission is \$.31 per cwt.
March 26	
Sell 220 hd. Market hogs locally @ $\$73.50$ base carcass price	April hog futures trading at $\$74$. Let April option expire
Results	
Cash price + gain or loss in options market = Actual price received or $\$73.50 - \$2.16 =$ \$71.34	Offset premium received - original premium paid and trade cost = $0 - \$1.85 - \0.31 or $\$2.16$

premium paid in January of $\$1.85/\text{cwt.}$ and option trading cost of $\$.31/\text{cwt.}$ or $\$71.34/\text{cwt.}$ The actions in both markets are summarized in Table 2.

In this case, the insurance policy was not needed. "Fire did not burn the barn down" and had this been known in advance the producer could have saved the premium. However, just as "fire" or other disasters cannot be perfectly predicted, price movements cannot be pre-

dicted with accuracy either. For this reason, the producer was willing to substitute the known loss (premium) for the possibility of a larger unknown loss.

What happens if the producer does need to collect on the option position? Assume the futures market price at the end of March is \$62/cwt. In this case, the option to sell does have value because others are willing to purchase the right to sell lean hog futures at \$68 when they are currently only \$62/cwt. Remember, this means the option is "in-the-money." One way to collect on an options policy is very much like collecting on insurance. Since the value of the loss is \$6/cwt., the producer should be able to sell the option back for at least this amount. The producer's broker is called and told to sell the April put at \$6 or better. This cancels the option, and the broker sends a check for \$6 per cwt. X 400 cwt. or \$2,400. Since a premium of \$1.85/cwt. was paid to begin with, the producer really nets \$3.84/cwt. after subtracting trading cost (\$6-\$1.85-\$0.31) on the option trade. The producer's hogs are sold for a base carcass price of \$61.50/cwt. if the normal basis of -.50/cwt. holds. The \$3.84/cwt. gained from the option market is added to the base carcass price to get a final net price of \$65.34. Thus, the option was successful in securing the producer's minimum price of \$65.34 as

Table 3. Price decline example.		
Cash Market	Hog Option Market	
January 5		
Expect to sell 220 hd. hogs in late March. Expected basis = $-.50$ Therefore: Expect minimum selling price of \$65.34 (Strike price - premium + basis-trade cost)		Buy a \$68 April lean hog put option for \$1.85 per cwt. premium. Option trade cost of interest and commission is \$.31 per cwt.
March 26		
Sell 220 hd. Market hogs locally @ \$61.50 base carcass price		April hog futures trading at \$62. Sell the \$68 put receiving a premium of \$6/cwt.
Results		
Cash price + gain or loss in options market = Actual price received or \$61.50 + \$.34 = \$65.34		Offset premium received - original premium paid and trade cost = \$6 - \$1.85 - \$.31 or \$3.84

assumed when the put was purchased in January. The actions in both markets are summarized in Table 3.

In this case "fire burned the barn" and the producer was able to collect on the option (policy). Just as with insurance, the producer collects to the extent of the loss. In options terminology, this is the strike price (face amount of policy) less the current lean hog futures price.

Thinking in the terms of fire insurance, the "barn did not burn to the ground", it was only damaged. The amount of money "collected" from the insurance is the amount it will take to restore the insured property to its insured value.

A second way in which the "insurance" could have been recovered would be to exercise the option, converting it into a sell (short) position in the futures market. If the futures position was then immediately closed out with a purchased April futures (long), the \$6/cwt. difference would be realized (\$68 - \$62 current futures) with only an additional commission for the futures purchase.

Table 4 shows how the purchase of the April hog put works to insure a minimum price, no matter the actual market price. Notice that while the maximum price obtain-

Table 4. Possible outcomes when a \$68 April lean hog put is purchased.

Futures Market price in late March	-	Difference between local hog price & futures price (basis)	-	Premium paid in January (\$1.85) and Option Trading Cost of Interest (\$.06) and Commission (\$.25)	+	Min. Sell value of April put in late March	=	Net price received
Dollars per hundredweight								
Out of the money								
78	-	.50	-	2.16	+	0	=	75.34
76	-	.50	-	2.16	+	0	=	73.34
74	-	.50	-	2.16	+	0	=	71.34
72	-	.50	-	2.16	+	0	=	69.34
70	-	.50	-	2.16	+	0	=	67.34
At the money								
68	-	.50	-	2.16	+	0	=	65.34
In the money								
66	-	.50	-	2.16	+	2.00	=	65.34
64	-	.50	-	2.16	+	4.00	=	65.34
62	-	.50	-	2.16	+	6.00	=	65.34
60	-	.50	-	2.16	+	8.00	=	65.34
58	-	.50	-	2.16	+	10.00	=	65.34
56	-	.50	-	2.16	+	12.00	=	65.34

able is not set, it will always be \$1.85/cwt. less than the market price because of the premium paid.

Figure 1 summarizes the resulting net price of purchasing an April put for \$1.85/cwt. under a range of market prices in late March and a realized $-.50$ /cwt. basis. It also makes clear why put option purchases are sometimes referred to as "floor pricing".

Actually, the producer will not be able to judge in advance exactly what the basis will be when selling the hogs. If the actual basis is better than anticipated (cash price closer to or even over the futures), then the realized net price from the options will be higher by this amount. If the actual basis is worse than anticipated (cash price

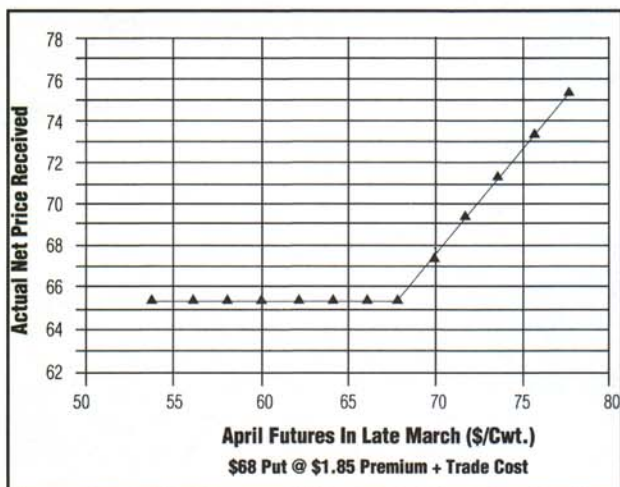


Figure 1. Possible Outcomes When a \$68 Lean Hog Put is Purchased With a $-.50$ Realized Basis.

further under the futures), then the realized net price from the options will be lower by this amount.

Buying More or Less Insurance

In the example, pork producer had the choice to buy other levels of insurance along with the \$68 put for \$1.85. Let's also look at the outcomes of purchasing a \$64 put for \$.50/cwt. and a \$72 put for a premium of \$4.45/cwt. Using a $-.50$ /cwt. expected difference between futures prices and the local base carcass price, the lowest price insurance results in a MSP of $\$64 - \$.50$ (premium) $- \$.50$ (basis) $- \$.27$ (trading cost of commission and interest) = $\$62.73$ /cwt. The highest price insurance results in a MSP of $\$72 - \$4.55 - \$.50 - \$.38 = \$66.57$ /cwt. Remember that the purchase of the \$68 put in the previous example resulted in a MSP of $\$65.34$. Which should the producer choose? The answer of course, depends upon the producer's marketing objectives. However, an examination of the outcomes from purchasing various strike price puts points out that producers should buy only as much insurance as is needed.

As can be seen by Figure 2, the lower strike price put results in a lower price received than the \$68 put until the \$64 strike price is exceeded. If the April futures market price when the hogs are sold is higher than \$66.50, the net price received from the \$64 put is higher than the purchase of the \$68 put. Why is this? The \$68 put costs \$1.85 while the \$64 put costs only \$.50. This initial cost must be subtracted from all the higher selling prices to obtain the actual net price received. The purchase of the lower priced put can be thought of as purchasing insurance with a high deductibility. The insurance costs less, but offers lower coverage. However, when the policy is not needed, the net proceeds may be higher.

The opposite is true for the purchase of higher priced insurance through higher strike price puts. The deductibility is lower, but the higher premium paid for this increased coverage results in a lower net price received when the insurance is not needed. As can be seen in Figure 2 at

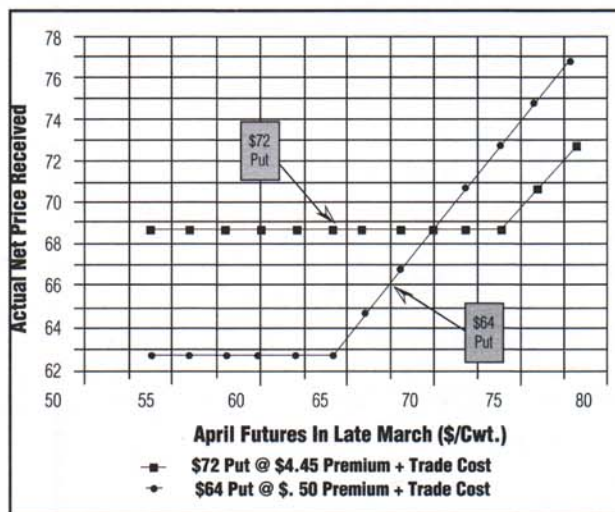


Figure 2. Possible Outcomes from a \$72 and \$64 April Lean Hog Put Purchase With a $-.50$ Realized Basis.

futures market prices beyond the \$72 strike price, the realized net price is lower than the \$68 strike price and the \$64 strike price purchase because of the higher premium payment.

This example has explored only one of many potential pricing strategies through options. In a very similar manner, the purchase of a call option against future feed purchases may be used to "insure" against price increases. However, only through the purchase of puts and (or) calls as discussed, can option pricing be thought of as price insurance. Other strategies usually involve additional price risk and must be thoroughly evaluated and understood before undertaken.

Summary

Purchasing lean hog put options or feed ingredient call options for price insurance is a way pork producers can use the options markets as a pricing alternative. This alternative should be carefully compared to all other pricing alternatives in light of the producer's objectives and risk-bearing ability. Options purchased for price insurance provide a kind of "hybrid" market with characteristics of both doing nothing (cash market pricing) and hedging or forward contracting. That is, the producer who purchases an option for price insurance has some of the same downside price protection offered through a hedge or forward contract, as well as most of the upside price potential of being open to the cash market. On the other hand, options are not as protective against unfavorable price movements as a hedge or forward contract, or as attractive as the open cash market if prices move favorably. In fact, option purchases will always be, at best, second to either of the other two pricing alternatives when evaluated after the fact. However, producers do not have the luxury of making pricing decisions after-the-fact. Because of this, many producers may find a place in their pricing plans for the kind of "hybrid vigor" offered through the options market.

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