MULTIPLE HEDGING SLAUGHTER HOGS WITH MOVING AVERAGES

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MULTIPLE HEDGING SLAUGHTER HOGS

WITH MOVING AVERAGES

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Hog producers confront production and marketing risks. Production risks refer to factors which affect the efficiency or quality of the product produced (Ikerd), 1978). Marketing risks refer to factors which influence input prices farmers pay or product prices farmers receive. Since hog producers tend to be more skilled in handling production risks and production risks tend to be more manageable, marketing risks are the focus of this study.

Evidence that hog production entails large marketing risks can be readily found. First, hog production decisions must be planned months in advance of reaping the benefits or incurring the losses from the sale of market weight hogs. Market conditions, beyond the control of an individual hog producer, may change dramatically, yet the producer will have based production intentions upon prior price expectations. Hog producers can make adjustments on the production side, but major price changes can overshadow many production adjustments.

Spiraling costs of production are additional factors which can increase marketing risks. The USDA (1981) calculates the average total cost of producing hogs to be $55.17/cwt. for all sizes and areas of farrow-to-finish enterprises in 1979. The USDA projection for 1981 is $71.95/cwt. The time lag required for increased costs of production to filter through the economic system leaves hog producers one step behind. This phenomenon creates financial difficulties for hog producers in the form of cash-flow problems, thus increasing the chances for financial failure.

Highly variable slaughter hog prices and input prices are two factors which can increase marketing risk. Since 1974 hog cash prices have fluctuated dramatically as illustrated in Figure 1. In 1980, monthly cash prices ranged from $28.56/cwt. to $48.30/cwt. To demonstrate the combined effects of highly variable inputs and hog slaughter prices, monthly net margins of hog producers are graphed over time in Figure 2.[1] In 1979, monthly net margins dropped from

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[1]The monthly net margin was calculated by subtracting the sell price per cwt. required to cover all costs of raising a 220 pound hog from the monthly average price per cwt. for barrows and gilts sold in the seven markets, combined.

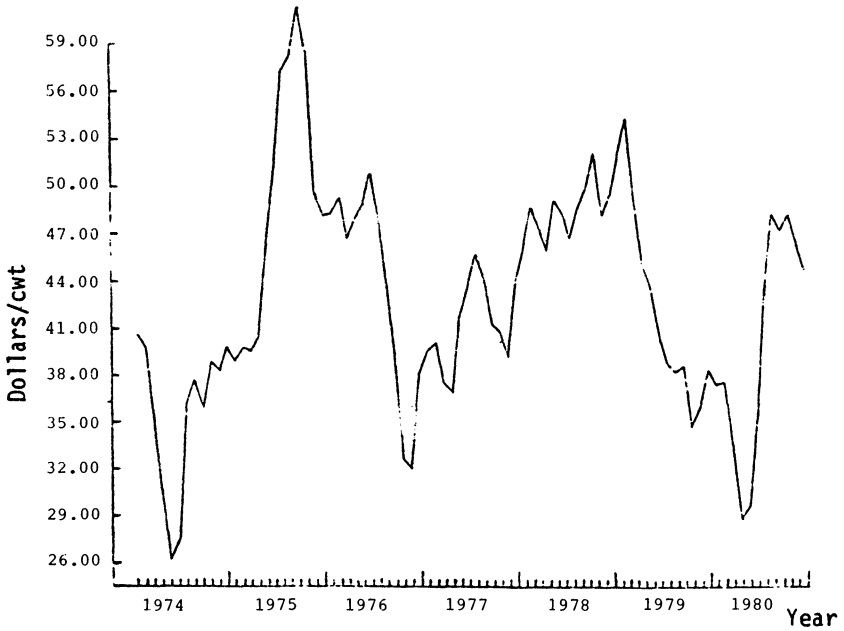

Figure 1. Monthly Average Prices for Barrows and Gilts from Seven Markets Combined, 1974-1980

Source: USDA, Livestock and Meat Situation (February, 1974-1981)

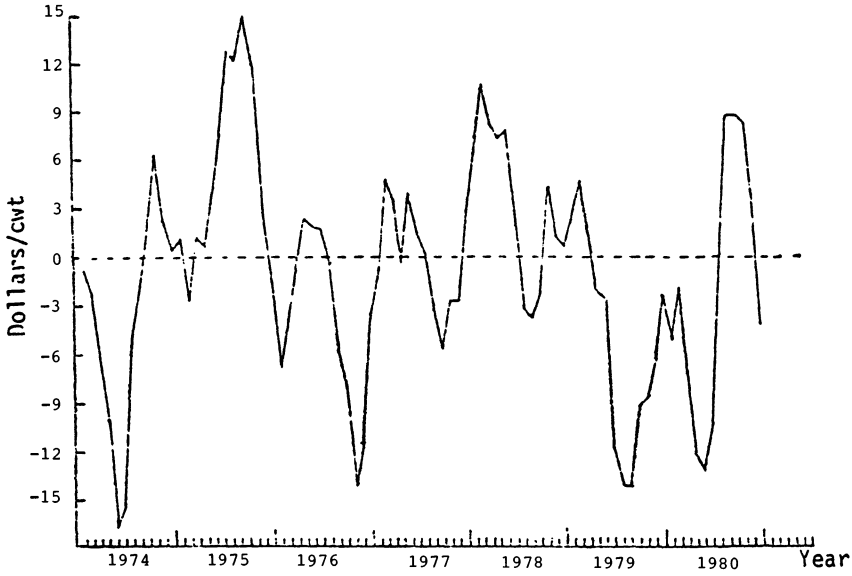

Figure 2. Monthly Net Margins of U.S. Hog Producers, 1974-1980

Source: USDA, Livestock and Meat Situation (February, 1974-1981)

$4,63/cwt. to a negative $14.18/cwt. then increased to a negative $2.45/cwt. In 1980, monthly net margins declined from a negative $1.94/cwt. to a negative $18.63/cwt. then increased to $8.65/cwt. and finally retreated to a negative $4.09/cwt.

The use of marketing techniques which are more flexible than those currently employed would permit producers to change their pricing positions as market conditions change. If successful, the potential for reaching a goal of greater profits would increase.

As improved marketing techniques are learned and implemented by all producers, a more efficient, stable hog production system could be expected to develop. Risks would be passed to speculative specialists and hog producers would be able to concentrate their efforts on improving production efficiency. Results of such actions would be a more stable supply of pork for consumers and a more efficient use of the resources employed in pork production. Consequently, consumers as well as producers would benefit from the implementation of improved marketing techniques.

Marketing Alternatives

Available marketing alternatives include cash marketing, forward pricing through the futures marketing and multiple hedging. Cash marketing occurs when commodities are simply sold as they are delivered to market. Holding unhedged commodities confronts the producer with maximum price risk. Even though faced with maximum price risk a producer may still prefer to use the cash market. Cash markets are far simpler, more familiar and more trusted by producers as a means of determining fair market value (Ikerd, 1978). Also, when low cash prices are received by producers generally, there is less psychological strain. Finally, selling in the cash market can also be as profitable as other marketing strategies.

A second marketing alternative is forward pricing. There are two reasons a producer may want to forward price a commodity. First, the producer may have treason to believe the current futures price is higher than the expected cash price. Also, the producer may not be willing or able to risk the chance of receiving a lower price than the prevailing adjusted futures price. The producer must examine variables such as personal factors, financial status, and production variables such as personal factors, financial status, and production risks to make a wise decision (Oster, 1979). Personal factors include the feeling of security, freedom from debt, wealth accumulation, spouse's attitude, and the number of dependents. Net worth, liquidity, and financial leverage are items relating to financial status. Production risks facing hog producers include drought, feed conversion rates, death rates and disease. By no means is this list exhaustive, but these items are examples of factors to be considered.

Two methods a producer may use to fix a price are by forward contracting and by hedging. Forward contracting makes use of a cash contract for future delivery. Other terms of the contract are specified by the seller and the buyer. Hedging means taking an equal

and opposite position in the cash and futures market. Table I depicts the arithmetic of a hedge and hold strategy for selling hogs and demonstrates the use of hedging. In essence, variation in the basis is substituted for price variation in the cash market. Since basis variation is more stable, risk is less.

TABLE I

AN EXAMPLE OF HEDGING HOGS UNDER A FAVORABLE CHANGE IN BASIS

Date	Cash Market	Futures Market	Basis
October 1	Expected price for Jan. 31 Delivery $39.27	Sells February futures for $40.77	$1.50
January 31	Sells hogs at local market for $38.19	Buys Feburary futures for $39.57	$1.38
	Difference $1.08	Profit $1.20	Dif. $.12
Results:	Cash price received	$38.19	
	Futures market profit	1.20	
	Net hedged price	$39.39	

Using a cash contract, a producer must be a skilled negotiator since price determination and terms of the contract are conducted on a one-on-one basis. Also, pricing flexibility is lost once the producer is committed to a forward contracting agreement. Futures contracts can be bought or sold at any time. The price is a cash contract tends to be biased downward compared to futures market prices because the buyer assumes the basis risk (Ikerd, 1978).

Once the cash contract is agreed upon, the producer knows with certainty the price he will receive. There is no price risk. When hedging, price level risk is traded for basis risk and involves more risk than forward contracting. Trading futures contracts requires margin deposits and commission fees while cash contract transactions avoid these inconveniences. Cash contract sizes are negotiable to fit production expectations, but futures contracts sizes are fixed. Finally, since cash contracts are primarily handled locally, they re less complicated and easier to comprehend than futures contracts.

A final marketing technique available to the producer is multiple hedging and offers the most marketing flexibility (Ikerd and Franzmann, 1980). When employing multiple hedging, a hedge may be placed and lifted any time up to delivery of the finished product. Thus, as economic conditions and risk carrying abilities change the

producer can change his price position. Futures positions are never in excess of expected output quantities and are only taken to offset cash market positions. These qualifications distinguish multiple hedging from speculation.

When a producer holds an unhedged product, he faces the maximum amount of price risk. By offsetting cash positions in the futures market for selected time periods throughout the production process, price risk is intuitively less. The main idea of multiple hedging is to protect the producer against a falling market when he is not willing or able to carry price risk and to take advantage of a rising cash market when he is willing or able to incur price risk. Ideally, the producer hopes to gain more in the futures market than he loses in the cash market during a falling market. Thus, profits can be enhanced while market risks are reduced compared to simply selling the commodity in the cash market.

Many of the disadvantages of multiple hedging are synonymous with the disadvantages of hedging. Futures contract transactions require margin deposits and commission fees. Also, a futures contract size is standardized; thus, the size may not match output of the producer. Finally, price risk is generally greater with multiple hedging than with forward pricing in the cash or futures markets. Even with these inconveniences, in today's fast changing economy,. flexibility is the key to financial survival for hog producers. Multiple hedging is a marketing technique which can provide marketing flexibility.

One technical tool used to signal placement and lifting of hedges is the moving average. The moving average is an objective, trend following device which can be easily calculated and implemented in a multiple hedging framework. In addition, a small data base is required for its use.

The Moving Average Technique

There are many types of moving averages. Exponential, linearly weighted, accumulated, and truncated moving averages are among the more common ones. Linearly weighted and truncated moving averages are the ones considered in this analysis. Truncated moving averages are commonly referred to as simple moving averages and are by far the most common price smoothing technique. The number of elements in the price series remains constant, but the interval of elements changes. To illustrate, suppose we have a set of prices, P, over the time period t: P_1, P_2, P_3, . . ., P_t. Assume we want a moving average of length n. The moving average, M_t, calculated from this set is:

$$M_t = \frac{P_t + P_{t-1} + P_{t-2} + \ldots + P_{t-n+1}}{n}$$

To achieve the smoothing effect a new price P_{t+1}, is added and the oldest price P_{t-n+1} is dropped from the set for each new time period.

The linearly weighted moving average is computed by assigning a weight factor to each price in the moving average. The oldest price

in the series is assigned a weight of one, the next price a weight of one, the next price a weight of two and continuing until the most recent price is given a weight of the moving average length.[2] The divisor is equal to the sum of the weights.

Buy and sell signals are generated by a "crossing over" action of two or more moving averages. To clarify signalling, a three moving average combination is illustrated in Figure 3 and discussed below.

The shortest moving average confirms the signal from the crossing of the other two moving averages. A buy signal is confirmed when the shortest moving average is above a buy signal generated by the crossing of the medium and long moving averages. A sell signal is confirmed when the shortest moving average is below a sell signal generated by the medium and long moving averages.

The third moving average helps eliminate false signals which produce whipsaw losses and an excess number of trades. A penetration rule or stop-loss option can be added to provide more complex trading signals. A trade-off occurs between shorter, more responsive and longer, slower reacting moving average combinations. the slow moving averages hold positions over long time spans allowing opportunity for greater profits as well as losses. A faster set of moving average parameters trades more frequently to capture short-term profits, but is susceptible to whipsaw losses when the moving average is not responding as quickly as prices are moving. Most importantly, no matter what options are used to signal trades, certain moving average parameters provide "better" trading signals. After obtaining these "better" trading signals for live hog price data, a hog producer will be better equipped to determine the appropriate timing for placement and lifting of hedges.

Method of Analysis

Many types of hog enterprises exist through the industry. In this analysis, the hog enterprise under consideration is a continuous farrow-to-finish operation. The first group of hogs is assumed marketed June 30, 1978. Each month a new group is marketed through March 31, 1981 for a total of 34 groups of hogs.

A total of 132 hogs were assumed fed to 240 pounds each. After deducting an assumed 3.85 percent for shrinkage, the market weight for

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[2] Illustration of calculating a 3-day linearly weighted moving average. Let n be the day of the most recent closing price.

Day	Price		Weight		Product
n	49.27	x	3	=	147.81
n-1	48.75	x	2	=	97.50
n-2	50.00	x	1	=	50.00
			6		295.31

The 3-day weighted average is 295.31/6 = 49.22

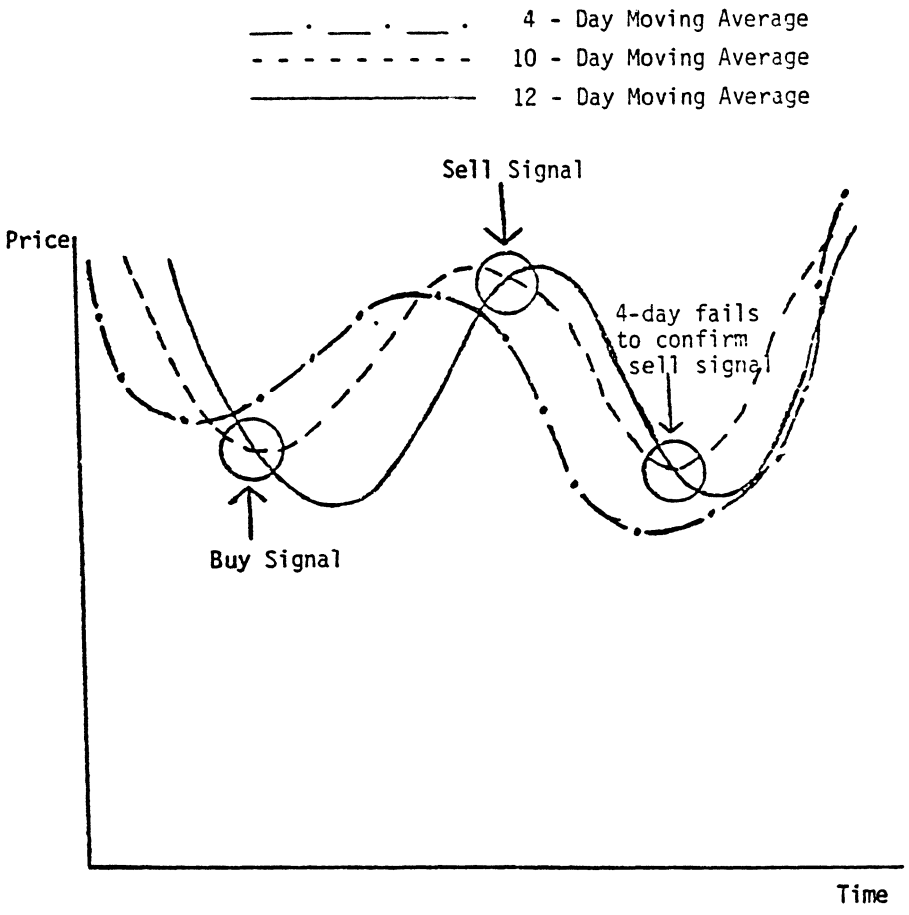

Figure 3. Crossing Action of Three Moving Averages

each hog is estimated as 230.77 pounds. Also, an average death rate of 1.5 percent is assumed.[3] The total market weight of 130 hogs weighing 230.77 pounds each, equals 30,000 which is the weight designated in one futures contract listed on the Chicago Mercantile Exchange.

In this model, raising a pig from conception to 240 pounds takes 340 days divided into 4 time frames. The first 115 days is the gestation period. The next 670 days pigs are fed from birth weight to 40 pounds. The third time frame also lasts 60 days and pigs are fed a grower feed ration from a weight of 40 to 120 pounds. During the fourth time frame, hogs are fed a finishing feed ration from 120 to 240 pounds which lasts 105 days. Table II depicts the assumed hog production process.

TABLE II

GROWTH STAGES OF THE PRODUCTION PROCESS FOR A FARROW-TO-FINISH HOG OPERATION

	Number of days
Conception to birth	115
Birth to 40 pounds	60
40 pounds to 120 pounds [a]	60
120 pounds to 240 pounds [b]	105
Total	340

[a] The grower feed ration is used to feed hogs through this time period.

[b] The finishing feed ration is used to feed hogs through this time period.

To simplify the analysis, the cost assumed for raising pigs from farrow-to-finish is the weekly average price for 40 pound feeder pigs on the southern Missouri markets as reported by the USDA in Livestock Meat Wool Market News. Since the publication reports 30-40 pound and 40-50 pound feeder pig prices, an average of those two prices is assumed to represent the 40 pound feeder pig price. the price reflects the opportunity cost of raising pigs from farrow-to-feeder pig.

[3] Shrinkage rates and death rates vary among hog operations. The shrinkage and death rates for this analysis were calculated from the following publication: Brumm, Michael C. 1979. Swine Production Profile, OSU Extension Facts No. 3657.

The largest cost of raising hogs is feed. Williams and Plain (1978) report that feed accounts for about 65-75 percent of the total cost of raising hogs. All other production costs are assumed fixed in this analysis. Feed prices for rearing pigs from 40 to 120 pounds are divided into two categories: grower and finisher feed ration prices. the grower ration is used to feed pigs from 40 to 120 pounds. the grower ration feed price used is the monthly average Oklahoma price for 14-18 percent hog feed as reported by the USDA in Agricultural Prices. The finishing feed ration is used to feed pigs from 120 to 240 pounds. this ration price is calculated as 94 percent of the grower ration feed price.[4]

The rate of gain is assumed to be 1 pound of grain for each 3.75 pounds of feed. Grower ration feed requirements for each group of 132 hogs are 19,800 pounds of feed per month for two months. The finishing ration feed requirements are 16,971 pounds per month for three and one-half months. In total 99,000 pounds of feed are needed to feed 132 hogs from 40 to 240 pounds.

Costs of hedging include a $50 commission fee per round of trading and interest on the initial $1,200 margin requirement. Since accurate daily accounting of margin calls is not considered in this analysis, a high initial margin requirement is set. The interest on the margin requirement is charged at a rate equal to the annual rate of interest plus one percent (Council on Economic Affairs, January 1981).

Hogs are marketed in the final week of each month beginning June 30, 1972 through March 31, 1981. Market hog prices are taken from the weekly average of Oklahoma City cash prices for U.S. 1 and 2, 230 pound barrows and gilts.

The next step in the analysis is to explain and demonstrate the net return to the fixed factors. The equation for calculating total returns is as follows:

$$\text{Total Return} = 300 \text{ cwt. } X \text{ (Net Price Received).} \qquad (1)$$

The net price change from futures trading is added to the cash price received for the slaughter hogs yielding the net price received for the slaughter hogs. The net price received times 300 cwt. is the total return to all factors of production.

The hog production costs are calculated as follows:

$$\text{Cost of 132 head of 40 pound feeder pigs} = \text{Current feeder pig price/cwt. x 132 head x .4 cwt./head} \qquad (2)$$

Equation (2) shows that the opportunity cost of raising each feeder pig group from farrow-to-feeder pig is equal to the current price per

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[4] After discussing the cost of the finishing ration feed price with local millers a price equal to 94 percent of the grower ration feed price is assumed.

cwt. of each feeder pig times the number of feeder pigs per group, 132 head, times the weight per pig, .4 cwt.

$$\text{Grower Ration Feed Cost} = 198.00 \text{ cwt.} \times \sum_{t=1}^{2} (\text{Price of grower feed ration})_t \quad (3)$$

Equation (3) indicates the cost of the grower feed ration is calculated by multiplying the monthly quantity of feed, 198.00 cwt., times the sum of the appropriate two months' prices of grower feed ration.

$$\text{Finishing Ration Feed Cost} = .94[169.714 \times \sum_{t=1}^{3} (\text{monthly price of grower feed ration})_t + 84.8571 \times \text{monthly price of growth feed ration}_4] \quad (4)$$

The finishing ration feed cost is equal to the amount of feed required per month times the respective price of the grower ration times 94 percent. The total is multiplied by 94 percent since the price of the finishing ration is 94 percent of the grower ration feed price.

$$\text{Production Cost} = \text{Cost of Feeder Pigs + Grower Ration Feed Cost + Finishing Ration Feed Cost} \quad (5)$$

The production costs considered in this analysis is simply the sum of equations (2), (3), and (4).

Another cost component is marketing cost.[5] Equations to compute each marketing cost and a description of each marketing cost are given below

$$\text{Commission Fees} = \$50 \times \text{number of trading rounds} \quad (6)$$

Equation (6) is the calculation of total commissions. The charge per trading round is $50. A trading round includes both the purchases and sale of a futures contract.

$$\text{Interest on initial margin requirement} = \$1,200 \times \text{number of months of multiple hedging}/12 \times \text{annual prime interest rate plus one percent} \quad (7)$$

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[5] If the product is cash marketed then the number of trading rounds and the number of months of multiple hedging is equal to zero. Therefore, the marketing cost component becomes zero.

The calculation of interest on the initial margin requirement is shown in equation (7). the initial margin requirement, $1,200, is multiplied by the fraction of the year multiple hedging is permitted. This number is then multiplied by the annual prime interest rate plus 1 percent resulting in the amount of interest on the initial margin requirement.

$$\text{Marketing Cost} = \text{Cost of Commission Fees + Interest on Initial Margin Requirement} \tag{8}$$

The marketing cost is the sum of equations (6) and (7).

The final calculation is the net return to the fixed factors of production. The calculation is as follows:

$$\text{Net Return} = \text{Total Return - [Production Costs + Marketing Costs]} \tag{9}$$

The net return to the fixed factors of production is calculated by subtracting the sum of the marketing and production costs from the total return. An example of calculating the net return is given in Table III.

Analysis of Results

The no-hedge strategy was used as a benchmark to compare alternative multiple hedging strategies. The mean net return as well as the coefficient of variation are the modes of comparison. Using the coefficient of variation as the appropriate measure, an ideal strategy is one which minimizes the coefficient of variation (price risk) and increases the mean net return.[6] A satisfactory strategy would either (1) increase mean net return without significantly increasing the coefficient of variation or (2) decrease the coefficient of variation without significantly decreasing the mean net return.

Trading signals generated by seven selected reoptimization combinations and four sets of moving average parameters are incorporated into a multiple hedging framework. Then the results of marketing slaughter hogs in this manner are compared on the basis of mean net return and variability of net returns as measured by the coefficient of variation. For each strategy, multiple hedging is begun 9, 6, 3, and 2 months prior to marketing each group of hogs and corresponds to alternatives denoted with the subscripts a, b, c, and d, respectively. The strategies are discussed and the results are presented below.

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[6] The mean net return refers to the net return per month.

TABLE III

AN EXAMPLE OF CALCULATING THE NET RETURN FOR COMPARING SELECTED MULTIPLE HEDGING STRATEGIES FOR HOG PRODUCERS

Returns				
Cash price received ($/cwt	$ 48.75			
Net price change from future trading ($/cwt)	+ 2.25			
		$ 51.00		
Weight of hogs marketed (cwt)		X 300		
Total Returns				$15,300.00
Costs				
Production Costs				
Price of feeder pigs ($/cwt)	$ 35.50			
Weight of feeder pigs (cwt)	X 52.8			
Cost of feeder pigs ($)		$1,874.40		
Grower ration price ($/cwt)*	$ 17.10			
Quantity of grower ration (cwt)	X 196.00			
Cost of grower ration feed ($)		$3,385.80		
Finishing ration price, 3 months (cwt) **	$ 25.38			
Quantity of finishing ration (cwt)	X 169.71			
Cost of finishing ration feed, 3 months ($)		$4,307.24		
Finishing ration price ($/cwt)	$ 9.30			
Quantity of finishing ration (cwt)	X 84.057			
Cost of finishing ration feed, 5 months ($)		$ 789.00		
Total Production Costs			$10,356.61	
Marketing Costs				
Charge per trading round	$ 50.00			
Number of trading rounds	X 8			
Cost of commissions ($)		$ 400.00		
Initial margin requirement ($)	$1,200.00			
Interest rate charge, 9 months (%)***	X 0.105			
Cost of interest, 9 months ($)		$ 126.00		
Total Marketing Costs			$ 526.00	
Total Costs				$10,882.61
Net Return				$ 4,417.39

*Grower ration price = $\sum_{i=1}^{2}$ Oklahoma monthly price of 14-18 percent protein hog feed $_i$

= 8.50 + 8.60 = 17.10

**Finishing ration price = .94(8.60 + 9.40 + 9.00) = .94(27.00) = 25.38

***Interest rate charge = .14 X 9/12 = 0.105

Results of the Multiple Hedging Strategies

Employing the Reoptimization Combinations

Strategy I. Strategy I used 4 months of live hog futures price data and optimized the data each month. Table IV depicts the results of beginning this multiple hedging strategy at 9, 6, 3, and 2 months prior to marketing each group of slaughter hogs. As indicated in the table, the coefficient of variation was smaller and mean net return larger for alternatives Ic and Id than for the no-hedge strategy. The coefficient of variation and mean net return were .872 and $2,533.07, respectively for alternative Ic, while for alternative Id they were .886 and $2,493.17, respectively. The no-hedge strategy resulted in a mean net return of $2,339,11 and coefficient of variation of .925.

TABLE IV

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES Ia-Id

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
Ia	2,265.17	1.074
Ib	2,351.22	1.025
Ic	2,533.07	0.872
Id	2,493.17	0.886
No hedge	2,339.11	0.925

Strategy II. For this strategy, 9 months of live hog futures price data are reoptimized every 3 months then employed to signal placement and lifting of hedges. Table V shows the results of alternatives IIa-IId and the no-hedge strategy. Although each alternative resulted in slightly higher mean net returns than the no-hedge strategy, neither IIa, IIb, Ic, nor IId resulted in a lower coefficient of variation. Within strategy II, the lowest coefficient of variation and highest mean net return was .961 and $2,419.65 associated with alternative IIc.

Strategy III. These multiple hedging strategies employed the strategy of reoptimizing 12 months of live hog futures price data every 8 months. These results are shown in Table VI. The mean net returns are slightly larger, yet each coefficient of variation is significantly higher than the no-hedge strategy. Among alternatives IIa-IId, alternative IIc resulted in the highest mean net return, $2,509.62, and lowest coefficient of variation, 1.018.

TABLE V

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES IIa-IId

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
IIa	2,405.69	1.132
IIb	2,396.27	1.007
IIc	2,419.65	0.961
IId	2,395.28	0.963
No Hedge	2,339.11	0.925

TABLE VI

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES IIIa-IIId

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
IIIa	2,481.78	1.169
IIIb	2,483.57	1.129
IIIc	2,509.62	1.018
IIId	2,444.25	1.020
No Hedge	2,339.11	0.925

Strategy IV. The results of multiple hedging moving average generated by reoptimizing 18 months of live hog futures price data every 6 months are presented in Table VII. Each alternative, IVa, IVb, IVc, and IVd, resulted in a higher coefficient of variation than the no-hedge strategy. Only alternatives IVc and IVd resulted in a higher mean net return than the no-hedge strategy. Their mean net returns are $2,393.04 and $2,357.63, respectively.

TABLE VII

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES IVa-IVd

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
IVa	2,228.84	1.332
IVb	2,285.86	1.217
IVc	2,393.04	1.027
IVd	2,357.63	1.029
No Hedge	2,339.11	0.925

Strategy V. The coefficients of variation and mean net returns from multiple hedging with the strategy of reoptimizing 24 months of live hog futures price data every 3 months are depicted in Table VIII. Alternative Vc indicated the most promising results of the four alternatives. This alternative resulted in a mean net return of $2,455.54 and a coefficient of variation of .976. The mean net return and coefficient of variation are both higher than the no-hedge strategy.

Strategy VI. Of all the reoptimization combinations used for multiple hedging, reoptimizing 24 months of live hog futures price data every 12 months indicated the best results. All alternatives resulted in higher mean net returns and lower coefficients of variation than the no-hedge strategy as depicted in Table IX. The highest mean net return is indicated by alternative VIa, $3,028.48. As evidenced in the table, mean net returns increased as the number of months of multiple hedging increased. Alternatives VIb, VIc, and VId resulted in mean net returns of $2,888.18, $2,705.18, and $2,571.40, respectively. The coefficient of variation is lowest for alternative VIc, .879. Alternatives VIa, VIb, and VId had coefficients of variation of .909, .893, and .911, respectively.

TABLE VIII

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES Va-Vd

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
Va	2,203.92	1.180
Vb	2,343.92	1.073
Vc	2,455.54	0.976
Vd	2,410.84	0.997
No Hedge	2,339.11	0.925

TABLE IX

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES VIa-VId

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
VIa	3,028.49	0.909
VIb	2,888.18	0.893
VIc	2,705.80	0.879
VId	2,571.40	0.911
No Hedge	2,339.11	0.925

Strategy VII. The last reoptimization strategy used in multiple hedging also used 24 months of live hog futures price data and optimized the data every 12 months, but included options for three unweighted and linearly weighted moving averages in the optimization program. Table X contains the results of this strategy. Each alternative resulted in lower mean net returns than the no-hedge strategy. Only alternative VIIc indicated a lower coefficient of variation, .901, than the no-hedge strategy.

Results of the Multiple Strategies

Employing Sets of Moving Average Parameters

The next four strategies are not reoptimization strategies. They are selected moving average parameters. The same time period and

modes of comparison were used in these strategies as were used in the previous seven strategies. The moving average parameters and their respective results re given below.

TABLE X

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES VIIa-VIId

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
VIIa	1,876.20	1.148
VIIb	1,889.55	1.072
VIIc	2,169.28	0.901
VIId	2,207.70	0.979
No Hedge	2,339.11	0.925

Strategy VIII. This multiple hedging strategy employed 7 and 10 day moving averages with a 26-cent penetration level. The results of this strategy with its alternatives are shown in Table XI. All alternatives demonstrated significant improvement over using the no-hedge strategy. Alternative VIIIa resulted in the highest mean net return of $3,280.22 and had a coefficient of variation of .851. Alternative VIIIc had the lowest coefficient of variation, .802, with a mean net return of $2,603.98.

Strategy IX. The next multiple hedging strategy used a 3, 13 and 20-day moving average combination with a 9-cent penetration level. As seen in Table XII, alternative IXa generated the highest mean net return and lowest coefficient of variation. The mean net return, $3,179.45, and coefficient of variation, .896, indicated significantly better results than the no-hedge strategy.

TABLE XI

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES VIIIa-VIIId

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
VIIIa	3,280.22	0.851
VIIIb	2,865.51	0.867
VIIIc	2,603.98	0.802
VIIId	2,524.40	0.863
No Hedge	2,339.11	0.925

TABLE XII

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES IXa-IXd

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
IXa	3,179.45	0.896
IXb	2,780.71	0.967
IXc	2,542.27	0.922
IXd	2,442.22	0.951
No Hedge	2,339.11	0.925

Strategy X. Multiple hedging strategy X employed a 4,10, and 12-day moving average combination with a 14-cent penetration level. The results of this strategy are also significantly better than the no-hedge strategy as indicated in Table XIII. j All alternatives performed better than the no-hedge strategy with respect to the mean net return and the coefficient of variation. The mean net return for alternatives Xa, Xb, Xc, and Xd are $3,692.39, $3,160.63, $2,716.04, and $2,562.61, respectively. The coefficients of variation are .564, .636, .738, and .840, respectively.

TABLE XIII

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES Xa-Xd

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
Xa	3,692.39	0.564
Xb	3,160.63	0.636
Xc	2,716.04	0.738
Xd	2,562.61	0.840
No Hedge	2,339.11	0.925

Strategy XI. The final multiple hedging strategy used a 4,11, and 14-day moving average combination with a 17-cent penetration level. The results are contained in Table XIV. Again, as in the previous strategy, all alternatives performed better than the no-hedge strategy. Alternative XIa showed the best results with a $3,505.30 mean net return and a coefficient of variation of .716.

TABLE XIV

THE MEAN NET RETURNS AND COEFFICIENTS OF VARIATION FOR THE NO-HEDGE STRATEGY AND MULTIPLE HEDGING STRATEGIES XIa-XId

Strategy	Mean Net Return	Coefficient of variation
	($)	(%)
XIa	3,505.30	0.716
XIb	3,051.24	0.778
XIc	2,764.04	0.798
XId	2,569.66	0.883
No Hedge	2,339.11	0.925

Further Comparisons of Multiple Hedging Strategies

There exists a trade-off between risk and return. Some producers are willing and able to accept more risk for a higher return while

other producers cannot. The decision as to which strategy a producer should choose is ultimately his own.

Tables XV and XVI contain a ranking of the 10 best multiple hedging strategies with respect to the mean net return and coefficient of variation. As seen in the tables, strategy Xa, 4, 10, 12-day moving average with a 14-cent penetration level, resulted in the highest mean net return and lowest coefficient of variation of all strategies considered in this analysis. The performance of the remaining strategies are difficult to rank according to their performance with respect to both mean net return and coefficient of variation because of the risk and return trade-off.

TABLE XV

RANKING OF THE TEN BEST MULTIPLE HEDGING STRATEGIES WITH RESPECT TO MEAN NET RETURN

Rank	Strategy	Mean Net Return
		($)
1	Xa	3,692.39
2	XIa	3,505.30
3	VIIIa	3,280.22
4	IXa	3,179.45
5	Xb	3,160.63
6	XIb	3,051.24
7	VIa	3,028.48
8	VIb	2,888.18
9	VIIIb	2,965.51
10	IXb	2,780.71
	No Hedge	2,163.06

TABLE XVI

RANKING OF THE TEN BEST MULTIPLE HEDGING STRATEGIES WITH RESPECT TO COEFFICIENT OF VARIATION

Rank	Strategy	Coefficient of variation
		(%)
1	Xa	.564
2	Xb	.636
3	XIa	.716
4	Xc	.738
5	XIb	.778
6	XIc	.798
7	VIIIc	.802
8	Xd	.840
9	VIIIa	.851
10	VIIId	.863
	No Hedge	.925

To examine the results of this analysis more extensively, strategies which displayed lower coefficients of variation and higher mean net return than the no-hedge strategy are selected for further comparison. Table XVII contains the distribution of net returns per head by year for each of these strategies. Although other strategies indicated higher net returns per head in some years, strategy Xa exhibited the highest total net return per head, $28.40. Another point to note is that for all strategies the net return per head declined from 1978 through 1981. These phenomena is due to higher input costs and lower prices received for slaughter hogs during this time period. Figure 2 indicates that monthly net margins were below the zero level from early 1979 through mid-1980, then returned to the zero level by late 1980. For this reason, continued declines in net return are not expected.

Summary and Conclusions

Eleven multiple hedging strategies plus the four alternatives for each strategy were employed in the assumed continuous farrow-to-finish hog operation. Comparisons were made on the basis of mean net return per group of hogs and the coefficient of variation. Currently, hog prices are at or near peak levels as hog inventory numbers are low. If interest rates decline as expected and feed prices remain at low levels, the economic incentive is overwhelming to increase hog

TABLE XVII

DISTRIBUTION OF NET RETURN PER HEAD BY YEAR AND COEFFICIENTS OF VARIATION FOR MULTIPLE HEDGING STRATEGIES WITH HIGHER MEAN NET RETURNS AND LOWER COEFFICIENTS OF VARIATION THAN THE NO-HEDGE STRATEGY

Strategy	1978	1979	1980	1981	Average	Coefficient of Variation
	($)	($)	($)	($)	($)	(%)
Xa	43.14	34.68	21.75	-4.47	28.40	0.564
XIa	50.90	31.01	17.67	-7.87	26.96	0.716
VIIIa	34.98	37.95	19.40	-25.03	25.23	0.851
IXa	47.95	31.24	15.57	-21.92	24.46	0.896
Xb	42.04	28.90	15.29	0.70	24.31	0.636
XIb	49.80	25.54	12.43	-2.06	23.47	0.778
VIa	31.80	41.38	9.87	-15.16	23.30	0.909
VIb	40.12	33.61	6.56	-2.53	22.21	0.893
VIIIb	33.94	34.12	11.91	-13.50	22.04	0.867
IXb	47.34	26.06	10.67	-14.97	21.39	0.967
XIc	44.44	21.23	11.09	7.99	21.26	0.798
Xc	37.91	22.90	12.46	6.87	20.89	0.738
VIc	43.69	23.85	8.37	6.07	20.81	0.879
VIIIc	36.89	24.91	9.97	1.41	20.03	0.802
VId	42.48	20.85	9.67	2.99	19.78	0.911
XId	42.29	18.95	11.31	4.30	19.77	0.883
Xd	37.56	20.91	12.36	2.67	19.71	0.840
IXc	42.82	20.61	9.57	0.97	19.56	0.922
Ic	38.67	20.05	10.07	10.14	19.49	0.872
VIIId	37.92	21.89	10.62	1.60	19.42	0.863
No Hedge	39.99	15.77	11.96	-0.32	17.99	0.925

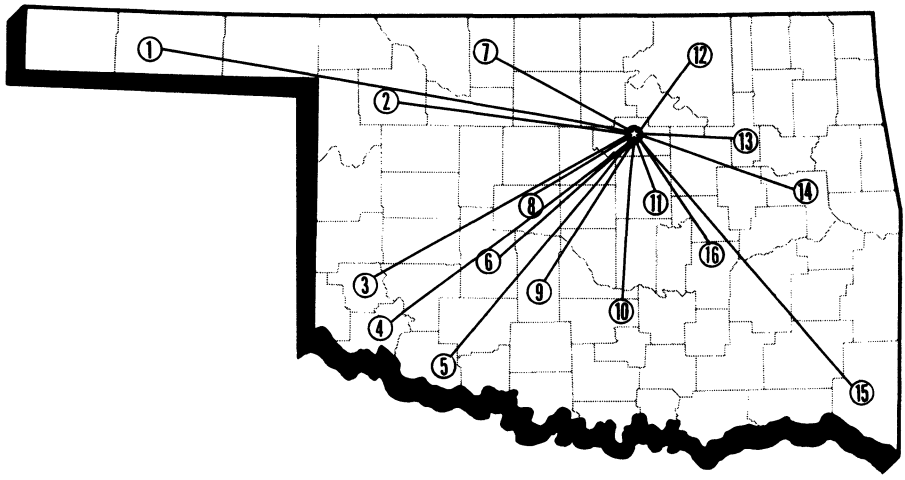
numbers. Hedging is one alternative to reduce the risk of lower returns in the future as prices adjust to increased hog numbers.

Moving averages provide a simple, objective technique to signal placement and lifting of hedges. The evidence from this research indicated that one set of moving averages tended to result in higher mean net returns and lower variability of net returns than attempting to use several sets of optimized moving averages. Strategy Xa, a 4-10-12 day moving average combination with a 14-cent penetration rule, resulted in the best performance. The mean net return and coefficient of variation of the no-hedge strategy were $3,692.39 and .564, respectively. The results compared very favorable to the mean net return and coefficient of variation of the no-hedge strategy, $2,339.11 and .925, respectively.

A producer should remember two points of consideration when electing to multiple hedge. First, the producer should carefully choose and adhere to one signalling strategy when entering the futures market. Multiple hedging will not always guarantee greater returns from each production period, but over a long time period average net returns should be higher and less variable. Also, the producer must be careful not to exceed the quantity specifications in the futures contract relative to his production capabilities. Exceeding the quantity specifications implies speculative activities in the futures market which increases price risk to the producer.

OKLAHOMA
Agricultural Experiment Station

System Covers the State



Main Station — *Stillwater, Perkins and Lake Carl Blackwell*

1. **Panhandle Research Station — *Goodwell***
2. **Southern Great Plains Field Station — *Woodward***
3. **Sandyland Research Station — *Mangum***
4. **Irrigation Research Station — *Altus***
5. **Southwest Agronomy Research Station — *Tipton***
6. **Caddo Research Station — *Ft. Cobb***
7. **North Central Research Station — *Lahoma***
8. **Southwestern Livestock and Forage Research Station — *El Reno***
9. **South Central Research Station — *Chickasha***
10. **Agronomy Research Station — *Stratford***
11. **Pecan Research Station — *Sparks***
12. **Veterinary Research Station — *Pawhuska***
13. **Vegetable Research Station — *Bixby***
14. **Eastern Research Station — *Haskell***
15. **Kiamichi Field Station — *Idabel***
16. **Sarkeys Research and Demonstration Project — *Lamar***

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