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Research Report

## **Performance of Selected Production Decision Rules For Hog Finishing Operations In Tennessee**

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and  
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PERFORMANCE OF SELECTED PRODUCTION DECISION  
RULES FOR HOG FINISHING OPERATIONS  
IN TENNESSEE

D. L. McLemore and J. R. Adams\*

Introduction

Slaughter hog prices have traditionally shown substantial cycles associated with the cycle in swine numbers and other factors. These price fluctuations coupled with changes in corn and feeder pig prices have created periods of prosperity and periods of net losses for producers who purchase and finish feeder pigs.

From the producer's viewpoint, it might be desirable to completely avoid production during periods of low returns. That is, if the producer feeding hogs could correctly anticipate when net returns would be below some minimum acceptable level, he could simply not purchase feeder pigs and allow his facilities to remain idle for that production period. If hog prices during the eliminated periods were too low to cover the producer's variable costs<sup>1</sup>, his total net returns over several years would be increased by such action. If hog prices during the eliminated periods were high enough to cover variable costs but too low to produce some minimum acceptable net return, the producer's total net returns over several years might be smaller but his average net return per group of hogs actually fed would increase. He would have a lower

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<sup>1</sup> Variable costs are those costs which will be incurred only if the pigs are bought and finished.

total net income but more time to devote to other activities. Either higher total net income or higher net income per group of hogs fed plus more free time would seem to be a desirable goal for the hog finisher.

The difficulty in implementing this idea lies in correctly anticipating when low net returns will occur. The research reported here evaluated whether selected rules or strategies for deciding when to produce would actually increase net returns to the producer. This evaluation was made based upon computer simulation of the actual use of the selected strategies by an imaginary Tennessee producer during the 1972-79 period. This approach implicitly assumes that the strategies that have worked well in the past will, at least to some extent, work well in the future.

#### Strategies Evaluated

A total of eight different production decision strategies were tested. The benchmark strategy against which all the other systems were compared was the full-production strategy. Under this strategy the producer would routinely buy and feed pigs during every production period. No attempt would be made to cease production during periods of low returns. For the seven selective production decision strategies, the decision of whether to produce was made based upon price conditions at the time when the feeder pigs were to be purchased.

#### Produce If Localized Futures Exceeds Breakeven

Since futures market prices for slaughter hogs represent an estimate or prediction of cash prices for hogs in the future, some have suggested

that producers use the futures price to determine when to produce and when to avoid production [7]. Two strategies were evaluated which were based upon the relationship between the futures price adjusted for the local basis (localized futures price) and the producer's breakeven price per hundredweight.<sup>2</sup> The futures price must be adjusted for the local basis because the basis represents the normal difference between the futures price and the local cash price which the producer can actually receive for his hogs at time of slaughter. Thus, an estimate of the basis for the period when the hogs will be sold is necessary in order to implement the strategy.<sup>3</sup>

The primary futures market-related strategy required that the producer buy and feed pigs only when the localized futures price for the period when the hogs would be sold exceeded the producer's breakeven price for that group of hogs. This means that the producer would operate only when the futures price indicated that he could at least cover the additional costs that he would incur by producing. An alternative version of this strategy which was also tested would allow production only when the localized futures price exceeded breakeven plus \$1 per hundredweight. This strategy would be slightly more conservative in that it would require coverage of variable costs plus at least \$1 per hundredweight to be applied to fixed costs.

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<sup>2</sup>The producer's breakeven price consists of the sum of his variable costs, or those costs that could be avoided by not producing, divided by the weight of the slaughter hog.

<sup>3</sup>Studies of the Tennessee basis for slaughter hogs by time period are available [4].

### Produce If Cash Price Exceeds Breakeven

Another, perhaps more naive, approach to price forecasting is to assume that prices in the near future (less than 6 months) will be the same as they are currently. Thus, the current cash price would provide a price estimate for decision purposes. Two strategies based upon this idea were evaluated. The first would allow production only if the current cash price exceeded the breakeven price for that particular group of hogs. As with the strategies discussed in the preceding section, the logic here is that the producer would always at least cover variable costs. A second, more conservative version of this type of strategy would require that cash price exceed breakeven plus \$1 per hundredweight.

### Produce If Localized Futures or Cash Exceeds Breakeven

The final three strategies tested were combinations of futures and cash-based strategies. They allowed production only when either localized futures prices or cash prices were greater than breakeven, breakeven plus \$1, or breakeven plus \$2 per hundredweight.

### Pricing Strategy Conditions

Each of the eight production decision strategies discussed above was evaluated under five different strategies for establishing the sale price for the hogs. These five pricing strategies were selected based upon an analysis of their historical ability to provide high net returns or because they represented commonly used strategies. This comparison of the pricing strategies was reported in a previous study [5].

The pricing strategies selected were: (1) full-cash, which uses the typical cash sale to price the hogs, (2) full-hedge, which consists of

routinely hedging the hogs on the futures market at the time the feeder pigs are purchased, (3) hedge if localized futures price exceeds cash price plus \$5, which hedges the hogs on the futures market only when the futures price minus the local basis is greater than the current cash price for hogs by at least \$5 per hundredweight, (4) hedge if localized futures price exceeds breakeven price plus \$10, and (5) contract if contract price exceeds breakeven price plus \$10, which consists of selling the hogs on a cash forward contract only when the contract price offered is greater than the breakeven price for the hogs by at least \$10 per hundredweight.

The latter three pricing strategies could establish price at anytime from the time the feeder pigs were purchased until approximately six weeks before the hogs were to be sold. If at any time during that period the particular criterion was met, the hedge or contract was executed. Those hogs not hedged or contracted were sold on the cash market as under the full-cash strategy. The use of these five pricing strategies as conditions under which the production decision strategies were evaluated provided a variety of circumstances in which to judge the performance of the production decision strategies.

#### Procedure

The level of net returns above breakeven (variable cost) was the measure used to evaluate which production decision strategies performed best. However, the individual producer may view net returns in two ways. He may place all emphasis on maximizing total net returns over a given time period. On the other hand, he may place some emphasis on maximizing

net returns per group of hogs actually fed. That is, he may be interested only in maximizing income from hogs and place little value on free time, or he may place a high value on free time or time for use in other farm or nonfarm enterprises. The former approach would probably be more applicable if hog finishing were the farmer's only enterprise. If he had other enterprises or employment, the latter approach might be more appropriate. Thus, the research reported here analyzed both total net returns over the 1972-79 period and net returns per group of hogs actually fed during the period.

#### Production Model

A simulation model was developed to represent the Tennessee producer who finishes purchased feeder pigs. This model was based upon production budgets contained in the Tennessee Farm Planning Manual [6]. The producer was assumed to purchase feeder pigs at approximately 45 pounds and to feed them for four months. At the end of the feeding period the hogs were assumed to average approximately 230 pounds each. Since the futures contract used in some of the pricing strategies requires 30,000 pounds of live hogs, the production unit or group size for feeding was set at 130 head. The simulation of this feeding operation was repeated twice each month during the 1972-79 period. This would represent a producer who started a new group of feeder pigs and sold a group of finished hogs every 15 days in a continuous operation. However, this does not imply that the production decision rules in this study could not be used by a smaller scale operation.



Only variable costs were included in the cost calculations. These included the cost of feeder pigs, corn, supplement, veterinary services and medicine, interest, trucking, grinding and mixing, labor, and an allowance for death loss. Revenues in excess of variable costs were assumed to be applied to paying fixed costs and management. Price and cost data for cost calculations were obtained from various issues of Tennessee Agricultural Statistics [8], USDA's Agricultural Statistics [9], and the Tennessee Farm Planning Manual [6].

#### Price Data

Weekly cash prices for slaughter hogs were obtained from Federal-State Market News Service sources for the 1970-79 period for 15 auction markets across Tennessee [2]. The average of these 15 prices was assumed to represent the cash market price in Tennessee. Data on live hog futures prices were obtained from the Chicago Mercantile Exchange [1]. The daily closing futures price was considered representative of that market. The cash prices used were for grades and weights as closely comparable as possible to the futures contract delivery grades and weights.

As noted earlier, those strategies using futures prices required an estimate of the basis (the difference between futures prices and local cash prices) in order to translate the futures price into a price applicable to the local cash market. When the producer uses the futures market his estimate of the basis must be a forecast or projection for the future time period when the hogs will be ready for slaughter. This study assumed that the producer used the average basis for the last two years for the period in question as the appropriate estimate of the basis for the corresponding future period. The basis for this study was calculated by subtracting the average cash price from the average futures

price for each 10-day period beginning in January 1970 and ending in March 1979. The basis figures for 1970 and 1971 were used to arrive at basis estimates for the first hog production simulations begun in 1972. The basis figures for 1971 and 1972 were, in turn, used to estimate the basis for 10-day periods in 1973, and so on. Other methods for estimating the basis are available [3].

### Results

Net returns from the application of each of the production decision strategies by the simulated hog producer are presented in Table 1. Results are shown for the eight production decision strategies applied under the five pricing strategy conditions. Net returns are given both as a total over the January 1972 - March 1979 period and as an average per group of hogs actually fed (production occurrence) during the period.

#### Total Net Returns

Based upon total net returns over the entire period, the full-production strategy (162 production occurrences) provided the best results in all cases except where the full-hedge pricing strategy was used. Thus, under four of the five pricing strategy situations simulated, the hog producer would have realized more total net returns by producing routinely during every production period rather than using the other, selective, production strategies simulated. Under the full-hedge pricing strategy, the "produce if localized futures exceeds breakeven" production strategy (132 production occurrences) gave the highest net revenue with an improvement of slightly less than \$12,000 (8%) above the full-production strategy for the 1973-79 period. However, the full-hedge pricing

Table 1. Total and Average Net Returns and Number of Production Occurrences for Selected Production Decision Strategies Simulated With Five Different Pricing Strategies for Hog Finishing Operations, Tennessee, 1972-1979<sup>a</sup>

Pricing Strategy	Production Decision Strategy	Total Net Returns --Dollars--	Number of Production Occurrences	Net Return Per Production Occurrence ---Dollars---	
Full-Cash	Full-Production	298,610	162	1843	
	Produce If Localized Futures Exceeds Breakeven	262,482	132	1989	
	Produce If Localized Futures Exceeds Breakeven + \$1	237,983	123	1935	
	Produce If Cash Exceeds Breakeven	270,229	142	1903	
	Produce If Cash Exceeds Breakeven + \$1	259,072	136	1905	
	Produce If Localized Futures Or Cash Exceeds Breakeven	289,324	157	1843	
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$1	289,533	156	1856	
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$2	262,344	140	1874	
	Full-Hedge	Full-Production	144,846	162	894
		Produce If Localized Futures Exceeds Breakeven	156,526	132	1186
Produce If Localized Futures Exceeds Breakeven + \$1		150,179	123	1221	
Produce If Cash Exceeds Breakeven		134,185	142	945	
Produce If Cash Exceeds Breakeven + \$1		124,967	136	919	
Produce If Localized Futures Or Cash Exceeds Breakeven		147,324	157	938	
Produce If Localized Futures Or Cash Exceeds Breakeven + \$1		146,991	156	942	
Produce If Localized Futures Or Cash Exceeds Breakeven + \$2		147,286	140	1052	

Table 1 (Continued)

Pricing Strategy	Production Decision Strategy	Total Net Returns --Dollars--	Number of Production Occurrences	Net Return Per Production Occurrence ---Dollars---
Hedge If Localized Futures Exceeds Cash + \$5	Full-Production	334,409	162	2064
	Produce If Localized Futures Exceeds Breakeven	299,428	132	2268
	Produce If Localized Futures Exceeds Breakeven + \$1	271,898	123	2211
	Produce If Cash Exceeds Breakeven	305,605	142	2152
	Produce If Cash Exceeds Breakeven + \$1	295,106	136	2170
	Produce If Localized Futures Or Cash Exceeds Breakeven	325,025	157	2070
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$1	324,693	156	2081
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$2	298,005	140	2129
	Hedge If Localized Futures Exceeds Breakeven + \$10	Full-Production	333,641	162
Produce If Localized Futures Exceeds Breakeven		298,346	132	2260
Produce If Localized Futures Exceeds Breakeven + \$1		274,504	123	2232
Produce If Cash Exceeds Breakeven		296,745	142	2090
Produce If Cash Exceeds Breakeven + \$1		284,785	136	2094
Produce If Localized Futures Or Cash Exceeds Breakeven		322,532	157	2054

Table 1 (Continued)

Pricing Strategy	Production Decision Strategy	Total Net Returns --Dollars--	Number of Production Occurrences	Net Return Per Production Occurrence ---Dollars---
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$1	322,740	156	2069
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$2	291,498	140	2082
Contract If Contract Price Exceeds Breakeven + \$10	Full-Production	347,228	162	2143
	Produce If Localized Futures Exceeds Breakeven	309,571	132	2345
	Produce If Localized Futures Exceeds Breakeven + \$1	284,281	123	2311
	Produce If Cash Exceeds Breakeven	316,981	142	2232
	Produce If Cash Exceeds Breakeven + \$1	304,503	136	2239
	Produce If Localized Futures Or Cash Exceeds Breakeven	337,906	157	2152
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$1	338,113	156	2167
	Produce If Localized Futures Or Cash Exceeds Breakeven + \$2	305,871	140	2185

<sup>a</sup>Net returns are the amounts by which revenues exceed breakeven or variable costs. Thus, net returns represent returns to management and fixed factors of production (land, fixed taxes, equipment and facilities).

strategy gave the poorest results of any of the pricing strategies used, indicating that it would probably be a poor choice for the producer [5].

For the four pricing strategies under which full-production was the best production strategy, the second and third best production strategies were always "produce if localized futures or cash exceeds breakeven" or "produce if localized futures or cash exceeds breakeven + \$1." The production strategy which consistently showed the lowest total net returns was "produce if localized futures exceeds breakeven + \$1" (123 production occurrences).

#### Net Returns Per Production Occurrence

The ranking of the alternative production decision strategies based upon average net return per group of hogs actually fed was markedly different compared to the ranking according to total net returns. Full-production was the poorest strategy under four of the five pricing strategy conditions when average net return per production occurrence was considered. The production strategy yielding the highest average net return in all cases except one was "produce if localized futures exceeds breakeven" (132 production occurrences). The second best strategy in all cases except one was "produce if localized futures exceeds breakeven + \$1" (123 production occurrences). The two exceptions in the first and second rankings occurred where these two strategies exchanged places in the rankings. Note that both the first and second best strategies involved using futures prices.

If the producer chose to use the "produce if localized futures exceeds breakeven" strategy, he would have increased his average net return per group of hogs fed (130 head) by an average of \$209 over all

five pricing strategies. In addition, he would have fed 30 fewer groups of hogs during the 1972-79 period. This reduction in feeding activity would have been equivalent to 15 months of time released from the hog finishing operation which could have been used in other activities. However, the producer would have realized an average of \$26,476 less total net income for the 87-month period analyzed.<sup>4</sup>

#### Differences Between Total and Average Net Income Results

The fact that the full-production strategy gave the largest total net return over the entire period but the smallest average net return per group of hogs actually fed, may, at first, seem to be inconsistent. The decrease in total net returns implies that the selective production decision strategies eliminated production during more positive net return periods than negative net return periods. However, the production periods eliminated by the selective strategies were typically periods of below-average net returns. Thus, the average net return per group of hogs fed would be increased. The choice of which set of results to use would depend upon whether the producer had alternative uses for the time released from the hog production enterprise and upon what value he placed upon the released time.

#### Conclusions and Implications

If the objective of the producer who finished purchased feeder pigs had been to maximize total net income from the swine enterprise, the production decision rules or strategies evaluated in this study would

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<sup>4</sup>This average decrease in total net income is the mean of the decreases across pricing strategies including the full-hedge strategy which showed an increase. Exclusion of the full-hedge strategy from the average would result in an average of \$36,015 less total income.

not have performed well during the 1972-79 period. The producer who wished to maximize net income would have been better off to have used the full-production strategy, producing 162 groups of hogs during the period rather than using any of the selective strategies in an attempt to avoid production during unprofitable periods. The selective production decision strategies were not successful in increasing total net income.

If the objective of the producer had been to increase average net returns per group of hogs finished, several production decision strategies would have provided results superior to the full-production strategy. Use of the selective production strategies would have released up to 19 months of time from the hog enterprise through avoiding production during portions of the 1972-79 period. The strategy which performed best under the pricing conditions simulated was to produce only when the localized futures price exceeded the producer's breakeven price for the particular group of hogs being considered. This strategy produced 132 groups of hogs during the period. Average net return per group was \$209 above the average for the full-production strategy.

The results presented here also indicate that use of routine futures market hedging of all hogs as a pricing strategy gave very low net returns. Use of selective hedging and contracting strategies to establish sale prices increased net returns above the full-cash pricing alternative. These results are discussed in more detail in a related publication [5].

To the extent that past results can be used to predict future outcomes, it appears that hog producers wishing to maximize total net income should continue routine production during each opportunity. However, producers who might make productive use of time released from hog production should consider using a strategy to avoid production during periods of lower net returns.



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