

Table 1. Key price variables, 1975-1990.

Variable	Avg.	Var:*	Min.	Max.
Feeder pig (head)	\$ 42.60	\$ 10.20	\$ 20.69	\$ 67.67
Feeder pig (cwt.)	94.66	22.67	45.98	150.38
Cash hog (cwt.)	46.99	7.17	27.60	66.06
Hog futures (cwt.)	46.55	6.22	30.20	60.50
N.C. Iowacorn (bu.)	2.32	0.48	1.11	3.37
Soybean meal (ton)	179	37	103	320
Interest rate (%)	11.82%	2.77%	8.25%	19.00%

*Variability is measured as the standard deviation.

Coefficients of the equations were estimated using weekly data from January 1975 through December 1985 which encompasses two complete hog cycles. The equations were then used to estimate feeder pig prices over the January 1986 through December 1990 period, a third complete hog cycle. The estimated prices were then compared to actual prices. Upon analysis, it was found that soybean meal prices and interest rates did not significantly impact feeder pig prices and were removed from the equations. Comparisons to actual prices are shown in Table 2.

Table 2. Formula prices for 40-50 lb. feeder pigs, 1986-1990 (\$/cwt.)

Pricing method	Avg.	Var:*	Min.	Max.
Actual price	\$102	\$22	\$56	\$149
Equation 1	98	9	80	125
Equation 2	105	17	67	152
Should pay	83	32	17	156
Cost plus	101	6	90	120
Profit share	86	15	58	117

*Variability is measured as the standard deviation.

The formulas for estimating feeder pig price per hundredweight are shown below:

Equation 1:

$$2.10 \times \text{HFP}$$

Equation 2:

$$32.85 + 2.73 \times \text{HFP} - 27.90 \times \text{CCP}$$

Equation 1 estimates feeder pig prices based only on the four-month-out hog futures prices. It is a simple formula. The feeder pig price per cwt. is 2.1 times the hog futures price per cwt. However, it explains only 44 percent of the variation in feeder pig prices. It has a lower average price and considerably less variability than the auction market (Table 2).

Equation 2 uses two variables, hog futures and cash corn prices. It explains 70 percent of the variation in feeder pig prices. On average, it slightly overestimates price relative to the auction market, and is less variable than cash (Table 2).

Partial budgeting pricing procedure

An alternative procedure is to develop a formula that is agreeable to both the buyer and seller based on their cost of production and profit objectives. Costs of production budgets for feeder pig producers and finishers were estimated from the *ISU Swine Enterprise Records*, File **B1-41**, **B1-42**, and **B1-43**.

While the resulting formulas use the same variables as the statistical analysis, they focus on what prices *should be* given expected performance to meet profit objectives, rather than what prices actually have been.

- **Maximum should pay**

The maximum price a finisher should be willing to pay for feeder pigs depends upon expected revenues, expected cost, and his or her profit objective. Multiplying the basis-adjusted hog futures price by 240 pounds serves as expected gross revenue. Costs depend on corn and supplement prices at the time the pig was bought. The profit objective is \$5.00 per head. The resulting price a finisher *should* pay is \$19.36/cwt. lower than the auction market price (Table 2) and more variable due to a lower minimum price. The budgeted maximum price is only slightly higher than the highest auction price, but the minimum is nearly \$40/cwt. lower than the auction minimum.

- **Cost-plus**

The cost-plus pricing formula represents a *should receive* price because it covers the seller's cost of production and includes a

predetermined profit. It uses the budget in Table 3, corn and supplement prices when the pigs are sold, and adds a \$5.00 per head profit. This price is \$0.94/cwt. below the auction price, but is much more stable (Table 2). Prices vary less than \$30/cwt. from high to low compared to the \$92.22 range in auction prices.

• Profit Sharing

A third formula involves sharing the actual profits determined after the hogs are sold. This procedure assumes a constant deathloss and animal performance. It assumes that actual profits are divided in proportion to the inputs supplied by each party (valued at pig purchase date) to finish the hog to market weight. Based upon the budgets in Table 3, the seller supplies 37 percent of the inputs and the buyer supplies 63 percent. Corn and supplement prices are the simple average of prices when the pig was bought and the hog was sold. This formula resulted in lower average and maximum prices, less variability, and a higher minimum price relative to actual prices.

Table 3. Budgets.

Inputs per head to produce:

	Feeder	Finisher
Corn (bu.)	3.30	10.50
Supplement (lbs.)	53.00	125.00
Operating cost w/labor	\$17.00	\$22.00
Overhead cost	\$8.00	\$7.00

Variability is measured as the standard deviation.

Impact on buyer and seller returns

While average prices and variability are of concern, the more important question is how profits are affected under the different pricing arrangements. Returns to labor, overhead, and management for feeder pig producers and finishers using actual auction market prices were compared to those using the formulas over the 1986 to 1990 period as shown in Table 4.

While the budgets indicate similar labor and overhead costs for both buyer and seller, auction prices provided the buyer a 28 percent higher return and a

41 percent wider range of returns than they do the seller. Comparing the pricing methods on returns rather than feeder pig price puts the formulas in a different light, and may cause one to be preferred to the other.

Profit sharing and paying what the finisher *should* pay produced the greatest return to the buyer. The remaining formulas generated returns similar to auction prices for the buyer. The seller received the greatest returns from Equation 2, the formula that depends on hog futures and corn prices. The *should pay* formula produced the smallest and most variable returns to the seller. Cost-plus pricing generated a slightly lower return than did the auction market, but it had no variability. However, feeder pig producer returns under cost-plus pricing will vary due to changes in production efficiency and price changes in inputs other than corn and protein supplement. Profit sharing cut seller returns by more than 50 percent compared with the auction market.

Choosing a formula

It is doubtful that any one formula will satisfy both buyer and seller. These formulas represent starting points for negotiation, rather than a fixed rule to follow. The *best* formula depends on the objective of each party. Equation 1, the one variable equation

Table 4. Returns per head to labor, overhead, and management by pricing method.

Buyer	Avg.	Var.*	Min.	Max.
Actual market	\$18.55	\$16.82	\$-20.69	\$62.39
Equation 1	20.30	20.29	-22.85	65.72
Equation 2	17.35	18.70	-20.68	67.33
Should pay	27.59	15.88	-7.55	73.95
Cost plus	18.97	23.40	-31.96	64.67
Profit share	25.84	14.60	-6.03	54.41
Seller	Avg.	Var.*	Min.	Max.
Actual market	\$13.42	\$11.87	\$-11.14	\$37.41
Equation 1	11.72	5.26	-0.32	24.42
Equation 2	14.57	9.81	-11.01	39.25
Should pay	4.71	16.24	-31.52	39.54
Cost plus	13.00	0.00	13.00	13.00
Profit share	6.39	8.47	-12.05	22.90

*Variability is measured as the standard deviation.

based on hog futures prices, is the simplest formula, and provided the buyer a \$1.75 per head higher return at only a slightly higher risk (downside risk increases by \$2.16 per head). The seller forgoes \$1.70 per head profit, but limits his or her downside risk to -\$0.32 per head. If one of the seller's objectives is to reduce price risk, this simple formula does quite well. Other formulas that may also be feasible include the profit share and cost-plus formulas, provided the terms are negotiated to make it attractive enough to the other party. The two variable equations, using both hog futures and corn prices, generated feeder pig prices that were \$2.55 per hundred higher than auction prices, but buyer returns that were \$1.20 lower and more variable than the auction market. Seller returns were \$1.15 per head higher, but with similar downside risk.

The formula of choice will differ between buyer and seller, and across buyers and sellers, depending on their cost of production and profit objectives. The two parties must decide which pricing method to use, the size of coefficients in the formula, and which prices to use (weekly average futures price or Friday closing price, local elevator corn price, etc.). Although they may wish to periodically renegotiate the coefficients in the model, once a buyer and seller agree upon a formula, they should stick with it for a specified time. Due to the nature of feeder pig prices, the formula may go through extended periods of under pricing or overpricing relative to auction prices, but adjustments should not be made hastily as the formulas are based on long-run relationships.

Adjusting for weight difference

The formulas discussed above are based on a 45-pound feeder pig (prices for the 40- to 50-pound weight class). However, pigs trade in a wide range of weights and buyers and sellers should adjust their formula to reflect the actual weight of each lot of pigs traded. Sioux Falls, South Dakota, terminal market prices for feeder pigs in three weight classes (30-40, 40-50, and 50-60) were compared weekly for a three year period (1988-1990) to establish the price relationship.

Weight range	Average	Difference
30 - 40	37.31	
40 - 50	44.29	6.98
50 - 60	49.40	5.11

The prices were highly correlated, but significantly different from each other. The differences were not significantly related to hog, corn, or soybean meal prices. Thus, the simple average difference captures the value of pigs at various weights reasonably well.

Buyers and sellers can adjust their formula price to reflect the relative value of pigs weighing other than 45 pounds by using the following formula. The pig is worth 69.8¢ less per head for each pound less than 45 pounds. The pig is worth 51.1¢ per head more for each pound over 45 pounds.

As with the initial formulas, buyers and sellers must negotiate the price adjustment that is satisfactory to both parties. The accompanying example illustrates how to use the formulas to estimate prices and make the weight adjustment for pigs weighing more or less than 45 pounds.

Problems of formula pricing

The formulas described here and their comparison to actual spot market prices has two inherent problems.

• **Differences in pig quality**

First, the statistical analysis and comparisons are based on auction market prices that represent pigs that may be different from direct trade pigs. In fact, buyers and sellers trade directly because they believe that their pigs are of higher quality (less stress, higher health status, etc.) than auction market pigs. Thus, the price derived by the statistical formulas may need to be adjusted upward, because direct trade pigs often sell at a premium to auction pigs.

The partial budget formulas are based on specific estimated production parameters. The production track record of the pigs on an individual's farm should be incorporated into the price negotiation process to more accurately reflect the value of the pigs to the buyer.

• **Declining access to auction prices**

The second problem is that auction reporting by third-party state and federal government agencies are declining. This lack of reporting is one of the reasons why producers may find formulas attractive as they are based on readily observable data. However, if feeder pig prices are no longer reported, it will not be possible to update the

formulas estimated here. Thus, formulas based on reported prices are only a short-term substitute for reported prices. Without a dependable feeder pig price series, formula updating will not be possible.

formulas discussed here are neither exhaustive nor perfect solutions, but serve as starting points for negotiation. Buyers and sellers should examine the impact the various pricing formulas have on their operation and cost of production. The appropriate formula will depend on the needs of the two parties and whether it is a one-time sale or an ongoing agreement. The formulas appear to work better in ongoing agreements where the impact of a too high or too low price estimate will be offset on a later time.

Summary

Feeder pig buyers and sellers seeking an alternative to the increasingly thinly traded spot market has many alternatives from which to choose. The

Example 1. Pricing formula.

Assume that on the day the pigs are priced:

Pig weight	48 lbs.	Finished weight	245 lbs.
Corn price	2.40/bu.	Supplement price	\$15/cwt.
Hog futures	\$50/cwt.	Expected basis	-\$1.50/cwt.
Operating cost per head		Feeder pig	\$17
Overhead cost per head		Finisher	\$22
Profit objective per head		Feeder pig	\$ 8
		Finisher	\$ 7
		Feeder pig	\$ 5
		Finisher	\$ 5

Step 1: Choose one of the formulas to calculate price of 45-lb. pig as base price per head.

Equation 1:	$2.1 \times \$50 = \105	$\times 45/100 = \$47.25$
Equation 2:	$32.85 + 2.73 \times \$50 - 27.9 \times \$2.40 = \$102.39$	$\times 45/100 = \$46.08$
Should pay:	$2.45 \times (\$50 - \$1.50) = \$118.83$	head expected revenue
	$-10.5 \times \$2.40 - 125 \times \$0.15 - \$22 - \$7 - \$5 = \40.88	
Cost plus:	$3.3 \times \$2.40 + 53 \times \$0.15 + \$17 + \$8 + \$5 = \45.87	
Profit share:	Actual performance and prices known when the hogs are sold.	
	Finished weight 247 lbs.	Cash price \$52/cwt.
	Corn 10.2 bu. @ \$2.50/bu.	Supplement 121 lbs. @ \$16.25/cwt.
	$2.47 \times \$52 = \128.40	head revenue
	$-10.2 \times \$2.50 - 121 \times \$0.1625 - \$22 - \$7 = \$54.24$	head return
	Initial payment for pigs = \$45.88 = Should pay before profit objective	
	Profit share, $\$54.24 - \$45.88 = \$8.36$ /head Profit	
	Seller share @ 37%	= \$3.09
	Buyer share @ 63%	= \$5.27
	Net payment =	\$48.97
	Net payment =	\$40.61

Step 2: Adjust 45-lb. pig base price for extra weight of 48-lb. pigs.

$48 - 45 = 3 \times \$0.511 = \1.53 additional per head added to each formula price.