

Using the Crush Margin to Manage Profits Rather than Price: Wean to Finish

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Why calculate a crush margin?

Buying weaned pigs, corn, and soybean meal and selling hogs at discrete times throughout the year exposes wean to finish producers to both input and output price risk. Weaned pig, corn, and soybean meal prices account for a significant share of total cost and are volatile, adding to a producer's risk. Managing the crush margin between the hog revenue and the major input costs, weaned pigs corn, and soybean meal that change with market conditions is very important. The term "crush" comes from the soybean processing sector where soybeans are crushed to produce oil and meal. Traders use the soybean, soybean oil, and soybean meal futures to find and manage profit opportunities as the three related markets trade months before the beans are physically processed. Similarly, prices for hogs, weaned pigs, corn, and soybean meal can be managed to protect a margin for a wean to finish producer.

The margin is the remaining revenue used to pay all other costs and, hopefully, return a profit. The crush margin provides an indicator of return that takes into account the variables with the greatest price risk. It is also tied to the futures market that can be used to manage price risk for several months before the hogs are sold.

Iowa State University Extension and Outreach, Department of Economics, provides a crush margin analysis with the following objectives:

- Calculate and report the crush margin based on Wednesday futures closing prices for wean to finish hogs that will be marketed more than a year into the future.
- Track how the margin for each contract has changed over time.

The crush margin calculation and tracked changes can serve as a quick indicator of risk management opportunities or pitfalls and help producers monitor the hog and feed markets for current and future marketing.

What is a crush margin?

The crush margin is defined in a variety of ways but what is important to understand is how the costs compare to the defined crush margin. In this analysis the crush margin (CM) is defined as the value of the hog less the cost of the weaned pig, corn, and soybean meal. Specifically,

$$CM_T = (2 * LHF_{BT}) - WP_{T-5} - (10 * CF_{BT-5}) - (0.075 * SBMF_{BT-5})$$

LHF_{BT} is the lean hog futures that expire in month T (or one month after T in the case of off contract months) adjusted for the Iowa/Southern Minnesota basis (B) for month T. This price is multiplied by 2 for a 200 pound carcass. WP_{T-5} is the weaned pig price at placement, five months prior to slaughter. Prior to purchasing the weaned pig the first Wednesday of the placement month the weaned pig price per head is estimated to be 50 percent of the 5-month-out lean hog futures price not adjusted for basis. Fifty percent is the average ratio of USDA reported national weaned pig price per head and the 5-month-out lean hog futures price. CF_{BT-5} is the corn futures price at placement adjusted by the North Central Iowa basis multiplied by 10

bushels per hog. $SBMF_{BT-5}$ is the soybean meal futures price at placement adjusted by the Iowa basis multiplied by 0.075 tons or 150 pounds per hog.

At placement, the first week of the month, it is assumed that the weaned pig, corn and soybean meal are purchased in the spot market (S) at the weekly average price. The CM then becomes:

$$CM_T = (2 * LHF_{BT}) - WP_S - (10 * CS) - (0.075 * SBMS)$$

When the hogs are sold in the spot market at time T the selling price is the total of all purchase types (negotiated, other market formula, swine/pork market formula, other purchase arrangement) daily weighted average price of producer sold Iowa/Southern Minnesota barrows and gilts. Upon such the final margin is calculated.

What does the crush margin cover?

The purpose of the crush margin is to serve as a simple indicator of potential returns and not as a measure of profit or loss to any one operation. There are two places that the crush can differ from an individual operation's return. First is the weighting in the crush margin calculation. Individuals may have different carcass weights, feed requirements, or hog or weaned pig pricing formulas. Second, is in the remaining cost that the crush margin must cover to sustain the enterprise. The weightings will differ between operations and even between groups of hogs, but the key is to use weightings that are accurate enough to signal the general direction and magnitude of margins.

The costs left to be covered by the crush margin also differ across operations and each individual operation should know how much margin is needed to meet its remaining costs. To frame the discussion, the values in Table 1 are from the Iowa State University Estimated Returns for Wean to Finish and total over \$40/head to breakeven. Note that the facility fixed cost is an economic value representing depreciation, interest, repairs, and taxes rather than a cash flow cost reflecting debt service and maintenance. The costs in Table 1 are relatively constant over time while the prices for hogs, weaned pigs, corn, and soybean meal may change daily or weekly.

Table 1. Estimated Wean to Finish Costs (Less Weaned Pig, Corn, and Soybean Meal)

Cost Item	\$/Head
Vitamins, Minerals, and Purchased complete feeds	11.35
Grind, mix, and deliver	3.62
Animal health and/or veterinary/medical	4.15
Labor and administrative	5.67
Operating interest	2.67
Utilities	2.57
Transportation	2.00
Facility fixed cost	<u>8.45</u>
Total cost (less weaned pig, corn, and soybean meal)	<u>40.48</u>

Source: Iowa State University Estimated Returns for Wean to Finish

An operation may have different weighting of hog and weaned pig prices and feed use and different costs that must be covered, and producers should evaluate how well the crush margin matches their own costs. Regardless, the crush margin can act as an indicator of hedging

opportunities by alerting the producer when futures prices are in the desired range. However, it is important to note that the crush margin accounts for hog, corn, and soybean meal prices together to protect a margin. For example, locking in only a hog price and not a corn and/or soybean meal price leaves the producer exposed to margin risk.

How does one use the crush margin information?

Once a favorable margin is identified the next step is to lock it in. Some producers have feed prices already set. For example, they may raise their own corn and price it to the hogs at the cost of production plus storage or the soybean meal needs are booked for the year. Likewise, a producer may have a contracted weaned pig price. These producers can still monitor the margin relative to their known prices, but they have fewer variables to monitor.

A challenge to using futures is that the contract sizes should be matched to the amount of cash commodity that producers are trying to protect. For example, 1,000 hogs in a finishing building matches approximately 5 lean hog futures contracts and 2 corn futures contracts but only 0.75 soybean meal futures contracts.

The weaned pig price can be cross-hedged in the lean hog futures contract because the prices are highly correlated and in the crush margin calculation above they are perfectly correlated. The hedge ratio, the number of pigs that can be hedged per hundredweight of lean hog futures is the weighting factor used in the formula (i.e., 50%), the relationship between the lean hog futures price in \$/cwt and the weaned pig price in \$/head. Thus, a 40,000 pound lean hog futures contract will cross hedge 800 weaned pigs (400 cwt divided by 0.5).

Locking in the weaned pig price and the market hog selling price at the same time seems confusing at first because they are offsetting and in the same contract, but it actually simplifies the process. Consider the example of a producer with a 1,000 head finishing building that will place pigs in July and sell hogs in December. It will take 5 lean hog futures contracts to hedge all the hogs, but the price for 800 weaned pigs and 200 market hogs are linked through a weaned pig pricing formula. Table 2 illustrates selling 4 December lean hog futures contracts in January and 1 lean hog futures contract in July when the weaned pigs are placed and then offsetting all 5 lean hog futures contracts in December when the hogs are sold. Whether lean hog futures prices moved higher, lower or both, the variation in return over pig cost is relatively small, \$1/head in this example. The difference is due to the change in price from January to July for the 1 contract spread over all 5 contracts. Selling the four contracts in January locked in a selling price on 800 head. Changes in price from January to July impacted the selling price of 200 hogs and buy price of 800 weaned pigs equally. Any gain or loss comes from the price change on the 200 weaned pigs that were not covered by the hedge.

The returns over weaned pig costs shown in Table 2 are vulnerable to changes in corn and soybean meal prices unless those are protected as well. For the 1,000 head finisher, 2 corn future contracts would lock in the corn price. One contract would cover 100 tons of soybean meal when approximately 75 tons are needed. The margin risk per head would then be the change in the price of the 25 additional tons of soybean meal divided by all 1,000 pigs.

Table 2. Futures Hedge for December Sales

Example: Placing weaned pigs in July and selling 4 December lean hog futures contracts in January, 1 December lean hog futures contract in July and offsetting all 5 lean hog futures contracts in December.

Futures	January	\$65	\$65	\$65	\$65	\$65	\$65	\$65
Prices	July	60	60	70	70	65	65	65
	December	60	70	60	70	60	70	65
Futures gain (loss), \$/cwt		4	-6	6	-4	5	-5	0
Weaned pig price at purchase, \$/hd		30	30	35	35	33	33	33
Hog sales price, \$/cwt		60	70	60	70	60	70	65
Return over pig cost, \$/hd		98	98	97	97	97.5	97.5	97.5

It is important to remember that basis risk still exists for all of the markets. Basis risk is found not only in the chance that actual basis is wider or narrower than was expected, but also in the timing of when to lift the hedge. Lean hog futures contracts can be offset as hogs are sold, but corn and soybean meal contracts are “lumpier” and a risk exists if you offset the futures position, but purchase only part of the corn or soybean meal in the cash market. Consider working with a supplier about forward contracting these inputs rather than a futures hedge to reduce this basis timing risk.

Summary

Unlike continuous flow hog production systems that market hogs throughout the year, wean to finish operations using all-in/all-out pig flow market hogs in a limited time window experience increased price risk exposure. Furthermore, increased price volatility in corn and soybean meal markets creates feed price risk that can be significant. As a result, hog farmers should monitor and manage margins rather than focusing on hog or feed prices alone. The crush margin is the return from selling a hog less the cost of the weaned pig, corn, and soybean meal. These four variables have price risk but can also be hedged with futures, options, or livestock insurance. The crush margin is a generic index of wean to finish returns and not an absolute measure of profitability for all operations. Comparing an operations own costs, historic performance, and recent trends, the crush margin can provide a useful tool for evaluating risk management strategies for producers.