

## Using the Crush Margin to Manage Profits Rather than Price

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Hog farmers and particularly wean-to-finish growers are starting to talk about the “crush”. 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. In the case of wean-to-finish pigs the margin is the value of the market hog less the cost of the pig and the corn and SBM to raise it. Livestock “Gross” Margin (LGM) SEW insurance starts with the value of the hog and subtracts corn and SBM, but not the price of the pig.

Regardless of the name, 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 the price risk for several months before the hogs are sold. The Iowa Pork Industry Center at Iowa State University provides a crush margin analysis tool on its website with the following objectives:

- Calculate and report the crush margin based on Wednesday futures closing prices for WF hogs that will be marketed for more than a year into the future.
- Track how the margin for each contract has changed over time
- Report the margin average and variability by month over the last 10 years.

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

### What is a “crush” margin?

Crush margin is defined in a variety of ways by different people but what is important to understand how your 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 pig, corn and SBM. Specifically,

$$1. \text{CM}_T = 2 \times \text{LHF}_{BT} - \text{WP}_{T-5} - 10 \times \text{CF}_{BT-5} - .075 \times \text{SBMF}_{BT-5}$$

$\text{LHF}_{BT}$  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 basis (B) for month T. This price is multiplied by 2 for a 200 pound carcass.  $\text{WP}_{T-5}$  is the weaned pig price at placement, 5 months prior to slaughter. Prior to buying the pig the first week of the placement month the pig price per head is estimated to be 50% of the 5-month-out LHF price not adjusted for basis. Fifty percent<sup>1</sup> is the average ratio of USDA reported national weaned pig price per head<sup>2</sup> and the 5-month-out LHF.  $\text{CF}_{BT-5}$  is the corn futures price at placement adjusted by the North Central Iowa Basis multiplied by 10 bushels.  $\text{SBMF}_{BT-5}$  is the SBM futures price at placement adjusted by the Iowa SBM basis multiplied by 0.075 tons or 150 pounds.

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<sup>1</sup> This relationship averaged 58% for Jan 2002-Apr 2009, 54% of Jan 2003-Sep 2006 and 50% for Oct 2006-Apr 2009.

<sup>2</sup> USDA-AMS NW\_LS255 National Direct Feeder Pig Report Early Weaned Pigs 10 lb Basis: Estimated 50-54% Lean Value, 750 head or more delivered

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

$$2. \text{ CM}_T = 2 \times \text{LHF}_{BT} - \text{WP}_S - 10 \times \text{C}_S - .075 \times \text{SBM}_S$$

When the hogs are sold in the spot market at time T the selling price is the weekly average price of Iowa – Southern Minnesota barrows and gilts and the final margin is calculated.

### What does the crush margin cover?

The purpose of the CM is to serve as a simple indicator of potential returns and not as a measure of profit or loss to any one farm. There are two places that the CM can differ from an individual's return. First, is the weighting in the CM equation. Individuals may have different carcass weights, feed requirements or pig pricing formula. Second, is in the remaining cost that the CM must cover to sustain the enterprise. The weightings will differ between producers 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 CM also differ across producers and each individual should know how much margin is needed to meet his or her remaining costs. To frame the discussion, the values in Table 1 are from the Iowa State University Estimated Returns to Wean-to-Finish Enterprises and total over \$40/head to essentially 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 expenses in Table 1 are relatively constant over time while the prices for hogs, pigs, corn and SBM may change weekly or daily.

Table 1. Estimated Wean-to-Finish Costs Beyond Pig, Corn and SBM. Source: ISU Extension Estimated Returns Series

Expense item	\$/head
Vitamins, minerals and purchase complete feeds	11.35
Grind, mix, deliver	3.62
Animal health or vet/med	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 beyond pig, corn, SBM	40.48

An individual may have different weighting of pig price and feed use and different costs that must be covered, and producers should evaluate how well the CM matches his or her costs. For example, the pig pricing formula may add \$2/head to the cost and the use of DDGS may reduce the feed costs by \$1.50/head for a net difference of \$.50/head. Perhaps the finishing contract cost is \$18/head and includes labor, administration, utilities and facility costs. Then the CM would need to cover \$41.79/head. Regardless, the CM 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 CM accounts for hog, corn and SBM prices together to protect a

margin. For example, locking in only hog prices and not corn and/or SBM prices leaves the producer exposed to margin risk.

### **What have crush margins been in the past?**

Daily crush margins were evaluated for a year prior to slaughter for each month 1999-2008. Not surprisingly, average margin were higher for hogs sold in summer months, May, June and July, and lowest for sales in November, December and January. The analysis also indicated that a breakeven or better margin opportunity was available on average in at least 50% of trading days in each month. There were only 19 of 120 months that didn't have at least 50% of the trading days offering a breakeven crush margin. The summary of the evaluation is available at: [www.econ.iastate.edu/outreach/agricultural/periodicals/ifo/margins/WFcrush99-08.pdf](http://www.econ.iastate.edu/outreach/agricultural/periodicals/ifo/margins/WFcrush99-08.pdf)

### **How to 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 cost of production plus storage or the SBM needs are booked for the year. Likewise, a producer may have a contracted pig price. These producers can still monitor the margin relative to their known prices, but they have fewer variables to monitor.

Perhaps the simplest method lock in a margin is to buy Livestock Gross Margin insurance on the number of pigs you want to protect. It protects a margin between LHF, corn and SBM, but it does not protect the pig price. It is available to purchase through approved insurance agents at the end of each month for up to 12 months into the future. For more details see: [www.rma.usda.gov/livestock](http://www.rma.usda.gov/livestock)

Futures and options on futures may also be used. Options may not be available or actively traded in the more distant months and time value of the option can make them costly, but they do have the advantage of not locking you out of more favorable prices if they occur. Futures contracts typically trade for at least a year into the future for LHF and longer for corn and SBM.

A challenge to using futures or options is that the contract sizes should be matched to the amount of cash commodity that you are trying to protect. For example, 1000 hogs in a finishing building matches approximately 5 LHF and 2 corn contracts but only .75 SBM futures contracts.

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

Locking in the weaned pig price and 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 farmer with a 1000 head finishing building that will place pigs in July and sell hogs in December. It will take 5 LHF to hedge all the hogs, but the weaned pig price for 800 pigs and 200 market hogs are linked through a weaned pig pricing formula<sup>3</sup>. Table 2 illustrates selling 4 December LHF in January and 1 LHF contract in July when the pigs are placed and then offsetting all 5 LHF contracts in December when the hogs are sold. Whether LHF 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

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<sup>3</sup> If the pigs are priced on the spot market the linkage would be close because spot prices track LHF, but not perfectly.

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 pigs equally. Any gain or loss comes from the price change on 200 weaned pigs that were not covered by the hedge.

Table 2. Futures Hedge Example for December Sales, Placing Pigs in July and Selling Four December LHF in January, One December LHF in July and Offsetting All Five LHF Contracts in December

Futures	Jan	\$65	\$65	\$65	\$65	\$65	\$65	\$65
Prices	Jul	60	60	70	70	65	65	65
	Dec	60	70	60	70	60	70	65
Futures gain/loss \$/cwt		4	-6	6	-4	5	-5	0
Pig price at purchase		30	30	35	35	33	33	33
Hog sales price		60	70	60	70	60	70	65
Return over pig cost \$/hd		98	98	97	97	97.5	97.5	97.5

The returns over pig costs shown in the table are vulnerable to changes in corn and SBM prices unless those are protected as well. For the 1000 head finisher, 2 corn future contracts would lock in the corn price. One contract would cover 100 tons of SBM 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 SBM divided by all 1000 pigs.

It is important to remember that basis risk<sup>4</sup> still exists for all of the markets. Basis risk is found not only the chance that actual basis is wider or narrower than was expected, but also in the timing of when to lift the hedge. LHF contracts can be offset as hogs are sold, but corn and SBM contracts are “lumpier” and a risk exists if you offset the futures position, but purchase only part of the corn or SBM in the cash market. Consider working with your 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 marketed 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 described in this paper is the return from selling the hog less the cost of the weaned pig, corn and SBM. These four variables have the greatest price risk but it can also be hedged with futures, options or livestock insurance.

The crush margin is a generic index of WF returns and not an absolute measure of profitability for all farms. Compared the farms own costs, historic performance and recent trends the crush margin can provide a useful tool for evaluating risk management strategies for farmers. To see a weekly snapshot of the crush margin and how it compares to history levels and recent trends visit: [www.econ.iastate.edu/outreach/agricultural/periodicals/ifo/margins](http://www.econ.iastate.edu/outreach/agricultural/periodicals/ifo/margins)

<sup>4</sup> Basis in the cash price – futures price. Basis risk is the change in actual basis from expected basis.