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Risk Assessment and Decision-Making Guidelines for Dairy Risk Management: Part 3

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Introduction

THIS BULLETIN IS THE THIRD in a three-part series intended to improve dairy farmers' risk-management assessments and decision-making. Part 3 offers some useful tools that provide expected market price information and will enable dairy producers to lock in a milk price or feed price(s) for their dairy operation.

Hedging with Futures

Once a dairy producer has calculated the production costs involved in her/his dairy enterprise (see "Relevance and Evaluation of Income Statements," part 1 of this series), s/he may manage the price risk by protecting (assuring) the milk price or the input prices via hedging. *Hedging* refers to using an *instrument* to offset the risk of any adverse and unknown upcoming price movement(s). A common hedging instrument is a *futures contract*. Use of a commodity's futures contract offsets any subsequent changes in the market price of that commodity by locking in a specific price, thus providing *price risk management*. With a futures contract, the *market risk* has been replaced by the *Basis risk* (explained below), which has less variability or risk. A futures contract is a transferable, legally binding obligation to either deliver or receive a specific type and amount of commodity for a *preestablished price*—at an agreed-upon future date. The future date may be next month, six months, a year, or two years ahead, etc. The futures contract represents the up-to-date consensus opinion of the value of a commodity, meeting certain specifications, at that agreed-upon future date.

An agricultural producer can place orders to sell ("go short on") a futures contract. This obliges her/him to either deliver the commodity or financially offset against the contract by buying back a similar futures contract (thus effectively cancelling the initial contract) at a future date

before or by the last trading day (contract expiration date). Conversely, an agricultural producer may place an order to buy ("go long on") a futures contract. This obliges her/him to receive the commodity (for example, corn) or financially offset against the contract by selling back a futures contract (again thus cancelling the initial contract) at a future date before or by the last trading day (contract expiration date).

Futures contracts for dairy products [milk (Class III or IV), cheese, butter, nonfat dry milk] do not permit the delivery or receipt of the commodity upon contract expiration. That is why the contract must be financially offset before or by the contract's expiration date. In contrast, futures contracts for corn, soybean meal, wheat, and other grains can be delivered upon contract expiration, in addition to being able to be financially offset.

The specifications of a futures contract include the contract unit size (examples: 200,000 lb; 5,000 bu); settlement method (examples: financially settled; deliverable); listed contracts or months traded (examples: all twelve months for Class III; March, May, July, September, and December for corn); and commodity price (examples: $17/cwt, $3.50/bu). Other specifications may be found at the CME (Chicago Mercantile Exchange) Group website (https://www.cmegroup.com/trading/agricultural/).

Futures contracts for raw milk offered by CME:

- Class III (Milk): Generally referred to as "cheese milk," since these contracts apply to milk that is primarily used for the production of (cheddar) cheese.
- Class IV (Milk): Contract applies to milk primarily used for the production of butter and nonfat dry milk.

Both of these contracts are settled financially by offsetting before or at the contract's expiration date. If settled before its expiration, the price is the contract's trading price for that day. If settled at its expiration date (at end of month), the price is the United States Department of Agriculture (USDA)-announced weighted average monthly price for Class III or Class IV, available online at https://www.ams.usda.gov/mnreports/dymclassprices.pdf.

Futures contracts for dairy products offered by CME:

- Nonfat Dry Milk
- Butter
- Dry Whey
- Cheese

Each of these contracts are also offset either prior to expiration or at an end-of-the-month expiration date. Again, the trading price on the expiration date is based on the USDA-announced weighted average monthly price of the dairy product.

In Idaho, the majority of dairy producers sell to cheese processors. Thus, the dairy futures contract most pertinent for hedging purposes is the Class III contract, as shown at https://www.cmegroup.com/trading/agricultural/dairy/class-iii-milk.html.

In summary, for Class III milk:

- Commodity price is measured in $/cwt
- Contract is for 200,000 lb or 2,000 cwt

Thus one contract at $17/cwt is equal to $34,000 (or 17 x 2,000). Sale or purchase of a contract does not require full exchange of this amount of money, as noted below where margin(s) are addressed.

The *minimum contract fluctuation* of $0.01/cwt is equal to $20 (or 0.01 × 20,000).

If a dairy producer sold (or bought) ten contracts, s/he must later buy (or sell) back ten contracts to offset the initial transaction. A *clearinghouse* (Figure 1) financially guarantees all the futures contracts and is responsible for the day-to-day settlement of all customer accounts at the "futures exchange" (CME or another futures exchange market). It acts as a third party to all trades initiated by the trader, serving as buyer to every seller and seller to every buyer, thus guaranteeing all contracts.

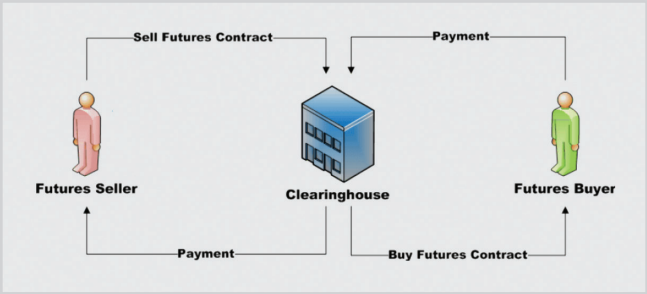

Figure 1. Clearinghouse and buyers and sellers of futures contracts.

To offset a previously sold futures contract, buy a new contract through the future exchange market's clearinghouse. If the initial futures contract sells at a higher price than the purchasing price at settlement, the clearinghouse will pay the difference. If the contract bought at settlement involves a higher price than that for which it was initially sold, then only the difference between these prices is paid to the clearinghouse.

Agricultural producers who place orders to buy or sell futures contracts use a trading account. Only a small percentage of the value of each contract—referred to as the *margin*—has to be deposited in the producer's trading account. Thus, the full payment of the contract is not required, only payment(s) to maintain the margin.

Once a futures contract is sold or bought, the dairy producer must provide a deposit, referred to as the *margin deposit*, which can be about 5%-10% or more of the value of the futures contract, depending on the contract's volatility (higher volatility requires higher margin). An initial deposit above the margin deposit is referred to as the *initial margin*.

If the market moves unfavorably against the dairy producer—for instance, it lowers the value of the account margin below a certain *maintenance margin* level (because of a change in the updated value of the futures contract)—more funds are required for deposit in order to sustain the "maintenance margin level." This request for (extra) funds is referred to as a *margin call* and the dairy producer is obliged to supply them. For the case of selling futures contracts, there are two possibilities:

1. If at later dates the futures contract price increases, a margin call is possible since the dairy producer sold at a lower value and thus needs to make up for that updated higher contract value.
2. If at later dates the futures contract price decreases, the maintenance margin increases and there is no need for a margin call.

As an aid to finding the latest data for these kinds of risk-management transactions, it's good to be familiar with the following sources of futures price quotes for commodities:

- http://www.cmegroup.com
  For Class III (Milk): https://www.cmegroup.com/trading/agricultural/dairy/class-iii-milk.html
- https://www.barchart.com/
- https://finance.yahoo.com/commodities

Basis

Basis is the difference between a local producer's (cash) milk price and a futures contract price. As mentioned, hedging with futures contracts replaces the price risk with Basis risk—which usually experiences much less variability. Basis considers the futures contract's expiration date or nearest expiration date. For example, the Basis for the month of April uses a futures contract that expires in April or perhaps the following month—if no expiring contracts for April exist (for example, corn futures do not have contracts that expire in April, so the Basis for April would consider a May contract).

As previously noted, the majority of milk in Idaho is used to process cheese. Thus, the Class III futures contract is the most applicable to Idaho dairy producers. Local cash milk price refers to the price of "raw" milk that a dairy producer receives, otherwise known as the *mailbox price*:

Basis = Mailbox Price - Class III price (announced by the USDA every month)

Both of these prices are tabulated or reported once a month, giving Basis a single value each month. Each dairy producer has a particular mailbox price that generates a particular Basis value.

For academic purposes, a *rough* approximation to the personal mailbox price is Idaho's All Milk Price provided by the USDA. The all milk price of a state represents the average gross price received by dairy producers per cwt for a given month, considering an average fat test. This gross price is determined without (or before) deductions for hauling, co-op fees, advertisements, and other related financial transactions. Therefore, the all milk price is generally *higher* than Idaho producers' mailbox prices. Full details regarding the all milk price of a state are available at https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Milk_Prices/index.php.

Cash and futures prices respond similarly to market information, tracking each other closely. Basis tends to be more stable and varies less in (money) amount than either cash or futures prices. Figures 2 and 3

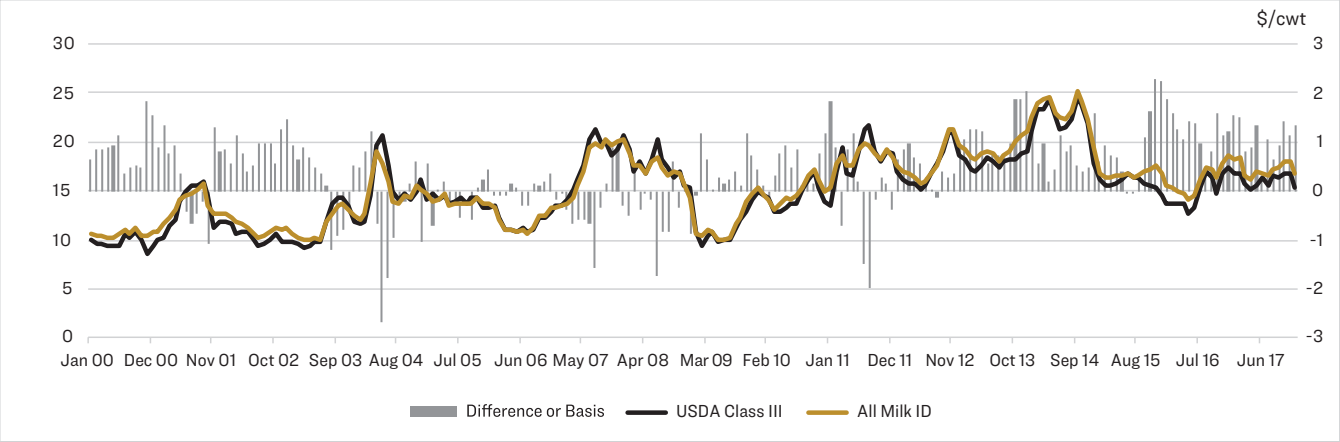

Figure 2. USDA—Class III milk prices, Idaho all milk price, and Basis values, 2000–17.

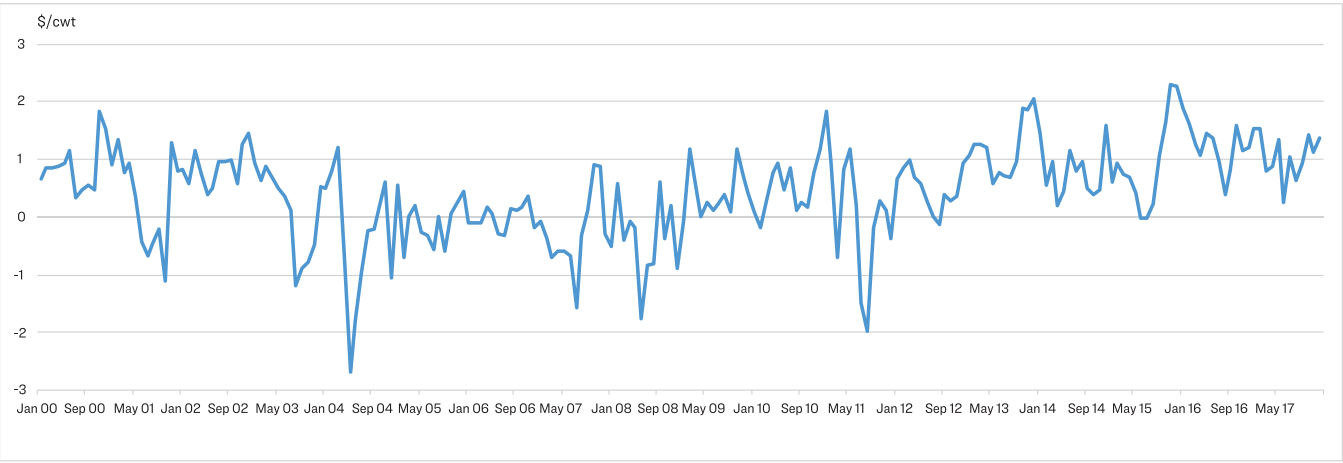

Figure 3. Idaho Basis values, 2000–17.

show examples of the monthly relationship between prices and Basis in Idaho. Specifically, monthly Idaho All Milk prices, Class III prices, and Basis from 2000 to 2017 are presented.

As seen from Figure 2, milk prices vary approximately between $10/cwt and $24/cwt. Conversely from Figure 2 right hand side Vertical axis or from Figure 3, the Idaho Basis fluctuates between a minimum of -$2.70/cwt and a maximum of $2.25/cwt, while most of the variation falls well below $2/cwt and above -$2/cwt.

Taking each month's Basis value from 2000 to 2017, and averaging them out each month, provides the average values illustrated in Figure 4.

As can be seen from Figure 4, the average monthly Basis values fluctuate between $0.84/cwt in November and -$0.02/cwt in July. Also, there are large monthly variabilities (the difference between the maximum and minimum values for a given month) in May of $4.12/cwt, in December of $3.30/cwt, and in June of $3.16/cwt.

Considering only the more recent data from 2010 onwards and again taking each year's monthly Basis and averaging it out per month provides the results shown in Figure 5.

In Figure 5, the average monthly Basis values fluctuate between $1.27/cwt in December and $0.11/cwt in August. Moreover, the largest monthly variabilities are lower than before ($2.92/cwt in August, $2.63/cwt in December, and $2.54/cwt in July).

In Basis terminology, strong Basis refers to when the Basis is more positive or less negative than its average value. Basis becoming more positive or less negative is referred to as *strengthening*. Conversely, a weak Basis refers to instances where it is less positive

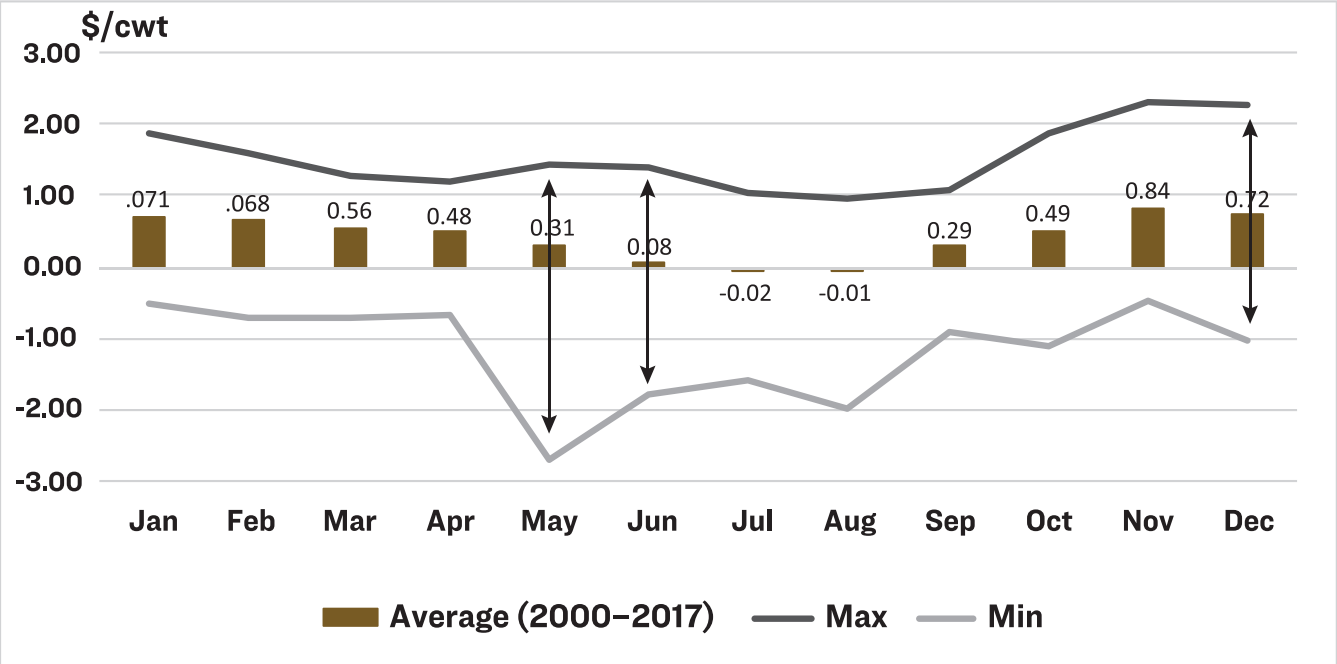

Figure 4. Idaho dairy average monthly Basis = Idaho all milk price - Class III, 2000–17.

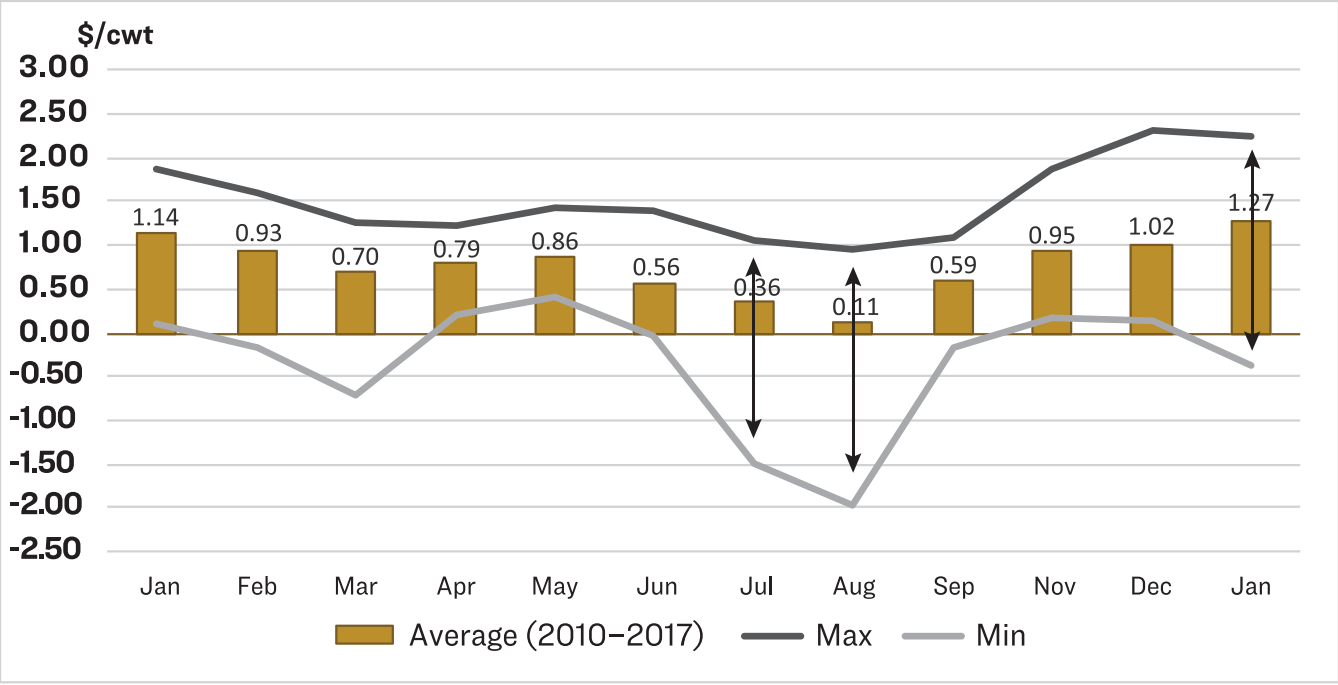

Figure 5. Idaho dairy average monthly Basis: Idaho all milk price – Class III, 2010–17.

or more negative than its average value. A gradual decrease of Basis indicates *it is weakening*.

Since Basis = Cash prices - Futures prices, we can rearrange the equation and obtain:

Cash (Expected) prices = Basis + Futures price

This last equation is *most important* for making use of your own (calculated) historical Basis. Knowing your average historical monthly Basis serves (at least) three useful purposes:

1. It helps you to analyze the potential outcome of a milk price hedge from selling a futures contract, thus replacing the cash price risk with Basis risk.

2. It helps you to analyze/evaluate the convenience of a potential forward price.
3. It helps you to set a target of a possible *option strike* price. (Options will be further discussed in an upcoming bulletin.)

Thus for estimating a potential cash price in the months ahead:

Cash (Expected) price (for a particular month) =
Basis (Average particular month)
+ Futures price (in that particular month)

Examples

Let's apply some of what we've learned by problem-solving some hypothetical case examples.

1. Hedging Examples with Basis Unchanged

Assume it's April 12, 2018, and you are selling milk amid the following market conditions:

- The October 2018 Class III milk contract rate is $15.95/cwt
- *Average or expected* Basis for October (considering data from 2010 to 2017) is 0.95 $/cwt

➔ Expected Cash Price = $16.90/cwt (or 0.95 + 15.95)

On October 31, 2018, when the "open position" is offset at expiration, the following conditions exist:

- The announced USDA Class III milk contract is $15.53/cwt
- The *actual* Basis remains the same, $0.95/cwt (assuming the cash mailbox price minus the announced Class III results in Basis being $0.95/cwt)

➔ Realized net price in October:

16.48 (0.95 + 15.53) + 0.42 (difference from offsetting futures contract: 15.95 - 15.53)
= $16.90/cwt

Assume now that the Class III milk contract (on October 31, 2018) is $16.55/cwt; *maintaining the same* Basis would have thus resulted in

➔ a realized net price in October:

17.50 (0.95 + 16.55) + -0.60 (difference from offsetting futures contract: 15.95 - 16.55)
= $16.90/cwt

In other words, *if the Basis has remained the same* once a dairy producer sells the futures contract, s/he will receive as a realized net price the expected cash price, *regardless of the offset futures price*. If the actual Basis has changed, becoming different than the expected Basis, then the realized net price will change equally to that change in the Basis. Thus by hedging, or selling a futures contract, a dairy producer has locked in a selling price and her/his realized net price *will only vary* if there are changes to the Basis. In this way, a dairy producer replaces the market price risk with the Basis risk, which has much lower volatility (as shown in the previous figures). If the Basis strengthens, then the realized net price in October will rise. If the Basis weakens, then the realized net price in October will decrease. The relevant matter is that the Basis strengthens or weakens with much less variability in comparison to market prices.

2. Evaluating a Potential Forward Contract's Price

To analyze whether a forward price for an upcoming month is convenient or not, a dairy producer once again can make use of the calculated own historic Basis value and the futures contract for that upcoming month. For example, assume again that it's April 12, 2018, and a dairy producer is evaluating a forward contract for October 2018. Just like in the previous example,

- the October 2018 Class III milk contract is $15.95/cwt
- the average or expected Basis (considering data from 2010 to 2017) is $0.95/cwt

➔ Expected Cash Price = $16.90/cwt (or 0.95 + 15.95)

If the dairy producer is offered a forward contract for October at $17/cwt, s/he may want to accept it since the price is currently higher than the resulting expected futures price. Moreover, the Basis may change (weakening or strengthening). Consequently, the expected $16.90/cwt is uncertain.

If the dairy producer is offered a forward contract for October at $16.80/cwt, s/he may still consider it favorably since it is with 100% certainty in comparison to the expected price (with futures

contract) of $16.90/cwt, which again may change with the actual Basis.

Lastly, if the dairy producer is offered a forward contract for October at $16/cwt, s/he may want to decline it since the minimum Basis for October for the past nine years is about $0.25/cwt, which, added to $15.95/cwt (October futures contract), results in $16.20/cwt.

3. Target Price for Option Strike

Assisting with futures contracts to set a target options strike price will be covered in an upcoming bulletin that addresses options as financial instruments.

Conclusion

Given the increasingly competitive and challenging economic environments impacting the industry, we hope this series helps dairy farmers to strategically manage their risk, thus helping to maintain the family dairy business as a viable operation.

References

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