Virginia Cattle Price Risk Management

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Elijah Griles, Commodity Specialist, Virginia Farm Bureau Federation

GENERAL AUDIENCE ABSTRACT

Recent feeder cattle market price shocks have adversely affected average size Virginia cow/calf producers. We develop a database of historical price and basis trends at five weekly state graded feeder cattle auctions. Analyzing historical trends in this database, we identify locational, seasonal, and weight related patterns in variation. We describe and evaluate Livestock Risk Protection insurance and hedging as strategies to mitigate price risk. We find that basis variations and trends can be used effectively to inform Livestock Risk Protection and hedging decisions to mitigate price risk in average size Virginia cow/calf operations.

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3. Hedging Strategies for Small Producers

Any discussion of cattle price risk management ultimately must address one of the longest standing forms of risk protection for agricultural commodities, the futures market. As noted in the previous sections, there are a myriad of considerations when it comes to effective price risk management. In the case of the average Virginia cow/calf operation, there are some immediate concerns whenever a discussion on futures comes up. In order to address these concerns, some background on the feeder cattle futures market is warranted.

The Chicago Mercantile Exchange (CME) Feeder Cattle (FC) futures contract is based on a very specific set of parameters. The contract represents a group of a fairly specific type of steers. Knowing the difference between the FC futures contract specifications and a producer's animal will be essential to being able to effectively utilize the futures market for risk management. The CME FC contract is a promise to deliver (or accept delivery, if bought) 50,000 lbs (500 cwt) of steers weighing 650-849 lbs each, graded medium-large frame with #1- #2 muscling at the expiration of the contract (Lacy et al. 2014). The price of the contract for a given expiration or maturity month is a projection of the value of that type of animal in that month. Another important consideration in the futures market is that contracts are only available in the following months: January, March, April, May, August, September, October, and November. Hedging can be used to lock in a target price using FC futures contracts in advance of selling the physical cattle at the cash market.

The simplest form of hedging is accomplished by selling a futures contract for the month in which the cattle are going to be marketed, or for the nearest month if the cattle are going to be marketed in a month for which there are no futures contracts (i.e., June, July, etc.). From the LRP example in the previous section, if a fall calving producer, who will have an average calving date of October 1st, is planning to market feeder calves in July, then they would sell an August FC futures contract as that is the closest contract month to

the time of marketing (Lacy et al. 2014). They would do this by calling a broker, someone who is licensed to trade futures, who would establish their futures position.

The other aspect of what is known as the straight hedge, which is the simplest form of hedging, is that the producer closes their futures position upon pricing (marketing) the cattle (Burdine 2013). So, when a fall calving producer who has sold an August FC futures contract for their cattle sells the physical cattle at the cash market, they will buy back their August FC futures contract as soon as possible. By taking opposite positions in these two markets that generally move together, (Cash and Futures) the producer is reducing their risk by offsetting their losses. A gain in one market can compensate for a loss in the other (Burdine 2013). The hedger benefits if the sale price of the futures contract exceeds the purchase price. For example, if a hedger sells (known as shorting) a FC futures contract for $144/cwt and then purchases that same contract back for $140/cwt, they have made $4/cwt or $2,000 ($4/cwt x 500 cwt) before brokerage commissions and fees (Burdine 2013). When the opposite happens, they would lose $2,000 from their futures position. Further details will be discussed in a later example. All market participants are required to have a brokerage account in order to gain access to futures markets. There are different types of brokerage firms depending on how they are registered with CFTC. Kub (2017) describes the following types of brokerage firms:

Futures Commission Merchants (FCMs) – An FCM is a firm that is set up to handle futures orders from customers and process those orders on the various exchanges. They also handle customer's margin money and the proceeds or losses from their trades, so they must keep highly detailed ledgers of all the trades they handle for the CFTC to review, and they must also provide daily statements to each individual customer. Basically, all the prime brokerage houses who participate on the futures exchanges are registered as FCMs.

Introducing Brokers (IBs) – An introducing broker is focused on communication with clients and accepts their orders to buy or sell futures, but the IB itself doesn't execute those trades at the exchange. Rather, it outsources that function to an FCM. The IB also doesn't plan any direct role in the handling of client capital; that, too, is done by an FCM.

Commodity Trading Advisors (CTAs) – A CTA not only handles futures trades on behalf of clients, but it may also charge those clients directly for giving advice on what trades to make.

Commodity Pool Operators (CPOs) – A CPO amasses funds from a number of participants, to be aggregated and invested in commodity futures and options trades. Sometimes, this is done under the framework of limited partnership (LP).

Associated Persons (APs) – An AP is any individual who is involved in handling customers and customer orders in the futures market, on behalf of a registered FCM, IB, CTA or CPO.

Your choice of broker will likely depend on the level of service and their fee structure which varies substantially across brokerage firms, so it is important to shop around. It is also wise to conduct some due diligence on a firm's status as a licensed market participant, particularly through the National Futures Association (https://www.nfa.futures.org/about/index.html) online Background Affiliation Status Information Center (BASIC) (https://www.nfa.futures.org/basicnet/) which details a firm's history of regulatory or arbitration actions.

Before continuing our discussion on risk management methods using the futures market, it is important to note that this study does not address options. An option is a right to either buy or sell a futures contract and can be used to create price protection in similar ways as LRP. Due to the Risk Management Agency's new subsidy levels of LRP premiums, LRP is less expensive than a put option in the futures market in all months of the year (Dennis 2021). Thus, producers would benefit from using LRP as opposed to put options for this type of risk management. While there are other risk management strategies that utilize put and call options that are valid for cattle price risk management, those strategies are beyond the scope of this study.

3.1 Virginia specific considerations

There are a few different considerations to address for the average Virginia cow/calf producer related to utilizing the futures market. First, there are concerns surrounding the

size of a futures contract (500 cwt) versus the pounds of physical cattle that the average Virginia producer would have. Another important consideration is how the historical basis and futures price can be used to determine a target price that the feeder cattle will be marketed at. Regardless of whether or not a producer takes a futures position, this target price can inform both marketing and input purchase decisions by helping to form price expectations. This section details two real world scenarios to demonstrate the opportunities and risks associated with hedging for the average Virginia cow/calf producer.

It is important to note that when a producer establishes a futures position, they will incur a commission fee cost from the broker and have to establish a margin account (Burdine 2014). Commission fees are a cost of doing business and can be as low as $2.25/contract. Margin however is a percentage of the value of the futures contract. It is collateral, as the money in the margin account is only lost if the producer loses money as a result of their futures position. For example, if a producer sells an August FC futures contract on Wednesday, and the price is $170/cwt, then a 500-cwt contract is worth $85,000. The broker requires the producer to deposit $3,000 in their margin account, a small percentage of the contract's value. If the price rises to $175/cwt on Thursday, the contract loses $5/cwt times 500 cwt, or $2,500 of its value, and the broker would call the producer (a margin call) and ask them to put more money in their margin account to cover the decrease in the contract's value. On the other hand, if the price goes down to $165/cwt, the contract gains $2,500 in its value, no margin call is made, and these funds can be withdrawn from the account as long as the minimum of $3,000 is always maintained. Any funds in the margin account are returned to the producer when the position is offset. Initial and maintenance margin requirements are set by the exchange (and disclosed on their website) to eliminate default risk in futures trading. Commission fees will vary from broker to broker depending on the amount of service included, as described above. While commission fees are generally very low, margin capital requirements may be substantial, especially when market prices are very volatile.

Another important consideration for the Virginia producer is how their animal varies from the specifications of the FC futures contract. There is an intersection between the previously discussed Feeder Cattle Index (FCI) and the futures contract, in that upon the expiration of a FC futures contract, any open contracts are settled based on the FCI after the termination of trading on the last Thursday of the contract month for that day (Lacy et al. 2014). As a reminder, the FCI is a weighted average of the prices of cattle meeting the FC contract specifications across a 12-state region in the Midwest. A futures contract is a projection of what the FCI will be in the future. This is an essential element of the futures contract, as it means that the FC futures contract will follow actual cash prices ultimately. This is important for Virginia producers when it comes to their evaluation of basis at their local market, as discussed previously. As the steer or heifer being marketed varies from the standardized 650–849-pound M&L #1-#2 steer, the local basis (difference of cash price from futures price) will vary.

Perhaps the most challenging aspect of the CME FC futures contract for the average Virginia cow/calf producer is its size. A 50,000-pound FC contract is equivalent to 100, 500-pound feeder calves, or simply 50,000 pounds divided by the average weight of the calf being marketed. This gives the number of head required to 'fill' a contract. From the previous sections, we know that a straight hedge is when the position taken in the futures market is perfectly opposite and equal in size to the position taken in the cash market, allowing for gains and losses to offset between cash and futures markets. For example, to fill a FC futures contract, a producer would have 65 calves in October that they anticipate marketing in August at an average weight of ~770 lbs. This would be just over 500 cwt. They would sell an August FC futures contract in October. Then, when they sell the cattle at the livestock auction in August, they would buy back that futures contract. Prices of the cattle and contract aside, the difficulty here is that many producers will not have the number of cattle to fill a contract. The average cow/calf operation in Virginia has 30 head (https://www.vabeef.org/farm-to-fork), and even with a 100% calving rate, over a limited time period and perfect growth, this means that there will be a maximum of 30 calves ready to market at a time, less than half of a single futures contract.

If a producer sells a futures contract while having less than 50,000 pounds of physical cattle, this will result in a situation known as overhedging. Overhedging means that a producer has a much larger position in the futures market than the size of the cash market position that they are trying to protect. For example, a cow/calf producer who has 30 feeder calves that they plan to market at an average weight of 600 lbs has 18,000 lbs of cattle. If they purchase one 50,000 lb FC futures contract they would be over hedged by 32,000 lbs. This means that they are essentially speculating on those 32,000 lbs. If prices decline, they stand to benefit from being over hedged. They will make more money on the futures than they will lose in the cash market (Burdine 2013). However, if prices increase, they will lose more money on the futures market then they will gain in the cash market. Overhedging will actually increase risk as opposed to mitigating it.

Cooperative hedging can be used to prevent overhedging. This means that a producer will either contractually or physically combine their cattle with other producers in order to be able to utilize a straight hedging strategy without overhedging. This could mean that Producer A and Producer B both have 40 feeder calves that they expect to sell at an average weight of 625 lbs. This would give them an even 50,000 lbs of cattle between both of them and mean that they have a perfectly straight hedge when they sell a FC futures contract. They would share the commission fees and margin commitments, and market their cattle simultaneously to ensure an effective strategy. This could take many forms from the rather informal small-scale example above, to a large-scale operation that combines multiple lots worth of cattle in order to be able to effectively hedge and market cattle. This type of service is offered by cattle merchants across the state.

3.2 An example

Hedging is a two-step process. The first step is when the forward price is established, when the hedge is placed. The second step is when the hedge is lifted, and the cash transaction is made. For the purposes of comparison, we are going to evaluate a hedging example that mirrors the LRP example. These will be based on the same timeline and cattle types in order to demonstrate the similarities and differences between hedging and LRP.

All FC futures prices are taken from the Feeder Cattle Historical Prices page on barchart.com [(https://www.barchart.com/futures/quotes/GFQ22/historical-prices?viewName=main&orderBy=contractExpirationDate&orderDir=asc&page=4)](https://www.barchart.com/futures/quotes/GFQ22/historical-prices?viewName=main&orderBy=contractExpirationDate&orderDir=asc&page=4). The Lynchburg Livestock Market cash prices are taken from the USDA Agricultural Marketing Service report for 7-19-2021 [(https://mymarketnews.ams.usda.gov/filerepo/sites/default/files/2184/2021-07-19/482439/ams_2184_00107.pdf](https://mymarketnews.ams.usda.gov/filerepo/sites/default/files/2184/2021-07-19/482439/ams_2184_00107.pdf)). Timelines and production schedules have been based on general production practices of Virginia cow/calf operations. This example is not intended to provide individual business guidance as needs and best practices vary significantly across operations.

For example, a fall calving producer has 35 brood cows that give birth to 17 heifers and 17 steers, while one calf did not survive. The producer decides to retain 7 heifers to raise as replacements for their herd or to be sold and 2 steers to raise to slaughter weight for freezer beef. This results in 10 heifers and 15 steers being kept to raise as feeder cattle. The calves are born across a ~45-day time period from September 15th to October 30th in 2020. The producer plans to sell the calves at an average weight of 650 lbs for the steers and 600 lbs for the heifers in about 9 months, which would be mid-July of 2021. After a few months of the calves growing and beginning to fill out, the producer decides that there is a lot of uncertainty surrounding the cattle market. So, on 1/14/2021 they called their broker to sell an August FC futures contract. The August FC futures contract is the nearby contract as there is not a July contract. This contract is a promise to deliver 50,000 lbs of feeder cattle before the contract expires on the last Thursday of August. On 1/14/2021, the closing price for this contract was $145.525/cwt. This is what will be used to set the target price for these cattle.

(3.2.1)   Target Price = Futures Price + Expected Basis

We can use historical basis trends to help set the target price. From the previous section, we see in Figure 2.2.1 that the five-location average basis in July for Steers M&L 1 that are 700-799 lbs is -$14.12/cwt. Given that we have a different target weight for our steers, we must adjust this expected basis. If we look at Figure 2.3.1, we see that there is

a $6.48/cwt premium for Steers M&L 1 that are 600-699 lbs over the 700-799 lbs category in July. This gives us an expected basis of -$7.64/cwt for our steers. The following equation will give us our Target Price for our steers.

(3.2.2)   **Target Price$_{Steers}$ = \$145.53/cwt + (-\$14.12/cwt+\$6.48/cwt) = \$137.89/cwt**

In the same way as above, we can calculate our target price for our heifers. From Figure 2.2.3, the average basis in July is -$33.68/cwt and from Figure 2.3.3 the average premium for a 600-699 lbs heifer M&L 1 is $6.80/cwt. This gives us an expected basis of -$26.88/cwt. We can use the following equation to calculate target price:

(3.2.3)   **Target Price$_{Heifers}$ = \$145.53/cwt + (-\$33.68/cwt + \$6.80/cwt) = \$118.65/cwt**

To determine the outcome of the scenario that we have outlined above we must calculate the realized price and the net effect of hedging. This is given by:

(3.2.4)   **Realized Price = Initial futures price + Realized Basis**

The initial futures price in this case is $145.53/cwt and the realized basis is the final futures price subtracted from the actual cash price received. Once the cattle were ready for market, the producer sold the 15 steers and 10 heifers at the Lynchburg Livestock Market in Rustburg, Virginia at the July 19, 2021, state graded feeder cattle sale. The price for Medium and Large 1 steers at an average weight of 643 lbs was $145.42/cwt. The price for Medium and Large 1 heifers at an average weight of 631 lbs was $125.62/cwt. These give us the actual cash (spot) price received. To determine the final futures price, we would look at the closing futures price for the August FC contract on 07/19/21, which is the day the producer would buy back their contract, because they are selling the physical cattle. The closing August FC futures contract price on 7/19/2021 was $159.450/cwt. The realized price for steers and heifers are given by the following two equations:

(3.2.5)   **Realized Price$_{Steers}$= \$145.53/cwt + (\$145.42/cwt-\$159.450/cwt) = \$131.50/cwt**

(3.2.6)   **Realized Price$_{\text{Heifers}}$= \$145.53/cwt + (\$125.62/cwt-\$159.450/cwt) =**

\$111.70/cwt

For both the steers and the heifers we see that the Realized Price is lower than the Target Price. Why is this? The lower price is a result of a weaker (more negative) basis than expected. The expected basis for the steers was -\$7.64/cwt, but the realized basis was -\$14.03/cwt. The expected basis for the heifers was -\$26.88/cwt, but the realized basis was -\$33.83/cwt. This is the nature of hedging as a price risk management strategy; hedging eliminates price risk, but it does not eliminate basis risk. Basis risk is how the local market varies from the futures market, and how the type of cattle being sold differs from the type of cattle specified in a futures contract. Exchanging basis risk for price risk through hedging does not mean that a producer will increase revenues in any given year, but it will reduce variability in cash flow year over year, when properly utilized. Understanding basis trends can help a producer set more accurate price expectations and capitalize on seasonal, locational, and weight-based basis variations.

Since this example is focused on utilizing hedging as a price risk management strategy, it is important to consider the actual total end result of the scenario outlined above. Before doing so however, it is important to note that the producer was over hedged. They had 157.5 cwt of physical cattle (15 steers x 6.5 cwt + 10 heifers x 6 cwt) and a 500 cwt FC futures contract. This means that they are speculating on 342.5 cwt of cattle. In order to demonstrate the results of overhedging we have performed the following calculations.

(3.2.7)   **Total Revenue$_{\text{Cash}}$ = (\$145.42/cwt x 6.5 cwt x 15 steers) + (\$125.62/cwt**

x 6 cwt x 10 heifers) = \$21,715.65

This total revenue figure would seem to be a cause for celebration, but, due to overhedging, it is not. To determine the actual outcome of the strategy, we will calculate the net price. First, we can find the total revenue of the futures contract transaction by subtracting the final futures contract price from the initial futures contract price.

(3.2.8)   **Total Revenue$_{\text{Futures}}$ = (\$145.53/cwt-\$159.450/cwt) x 500 cwt futures**

contract = -\$6,960

It is quickly apparent that the futures contract represents a significant loss. This is because the price at which the producer sold their futures contract is substantially lower than the price at which they bought the contract back. The net effect of the futures contract (not accounting for commission fees) is given by:

(3.2.9)   **Net Price = (Total Revenue$_{Cash}$ + Total Revenue$_{Futures}$)/Total cwt of physical cattle**

(3.2.10)   **Net Price = ($21,715.65 - $6,960)/157.5 cwt = $93.69/cwt**

The net price is the result of the cattle producer selling the 25 head at the Lynchburg livestock auction on 07/19/2021 and making an order to their broker to buy back their August FC futures contract and close their position. This is a true straight hedge as the producer is taking opposite positions in the cash and futures market. They sold a FC futures contract in January, which was a promise to deliver the physical cattle, and they bought back the FC futures contract in July when they sold the physical cattle in the cash market. The net price suffers substantially due to overhedging. The producer's actual average cash price is higher than their target price meaning that they are gaining in the cash market. Their losses in the futures market offset all of these gains however, because they are speculating on 342.5 cwt of cattle without having physical cattle gaining in the cash market to offset these losses.

The target price is based on the 15 steers being 650 lbs, M&L #1 at the time of marketing at the cash market and the heifers being 600 lbs, M&L #1. This target price sets an expectation of the average cash price that the producer will receive when the physical cattle are marketed. Regardless of whether the producer takes a futures position, the ability to set target prices based on historical basis can help to form revenue expectations, which can then affect management decisions. For instance, the decision to retain replacement heifers can be informed by the value of those heifers on the market.

While there are many implications of the outcomes of this example, perhaps the greatest is that of the infeasibility of hedging for a small producer. Ultimately, producers that cannot 'fill' a futures contract by having 500 cwt of physical cattle are increasing their

risk due to overhedging as opposed to reducing it. One potential strategy to avoid a situation like this is to cooperatively hedge as discussed before. Cooperative hedging can help groups of multiple producers fill a FC futures contract and reduce their risk by avoiding overhedging. This will allow these producers to exchange their price risk for basis risk which will help to stabilize their incomes and cash flows over time.

To further illustrate the effects of hedging, we can look at an example from 2019-2020. In this example the Lynchburg Livestock Market cash prices are taken from the USDA Agricultural Marketing Service report from 7/14/2020 (https://mymarketnews.ams.usda.gov/filerepo/sites/default/files/2184/2020-07-13/298184/ams_2184_00056.pdf). The same fall calving producer as before has 10 heifers and 15 steers being kept to raise as feeder cattle. The calves are born across a ~45-day time period from September 15th to October 30th in 2019. The producer plans to sell the calves at an average weight of 650 lbs for the steers and 600 lbs for the heifers in about 9 months, which would be mid-July of 2020. So, on 1/14/2020 they called their broker to sell an August FC futures contract. On 1/14/2020, the closing price was $152.885/cwt. This is what will be used to set the target price for these cattle.

The historical basis trends remain the same as the previous example, so we will use the new futures price to find our target prices for both the steers and heifers.

(3.2.11)   Target Price$_{Steers}$ = \$152.89/cwt + -\$7.64/cwt = \$145.25/cwt

(3.2.12)   Target Price$_{Heifers}$ = \$152.89/cwt + -\$26.88/cwt = \$126.01/cwt

Once the cattle were ready for market, the producer sold these cattle at the Lynchburg Livestock Market in Rustburg, Virginia at the July 13, 2020, state graded feeder cattle sale. The average price for Medium and Large 1 steers at an average weight of 645 lbs was $137.83/cwt. Medium and Large 1 heifers with an average weight of 636 lbs brought $113.75/cwt. In order to find the realized price, we would look at the closing futures price for the August contract on 07/13/20, which is the day the producer would buy back the contract, because they are selling the physical cattle. The closing August FC futures

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contract price on 7/13/2020 was $135.511/cwt. This gives us the following realized price equations:

(3.2.13)   **Realized Price$_{Steers}$= \$152.89/cwt + (\$137.83/cwt-\$135.51/cwt) = \$155.21/cwt**

(3.2.14)   **Realized Price$_{Heifers}$= \$152.89/cwt + (\$113.75/cwt-\$135.51/cwt) = \$131.13/cwt**

It is quickly apparent that the realized prices for both cattle types are substantially higher than the target prices. This is due to strengthened basis. The expected basis for the steers was -$7.64/cwt while the realized basis was $2.32/cwt. The expected basis for the heifers was -$26.88/cwt, while the realized basis was -$21.76/cwt. As the basis was stronger (less negative/more positive) than expected, the realized prices were higher than the target prices. In order to understand the net effect, we will have to look at the gains and losses in both the cash and futures market.

(3.2.15)   **Total Revenue$_{Cash}$ = (\$137.83/cwt x 6.5 cwt x 15 steers) + (\$113.75/cwt x 6 cwt x 10 heifers) = \$20,263.43**

(3.2.16)   **Total Revenue$_{Futures}$ = (\$152.89/cwt-135.51/cwt) x 500 cwt futures contract = \$8,690**

(3.2.17)   **Net Price = (\$20,263.43 + \$8,690)/157.5 cwt = \$183.83/cwt**

In this example, overhedging resulted in a significant gain for the producer, although cash prices fell significantly below the target price, their returns in the futures markets far outweighed those losses.

The net prices in both of these examples show the effects of overhedging. This is an important aspect of understanding the complexities of hedging in the Virginia cattle industry. Another important takeaway is that if producers were to cooperatively hedge they can still achieve positive results in stabilizing incomes. Handling margin requirements, commission fees and developing the relationships with other cattle producers necessary to fill FC futures contracts requires a significant time and financial

investment that may not be feasible for small and/or part-time producers. The value of setting price expectations should not be underestimated however, regardless of whether producers take a futures position or purchase LRP. Setting target prices helps producers to understand the relationship of their local market to the futures market and aid in relating national and international feeder cattle market trends to their operation. Setting a target price for cattle will provide an opportunity for better informed price risk management and general management decisions as opposed to surrendering to the volatility of a particular individual market's volatility.

3.3 References

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