Comparing the Risks and Returns of Alternative Price Risk Management Strategies for Southeastern Feeder Cattle Production [*]

Matias G. Nardi **

Todd D. Davis

Curt Lacy

J. Walter Prevatt

and

Timothy D. Hewitt

Abstract

A non-parametric simulation model incorporating price risk determined gross revenue less risk management costs for cow-calf, winter stockering, and retained ownership scenarios for cattle producers in the Southeast. Risk management scenarios simulated hedging with commodity futures and purchasing at-the-money put options at alternative dates prior to the expected sales date.

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[**] Matias G. Nardi and Todd D. Davis are Graduate Student and Assistant Professor, respectively, in the Department of Applied Economics and Statistics, Clemson University, Clemson, SC 29634-0313. Curt Lacy is Assistant Professor in the Department of Agricultural and Applied Economics at the University of Georgia. J. Walter Prevatt is Professor in the Department of Agricultural Economics and Rural Sociology at Auburn University. Timothy D. Hewitt is Professor in the Department of Food and Resource Economics at the University of Florida North Florida Research and Education Center.

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Feeder cattle producers have to wear many hats while operating their business. They must be skilled in nutrition, herd health, pasture and forage management, as well as managing the financial and economic aspects of their business. While many producers recognize that price risk management is important, few producers may actually use price risk management tools.

Perhaps producers become overwhelmed by the numerous price risk management strategies available. For example, producers need to consider whether it is better to hedge with commodity futures or to purchase a put option. Producers deciding to use put options have to decide which strike-price is best in managing risk for their business. Another issue which may confuse producers is the timing of implementing the risk management strategy. Producers need to understand the risks and returns from implementing a risk management strategy six months in advance of an expected sale compared to a strategy of purchasing risk protection one or two months in advance.

Another issue of interest to producers, extension specialists and extension agents is identifying the risk reduction provided by futures and options for different phases of cattle production. The effectiveness of futures and options in reducing price risk may differ for a cow-calf operation selling light-weight calves in the fall compared to a winter stockering operation or an operation retaining ownership of calves in a Kansas feedlot.

The objective of this paper is to identify the revenue risk protection provided by futures and options for feeder cattle production in South Carolina. Three general risk management strategies are compared: hedging with futures, buying at-the-money put

options, and the strategy of selling in the cash market without price protection. The effect on revenue risk reduction by implementing the risk management strategies at alternative dates prior to the expected cash market sales date is also studied.

Data and Methods

A non-parametric simulation model is used to determine per cow or per head gross revenue, less risk management costs, for alternative phases of cattle production. Since the variable costs of production are expected to be the same regardless of risk management practice, only gross revenues are considered.

The cash market prices, future market prices, and option premiums are organized by year and week in an Excel spreadsheet. A number is drawn from a uniform distributions ranging from 1 to 17 which represents the simulation years 1988-2004. This number determines the prices used for this iteration of the simulation model. The simulation model is developed in @Risk using 10,000 iterations per simulation.

South Carolina weekly feeder cattle cash prices by weight class and sex from 1988-2004 were collected from the USDA Livestock Market News Service. Similarly, the weekly Kansas cash market prices for slaughter cattle were collected from 1988-2004 (www.agmanager.info). Daily feeder and live cattle futures prices and option premium data from 1988-2004 were purchased from the Commodity Research Bureau.

Description of Simulated Risk Management Scenarios

This study simulated the effectiveness of alternative price risk management strategies for cow-calf producers selling 500 pound feeder calves in September; winter

stockering operations that purchase feeder calves in September and sell 800 pound calves in January; and operations retaining ownership of the heavy-weight feeders and finishing them in a feedlot in Kansas. Similarly, combinations of the three distinct production phases were simulated including cow-calf operations winter stockering their own produced feeder calves; winter stockering and retained ownership through the finishing stage; and cow-calf operations retaining ownership through a Kansas feedlot.

The risk management strategies simulated in this study are described in Table 1. Scenarios 1-13 are risk management strategies for a cow-calf operation producing light-weight feeder calves (500 lbs) with an expected sales date of September 1. Scenario 1 is the base case of no risk management practices. Scenarios 2-7 involve hedging using the October Feeder Cattle Futures contract implemented six months to one month in advance of the expected sales dates (Table 1). Similarly, Scenarios 8-13 involve purchasing at-the-money put options on the October Feeder Cattle Futures contract implemented six months to one month prior to the expected cash sales date (Table 1).

Scenarios 14-23 are risk management strategies for a winter stockering operation where light-weight feeder calves are purchased in September. The heavy-weight feeders are expected to be sold in the cash-market on January 25 (Table 1). Scenario 14 is the base case where no price risk management is used. Scenarios 15-19 are hedging with the March Feeder Cattle Futures contract where contracts are sold five months to one month prior to the expected cash market sales date (Table 1). Similarly, Scenarios 20-23 involve purchasing at-the-money put options on the March Feeder Cattle Futures contract five months to two months in advance of the expected cash sales date (Table 1).

Scenarios 24-32 are risk management strategies for an operation where the ownership of the feeder calf is retained and the calf is finished in a Kansas feedlot. Scenario 24 is the baseline of no risk management. Scenarios 25-28 are hedging with the June Live Cattle Futures contract for strategies implemented four months to one month prior to the May 20 expected cash sales date (Table 1). Similarly, Scenarios 29-32 involve buying at-the-money put options on the June Live Cattle Futures contract four months to one month in advance of the expected cash market sales date (Table 1).

Combinations of the risk management strategies were also simulated for a cow-calf operation stockering produced calves with a January 25 expected sales date. Similarly, selective risk management strategies for a cow-calf operation retaining ownership through the Kansas feedlots were also simulated.

Results

Table 2 reports the summary statistics of the simulated revenues for the risk management strategies defined in Table 1. The no-risk management scenarios for both the cow-calf and winter stockering operations (Scenario 1 and Scenario 14) had the largest average revenues and the largest minimum revenues (Table 2). In general, the results suggest that the naïve risk management strategies did not provide any truncation of the simulated revenue distribution for the cow-calf and winter stockering operations. However, purchasing an at-the money put option four months prior to the expected sales date of the finished calf did provide revenue risk protection. This strategy improved the minimum revenue by $13 per head from the no-risk management scenario (Table 2).

However, the average revenue for this strategy was $7 per head less than the average revenue for the no-risk management scenario (Table 2).

The best and worst performing strategies, ranked by minimum revenue, for cow-calf operations choosing to winter stocker their own calves are reported in Table 3. Combining price risk management strategies in both production phases did provide some improvement in the minimum gross revenue over the no-risk management scenario (Table 3). Hedging with futures in both phases of production improved the minimum gross revenue by $19-$25 per cow over the no-risk management scenario (Table 3). However, on average the revenues for these scenarios were $14-$18 per cow less than the average revenue for the no-risk management scenario (Table 3). The worst performing strategies were those using put options. The strategies providing the best risk reduction were implemented six months in advance of the expected September sales date and five months in advance of the expected January sales date (Table 3).

The best and worst performing strategies, ranked by minimum revenue, for the winter stockering and finishing operation are reported in Table 4. Purchasing put options in both phases of production improved the minimum gross revenue by $10-$24 per head over the no-risk management scenario (Table 4). However, on average the revenues for these strategies were $5-$12 per head less than the average revenue for the no-risk management scenario (Table 4). The strategies implemented earlier in the production process tended to provide greater risk reduction than those implemented close to the expected cash market sales dates (Table 4).

The best and worst performing strategies for cow-calf operations retaining ownership through the finishing production phase are reported in Table 5. Using futures

and options improved the minimum gross revenue by $11 to $20 per cow over the no-risk management scenario (Table 5). However, on average the revenues were $3 to $8 per head less than the average revenue for the no-risk management scenario (Table 5). Strategies implemented early in the production process tend to perform better in reducing revenue risk than those implemented close to the expected sales date (Table 5).

Conclusions

The results suggest that further evaluation of the timing of the naïve strategies is necessary before broad conclusions can be reached about the effectiveness of price risk management for cattle producers in the Southeast. The period studied from 1988-2004 was predominantly a period of decreasing inventories and generally increasing prices. Thus, the downside price risk may not be accurately reflected in the model and understating the effectiveness of price risk management strategies. A longer price series needs to be considered to understand the downside price risk.

Further research will consider the effect of cattle-cycles on risk management effectiveness. Other risk management practices, like using calls to hedge the feeder purchase for winter stockering or hedging feed costs in the finishing stage will be considered. Different locations throughout the Southeast region will be considered. The simulation model will be expanded to consider other risks, such as production risks like calving percentage and rate of gain of feeder and fed calves. Input price variability will also be incorporated in the simulation model.

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Table 1. Risk Management Scenarios Simulated by Phase of Production.

Cow-Calf Production Selling Calves -- September 1 Expected Sales Date	
Scenario 1	No Risk Management
Scenario 2	Sell October Feeder Cattle Contract on March 1 (Offset September 1)
Scenario 3	Sell October Feeder Cattle Contract on April 1 (Offset September 1)
Scenario 4	Sell October Feeder Cattle Contract on May 1 (Offset September 1)
Scenario 5	Sell October Feeder Cattle Contract on June 1 (Offset September 1)
Scenario 6	Sell October Feeder Cattle Contract on July 1 (Offset September 1)
Scenario 7	Sell October Feeder Cattle Contract on August 1 (Offset September 1)
Scenario 8	Buy At-Money October Feeder Cattle Put on March 1
Scenario 9	Buy At-Money October Feeder Cattle Put on April 1
Scenario 10	Buy At-Money October Feeder Cattle Put on May 1
Scenario 11	Buy At-Money October Feeder Cattle Put on June 1
Scenario 12	Buy At-Money October Feeder Cattle Put on July 1
Scenario 13	Buy At-Money October Feeder Cattle Put on August 1
Winter Feeding Calves – January 25 Expected Sales Date	
Scenario 14	No Risk Management
Scenario 15	Sell March Feeder Cattle Contract on September 1 (Offset January 25)
Scenario 16	Sell March Feeder Cattle Contract on October 1 (Offset January 25)
Scenario 17	Sell March Feeder Cattle Contract on November 1 (Offset January 25)
Scenario 18	Sell March Feeder Cattle Contract on December 1 (Offset January 25)
Scenario 19	Sell March Feeder Cattle Contract on December 20 (Offset January 25)
Scenario 20	Buy At-Money March Feeder Cattle Put on September 1
Scenario 21	Buy At-Money March Feeder Cattle Put on October 1
Scenario 22	Buy At-Money March Feeder Cattle Put on November 1
Scenario 23	Buy At-Money March Feeder Cattle Put on December 1
Retained Ownership in Kansas Feedlots – May 20 Expected Sales Date	
Scenario 24	No Risk Management
Scenario 25	Sell June Live Cattle Contract on January 25 (Offset May 20)
Scenario 26	Sell June Live Cattle Contract on February 25 (Offset May 20)
Scenario 27	Sell June Live Cattle Contract on March 25 (Offset May 20)
Scenario 28	Sell June Live Cattle Contract on April 25 (Offset May 20)
Scenario 29	Buy At-Money June Live Cattle Put on January 25
Scenario 30	Buy At-Money June Live Cattle Put on February 25
Scenario 31	Buy At-Money June Live Cattle Put on March 25
Scenario 32	Buy At-Money June Live Cattle Put on April 25

Table 2. Summary Statistics of Simulated Revenues for Naïve Risk Management Strategies by Phase of Production.

Cow-Calf Production	Mean	Standard Deviation	Minimum	Maximum	c.v.
Scenario 1 [1.]	$439.97	$72.99	$292.47	$602.08	0.166
Scenario 2	$425.56	$56.96	$266.97	$500.33	0.134
Scenario 3	$423.67	$57.94	$273.97	$503.08	0.137
Scenario 4	$427.83	$62.78	$270.22	$540.48	0.147
Scenario 5	$428.23	$71.07	$268.72	$578.98	0.166
Scenario 6	$432.75	$73.99	$274.47	$604.23	0.171
Scenario 7	$440.27	$75.22	$283.57	$613.23	0.171
Scenario 8	$428.59	$69.49	$277.72	$583.08	0.162
Scenario 9	$427.06	$73.76	$278.97	$582.58	0.173
Scenario 10	$428.79	$71.36	$268.22	$578.83	0.166
Scenario 11	$430.26	$73.35	$273.97	$583.83	0.170
Scenario 12	$430.33	$73.30	$277.22	$585.83	0.170
Scenario 13	$432.97	$75.22	$278.22	$595.58	0.174
Winter Stockering	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**c.v.**
Scenario 14 [1.]	$573.87	$78.16	$385.56	$738.24	0.136
Scenario 15	$569.39	$75.39	$387.84	$744.99	0.132
Scenario 16	$569.96	$79.25	$370.41	$747.06	0.139
Scenario 17	$568.98	$81.66	$374.41	$764.27	0.144
Scenario 18	$569.45	$83.18	$366.28	$767.03	0.146
Scenario 19	$568.90	$82.44	$376.13	$764.07	0.145
Scenario 20	$563.82	$78.27	$369.38	$748.36	0.139
Scenario 21	$564.12	$82.22	$365.93	$763.58	0.146
Scenario 22	$563.49	$80.57	$367.52	$753.74	0.143
Scenario 23	$563.78	$84.04	$359.94	$768.54	0.149
Finishing Phase	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**c.v.**
Scenario 24 [1.]	$803.41	$83.74	$677.87	$981.88	0.104
Scenario 25	$807.28	$91.25	$646.44	$982.39	0.113
Scenario 26	$813.08	$89.84	$672.53	$993.63	0.110
Scenario 27	$813.91	$85.55	$669.49	$982.72	0.105
Scenario 28	$802.94	$80.46	$667.81	$970.58	0.100
Scenario 29	$796.82	$72.29	$691.61	$922.06	0.091
Scenario 30	$803.21	$77.34	$678.38	$928.44	0.096
Scenario 31	$803.39	$81.67	$677.70	$931.74	0.102
Scenario 32	$798.05	$80.97	$637.98	$939.46	0.101

[1.] Base case scenario of no-risk management.

Table 3. The Top Fifteen and Bottom Fifteen Risk Management Alternatives Ranked by Minimum Gross Revenue in Managing Risk for Cow-Calf Producers with Stockering.

Top 15 Risk Management Strategies -- Ranked by Minimum Revenue [1.]						
	Minimum	Rank	Mean	Rank	c.v.	Rank
Scenario 2 / Scenario 15 [2]	$403.67	1	$535.93	57	0.112	1
Scenario 2 / Scenario 14	$397.30	2	$539.18	34	0.115	4
Scenario 2 / Scenario 19	$395.17	3	$535.57	59	0.115	5
Scenario 2 / Scenario 17	$393.92	4	$535.63	58	0.116	8
Scenario 8 / Scenario 14	$393.37	5	$542.21	27	0.136	26
Scenario 2 / Scenario 16	$391.02	6	$536.34	55	0.115	3
Scenario 4 / Scenario 15	$390.77	7	$538.20	43	0.115	6
Scenario 3 / Scenario 15	$389.67	8	$534.04	70	0.114	2
Scenario 4 / Scenario 14	$389.12	9	$541.45	29	0.120	15
Scenario 7 / Scenario 15	$388.17	10	$550.64	6	0.133	23
Scenario 2 / Scenario 18	$388.02	12	$535.97	56	0.115	7
Scenario 3 / Scenario 14	$388.02	11	$537.29	46	0.117	9
Scenario 7 / Scenario 14	$386.52	13	$553.89	1	0.139	36
Scenario 6 / Scenario 15	$385.02	14	$543.12	23	0.131	21
Scenario 5 / Scenario 15	$384.17	15	$538.60	39	0.125	19
Bottom 15 Risk Management Strategies -- Ranked by Minimum Revenue						
	Minimum	Rank	Mean	Rank	c.v.	Rank
Scenario 10 / Scenario 22	$353.77	62	$534.88	66	0.141	39
Scenario 10 / Scenario 21	$352.62	63	$535.34	60	0.144	56
Scenario 12 / Scenario 20	$351.62	64	$536.66	49	0.139	37
Scenario 11 / Scenario 20	$351.37	65	$536.59	51	0.141	43
Scenario 12 / Scenario 22	$350.27	66	$536.42	53	0.143	52
Scenario 11 / Scenario 22	$350.02	67	$536.35	54	0.144	57
Scenario 12 / Scenario 21	$349.12	68	$536.88	47	0.145	63
Scenario 11 / Scenario 21	$348.87	69	$536.81	48	0.147	70
Scenario 10 / Scenario 23	$348.27	70	$535.09	63	0.144	59
Scenario 9 / Scenario 20	$345.02	71	$533.39	74	0.146	65
Scenario 12 / Scenario 23	$344.77	72	$536.63	50	0.146	66
Scenario 11 / Scenario 23	$344.52	73	$536.56	52	0.148	71
Scenario 9 / Scenario 22	$343.67	74	$533.15	76	0.148	72
Scenario 9 / Scenario 21	$342.52	75	$533.61	73	0.151	76
Scenario 9 / Scenario 23	$338.17	76	$533.36	75	0.151	75

[1.] The no-risk management scenario minimum revenue was $378.37 (#29), the mean revenue was $553.60 (#2), and the coefficient of variation was 0.141 (#41).

[2.] The first scenario is for the cow-calf operation and the second is for the winter stockering phase.

Table 4. The Top Fifteen and Bottom Fifteen Risk Management Alternatives Ranked by Minimum Gross Revenue in Managing Risk for Stockering Operations with Retained Ownership Through Kansas Feedlots.

Top 15 Risk Management Strategies -- Ranked by Minimum Revenue						
	Minimum	Rank	Mean	Rank	c.v.	Rank
Scenario 21 / Scenario 29 [1.]	$696.77	1	$787.07	51	0.093	3
Scenario 22 / Scenario 29	$696.71	2	$786.43	54	0.091	2
Scenario 23 / Scenario 29	$696.11	3	$786.73	53	0.097	6
Scenario 14 / Scenario 29	$691.61	4	$796.82	34	0.091	1
Scenario 23 / Scenario 30	$686.99	5	$793.12	43	0.103	13
Scenario 22 / Scenario 30	$685.62	6	$792.83	46	0.097	7
Scenario 21 / Scenario 30	$683.55	7	$793.47	37	0.100	8
Scenario 15 / Scenario 24	$680.14	8	$798.93	26	0.108	25
Scenario 14 / Scenario 30	$678.38	9	$803.21	17	0.096	5
Scenario 14 / Scenario 24 [2]	$677.87	10	$803.41	14	0.104	17
Scenario 14 / Scenario 31	$677.70	11	$803.39	15	0.102	11
Scenario 23 / Scenario 31	$676.66	12	$793.30	41	0.109	28
Scenario 14 / Scenario 26	$672.53	13	$813.08	2	0.110	35
Scenario 15 / Scenario 27	$671.77	14	$809.44	5	0.110	30
Scenario 20 / Scenario 29	$670.60	15	$786.77	52	0.095	4
Bottom 15 Risk Management Strategies -- Ranked by Minimum Revenue						
	Minimum	Rank	Mean	Rank	c.v.	Rank
Scenario 19 / Scenario 24	$668.44	18	$798.44	30	0.114	40
Scenario 15 / Scenario 26	$668.25	19	$808.60	10	0.115	44
Scenario 14 / Scenario 28	$667.81	20	$802.94	18	0.100	9
Scenario 17 / Scenario 24	$666.71	21	$798.52	28	0.114	39
Scenario 20 / Scenario 31	$666.19	22	$793.34	39	0.107	22
Scenario 19 / Scenario 26	$663.10	23	$808.11	12	0.115	42
Scenario 16 / Scenario 24	$662.72	24	$799.50	23	0.110	33
Scenario 20 / Scenario 24	$661.69	25	$793.36	38	0.106	20
Scenario 17 / Scenario 26	$661.37	26	$808.19	11	0.120	50
Scenario 19 / Scenario 27	$660.06	27	$808.95	8	0.110	34
Scenario 22 / Scenario 24	$659.83	28	$793.03	44	0.108	24
Scenario 18 / Scenario 24	$658.59	29	$798.99	25	0.116	46
Scenario 19 / Scenario 28	$658.37	30	$797.97	33	0.108	26
Scenario 17 / Scenario 27	$658.34	31	$809.02	7	0.115	43
Scenario 21 / Scenario 24	$658.24	32	$793.67	35	0.110	31

[1] The first scenario is for the winter stockering phase and the second is for the finishing phase.
[2.] The no-risk management scenario.

Table 5. The Top Fifteen and Bottom Fifteen Risk Management Alternatives Ranked by Minimum Gross Revenue in Managing Risk for Cow-Calf Operations Retaining Ownership through Kansas Feedlots.

Top 15 Risk Management Strategies -- Ranked by Minimum Revenue [1.]						
	Minimum	Rank	Mean	Rank	c.v.	Rank
Scen. 2 / Scen. 15 / Scen. 24 [2.]	$658.50	1	$740.79	38	0.086	11
Scen. 7 / Scen. 15 / Scen. 29	$657.80	2	$750.71	22	0.097	19
Scen. 2 / Scen. 14 / Scen. 31	$657.53	3	$744.03	32	0.085	10
Scen. 2 / Scen. 15 / Scen. 26	$654.70	4	$747.67	25	0.088	14
Scen. 2 / Scen. 14 / Scen. 30	$652.80	5	$743.90	33	0.082	5
Scen. 2 / Scen. 15 / Scen. 27	$652.54	6	$748.26	24	0.084	6
Scen. 2 / Scen. 14 / Scen. 24	$652.33	7	$744.04	31	0.085	8
Scen. 2 / Scen. 15 / Scen. 28	$651.34	8	$740.45	41	0.079	2
Scen. 2 / Scen. 14 / Scen. 27	$650.89	9	$751.51	20	0.082	4
Scen. 1 / Scen. 14 / Scen. 29	$649.83	10	$753.67	18	0.097	20
Scen. 2 / Scen. 14 / Scen. 28	$649.69	11	$743.70	34	0.078	1
Scen. 2 / Scen. 15 / Scen. 31	$648.85	12	$740.77	39	0.091	17
Scen. 2 / Scen. 15 / Scen. 29	$648.33	13	$736.00	45	0.084	7
Scen. 7 / Scen. 15 / Scen. 30	$648.20	14	$755.36	13	0.101	23
Scen. 1 / Scen. 14 / Scen. 30	$647.03	15	$758.31	8	0.100	22
Bottom 15 Risk Management Strategies -- Ranked by Minimum Revenue						
	Minimum	Rank	Mean	Rank	c.v.	Rank
Scen. 1 / Scen. 14 / Scen. 26	$629.40	31	$765.34	2	0.114	43
Scen. 8 / Scen. 14 / Scen. 30	$628.78	32	$746.92	28	0.102	24
Scen. 2 / Scen. 14 / Scen. 32	$627.89	33	$740.14	42	0.085	9
Scen. 1 / Scen. 14 / Scen. 27	$627.24	34	$765.93	1	0.112	39
Scen. 1 / Scen. 14 / Scen. 28	$626.04	35	$758.12	10	0.109	35
Scen. 8 / Scen. 14 / Scen. 25	$625.84	36	$749.82	23	0.111	37
Scen. 8 / Scen. 14 / Scen. 24	$623.58	37	$747.07	26	0.111	38
Scen. 2 / Scen. 14 / Scen. 25	$623.17	38	$746.79	29	0.089	15
Scen. 7 / Scen. 15 / Scen. 25	$620.64	39	$758.25	9	0.113	42
Scen. 1 / Scen. 14 / Scen. 31	$619.43	40	$758.44	7	0.105	25
Scen. 8 / Scen. 14 / Scen. 32	$619.24	41	$743.17	36	0.106	30
Scen. 7 / Scen. 15 / Scen. 32	$614.04	42	$751.61	19	0.107	31
Scen. 1 / Scen. 14 / Scen. 25	$610.84	43	$761.21	5	0.116	45
Scen. 1 / Scen. 14 / Scen. 32	$604.24	44	$754.56	15	0.107	32
Scen. 8 / Scen. 14 / Scen. 31	$601.18	45	$747.05	27	0.106	29

[1.] The no-risk management scenario had minimum revenue of $533.20 (#27), mean revenue of $758.46 (#6), and a coefficient of variation of 0.115 (#44).

[2.] The first scenario is for the cow-calf phase, the second is for the winter stockering phase, and the third is for the finishing stage.