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A Comparison of the Effectiveness of Using Futures, Options, LRP Insurance, or AGR-Lite Insurance to Manage Risk for Cow-calf Producers

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A Comparison of the Effectiveness of Using Futures, Options, LRP Insurance, or AGR-Lite Insurance to Manage Risk for Cow-calf Producers

Practitioner's Abstract

A comparative analysis was performed looking at using cash, futures, options, or insurance to manage the price of calves for cow-calf producer. Risk can be reduced with the futures market and with options or LRP insurance. Options and LRP insurance are equivalent in the amount of risk that is reduced. AGR-Lite does not appear to be an effective policy at reducing risk for cow-calf producers.

Keywords: Cow-calf risk, Feeder cattle futures, Options, LRP Feeder Cattle, AGR-Lite

Introduction

Historically most cow-calf producers have not used the CME Feeder Cattle futures or options to hedge the sale price of their calves. University extension specialists have conducted numerous workshops over many years to educate producers on the use of futures and options (Falconer and Parker, 2001) and yet only a small percentage of producers use these risk management tools. Feuz and Umberger, 2001, found that in a survey of Nebraska cow-calf producers only 20 percent had used futures or options on futures to hedge their calves. One explanation has always been that the Feeder Cattle contract specifications don't fit a weaned calf and that the basis variability for this cross hedge may be too large for an effective hedge (Feuz and Umberger, 2000). However, when the CME introduced the Stocker Cattle contract in 1998 to provide a contract specifically designed for cow-calf producers, Feuz and Umberger, found that basis variability for 500-600 pound steers on the stocker contract still exceeded basis variability for 700-800 pound steers on the feeder contract in ten different markets. For the most part, cow-calf producers did not use this contract to hedge and speculators didn't trade it because of the lack of liquidity (Diersen and Klein, 2000). The CME was forced to de-list this contract.

Another reason often put forth for the lack of use of futures and options by cow-calf producers is the fixed contract size (50,000 lbs.) does not work well for smaller producers. In 2002 the USDA-Risk Management Agency (USDA-RMA) introduced Livestock Risk Protection (LRP) insurance for feeder cattle. It is now available in 37 states, which include all of the largest cow-calf producing states. This insurance product is very similar to purchasing a Put Option. However, producers can insure as few as one head if they desire; thus overcoming the size of contract issue with the CME feeder cattle contract. Mark, 2005, examines the similarities and differences between using a traditional future hedge or put option and using LRP insurance to protect feeder cattle prices. He points out that basis risk is still an issue, and in fact in Nebraska, LRP basis variability is greater than feeder cattle futures basis variability for 500-600 pound steers. While this is a fairly new product, cow-calf producers don't seem to be any more interested in it than they have been in the futures market. The 2008 state profiles provided by the USDA-Risk Management Agency show that for the four intermountain states of Arizona, Nevada, Utah and Wyoming there was only 1,874 head of feeder cattle insured with LRP-Feeder cattle insurance. The northern plains states of Montana, North

Dakota and South Dakota insured less than 40,000 head, which would be less than one percent of the 2008 calf crop of these three states.

USDA-RMA more recently introduced Adjusted Gross Revenue-Lite insurance (AGR-Lite) as another insurance product that cow-calf producers could use to insure against risk (USDA-RMA, 2009). Once again, university extension specialists have been involved in conjunction with USDA-RMA in educating producers about this insurance product. While this insurance product has the added benefit of insuring against production risks that will impact revenue in addition to insuring against lower market prices that will impact revenue, still the use of this insurance product has been very limited to date.

In the last few years there has been an increase in market price volatility and profitability in the cow-calf industry has declined. One would think that cow-calf producers would be looking for some form of risk protection. Rather than wondering why cow-calf producers are not using the available risk management tools, perhaps it would be instructive to evaluate how effective these tools actually are in mitigating risk at an acceptable level of return. Perhaps that will provide greater insight into why producers are not using the market and insurance products.

The objective of this research is to compare the expected net returns and the variability of those returns for cow-calf producers using cash, futures, options, LRP, and AGR-Lit pricing strategies when: 1) only market price level risk is considered, 2) market price level and local price (basis risk) are considered, and 3) market price level, basis risk and production risk are considered.

Methods and Data

A simulation analysis will be conducted to compared the expected gross returns from using a cash only pricing strategy to that of placing a hedge using CME feeder cattle futures, buying a put option on the feeder cattle futures, buying LRP feeder cattle insurance, or buying Adjusted Gross Revenue-Lite insurance. The simulation analysis is conducted using the SIMETAR add-in to Excel (Richardson, Schumann and Feldman, 2006). There are three types of risk identified and modeled in the simulation: market price level risk, local price or basis risk, and production risk. With a cash only strategy no measures are taken to manage any of these risks. The use of futures, options, and LRP insurance all address market price level risk, but do nothing to protect against basis risk or production risk. AGR-Lite insurance is designed to insure against an unexpected loss in gross revenue, which could incur because of a decline in the market level price, a decline in the local price (basis), or a reduction in the number of calves to sell or the weight of the calves. Therefore, only AGR-Lite insurance is designed to manage all three types of risk identified in this paper.

A fairly simple budget is constructed within Excel. The number of cows to calve is entered. The expected weaning rate is a stochastic variable which is used to determine the number of steer and heifer calves to sell; seventeen percent of the heifer calves are held as replacements and 15 percent of the cows are sold as culls. Steer calf weight is a

stochastic variable and heifer weight is 40 pounds less than the steer weight. The steer market price is a stochastic variable compose of two separate stochastic variables: the market price level and the local price or basis. The expected mean basis for the stochastic simulation is also adjusted based on the stochastically generated weight of the calf. A heavier calf will have a lower expected basis and a lighter calf will have a higher expected basis. The heifer calf price is a fixed $8 per cwt. less than the steer price.

The methodology used to determine the distribution for each of the stochastic variables is now set forth. There are several methods one could use to measure market price level risk. The CME feeder cattle future contract is cash settled against the CME Feeder Cattle Index. This index is a 7-day, rolling, weighted average of local auctions, video auctions and direct sales of 650-849 pound, medium and large frame number 1 and number 1-2 steers in a 12 state region (Chicago Mercantile Exchange, 2009). This index represents the national level price. One could look at the variability of this index over time as one measure of market price level variability. However, while this would capture variability, it would not capture the true risk or uncertainty that producers face each year, because some of that variability is predictable based on seasonal patterns or expected increases or decreases in costs over time.

The literature on the efficiency of futures markets to predict future cash prices has been mixed (Frank and Garcia, 2005; Mckenzie and Holt, 1998). However, the inefficiencies sometimes found in the market are usually not enough to encourage vast numbers of traders to try and exploit them. For this paper, I will assume that the feeder cattle futures are at least as good as a predictor of future cash prices as any other model. Therefore, if we consider a cow-calf producer, with spring-born calves, to sell in the fall, who observes fall feeder cattle contracts to establish an expected price level for the fall, that producer's risk is how much that fall contract changes from spring to fall.

When should cow-calf producers look to hedge their calves or buy LRP insurance? When the calf is born? When the previous calf is sold? When the cow is bred? Those hedges could range from approximately 7 to 16 months in duration. The feeder cattle contracts are only listed for 12 months in advance of expiration. However, while the futures contracts are listed that far in advance, often there are no options traded more than six months in advance of expiration. Likewise, a producer can theoretically purchase LRP insurance 52 weeks in advance of the expected sale date. However, when no options are traded that far in advance, you also cannot purchase the insurance. The reality in the market place is the options and LRP insurance is often only available about six months, 26 weeks prior to the expected sale date. Many cow-calf producers who forward contract their calves either direct with a buyer or through a satellite video auction do not do so prior to July.

Therefore, to measure market price level risk for this paper the changes in the November Feeder Cattle contract will be analyzed from May to November and also from July to November. Monthly averages for the months of May, July and November will be determined for the November contract and the change in market level determined. Futures prices for 1999-2008 will be analyzed. The mean, standard deviation and a test

for normality will be conducted to determine the appropriate distribution to use in simulating the market level risk faced by cow-calf producers.

Determine basis risk is a straight-forward task. One only needs to compare a specific set of cash prices for feeder cattle with the feeder cattle contract. However, while monthly averages were used to determine market level risk, producers do not normally sell for the monthly average. Most livestock auctions across the country have one feeder cattle sale per week. The day of the week varies by auction, with the majority of sales occurring in Tuesday, Wednesday, or Thursday. October and November are by far the largest volume sale months for spring-born calves. Weekly average futures prices for October and November for the Oct and Nov feeder cattle contracts were used to calculate the basis for the Dodge City, KS auction. Basis is determined by subtracting the futures prices from the weighted average price for a 500-599 pound medium to large frame, number 1steers at the Dodge City auction for each sale week in October and November from 1999-2008.

Basis variability varies by location (Feuz and Umberger, 2000). Dodge City, Kansas was chosen for this paper because it was in the mid range of variability reported by Feuz and Umberger; it is a fairly large feeder cattle auction with consistent sales throughout the time period of the analysis; and it is centrally located within the 12-state region that makes up the CME Feeder Cattle Index. As with the market level data, the mean, and standard deviation are determine for the Dodge City basis data and a test of normality is performed to see if a normal distribution is appropriate for simulating basis risk.

During the winter of 2007-08 and 2008-09, cow-calf producers who participated in risk management workshops conducted by the author were asked to describe their production risk. They were specifically asked to state their typical percent of calves weaned based on cows exposed over the last ten years, and their highest and lowest percent over that time period. Similarly, they were asked for their typical, heaviest and lightest steer calf weights over the last ten years as well. Producers from multiple locations in Utah and Wyoming participated in the workshops. The responses on percentage of calf crop weaned were very consistent in both the expected percentage and the highest and lowest percentage. The typical or expected weight varied by location, but interesting the range for the heaviest and lightest weight were fairly consistent across all areas.

Once all of the distributions were determined for the stochastic variables, four separate simulations of 500 iterations each were conducted: the first simulation involved only market level risk and the weight of calves to sell was expected to equal 50,000 pounds, one CME feeder cattle contract; the second simulation was the same as the first with the exception that the number of cows were reduced to show differences in the pricing alternatives when there is not sufficient weight to fulfill a feeder cattle contract; the third simulation analysis involved market level risk and basis risk for the expected 50,000 pounds of calves to sell; and the fourth simulation included market level, basis and production risk.

Results

The monthly average futures prices for the November feeder cattle contract for 1999-2008 for the months of May, July and November are displayed in Table 1. The changes from May to November and from July to November were determined and these series were tested for normality. The null hypothesis of a normal distribution could not be rejected at the 95% probability. The two series were also tested determine if the mean and variance were equal using a t test for the means and an F test for the variances. We failed to reject the null hypothesis of equal means and of equal variance at the 95% confidence level. Therefore, a joint spring/summer to November market level price change, normal distribution was established with mean=0 (assumes futures efficiency) and a standard deviation of 9.83. These values were used for the stochastic simulation of market level risk.

The weekly average feeder cattle futures prices for October and November and the weekly average auction price for 500-599 pound steers at Dodge City, Kansas from 1999-2008 are listed in Table 2. The Dodge City basis is calculated for each week and the average and standard deviation of basis is determined. The basis series was tested for normality and we failed to reject the null hypothesis of a normal distribution at the 95% confidence level. Therefore, for the basis risk for the simulation model a normal distribution with a mean of 7.51 and a standard deviation of 4.01 was used.

Modified triangle distributions, the GRK distribution (Richardson, Schumann and Feldman, 2006) were used in the simulation analysis to model production risks. The expected percent calf crop weaned was 90% and the minimum and maximum percents were 85% and 93%, respectively. The GRK distribution allows for some values in the tail of this distribution to exceed the minimum and maximum values. The expected weight for steer calves was 550 pounds and the minimum and maximum weights were 510 pounds and 575 pounds.

Table 1. Monthly Average Futures Prices for the November Feeder Cattle Contract for 1999-2008.

Year	May	Jul	Nov	May-Nov	Jul-Nov
1999	75.37	77.76	81.30	5.93	3.54
2000	86.55	88.57	88.28	1.73	-0.30
2001	89.66	90.64	84.88	-4.78	-5.76
2002	76.90	77.63	82.98	6.08	5.34
2003	85.38	88.21	103.02	17.65	14.81
2004	99.34	106.84	107.95	8.62	1.11
2005	107.77	104.00	115.81	8.04	11.82
2006	104.02	112.14	99.65	-4.37	-12.49
2007	110.42	115.71	109.83	-0.59	-5.89
2008	114.19	115.86	96.97	-17.22	-18.88
Mean				2.11	-0.67
Standard Deviation				9.54	10.42

Table 2. CME October and November Weekly Average Prices, Dodge City, Kansas Weekly Cash Auction Prices for 500-599 Pound Medium and Large Frame, Number 1 Steers, and Basis, 1999-2008 For the Months of October and November.

Date	Futures	Cash	Basis	Date	Futures	Cash	Basis
10/01/99	80.53	88.29	7.76	11/14/03	102.79	107.87	5.09
10/08/99	81.41	83.68	2.27	11/21/03	103.18	108.71	5.52
10/15/99	78.97	90.36	11.39	10/15/04	114.02	127.14	13.13
10/22/99	80.69	88.86	8.16	10/22/04	112.91	124.99	12.08
10/29/99	80.11	84.52	4.41	10/29/04	113.85	121.91	8.06
11/05/99	80.89	86.20	5.31	11/05/04	107.92	119.14	11.22
11/12/99	81.22	90.26	9.04	11/12/04	107.74	118.48	10.73
11/19/99	81.90	92.21	10.30	11/19/04	108.28	115.56	7.28
10/06/00	86.45	91.28	4.83	10/07/05	117.42	129.05	11.63
10/13/00	86.58	92.69	6.11	10/14/05	118.51	126.26	7.75
10/20/00	87.35	93.04	5.68	10/21/05	117.04	125.34	8.30
10/27/00	87.28	92.54	5.26	10/28/05	115.78	123.95	8.16
11/03/00	88.53	99.47	10.94	11/04/05	115.80	125.44	9.64
11/10/00	88.10	96.30	8.19	11/11/05	115.46	129.71	14.25
11/17/00	88.36	96.87	8.51	11/18/05	116.29	128.48	12.19
10/05/01	86.38	90.68	4.30	10/06/06	113.21	126.09	12.88
10/12/01	88.59	93.62	5.03	10/13/06	108.94	124.88	15.94
10/19/01	88.34	92.63	4.28	10/20/06	106.94	119.33	12.39
10/26/01	88.66	90.11	1.45	10/27/06	106.74	115.36	8.62
11/02/01	86.69	91.92	5.23	11/03/06	103.08	122.44	19.36
11/09/01	85.20	90.27	5.07	11/10/06	99.64	108.13	8.49
11/16/01	83.74	87.87	4.13	11/17/06	97.45	112.13	14.68
10/04/02	80.18	88.97	8.80	10/05/07	114.97	123.10	8.13
10/11/02	80.00	83.87	3.86	10/12/07	113.60	119.99	6.38
10/18/02	81.26	86.54	5.28	10/19/07	112.28	119.27	6.99
10/25/02	81.94	83.30	1.36	10/26/07	111.04	119.00	7.96
11/01/02	82.00	85.86	3.86	11/02/07	108.92	118.77	9.85
11/08/02	82.93	91.73	8.80	11/09/07	108.16	119.00	10.84
11/15/02	83.05	88.68	5.63	11/16/07	108.70	118.88	10.18
11/22/02	82.74	87.13	4.39	10/03/08	102.32	105.07	2.75
10/03/03	100.53	107.55	7.02	10/10/08	97.93	104.00	6.07
10/10/03	105.19	113.49	8.30	10/17/08	97.15	95.00	-2.15
10/17/03	106.89	110.87	3.98	10/24/08	98.17	109.83	11.66
10/24/03	102.98	103.63	0.65	10/31/08	95.88	101.38	5.50
10/31/03	106.43	103.12	-3.31	11/07/08	99.73	105.26	5.52
11/07/03	103.14	106.28	3.14	11/14/08	97.58	109.38	11.79

	Mean	Std Dev	Max	Min
Basis	7.51	4.01	19.36	-3.31

The initial simulation was run with only market price level risk as a stochastic variable. In Figure 1, are cumulative distribution functions (CDFs) of the five pricing alternatives. A few important observations can be made from this set of CDFs. The futures hedge eliminates most of the market price level risk faced by cow-calf producers. The model sells 15% of the cows each year as culls, and no price protection is taken on them. That is the source of variability. Since the futures were assumed to be efficient, there is an equal probability that cash prices will be higher or lower than the hedged price. Both the put option and LRP insurance protect against downside price risk and yet allow producers to take advantage of higher market prices. There is also little difference between the put option and LRP insurance. A futures hedge, a put option, and LRP insurance all behave as theory would suggest and as is taught to producers by extension specialists. One other note from the CDFs; AGR-Lite appears to be a poor choice for most producers. Table 3 contains summary statistics for each of these distributions.

The second simulation involved looking at the pricing alternative when there was not sufficient number of calves being marketed to fill a feeder cattle contract. In the first scenario, the number of cows to calve was set so that the expected pounds of calves to sell would equal 50,000. For this second scenario, cow numbers were reduced so that the expected pounds of calves to sell would be 25,000. With this scenario, the futures hedge becomes more risky as producers are over hedged. Effectively they are speculating on a half of a contract. The LRP insurance is superior to the put option if the market is above the expected price but the put is superior if the market declines. The reason for this is that when prices rise, there is no insurance indemnity paid not option premium to sell in the market place. However, with the put, producers had to pay for insurance on 50,000 pounds, whereas with the LRP insurance, producers only paid for 25,000 pounds. When prices decline, the put is superior because producers receive the put premium on 50,000 lbs. but the LRP insurance only pays out on the insured 25,000 lbs.

The third simulation scenario involved the addition of basis risk with market level risk. This is the price risk that cattle producers face. Figure 3 contains the CDFs for this simulation. The futures hedge pricing alternative still reduces price risk the most. That is statistically evident by the lower standard deviation displayed in Table 3. However, variability or risk as measured by the standard deviation of per cow returns as more than doubled for the hedge pricing scenario when both basis and market level risk is considered, as compared to the first scenario when only market level risk was considered. The put option and LRP insurance alternative are still very close in their distribution of returns. The AGR-Lite policy is still an inferior alternative.

The last simulated scenario involves market level, basis and production risk. The CDFs for this simulation are displayed in Figure 4 and summary statistics are in Table 3. The distributions appear similar to those from the previous scenario with the addition of slightly more variability. The means and variances for each simulated distribution for this final scenario were tested for significant differences using a t test for the means and an F test for the variances. All tests are reported based on the 95% probability. The mean, or expected, revenue per cow were statistically equivalent for all pricing

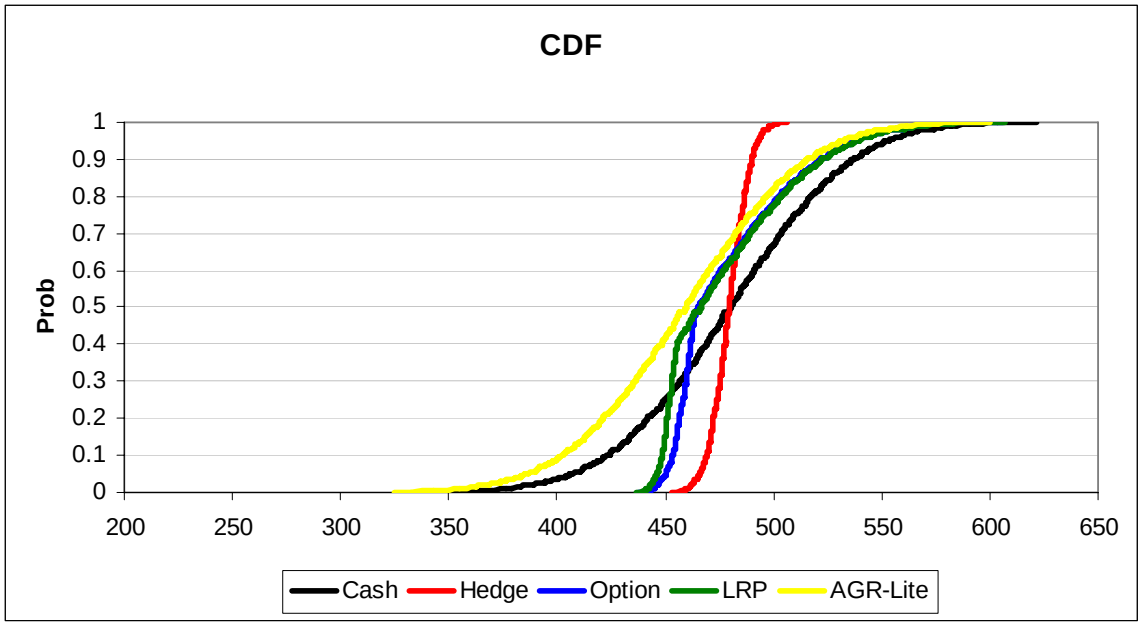

Figure 1. CDFs for the pricing alternatives when only market level risk is considered.

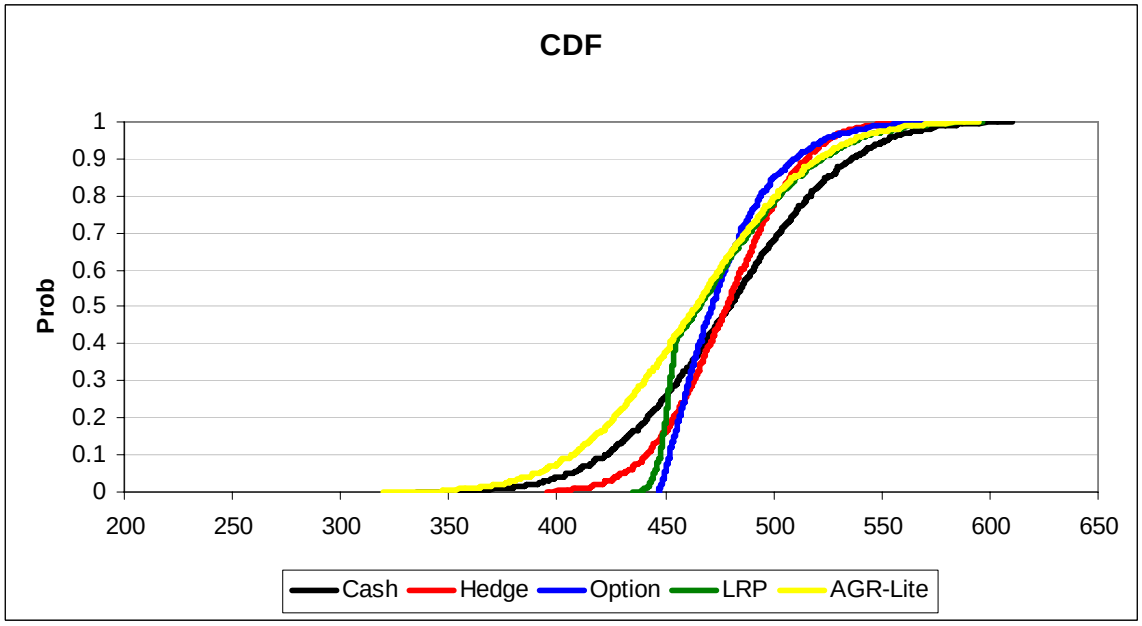

Figure 2. CDFs when only market level risk is consider but when there is less than a full contract of weight to sell.

statistically lower mean. The futures hedge pricing alternative results in a statistically smaller variance than all other alternatives. Using either put options or LRP insurance statistically reduces variance from the cash or AGR-Lite alternative and option and LRP

variance are statistically equivalent. The AGR-Lite alternative would not be preferred by producers as the expected return is reduced and variability is not reduced.

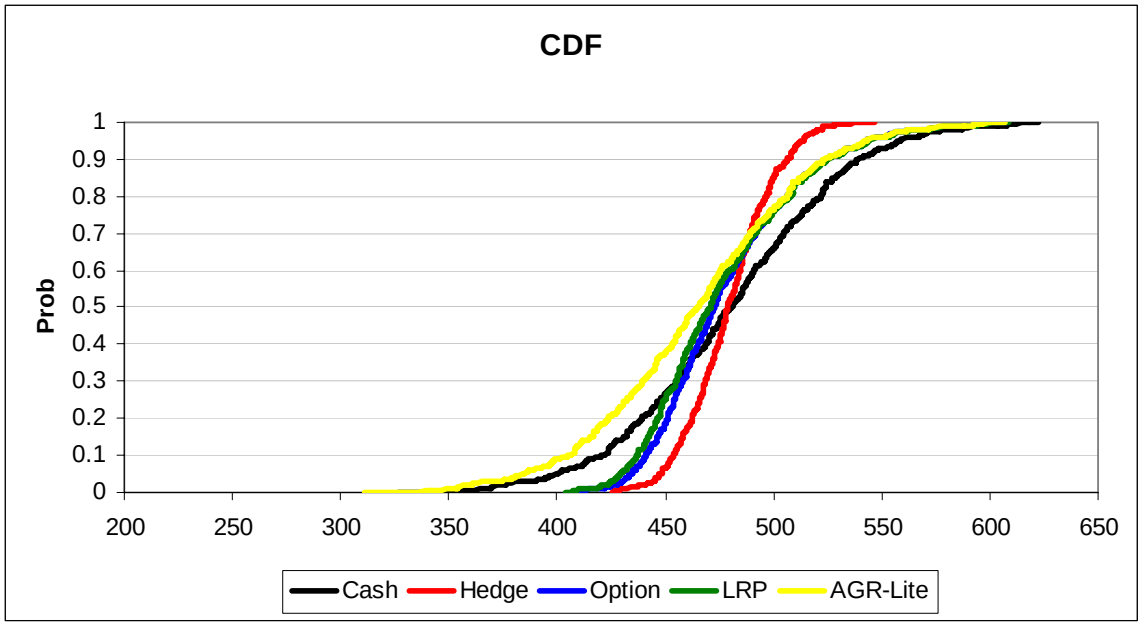

Figure 3. CDFs for the pricing alternatives when market level and basis risk are considered.

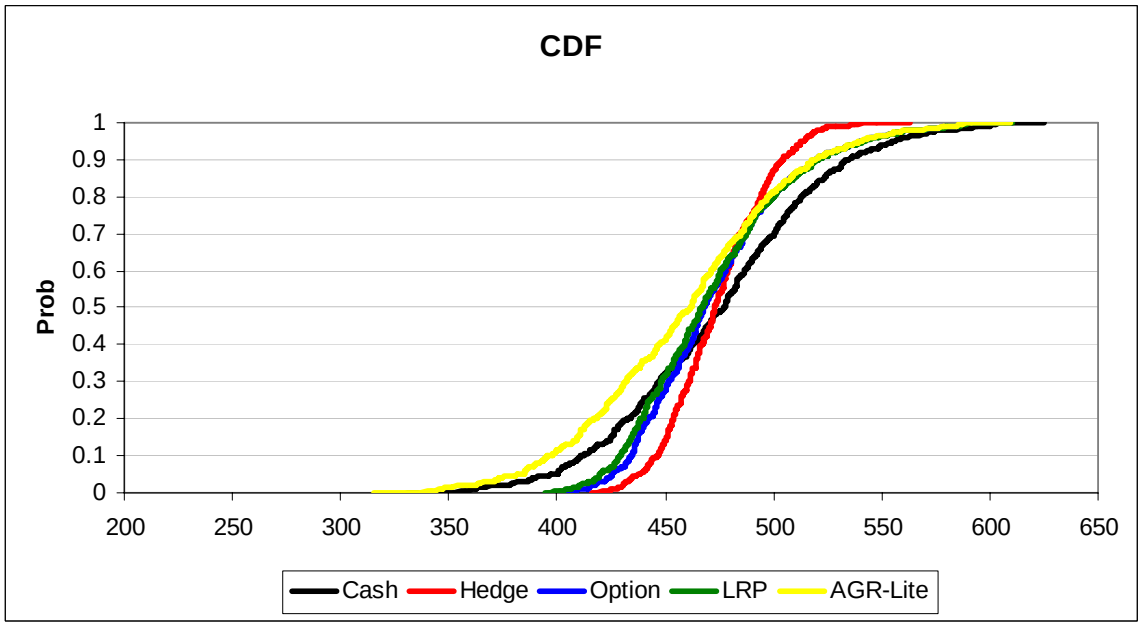

Figure 4. CDFs for the pricing alternatives when market level, basis, and production risk are considered

Table 3. Descriptive Statistics for Each of the Four Simulation Scenarios.

	Cash	Hedge	Option	LRP	AGR-Lite
			Market Level Risk		
Mean	480.10	479.55	479.00	477.07	459.23
StDev	44.76	8.35	29.19	31.45	44.72
CV	9.32	1.74	6.09	6.59	9.74
Min	339.72	452.87	437.13	436.26	324.43
Max	621.35	506.35	606.35	607.35	600.47
			Market Level Risk Less Than a Feeder Cattle Full Contract		
Mean	479.23	478.14	476.99	476.21	463.76
StDev	44.57	28.79	23.71	31.27	44.57
CV	9.30	6.02	4.97	6.57	9.61
Min	334.81	394.96	446.52	434.81	319.34
Max	610.42	569.90	580.20	596.47	594.95
			Market Level and Basis Risk		
Mean	480.08	479.54	478.97	477.04	464.61
StDev	48.60	20.16	34.43	36.36	48.60
CV	10.12	4.20	7.19	7.62	10.46
Min	326.66	425.81	410.07	403.80	311.20
Max	622.58	546.69	607.58	608.58	607.11
			Market Level, Basis, and Production Risk		
Mean	474.61	474.07	473.49	471.69	459.14
StDev	48.85	23.10	35.52	37.41	48.85
CV	10.29	4.87	7.50	7.93	10.64
Min	330.36	415.73	399.99	394.22	314.89
Max	624.70	563.39	609.70	610.20	609.23

Implications

There are several implications from this research. The first implication is that producers can reduce the variability of returns by using futures, put options or LRP insurance. However, with a futures hedge, which eliminates the most variability, that reduction not only eliminates significant downside risk but also caps upside potential. This remains a stumbling block for many producers. Another implication from this research is that it appears that LRP insurance is a good substitute for buying a put option for those producers who would prefer to deal with an insurance salesman rather than a commodity broker. The LRP insurance premiums are prices similar to the put option premiums and the resulting distributions of returns are statistically equivalent. For those smaller producers, who have not been able to utilize the option market because they couldn't fill a feeder cattle contract, it appears the LRP insurance is a viable alternative. However, it appears that the AGR-Lite insurance policy is not an effective policy for cow-calf producers. The premiums are set too high relative to the risks that are insured. If the USDA-Risk Management Agency would like to see more of this insurance product sold to cow-calf producers, some changes to the policy will have to be made.

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