Applied Risk Analytics

Evaluating LRP Coverage With the Multi-Temporal Risk Analyzer

Bill Bates* is looking to protect against price declines on 100 head of 1,350 pound fat steers they typically market in December. It is currently May. Bill selects a 26-week Livestock Risk Protection (LRP) contract with 96 percent coverage and a premium of $2.51/cwt ($3,389 total). The contract price is $137.75, resulting in a coverage price of $132.37/cwt (or $178,700 total coverage).

LRP is an insurance policy designed to manage market price risk. LRP is available for feeder and fed cattle, and swine producers. To purchase a policy, a producer selects a production period and corresponding coverage levels, like many insurance contracts.

Important features of LRP include: contracts can be from 70-100 percent of the expected ending value of cattle; contract lengths can range from 13 to 52 weeks; indemnities are paid if the contract actual ending value is lower than the coverage value; prices are determined by Chicago Mercantile Exchange (CME) indexes; total number of insurable livestock varies by species; and the actual cash price received for the livestock has no bearing on insurance coverage.

RightRisk Analytics
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Multi-Temporal Risk Analyzer

The Multi-Temporal Risk Analyzer (MTRA) is designed to offer users a tool to examine the long term variability of a proposed business change or strategy adjustment in a partial budget format, generating results

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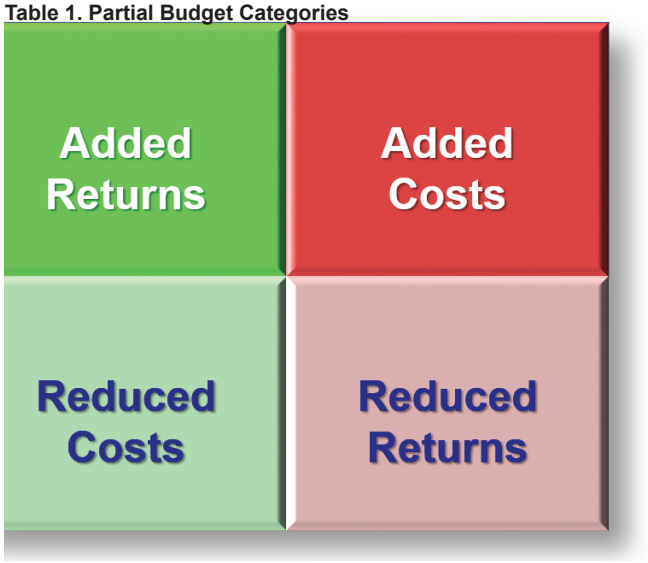
with probability analysis of the expected outcomes. The tool lets users enter inflows (added returns and reduced costs) and outflows (reduced returns and added costs) (Table 1).

A unique feature of MTRA is the ability to turn on/off each of these items over a twenty year period, allowing the user to adequately project long term expectations for the decision or potential scenario.

To examine Bill's LRP strategy, the variables necessary to assess net returns over time include: the cash sale price (assumed to be the coverage level shown as a total), the potential indemnity payment, and the premium price.

Table 1. Partial Budget Categories



Following Bill's example, under added returns we enter fed steer sales value of $178,700 or the coverage price in Table 2. We expect the most likely value to be equal to the coverage price and enter it accordingly. Next, we assume a 10 percent variation in total sales, resulting in a low value of $160,830 and a high value of $196,570, including the local basis (the difference between the cash price and the LRP index price). Note that we could enter basis as an added return or cost with corresponding most likely, low and high values to allow for variation over time. We elected here to include basis in the added return estimate to make the results more easily interpreted.

Table 2. MTRA Entries for Bill Bates Livestock Risk Protection (LRP) Coverage Example

Proposed Change:	Interest Rate:	5.00%		~ Check the boxes below for y							
Bates Fed Cattle LRP Strategy	Most Likely VALUE	Expected Low/High Value			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Y
Added Returns											
Fed Steer Sales (Coverage Price)	$ 178,700	$ 160,830	Low	All	☑	☑	☑	☑	☑	☑	
		$ 196,570	High	None							
LRP Indemnity Payment	$ 3,389	$ -	Low	All	☑	☑	☑	☑	☑	☑	
		$ 12,000	High	None							
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	
		$ -	High	None							
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	
		$ -	High	None							
Reduced Costs											
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	
		$ -	High	None							
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	
		$ -	High	None							
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	
		$ -	High	None							
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	
		$ -	High	None							
Added Costs											
LRP Indemnity Payment	$ 3,389	$ 3,389	Low	All	☑	☑	☑	☑	☑	☑	
		$ 3,389	High	None							
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	

The potential LRP indemnity payment is $3,389 (equal to the premium) and set as the expected value, with a low of zero and a high of $12,000. Under added costs we enter the premium price of $3,389 and hold it constant (the same value entered for both the low and high values).

We also select all 20 years for each variable by clicking All, rather than checking the box for each individual year (Table 2).

MTRA Risk Analytics

MTRA evaluates risk scenarios for single or multi-year periods by using a set of random draws to simulate the possible actual cost and returns to account for uncertainty. Results include annual and cumulative net returns on a cash and net-present value basis via the output screen after clicking ***RUN***. Each run of the simulation generates a different set of individual results for cash- and net present value-basis (NPV) results. For our first example run, MTRA generates an average net return (cash basis) of $178,677 or $3,573,568 total over 20 years (Table 3). The average net return on a net present value basis for this run equals $116,161/year or $2,323,214 total for the 20 years.

One of the more powerful analytical features of MTRA is the cumulative probability analysis. This allows the user to see both the range of potential net returns and the associated probabilities, based on the data input. Eight different charts are generated. This analysis can give us much clearer understanding of the basic question we began with: "What is the potential for a strategy using LRP for price risk protection to be profitable in the long term?" In other words, "Can purchasing LRP coverage consistently generate a positive net return when compared with cash sales over a series of years?"

Table 3. MTRA Cash-basis and Present Value-basis Net Return Output Estimates for Bill Bates LRP Coverage Example, Single Draw

Interest Rate: 0.00%

CASH-basis analysis

YEAR	Projected Total Added Returns	Projected Total Reduced Costs	Projected Total Added Costs	Projected Total Reduced Returns	Projected NET ANNUAL Return
1	170,162	-	3,389	-	166,773
2	173,519	-	3,389	-	170,130
3	195,972	-	3,389	-	192,583
4	169,495	-	3,389	-	166,106
5	170,981	-	3,389	-	167,592
6	178,759	-	3,389	-	175,370
7	187,142	-	3,389	-	183,753
8	183,875	-	3,389	-	180,486
9	172,354	-	3,389	-	168,965
10	185,152	-	3,389	-	181,763
11	178,767	-	3,389	-	175,378
12	182,704	-	3,389	-	179,315
13	183,457	-	3,389	-	180,068
14	190,666	-	3,389	-	187,277
15	177,815	-	3,389	-	174,426
16	189,475	-	3,389	-	186,086
17	184,231	-	3,389	-	180,842
18	190,277	-	3,389	-	186,888
19	186,806	-	3,389	-	183,417
20	189,740	-	3,389	-	186,351

Net Return:	3,573,568
MIN Rtn:	166106
AVG. Rtn:	178678
MAX Rtn:	192583

Interest Rate: 5.00%

PRESENT VALUE-basis analysis

YEAR	Projected PV-Total Added Returns	Projected PV-Total Reduced Costs	Projected PV-Total Added Costs	Projected PV-Total Reduced Returns	Projected PV-NET ANNUAL Return
1	170,162	-	3,389	-	166,773
2	165,256	-	3,228	-	162,028
3	177,753	-	3,074	-	174,679
4	146,416	-	2,928	-	143,489
5	140,666	-	2,788	-	137,878
6	140,062	-	2,655	-	137,407
7	139,648	-	2,529	-	137,119
8	130,677	-	2,408	-	128,268
9	116,656	-	2,294	-	114,362
10	119,350	-	2,185	-	117,166
11	109,747	-	2,081	-	107,667
12	106,823	-	1,981	-	104,842
13	102,155	-	1,887	-	100,268
14	101,114	-	1,797	-	99,317
15	89,809	-	1,712	-	88,097
16	91,141	-	1,630	-	89,510
17	84,398	-	1,553	-	82,846
18	83,017	-	1,479	-	81,539
19	77,622	-	1,408	-	76,213
20	75,086	-	1,341	-	73,745

Net Return:	2,323,214
MIN Rtn:	73745
AVG. Rtn:	116161
MAX Rtn:	174679

MTRA generates probabilities based on the single draw shown, or a multi-draw analysis, giving a more cumulative, long term result. For Bill's example, a 5 percent interest rate is entered to estimate the effect of the time value of money on net returns. The multi-draw net return analysis shows the cumulative probabilities generated by repeating the random draws 1,000 times for the 20 year period.

The curves in Table 4 show the expected values and associated probabilities for Bill's proposed LRP strategy, summing across the entire 20-year project. The orange line represents a probability curve describing net returns on a present value basis The purple curve describes the same returns on a cash value basis. This chart illustrates that if Bill repeated his LRP purchase strategy 1,000 times, he could expect the annual net return on a net present value basis (NPV basis) to be $117,618 (or $2,352,352 / 20 years) as the most likely outcome. Bill should expect the outcome to be no less than $2,060,177 and no more than $2,684,774 when factoring in the time value of money.

The reader will no doubt note that the purple curve results in higher values (to the right) in all cases as it depicts the cash-basis analysis, assuming the time value of money is equal to $0 (an uncommon situation). We should also keep in mind, for this example as with many risk management strategies, that purchasing insurance is intended to mitigate risk, not guarantee a payout.

The results presented in Table 4 illustrate the potential benefits for a strategy of consistently purchasing the Fed Cattle LRP policy each year for the 20 years. Bill might also wonder what results he should expect if the strategy was applied inconsistently? For instance, assume Bill was trying to anticipate years where there would be a lower price for fed cattle and purchase LRP coverage only when he guessed he might need it. This might look like a strategy of purchasing coverage only 10 years out of 20. MTRA will allow the user to select every other year on some or all input categories and re-run the simulation. A check is entered in every other box (year) for the LRP indemnity and premium inputs and click ***RUN*** to generate these results.

The resulting probability curves are similar in shape to those presented in Table 4. The results may also be viewed in tabular form, Table 5.

Table 4. MTRA Cash-basis and Present Value-basis Estimated Net Return Cumulative Probability Distribution for Bill Bates LRP Coverage Example, Multi-draw Analysis

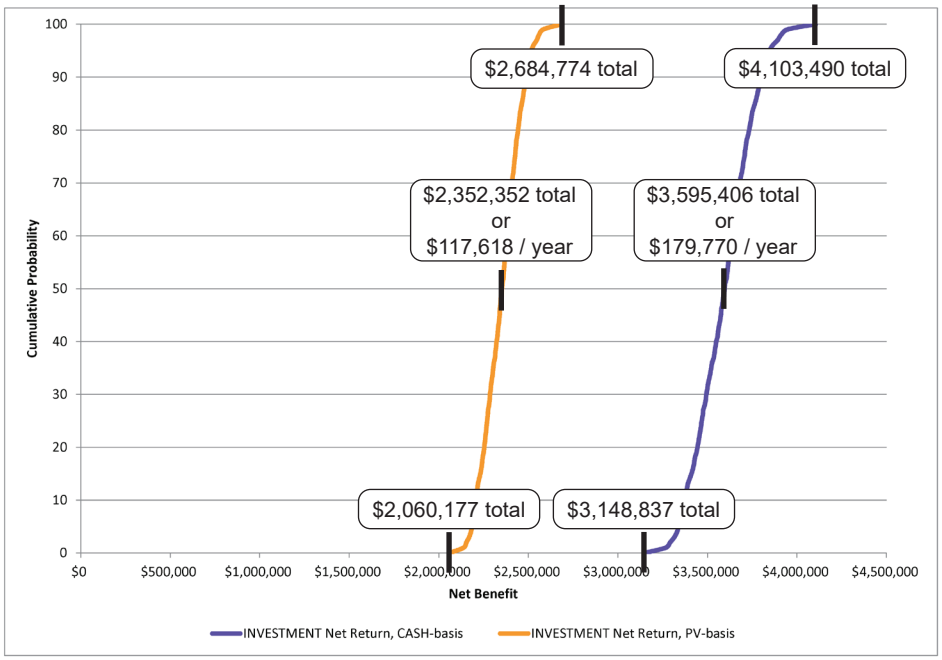


Table 5. MTRA Cash-basis and Present Value-basis Estimated Net Returns Comparison for Bill Bates LRP Coverage Example, Multi-draw Analysis

		-- Cash Sales, No LRP --		-- LRP Every Year --			-- LRP Every Other Year --		
		Cash-basis	Present Value-basis	Cash-basis	Present Value-basis	% Inc. Over Cash Sales, PV-basis	Cash-basis	Present Value-basis	% Inc. Over Cash Sales, PV-basis
Expected	Annual	$ 196,567	$ 128,607	$ 205,175	$ 134,239	4.4%	$ 200,871	$ 128,607	0.0%
High	20-yr Total	$ 3,931,348	$ 2,572,147	$ 4,103,490	$ 2,684,774	4.4%	$ 4,017,421	$ 2,629,836	2.2%
50/50 or	Annual	$ 178,964	$ 117,090	$ 179,770	$ 117,618	0.5%	$ 179,367	$ 117,090	0.0%
Most Likely	20-yr Total	$ 3,579,280	$ 2,341,801	$ 3,595,406	$ 2,352,352	0.5%	$ 3,587,349	$ 2,347,209	0.2%
Expected	Annual	$ 160,831	$ 105,227	$ 157,442	$ 103,009	-2.1%	$ 159,137	$ 105,227	0.0%
Low	20-yr Total	$ 3,216,629	$ 2,104,531	$ 3,148,837	$ 2,060,177	-2.1%	$ 3,182,732	$ 2,081,812	-1.1%

In both formats, the results suggest the benefits of LRP protection are essentially lost, following an inconsistent purchase strategy (purchase every other year). The most likely values for LRP Every Other Year are essentially the same as those for Cash Sales, No LRP on a net present value basis. Values for the expected high and low values are also the same as estimated for the Cash Sales strategy.

Table 5 also provides estimated values, on a multi-draw basis, for the other two strategies discussed: Cash Sales, No LRP and LRP Every Year. These results show that the Cash-basis result for the most likely annual average return of $173,964 equates with $117,090 on a net present value basis. (The value is lower when we discount those future returns back to today's dollars using the 5 percent interest rate.) In addition, the expected annual average return from purchasing LRP coverage every year increases the most likely return to $117,618 on average on a net present value basis.

Other points to note include, the expected low value for LRP Every Year is lower than under Cash Sales. This makes sense given that LRP premium payments must be paid, even in years where no indemnities are received, lowering the estimated value. However, it should also be noted that the LRP Every Year strategy results in higher expected high values when compared to Cash Sales. This also makes sense where LRP indemnity payments would increase net returns over cash revenues, in years where they are received.

An important question is whether purchasing LRP insurance is a financially beneficial strategy for Bill. The results of the analysis suggests the answer is more complex than initially expected. First, Table 5 net present value results indicate that there is some financial benefit for Bill to purchase coverage consistently. However, those benefits might be lower than we would have guessed without MTRA analysis. Still, Table 5 suggests a significant upside potential in years where LRP indemnities are received. Also, keep in mind that the values in Table 5 hinge on the assumptions and input values. Changing those would lead to different MTRA outputs.

Producers should understand that making money from insurance is not its purpose. Rather, coverage should be viewed as protection against bad outcomes we are concerned might significantly impact our ability to stay in business into the future. These considerations, along with Bill's perspective on risk, as well as his sense about the stability of the fed cattle markets into the future will all feed into his decision to purchase LRP coverage. What Bill chooses to do may not be what his neighbors choose as their risk management strategy. MTRA analysis can help managers make more informed decisions about the trade-offs of insurance coverage levels and traditional cash sales strategies.

** The Bill Bates operation is a case study example created to demonstrate RightRisk tools and their applications. No identification with actual persons living or deceased, places, or agricultural operation is intended nor should be inferred.*