Evaluation of Pricing within Livestock Risk Protection Insurance and the Associated Vulnerability towards Subsidy Harvesting

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Introduction and Objectives

Livestock Risk Protection (LRP) insurance, made available through the United States Department of Agriculture's Risk Management Agency (USDA RMA), offers a tool for producers to mitigate financial losses by providing a safety net against declining market prices. LRP functions much like an exchange traded put option establishing an effective price floor for livestock. Producers pay a premium (partially subsidized) to lock in a price in the future based on coverage lengths and levels selected by the producer. The pricing methodology for LRP premium rates is proprietary, with limited publicly available information. The effectiveness and integrity of the LRP program depend on sound pricing mechanisms and strong safeguards against misuse

Objectives:

1. Improve transparency in LRP pricing by examining how LRP premiums relate to put option prices. Understanding this relationship can help producers make more informed risk management decisions. However, it also reveals a potential vulnerability in program design—subsidy harvesting also known as subsidy capture or subsidy arbitrage exploits the premium subsidy to generate financial gains that deviate from the program's intent. When the subsidized LRP premiums are lower than premiums for equivalent put options (same coverage level and expiration date), producers can effectively extract or "harvest" the premium difference as a gain by purchasing the LRP contract while simultaneously selling the aligning put.
2. Evaluate the potential scale of subsidy harvesting in the LRP program. We define and examine the practice in detail, present graphical and empirical evidence of its prevalence, and estimate the maximum value of subsidies potentially harvested in recent years.

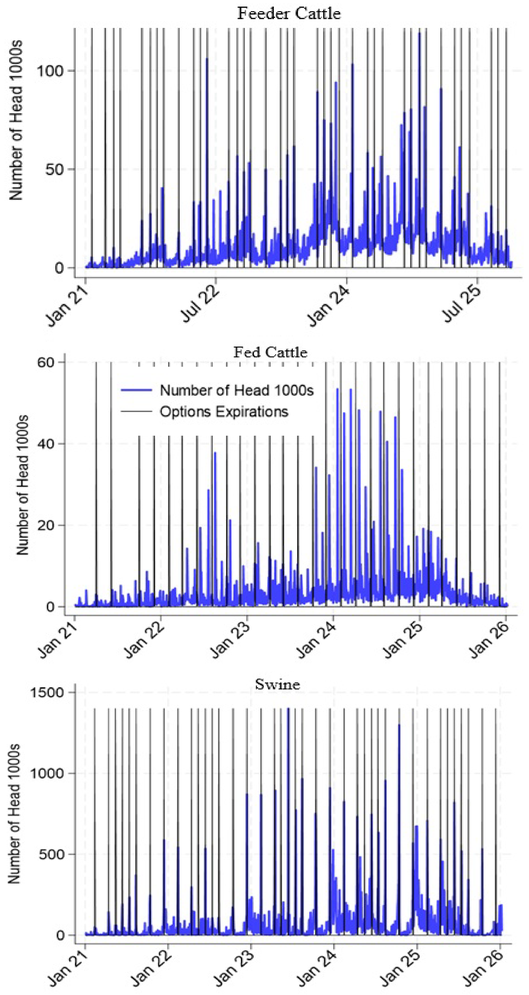

Figure 1. Livestock risk protection feeder cattle, fed cattle, and swine number of head contracted per ending date

Methods

- We compare (Table 1) historical put option premiums with LRP premiums for feeder cattle, fed cattle, and swine. The analysis is restricted to LRP and put options contracts with shared coverage levels and expiration dates across both products. We refer to these contracts as "**aligning contracts**."
- This comparison could establish the pricing conditions under which subsidy harvesting can occur but provides no indication of whether producers are exploiting this vulnerability. To explore the magnitude of the potential subsidy harvesting problem we model (Table 2) the percentage change in the number of head contracted for commodity c (feeder cattle, fed cattle, or swine) on expiration date t relative to the average number of head contracted per expiration date t within commodity year y ($\%\Delta head_{cty}$) as:

1) $$\%\Delta head_{cty} = \beta_{1c} Aligning_{cty} + \beta_{2c} Sub\_20\_Aligning_{cty} + \beta_{3c} Sub\_Current\_Aligning_{cty} + e_{cty}$$

where *Aligning* is a dummy variable equal to 1 if the expiration date coincides with a CME put option expiration date for commodity c in year y, *Sub_20_Aligning* and *Sub_Current_Aligning* are interaction dummies for aligning dates during the 2020 and post-2020 LRP subsidy regimes, and e_{cty} is the random error term.

- If we assume all volume increases (changes in head contracted) for aligning contracts are due to subsidy harvesting, the maximum potential subsidy amount harvested for a given commodity year can be calculated (Table 4) as in:

2) $$H_{cy} = (\bar{S}_{cy})(E_{cy}) \begin{cases} (\beta_{1c}\overline{hd}_{cy}), & if\ y < 2020 \\ (\beta_{1c}\overline{hd}_{cy} + \beta_{2c}\overline{hd}_{cy}), & if\ y = 2020 \\ (\beta_{1c}\overline{hd}_{cy} + \beta_{3c}\overline{hd}_{cy}), & if\ y > 2020 \end{cases}$$

Methods (Continued)

where H_{cy} is the estimated maximum amount of LRP subsidy harvested for commodity *c* in commodity year *y*, $\bar{S}_{cy}$ is the average subsidy amount per head, E_{cy} is the number of aligning expiration dates for commodity *c* in year *y*, $\overline{hd}_{cy}$ is the average head insured per aligning contact, and β_{1c}, β_{2c}, and β_{3c} are the coefficients estimated in equation 1.

- A higher probability of a positive net indemnity for aligning contracts would suggest that purchases of aligning contracts may be driven in part by perceived increased risk management efficiency as opposed to solely facilitating subsidy harvesting practices. We model (Table 3) the likelihood of an LRP contract receiving a net positive indemnity payment with a logistic regression model as in

3) $$Pos\_Indemnity_{ci} = \alpha_{0c} + \beta_{1c}\sum_{m}^{11} Month_i + \beta_{12c} Length_{ci} + \beta_{13c} Level_{ci} + \beta_{13c} Sub\_20_{ci} + \beta_{14c} Sub\_Current_{ci} + \beta_{15c} Numberofhead_{ci} + \beta_{16c}\, Aligning_{ci} + \beta_{17c} Aligning\_x\_Numberofhead_{ci} + e_{ci}$$

where $Pos\_Indemnity_{ci}$ is an indicator variable equal to 1 when the *i*th LRP contract for commodity *c* has a positive net indemnity and equal to 0 otherwise, *Month* is a series of monthly indicator variables equal to 1 when the contract corresponds to an ending date within a given month and equal to 0 otherwise (seasonality controls), *Length* and *Level* are a continuous variables accounting for the length in weeks and the coverage level percentage of the LRP contract respectively, *Aligning* is a dummy variable equal to 1 if the expiration date coincides with a CME put option expiration date, *Sub_20* and *Sub_Current* are dummy variables designating the respective subsidy regimes of the *i*th contracts, *Numberofhead* is a continuous variable for the number of head contracted (1000s), *Aligning_x_Numberofhead* is an interaction variable between *Aligning* and *Numberofhead*, and e_{ci} is the random error term.

Results

- As shown in Table 1, LRP premiums (nonsubsidized) for aligning contracts are consistently priced such that the markup over the equivalent put option is equal to 12% of the LRP premium. This difference can be interpreted as a contingency load to support the financial integrity of the program and is in line with the RMA mandated maximum load of 12% as established in US code (7 U.S.C § 1508 (K)(4)(F) 2025). This 12% markup enables a viable subsidy harvesting opportunity.
- While the 12% contingency load holds across all sampled feeder cattle and swine aligning contracts, the same pattern is not found within fed cattle. This suggests that unlike feeder cattle and swine, the pricing model for LRP fed cattle is not directly based on the corresponding CME options market.
- OLS regression results (Table 2) suggest that during the current tiered subsidy rate regime, LRP aligning contracts within feeder cattle and swine are associated with 240% and 563% increases, respectively, in head insured relative to the average for non-aligning contracts. No significant increase is expected within fed cattle. This result is supported graphically in Figure 1.

Net Indemnity Outcomes (Table 3):

- In swine and in feeder cattle aligning contracts are, respectively, 1.475 and 1.071 times more likely to produce a positive net indemnity than non-aligning contracts. This suggests that on average aligning contracts in these commodities offer better insurance outcomes. As a result, a share of the increased volume in aligning contracts within these commodities may reflect legitimate risk management decisions rather than behavior motivated by subsidy harvesting.
- The effect in feeder cattle is statistically significant yet the magnitude is small suggesting the advantage of aligning contracts does not fully explain the 200%+ increase in aligning contract use under the current tiered subsidy regime.
- No evidence to suggest that aligning contracts within fed cattle offer a benefit towards the likelihood of receiving a positive net indemnity.

Table 1. Comparison of Livestock Risk Protection and Put Options Premiums for Contracts with Aligning Expiration Dates

Start Date	Expiration Date	Expected Ending Value	Coverage Level	Coverage Price	LRP Premium ($/CWT)	Put Option Price	LRP Markup[a]
Feeder Cattle							
6/6/2024	10/31/2024	$254.95	0.9963	$254.00	$9.208	$8.100	12%
6/6/2024	10/31/2024	$254.95	0.9257	$236.00	$3.041	$2.675	12%
5/2/2024	10/31/2024	$256.08	0.9997	$256.00	$11.846	$10.425	12%
5/2/2024	10/31/2024	$256.08	0.9294	$238.00	$4.970	$4.375	12%
4/4/2024	10/31/2024	$256.55	0.9979	$256.00	$13.416	$11.800	12%
4/4/2024	10/31/2024	$256.55	0.9277	$238.00	$5.938	$5.225	12%
Swine							
5/15/2024	8/14/2024	$100.03	0.9998	$100.00	$5.855	$5.150	12%
5/15/2024	8/14/2024	$100.03	0.8398	$84.00	$1.023	$0.900	12%
6/17/2024	10/14/2024	$78.23	0.9971	$78.00	$5.397	$4.750	12%
6/17/2024	10/14/2024	$78.23	0.767	$60.00	$0.596	$0.525	12%
5/20/2024	10/14/2024	$84.13	0.9985	$84.00	$5.766	$5.075	12%
5/20/2024	10/14/2024	$84.13	0.9034	$76.00	$2.414	$2.125	12%

LRP Insurance Coverage Prices and Rates sourced from: https://public.rma.usda.gov/livestockreports/LRPReport.aspx
Put Options Pricing sourced from: https://www.barchart.com/
[a]LRP markup is the difference in the LRP and aligning put option premium taken as a percentage of the LRP premium.

Table 2. Regression Results of the Percentage Change in the Number of Head Contracted per Expiration Date within Livestock Risk Protection Insurance for Feeder Cattle, Fed Cattle, and Swine Relative to the Average Number of Head Contracted per Expiration Date within a Commodity Year

	Feeder Cattle		Fed Cattle		Swine	
Variable	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
Aligning	0.227	0.025	-0.102	0.681	-0.058	0.841
Sub_20_align	1.318	0.002	0.277	0.766	-0.554	0.577
Sub_current_align	2.180	0.000	0.318	0.352	5.626	0.000
	n=6,347		n=3,736		n=3,370	

Table 3. The Likelihood of a Livestock Risk Protection Contract Receiving a Net Positive Indemnity Payment within Feeder Cattle, Fed Cattle, and Swine

	Feeder Cattle		Fed Cattle		Swine	
Variable	Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value
Length	0.969	0.000	0.957	0.000	0.981	0.000
Level	1.148	0.000	1.188	0.000	1.037	0.000
Sub_20	2.550	0.000	5.002	0.000	11.513	0.000
Sub_current	1.118	0.000	0.234	0.000	1.239	0.003
Numberofhead[a]	1.155	0.000	1.184	0.000	1.000	0.881
Aligning	1.071	0.025	1.169	0.411	1.475	0.000
Aligning_x_head[b]	0.783	0.000	0.786	0.507	1.000	0.164
Constant	0.000	0.000	0.000	0.000	0.014	0.000
	n=132,804		n=23,237		n=28,066	

[a]Number of head contracted (1000s)
[b]Interaction of *Aligning* and *Numberofhead*

Table 4. Estimated Annual Maximum Subsidy Harvest ($) within Livestock Risk Protection Insurance for Feeder Cattle, Swine, and Fed Cattle

Commodity Year	Policies Sold	Head	Total Subsidy ($)	Subsidy ($/hd.)	Expiration Dates[a]	Head per Expiration Date	Increase on Options-Expiring Dates[b]	Maximum Subsidy Harvest[c]	Subsidy Harvest % of Total Subsidy
Feeder Cattle									
2020	5,481	79,593	$651,536	$8.19	238	334	4,134	**$33,844**	**5.19%**
2021	16,694	862,699	$14,949,111	$17.33	381	2,264	59,944	**$1,038,723**	**6.95%**
2022	14,839	2,079,348	$39,839,255	$19.16	389	5,345	180,104	**$3,450,694**	**8.66%**
2023	19,217	4,198,098	$90,768,122	$21.62	425	9,878	309,046	**$6,681,971**	**7.36%**
2024	28,562	4,860,174	$140,532,554	$28.92	425	11,436	357,786	**$10,345,421**	**7.36%**
Swine									
2020	109	390,061	$607,666	$1.56	117	3,334	(6,121)	**-$9,536**	**-1.57%**
2021	1,296	8,776,556	$37,355,153	$4.26	375	23,404	1,694,332	**$7,211,490**	**19.31%**
2022	1,368	17,385,811	$70,637,191	$4.06	426	40,812	2,954,548	**$12,004,099**	**16.99%**
2023	1,543	36,528,794	$141,000,000	$3.86	431	84,754	6,135,696	**$23,683,594**	**16.80%**
2024	1,906	40,421,574	$153,000,000	$3.79	411	98,349	7,667,642	**$29,022,850**	**18.97%**
Fed Cattle									
2020	658	8,098	$87,724	$10.83	85	95	50	**$542**	**0.62%**
2021	3,322	180,660	$4,434,834	$24.55	309	585	630	**$15,467**	**0.35%**
2022	3,621	594,694	$15,581,831	$26.20	378	1,573	3,391	**$88,846**	**0.57%**
2023	6,741	858,085	$23,066,058	$26.88	419	2,048	4,855	**$130,516**	**0.57%**
2024	12,024	1,617,408	$56,869,796	$35.16	438	3,693	7,959	**$279,845**	**0.49%**

[a]Total number of expiration dates for which contracts were sold during a commodity year.
[b]The estimated number of additional head contracted on all aligning contract dates within a commodity year as calculated in equation 2.
[c]Maximum estimated amount of total subsidy potentially harvested in each commodity year as calculated with equation 2.
Notes: A flat 20% subsidy was in place for commodity year 2020 while the tiered subsidy structure (35-55%) was in place for subsequent years

Conclusion

The results point to a clear structural vulnerability in the LRP program that emerges for contracts with expiration dates aligning with CME put option expirations. The evidence suggests that subsidy harvesting is likely occurring in both feeder cattle and swine.

In both commodities, we find that aligning contracts are more likely to yield positive net indemnities than non-aligning contracts. These gains complicate the narrative and imply that not all increased use of aligning contracts is abusive.

The magnitude of the increase in aligning contract volume raises concerns that a significant share of this activity may not be consistent with the risk management objectives of the LRP program.

To protect the integrity of the program, targeted policy adjustments are warranted. RMA should consider formal language in the program to prohibit the practice of subsidy harvesting, clearly identifying it as incompatible with the intended program use.

RMA should consider restricting LRP contract offerings with expiration dates falling within a defined window (e.g., ±2-3 days) surrounding CME option expiration dates. This would directly limit the timing-based arbitrage opportunities without impeding the majority of legitimate risk management activity. Policymakers have a responsibility to protect the integrity of LRP, not only to ensure fair and effective support for producers, but also to safeguard public resources.