OPTIMAL LIVESTOCK GROSS MARGIN FOR DAIRY INSURANCE (LGM-DAIRY) COTRACT DESIGN

EXCELLENCE IN EDUCATION AND DISCOVERY
UNIVERSITY OF WISCONSIN - MADISON

Mayuri Valvekar, Victor E. Cabrera, and Brian W. Gould

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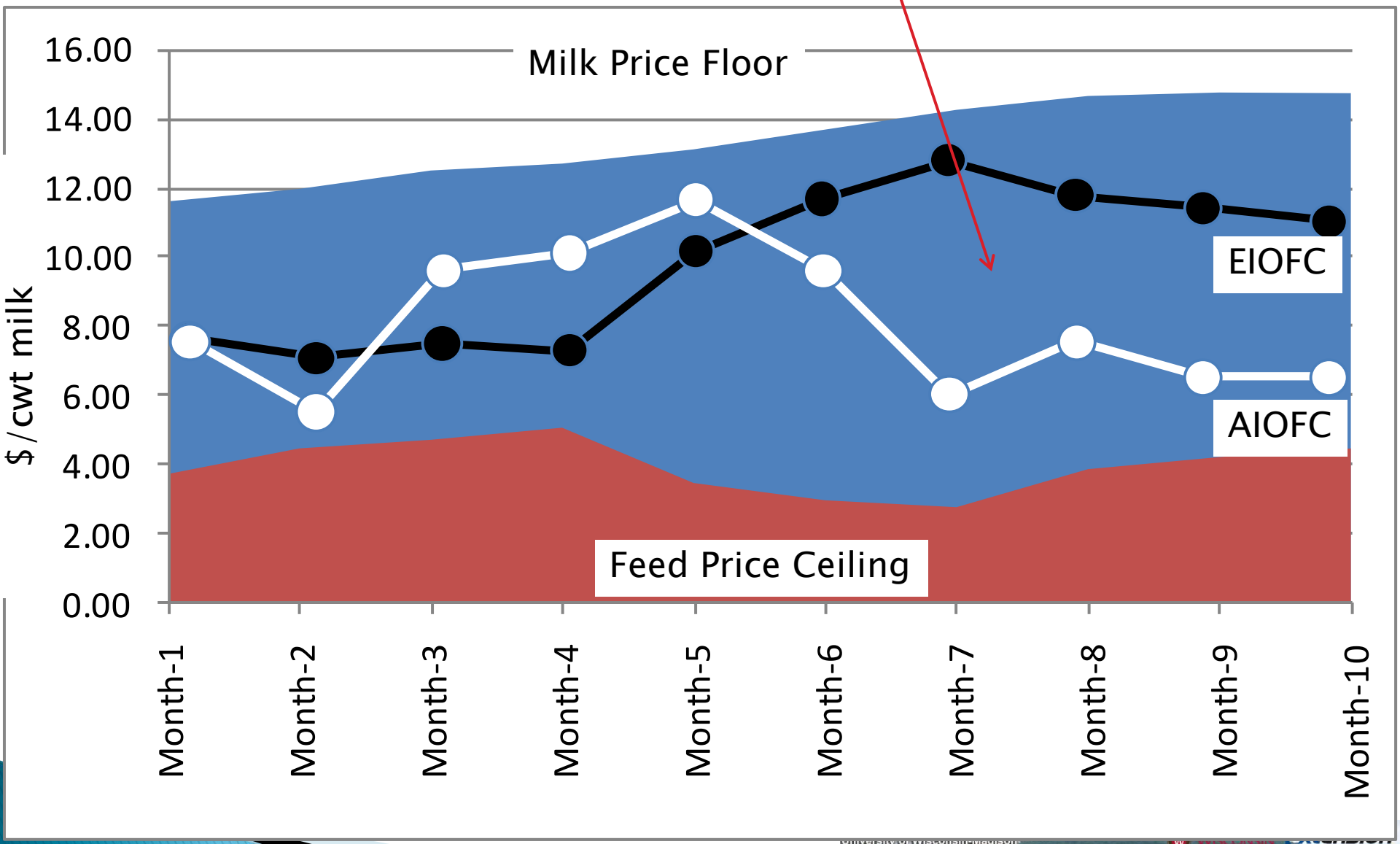
Introduction to LGM-Dairy

- Livestock Gross Margin for Dairy Insurance protects the *floor* "Gross Margin" = "Income Over Feed Cost" (Bundled Price Risk Option)
- Uses CME future prices (Class III, Corn, SBM)
- Works on 10-month cycles

"Insurance Months"

Current Month	Next Month	Following 10 Months that can be insured


Lost IOFC
Milk Price Floor
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
$/cwt milk
EIOFC
AIOFC
Feed Price Ceiling
Month-1
Month-2
Month-3
Month-4
Month-5
Month-6
Month-7
Month-8
Month-9
Month-10

Rationale

- Guarantee IOFC (GIOFC) and Premium depend on program configuration

- Factors that impact GIOFC and Premiums:
  - Market controlled:
    - Futures prices
    - Volatility of futures prices
  - Producer controlled:
    - Insured milk (%C_m)
    - Insured feed (should reflect farm feed efficiency)
    - Deductible level (least relative premium at highest deductible (Cabrera et al.,2009))

Objectives

- To develop and demonstrate an algorithm to identify the **least cost strategy** for guaranteeing a desired IOFC via use of the LGM-Dairy insurance contract

- To compare a non-optimal with an optimal strategy one in terms of the cost of insurance and protection level

Materials and Methods

- Premium Calculation
  - LGM-Dairy premium is set equal to the long-term expected (average) indemnity
  - 5,000 simulated indemnities are obtained using random draws of Class III, corn and SBM future prices and the specific contract design under consideration
    - 3 commodities x 10 mo x 5,000 prices = 150,000 variables
  - Random draws are obtained from assumed lognormal distributions and closed form probability density functions as detailed by RMA insurance policy

Formulation of the Optimization Problem

$$LGM_Premium = \frac{(1.03)(LGM_Indemnity)}{\sum_{m=1}^{10} Milk_Insured_m}$$

$$FARM_Premium = \frac{(1.03)(LGM_Indemnity)}{\sum_{m=1}^{10} Milk_Produced_m}$$

$$LGM_Indemnity = \frac{\sum_{t=1}^{5,000} Max[(GIOFC_t - SIOFC_t), 0]}{5{,}000}$$

$$GIOFC = \%C_m[(Milk_Produced_m)(ECL3P_m) - (C_m)(ECP_m) - (SBM_m)(ESBMP_m) - (DL)(Milk_Produced_m)$$

Formulation of the Optimization Problem

$$Least_Cost_LGM_Premium = \frac{Min}{(\%C_m)}[FARM_Premium]$$

Subject to:

$$TGIOFC \geq GIOFC - FARM_Premium$$

$$\sum_{m=1}^{10} Milk_Insured_m \leq 240{,}000\ cwt$$

Valvekar, M., Cabrera, V.E., Gould, B.W. 2010. Identifying optimal strategies for guaranteeing target dairy income over feed cost. Journal of Dairy Science 93:3350-3357.

Analysis: Non-Optimal Contract

Premium Calculator

Input your planned feed and milk production for LGM Dairy Insurance. This program will calculate your estimated premium for various deductible levels to aid you in your decision. For the month of **Apr 2010** we use the latest available data to estimate the premiums.

Insurance contract month: 2010 Apr

Choose your deductible level ($/cwt) 1.5

If you wish to upload a currently existing csv file containing your farm's data instead of typing it in, please click here

Default Feeding values?

Coverage Month	Production (cwt)	Corn Equiv (tons)	Soybean Equiv (tons)	% covered
Jun 2010	4000	56	8	50
Jul 2010	4000	56	8	50
Aug 2010	4000	56	8	50
Sep 2010	4000	56	8	50
Oct 2010	4000	56	8	50
Nov 2010	4000	56	8	50
Dec 2010	4000	56	8	50
Jan 2011	4000	56	8	50
Feb 2011	4000	56	8	50
Mar 2011	4000	56	8	50

Save this Data | Calculate LGM Premium

Analysis: Non-Optimal Contract Results

Results

GIOFC

Insurance Contract Month : 2010-04

The data is derived from futures and options prices from dates: **2010-04-14, 2010-04-15, 2010-04-16**

Insured Months	Covered Production (cwt)	Covered Corn Equiv (Tons)	Covered Soybean Equiv (Tons)	Avg. Milk Futures ($/cwt)	Avg. Corn Futures ($/bu)	Avg. Soybean Meal Futures ($/ton)	Gross Margin Guarantee @ Base Deductible ($)	
							Total $	$/cwt
Jun 2010	2,000	28.0	4.0	13.34	3.67	278.90	18,894	9.45
Jul 2010	2,000	28.0	4.0	14.00	3.72	278.77	20,165	10.08
Aug 2010	2,000	28.0	4.0	14.63	3.77	275.49	21,387	10.69
Sep 2010	2,000	28.0	4.0	15.05	3.82	269.82	22,200	11.10
Oct 2010	2,000	28.0	4.0	14.99	3.86	261.49	22,077	11.04
Nov 2010	2,000	28.0	4.0	14.72	3.89	260.80	21,503	10.75
Dec 2010	2,000	28.0	4.0	14.72	3.93	260.12	21,469	10.73
Jan 2011	2,000	28.0	4.0	14.64	3.97	260.92	21,266	10.63
Feb 2011	2,000	28.0	4.0	14.57	4.01	261.95	21,081	10.54
Mar 2011	2,000	28.0	4.0	14.55	4.05	262.98	20,997	10.50
Total	**20,000**	**280**	**40**				**211,038**	**10.55**

Analysis: Non-Optimal Contract Results

The Premium at $**1.5** /cwt deductible level is **$3,214** ($0.16 /cwt).

Sensitivity Analysis

GMG = IOFC

Deductible Level ($/cwt)	Total Premium ($)	Prem/cwt ($/cwt)	Gross Margin Guarantee ($)	Premium as % of GMG (%)	GMG/cwt ($/cwt)	% Prem/cwt change	% GMG Change
0.0	14,024	0.70	241,038	5.82	12.05	-	-
0.1	12,968	0.65	239,038	5.43	11.95	-7.53	-0.83
0.2	11,964	0.60	237,038	5.05	11.85	-14.69	-1.66
0.3	11,011	0.55	235,038	4.68	11.75	-21.48	-2.49
0.4	10,105	0.51	233,038	4.34	11.65	-27.94	-3.32
0.5	9,246	0.46	231,038	4.00	11.55	-34.07	-4.15
0.6	8,430	0.42	229,038	3.68	11.45	-39.89	-4.98
0.7	7,663	0.38	227,038	3.38	11.35	-45.35	-5.81
0.8	6,946	0.35	225,038	3.09	11.25	-50.47	-6.64
0.9	6,280	0.31	223,038	2.82	11.15	-55.22	-7.47
1.0	5,659	0.28	221,038	2.56	11.05	-59.65	-8.30
1.1	5,087	0.25	219,038	2.32	10.95	-63.73	-9.13
1.2	4,556	0.23	217,038	2.10	10.85	-67.51	-9.96
1.3	4,068	0.20	215,038	1.89	10.75	-70.99	-10.79
1.4	3,621	0.18	213,038	1.70	10.65	-74.18	-11.62
1.5	**3,214**	**0.16**	**211,038**	**1.52**	**10.55**	**-77.08**	**-12.45**

Download Excel File

Farm IOFC

- 50% production covered @ $1.5/cwt deductible
  - LGM_Premium = $3,214 = $0.16/cwt insured milk
  - Farm_Premium = 50% * $0.16/cwt = $0.08/cwt
  - Net Farm GIOFC = 50% * $10.55/cwt -$0.08/cwt =

$5.2/cwt

Analysis: Optimal Contract

Optimum Coverage for LGM Insurance

Input your planned feed and milk production for LGM Dairy Insurance. This program will calculate the optimum coverage for lowering your premium for various deductible levels to aid you in your decision. For the month of **Apr 2010** we use the latest available data to estimate the premiums.

Change the Insurance contract month: 2010 Apr

Target NGIOFC ($/cwt) 5.2

Choose your deductible level ($/cwt) 1.5

If you wish to upload a currently existing csv file containing your farm's data instead of typing it in, please click here

☑ Default Feeding Values?

Coverage Month	Production (cwt)	Corn Equiv (tons)	SBM Equiv (tons)
Jun 2010	4000	56	8
Jul 2010	4000	56	8
Aug 2010	4000	56	8
Sep 2010	4000	56	8
Oct 2010	4000	56	8
Nov 2010	4000	56	8
Dec 2010	4000	56	8
Jan 2011	4000	56	8
Feb 2011	4000	56	8
Mar 2011	4000	56	8

Save this Data | Calculate coverages to minimize premium for a target NGIOFC

Analysis: Optimal Contract Results

Insured Months	Production (cwt)	Corn Equiv (tons)	SBM Equiv (tons)	Recommended Coverage (%)
Jun 2010	4,000	56.0	8.0	100.00
Jul 2010	4,000	56.0	8.0	100.00
Aug 2010	4,000	56.0	8.0	100.00
Sep 2010	4,000	56.0	8.0	16.07
Oct 2010	4,000	56.0	8.0	0.00
Nov 2010	4,000	56.0	8.0	63.80
Dec 2010	4,000	56.0	8.0	27.55
Jan 2011	4,000	56.0	8.0	22.77
Feb 2011	4,000	56.0	8.0	4.70
Mar 2011	4,000	56.0	8.0	74.62

Premium

$2,296

-29%

$0.06

Decision Variables

Avg. $\%C_m$=50.1%

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This gives you a premium of $2,296 ($0.06 /cwt of Farm Milk). The GIOFC is $210,296 ($5.26 /cwt of Farm Milk). The NGIOFC is $208,000 (5.20 $/cwt of all milk)

If you would like to evaluate premium costs using other coverage percentages, you can change the coverages above and estimate the LGM insurance premium using our Premium Calculator

Return to the Optimization Input Page

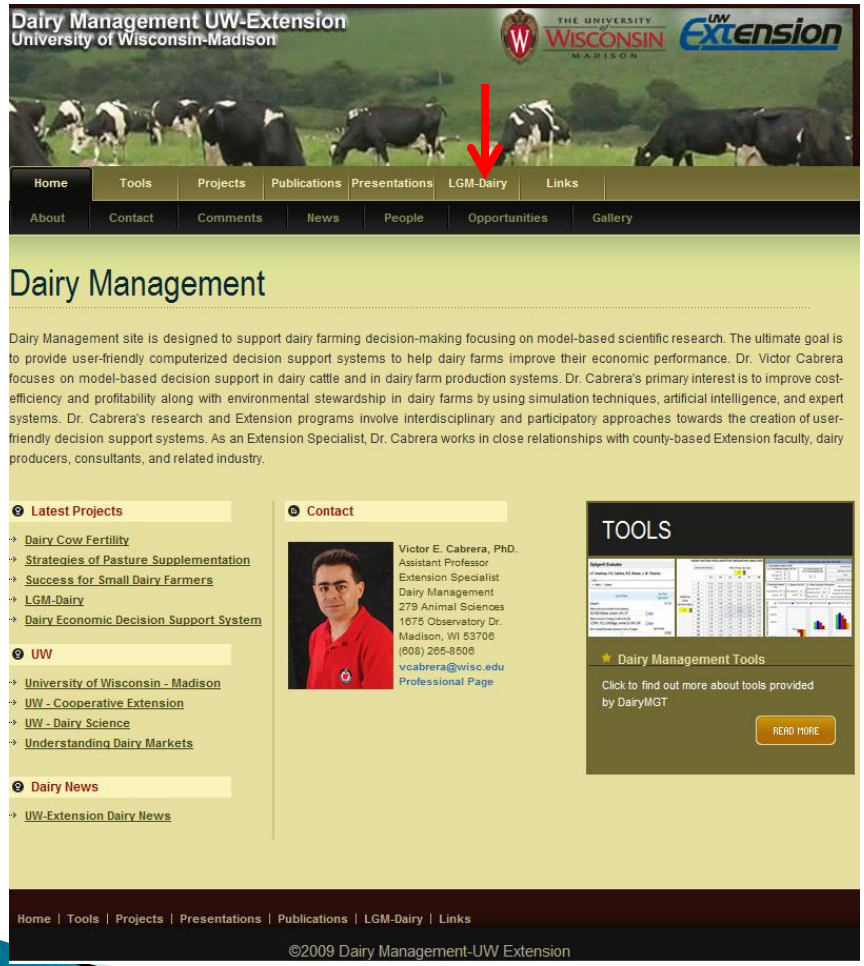
Sensitivity

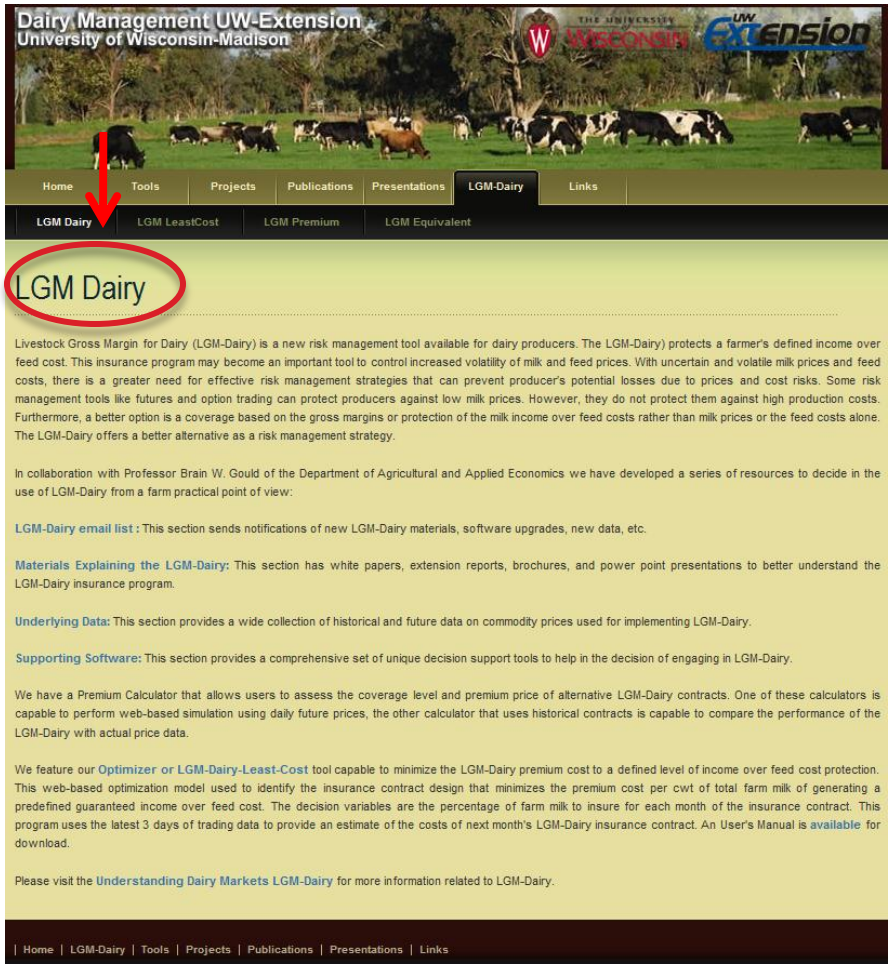
	Non-Optimal			Optimal			
	Farm	Total	Farm	Total	Farm	Farm	Farm
% Coverage	NGIOFC	Premium	Premium	Premium	Premium	Savings	Savings
	$/cwt	$	$/cwt	$	$/cwt	$	%
20%	$2.08	$1,285	$0.03	$594	$0.01	$691	54%
30%	$3.12	$1,928	$0.05	$1,046	$0.03	$882	46%
40%	$4.16	$2,517	$0.06	$1,645	$0.04	$872	35%
50%	$5.20	$3,214	$0.08	$2,296	$0.06	$918	29%
60%	$6.23	$3,856	$0.10	$3,004	$0.08	$852	22%
70%	$7.27	$4,499	$0.11	$3,764	$0.09	$735	16%
80%	$8.31	$5,142	$0.13	$4,595	$0.11	$547	11%
90%	$9.35	$5,785	$0.14	$5,476	$0.14	$309	5%
100%	$10.39	$6,427	$0.16	$6,427	$0.16	$0	0%

Sensitivity

		Non-Optimal		Optimal			
	Farm	Total	Farm	Total	Farm	Farm	Farm
Coverage	NGIOFC	Premium	Premium	Premium	Premium	Savings	Savings
Month	$/cwt	$	$/cwt	$	$/cwt	$	%
Apr-10	5.00	2,592	0.06	1,663	0.04	929	36
Oct-09	5.00	3,047	0.08	1,732	0.04	1,315	43
Apr-09	5.00	6,302	0.16	4,055	0.10	2,247	36
Oct-08	5.00	4,594	0.11	2,875	0.07	1,719	37
Apr-08	5.00	5,678	0.14	3,284	0.08	2,394	42
Oct-07	5.00	2,581	0.06	1,580	0.04	1,001	39
Apr-07	5.00	2,283	0.03	1,225	0.03	1,058	46
Oct-06	5.00	1,556	0.04	814	0.02	742	48
Apr-06	5.00	892	0.02	457	0.01	435	49

DairyMGT.info





Thanks