Livestock Gross Margin Insurance Policy

Step-by-Step Instructions to Calculate Premium

The premium is calculated by a determinant Monte Carlo simulation procedure. The procedure is determinant because the same random "draws" are used for every insured. Inputs into this simulation are projected monthly gross margin levels, 5,000 monthly gross margin draws, a marketing plan that shows the number of cattle marketed in each of ten months, and a deductible level.

Let $p(m)$ be per-head expected gross margin (EGM) for month m, m = 1, 2, …, 10. Let $h(m)$ be the number of cattle marketed in each month under the producer's marketing plan, m = 1, 2, …, 10. Let $gm(i,m)$ denote simulated gross margin i, for month m; i = 1, 2, …., 5,000; m = 1, 2, …, 10. Let DL equal the deductible level. Let GMG equal the gross margin guarantee for the insurance period. Let SGM equal the simulated gross margin.

Step 1. Calculate projected gross margin and gross margin guarantee.

$$EGM = \sum_{m=1}^{10} p(m)*h(m) \text{ (round to dollars and cents)}$$

$$GMG = EGM\text{-}DL*\sum_{m=1}^{10} h(m) \text{ (round to dollars and cents)}$$

Step 2. Calculate ten-month simulated gross margins (SGM).

$$SGM(i) = \sum_{m=1}^{10} gm(i,m)*h(m) \text{ (round to dollars and cents)}$$

Step 3. Calculate simulated losses.

$$loss(i) = \max(GMG - SGM(i),0) \text{ (round to dollars and cents)}$$

Step 4. Calculate premium.

$$premium = \frac{1}{5,000} \sum_{i=1}^{5,000} loss(i) \text{ (round to dollars and cents)}$$

Step 5. Calculate total premium.

$$total\ premium = 1.03*premium \text{ (round to whole dollar amount)}$$

Worked Example of Premium Calculation

The data for the worked example for a March to December insurance period for yearlings are shown here. The deductible level used is $0.00.

p(m)
Expected Gross Margins for Cattle ($/head)

March	April	May	June	July	August	September	October	November	December
223.45	240.92	211.39	191.38	160.89	163.84	144.31	165.78	207.88	239.65

h(m)
Marketing Plan: Number of Insured Cattle

March	April	May	June	July	August	September	October	November	December
100	100	0	0	200	200	0	0	100	100

First 10 Rows of Simulated Gross Margins

			Simulated Gross Margins ($/head)						
March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
205.37	195.27	142.79	97.53	114.66	166.39	167.11	191.83	206.49	205.08
321.92	392.24	302.19	226.54	183.38	177.96	160.96	203.15	244.06	279.25
263.05	333.5	254.45	183	123.76	105.15	149.9	231.11	366.45	502.48
210.06	233.27	190.16	155.14	172.88	240.44	262.79	302.11	362.7	410.95
196.37	225.38	195.71	167.13	125.11	127.18	101.19	125.1	166.66	190.04
331.21	348.83	389.5	432.6	401.84	409.69	399.11	418.66	502.1	577.8
212.36	194.63	119.39	53.76	68.24	117.3	89.74	121.3	90.05	44.64
271.75	365.53	318.38	275.75	145.88	62.66	33.34	88.89	215.26	336.78
190.92	154.99	177.38	211.29	202.91	222.23	195.45	187.58	152.99	103.48
189.7	169.43	160.98	161.36	213.89	303.59	325.81	314.48	313.11	309.09

Step 1. Calculate total expected gross margin and gross margin guarantee.

$EGM =$ 223.45 * 100 + 240.92 * 100 + 211.39 * 0 + 191.38 * 0 + 160.89 * 200 + 163.84

* 200 + 144.31 * 0 + 165.78 * 0 + 207.88 * 100 + 239.65 * 100

= 56,136.00.

$GMG =$ 156,136.00 – 0.00 * (100 + 100 + 0 + 0 + 200 + 200 + 0 + 0 + 100 + 100)

= 156,136.00.

Step 2. Calculate ten-month simulated total gross margins.

As an example, for the first row of simulations:

$SGM =$ 205.37 * 100 + 195.27 * 100 + 142.79 * 0 + 97.53 * 0 + 114.66 * 200 + 166.39

$* 200 + 167.11 * 0 + 191.83 * 0 + 206.49 * 100 + 205.08 * 100$

$=$ 137,431.00.

The results for the first 10 rows are shown here.

Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	SGM
205.37	195.27	142.79	97.53	114.66	166.39	167.11	191.83	206.49	205.08	137,431.00
321.92	392.24	302.19	226.54	183.38	177.96	160.96	203.15	244.06	279.25	196,015.00
263.05	333.50	254.45	183.00	123.76	105.15	149.90	231.11	366.45	502.48	192,330.00
210.06	233.27	190.16	155.14	172.88	240.44	262.79	302.11	362.70	410.95	204,362.00
196.37	225.38	195.71	167.13	125.11	127.18	101.19	125.10	166.66	190.04	128,303.00
331.21	348.83	389.50	432.60	401.84	409.69	399.11	418.66	502.10	577.80	338,300.00
212.36	194.63	119.39	53.76	68.24	117.30	89.74	121.30	90.05	44.64	91,276.00
271.75	365.53	318.38	275.75	145.88	62.66	33.34	88.89	215.26	336.78	160,640.00
190.92	154.99	177.38	211.29	202.91	222.23	195.45	187.58	152.99	103.48	145,266.00
189.70	169.43	160.98	161.36	213.89	303.59	325.81	314.48	313.11	309.09	201,629.00

Step 3. Calculate simulated indemnities.

Again, the first 10 rows of calculations are shown.

SGM	Simulated Indemnity
137,431	18,705
196,015	0
192,330	0
204,362	0
128,303	27,833
338,300	0
91,276	64,860
160,640	0
145,266	10,870
201,629	0

Step 4. Calculate premium.

The average of all simulated indemnities equals 23,415.01.

Step 5. Calculate total premium.

total premium = 1.03 * 23,415.01 = 24,117.46, which is rounded to 24,117.