Livestock Gross Margin for Swine 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 swine marketed in each of five months, and a deductible level.

Let *p(m)* be per-head expected gross margin for month m, m = 2, 3, …, 6. Let *h(m)* be the number of swine marketed in each month under the producer's marketing plan, m = 2, 3, …, 6. Let *gm(i,m)* denote simulated gross margin i, for month m; i = 1, 2, …., 5,000; m = 2, 3, …, 6. Let *DL* equal the deductible level. Let EMG equal the Expected Total Gross Margin. Let *GMG* equal the Gross Margin Guarantee for the insurance period. Let *SGM* equal the Simulated Total Gross Margin.

Step 1. Calculate Expected Total Gross Margin (EGM) and Gross Margin Guarantee (GMG)

$$EGM = \sum_{m=2}^{6} p(m)*h(m) \text{ (round to dollars and cents)}$$

$$GMG = EGM\text{-}DL*\sum_{m=2}^{6} h(m) \text{ (round to dollars and cents)}$$

Step 2. Calculate five month Simulated Total Gross Margins (SGM)

$$SGM(i) = \sum_{m=2}^{6} gm(i,m)*h(m) \text{ (round to dollars and cents)}$$

Step 3. Calculate simulated losses

$loss(i) = \max(GMG - SGM(i),0)$ (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* (round to whole dollar amount)

Worked Example of Premium Calculation

Here are the data for the worked example for a February to July insurance period. The deductible level used is $0.00.

Expected Gross Margins ($/head)

March	April	May	June	July
p(2)	p(3)	p(4)	p(5)	p(6)
71.12	71.62	78.05	84.59	81.30

Marketing Plan: Number of Insured Swine

March	April	May	June	July
h(2)	H(3)	h(4)	h(5)	h(6)
0	500	0	500	1000

First 10 rows of Simulated Gross Margins ($/head)

March	April	May	June	July
59.52	52.88	51.77	50.70	48.96
68.28	66.00	71.81	77.43	83.79
69.32	66.71	79.93	91.78	88.63
64.22	59.75	62.47	64.16	50.49
80.03	83.89	87.21	88.68	87.51
73.43	73.07	73.17	72.67	63.89
79.34	81.43	92.71	103.79	84.08
76.74	83.91	89.13	93.55	102.41
79.92	85.15	91.56	96.98	88.15
81.92	91.53	100.49	109.15	103.91

Step 1. Calculate Expected Total Gross Margin and Gross Margin Guarantee

EGM = 71.12 * 0 + 71.62 * 500 + 78.05 * 0 + 84.59 * 500 + 81.30 * 1000

$\qquad$ = 159,405.00

GMG = 159,405.00 – 0.00 * (0 + 500 + 0 + 500 + 1000) = 159,405.00

Step 2. Calculate five month Simulated Total Gross Margins

As an example, for the first row of simulations:
$SGM = 59.52 * 0 + 52.88 * 500 + 51.77 * 0 + 50.70 * 500 + 48.96 * 1000$
$= 100,750.00$

Here the results for the first 10 rows are shown.

March	April	May	June	July	SGM
59.52	52.88	51.77	50.70	48.96	100,750.00
68.28	66.00	71.81	77.43	83.79	155,505.00
69.32	66.71	79.93	91.78	88.63	167,875.00
64.22	59.75	62.47	64.16	50.49	112,445.00
80.03	83.89	87.21	88.68	87.51	173,795.00
73.43	73.07	73.17	72.67	63.89	136,760.00
79.34	81.43	92.71	103.79	84.08	176,690.00
76.74	83.91	89.13	93.55	102.41	191,140.00
79.92	85.15	91.56	96.98	88.15	179,215.00
81.92	91.53	100.49	109.15	103.91	204,250.00

Step 3. Calculate simulated losses

Again the first 10 rows of calculations are shown.

SGM	Simulated Loss
100,750.00	58,655.00
155,505.00	3,900.00
167,875.00	0.00
112,445.00	46,960.00
173,795.00	0.00
136,760.00	22,645.00
176,690.00	0.00
191,140.00	0.00
179,215.00	0.00
204,250.00	0.00

Step 4. Calculate premium

The average of all simulated losses equals 13,216.00

Step 5. Calculate total premium

$total\ premium = 1.03 * 13,216.00 = 13,612.48$, which is rounded to 13,612