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 hogs marketed in each of five months, and a coverage level.

Let \( p(m) \) be per-head Expected Gross Margin (EGM) for month \( m \), \( m = 2, 3, \ldots, 5 \). Let \( h(m) \) be the number of hogs marketed in each month under the producer’s marketing plan, \( m = 2, 3, \ldots, 5 \). Let \( gm(i,m) \) denote simulated gross margin \( i \), for month \( m \); \( i = 1, 2, \ldots, 5000; \ m = 2, 3, \ldots, 5 \). Let \( CL \) equal the coverage 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**

\[
EGM = \sum_{m=1}^{5} p(m) \times h(m) \quad \text{(round to dollars and cents)}
\]

\[
GMG = CL \times EGM \quad \text{(round to dollars and cents)}
\]

**Step 2. Calculate five month simulated Gross Margins (SGM)**

\[
SGM(i) = \sum_{m=1}^{5} gm(i,m) \times h(m) \quad \text{(round to dollars and cents)}
\]

**Step 3. Calculate simulated losses**

\[
loss(i) = \max(GMG – SGM(i), 0) \quad \text{(round to dollars and cents)}
\]

**Step 4. Calculate premium**

\[
premium = \frac{1}{5000} \sum_{i=1}^{5000} loss(i) \quad \text{(round to dollars and cents)}
\]

**Step 5. Calculate total premium**

\[
total \text{ premium} = 1.03 \times premium \quad \text{(round to whole dollar amount)}
\]
Worked Example of Premium Calculation

Here are the data for the worked example for a Feb. to July insurance period. The coverage level used is 100%.

\[
p(m) \\
\text{Expected Gross Margin Per Head} \\
\begin{array}{cccccc}
\text{February} & \text{March} & \text{April} & \text{May} & \text{June} & \text{July} \\
p(2) & p(3) & p(4) & p(5) & p(6) \\
71.12 & 71.62 & 78.05 & 84.59 & 81.30 \\
\end{array}
\]

\[
h(m) \\
\text{Marketing Plan} \\
\begin{array}{cccccc}
\text{February} & \text{March} & \text{April} & \text{May} & \text{June} & \text{July} \\
h(2) & h(3) & h(4) & h(5) & h(6) \\
0 & 500 & 0 & 500 & 1000 \\
\end{array}
\]

First 11 rows of simulated Gross Margins

\begin{array}{cccccc}
\text{February} & \text{March} & \text{April} & \text{May} & \text{June} & \text{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 \\
65.01 & 60.97 & 61.71 & 61.55 & 61.16 \\
\end{array}

Step 1. Calculate Expected Gross Margin

\[
EGM = 71.12 \times 0 + 71.62 \times 500 + 78.05 \times 0 + 84.59 \times 500 + 81.30 \times 1000 \\
= 159,405.00
\]

\[
GMG = 1.0 \times 159,405.00
\]
Step 2. Calculate six month simulated Gross Margins

Here the results for the first 11 rows are shown.

<table>
<thead>
<tr>
<th></th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Simulated Gross Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulated Gross Margin</td>
<td>100750.00</td>
<td>155505.00</td>
<td>167875.00</td>
<td>112445.00</td>
<td>173795.00</td>
<td>136760.00</td>
<td>176690.00</td>
</tr>
<tr>
<td>Simulated Gross Margin</td>
<td>59.52</td>
<td>68.28</td>
<td>69.32</td>
<td>64.22</td>
<td>80.03</td>
<td>73.43</td>
<td>79.34</td>
</tr>
<tr>
<td>Simulated Gross Margin</td>
<td>52.88</td>
<td>66.00</td>
<td>66.71</td>
<td>59.75</td>
<td>83.89</td>
<td>73.07</td>
<td>81.43</td>
</tr>
<tr>
<td>Simulated Gross Margin</td>
<td>51.77</td>
<td>71.81</td>
<td>79.93</td>
<td>62.47</td>
<td>87.21</td>
<td>73.17</td>
<td>92.71</td>
</tr>
<tr>
<td>Simulated Gross Margin</td>
<td>50.70</td>
<td>77.43</td>
<td>91.78</td>
<td>64.16</td>
<td>88.68</td>
<td>72.67</td>
<td>103.79</td>
</tr>
<tr>
<td>Simulated Gross Margin</td>
<td>48.96</td>
<td>83.79</td>
<td>88.63</td>
<td>50.49</td>
<td>87.51</td>
<td>63.89</td>
<td>84.08</td>
</tr>
</tbody>
</table>

Step 3. Calculate simulated losses

Again the first 11 rows of calculations are shown.

<table>
<thead>
<tr>
<th>Simulated Gross Margin</th>
<th>loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>100750.00</td>
<td>58655.00</td>
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<tr>
<td>155505.00</td>
<td>3900.00</td>
</tr>
<tr>
<td>167875.00</td>
<td>0.00</td>
</tr>
<tr>
<td>112445.00</td>
<td>46960.00</td>
</tr>
<tr>
<td>173795.00</td>
<td>0.00</td>
</tr>
<tr>
<td>136760.00</td>
<td>22645.00</td>
</tr>
<tr>
<td>176690.00</td>
<td>0.00</td>
</tr>
<tr>
<td>191140.00</td>
<td>0.00</td>
</tr>
<tr>
<td>179215.00</td>
<td>0.00</td>
</tr>
<tr>
<td>204250.00</td>
<td>0.00</td>
</tr>
<tr>
<td>122420.00</td>
<td>36985.00</td>
</tr>
</tbody>
</table>

Step 4. Calculate premium

The average of all losses equals 15,376.82

Step 5. Calculate total premium

\[ total\ premium = 1.03 \times 15,376.82 = 15,838.12 \] which is rounded to 15,838.