CALCULATING IBNR BASED ON CASE RESERVES

Rick Atkinson
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by

Rick Atkinson

I. The Problem

Faced with the task of producing an estimate of incurred by not reported (IBNR) loss reserves, as of a particular evaluation date, given only

1. Case reserves as of the evaluation date;
2. Industrywide reported and paid loss development factors (LDFs) to ultimate; and
3. Sufficient evidence to believe that the industrywide LDFs are applicable

how should one proceed?

II. General Approach

Noting that

\[ \text{IBNR} = \text{ultimate loss} - \text{paid loss} - \text{case reserves} \]

and that case reserves are known, an estimate of IBNR can be made if a reasonable estimate of ultimate loss and paid loss is available.

III. Estimating Ultimate Loss

An estimate of ultimate loss can be made using the known case reserves and the applicable industrywide LDFs. Noting that

\[ \text{case reserves} = \text{reported loss} - \text{paid loss} \]

we have

\[
\begin{align*}
\text{case reserves} &= \frac{\text{reported loss} - \text{paid loss}}{\text{ultimate loss}} \\
&= \frac{1}{\text{reported-to-ult LDF}} - \frac{1}{\text{paid-to-ult LDF}}
\end{align*}
\]

which implies

\[
\begin{align*}
\text{ultimate loss} &= \frac{\text{case reserves}}{\frac{1}{\text{reported-to-ult LDF}} - \frac{1}{\text{paid-to-ult LDF}}}
\end{align*}
\]
Calculating IBNR (Continued)

IV. Estimating Paid Loss

An estimate of paid loss in now readily obtainable.

\[
paid \ loss = \frac{\text{ultimate loss}}{\text{paid-to-ult LDF}}
\]

Finally, IBNR can be estimated using the formula

\[
\text{IBNR} = \text{ultimate loss} - \text{paid loss} - \text{case reserves}
\]

V. Conclusion

Exhibit 1 displays sample calculations of IBNR using this methodology.

In addition to being used to produce an estimate of IBNR, this method may also be used as a reasonableness check of case reserves or IBNR estimates developed using different methods.
### Sample Calculation of IBNR Based on Case Reserves

<table>
<thead>
<tr>
<th>Age of Accident Year</th>
<th>Reported to Ultimate LDF</th>
<th>Paid to Ultimate LDF</th>
<th>Reported Completion Ratio</th>
<th>Paid Completion Ratio</th>
<th>Case Reserves</th>
<th>Case Reserves as a Ratio of Ultimate Loss</th>
<th>Estimate of Ultimate Loss</th>
<th>Estimate of Paid Loss</th>
<th>Estimate of IBNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1.700</td>
<td>3.900</td>
<td>0.588</td>
<td>0.256</td>
<td>100,000</td>
<td>0.332</td>
<td>301,364</td>
<td>77,273</td>
<td>124,091</td>
</tr>
<tr>
<td>24</td>
<td>1.350</td>
<td>1.950</td>
<td>0.741</td>
<td>0.513</td>
<td>85,000</td>
<td>0.228</td>
<td>372,938</td>
<td>191,250</td>
<td>96,688</td>
</tr>
<tr>
<td>36</td>
<td>1.250</td>
<td>1.650</td>
<td>0.800</td>
<td>0.606</td>
<td>60,000</td>
<td>0.194</td>
<td>369,375</td>
<td>187,500</td>
<td>61,875</td>
</tr>
<tr>
<td>48</td>
<td>1.200</td>
<td>1.500</td>
<td>0.833</td>
<td>0.667</td>
<td>45,000</td>
<td>0.167</td>
<td>270,000</td>
<td>100,000</td>
<td>45,000</td>
</tr>
</tbody>
</table>

(2) Based on industry data.
(3) Based on industry data.
(4) \(1/(2)\)
(5) \(1/(3)\)
(6) Available from company.
(7) (4) - (5)
(8) (6) / (7)
(9) (8) / (3)
(10) (8) - (9) - (6)
<table>
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Notes:
1. Based on industry data.
2. Based on industry data.
3. \(1 / (2)\)
4. \(1 / (3)\)
5. Available from company.
6. \((4) / (5)\)
7. \((6) / (7)\)
8. \((8) / (9)\)
9. \((10) / (8) / (9) / (6)\)