Abstract—Claims reserving play a very important role for the insurance company. Reserves enable the company to meet its future obligation. Reserve are required for the balance sheet and also for the performance measurement and for the premium calculation. Estimating IBNR claim reserve (Incurred But Not Reported) is an important issue for the actuary.

Keywords—Best estimate reserve; IBNR; chain ladder; incremental loss ratio, coefficient of variation

I. INTRODUCTION

The chain ladder method is the most popular method for the estimation of outstanding claims reserve, because of its simplicity and the fact that it is distribution free. In this paper we analyze the results of the methodologies used for estimating IBNR reserve for an Albanian non-life insurance company. For this purpose we examined the Domestic Motor Third Party Liability claims data from 2007 to 2014. The calculations are done on a quarterly basis. The amounts are in Albanian Currency, Lek (ALL). The change rate is 1Eur=140 ALL

II. CHAIN LADDER METHOD

Claims experience prior accident years describes the changes of the insurance liabilities over the next accounting year [1]. The best estimate (BE) claims reserve at time I is an prediction for the outstanding claims liabilities at time I based on the available information at time I.

\[ X - \text{is the future cash flow (random variable) to be predicted} \]
\[ D_i \text{ is the available information at time } i \]
\[ \hat{X}_i \text{ is a } D_i \text{ measurable predictor for } X \]

The mean square error of prediction is defined by
\[ msep_{X|D_i}(\hat{X}) = E[(X - \hat{X})^2|D_i] \]
\[ = Var(X|D_i) + (E[X|D_i] - \hat{X})^2 \]

So \( \hat{X} \) is a predictor for \( X \) and an estimator for \( E[X|D_i] \) [4].

A. Standard Chain Ladder Model - Assumptions

- Different accident years \( i \) are independent
- \( \{C_{ij}\} \) are Markov chain with
\[ E[C_{ij}|C_{i,j-1}] = f_{i-1} \]
\[ \text{and } \text{Var}(C_{ij}|C_{i,j-1}) = \sigma^2 C_{ij} \]
for all \( i, j \).

Expected ultimate claim \( C_{ij} \) given \( D_i \) is
\[ E[C_{ij}|D_i] = C_{ij} \sum_{j=0}^{\infty} f_j \]
The Chain Ladder factor estimators at time \( I \) and \( I+1 \) are
\[ \hat{f}_j = \frac{\sum_{i=0}^{j} C_{ij+1}}{\sum_{i=0}^{j} C_{ij}} \text{ and } \hat{f}^{I+1}_j = \frac{\sum_{i=0}^{j} C_{ij+1}}{\sum_{i=0}^{j} C_{ij}} \]

Best estimate Chain Ladder reserves at time I is:
\[ \hat{R}^{D_i}_I = \hat{C}_{ij} - C_{ij-1} = C_{ij-1} \sum_{j=1}^{I-1} \hat{f}_j - C_{ij-1} \]

Best estimate Chain Ladder reserves at time \( I+1 \) is:
\[ \hat{R}^{D_i+1}_I = \hat{C}_{ij} - C_{ij-1+1} = C_{ij-1+1} \sum_{j=1}^{I-1} \hat{f}_j - C_{ij-1+1} \]

The observable claims development result is CDR
\[ \hat{CDR}(I+1) = \hat{R}^{D_i}_I - (X_{I+1} - \hat{R}^{D_i+1}_I) \]

B. Incremental Loss Ratio – Assumptions

\( \nu_i \) is the exposure measure for accident year \( i \)

\( S_i \) is the incremental payments made in accident year \( i \) and development year \( j \)

\( m_k \) is the incremental claim ratio in accident year \( i \) and development year \( j \)

\[ E[S_{ij}] = m_{ij} \nu_i \]
\[ \text{Var}(S_{ij}) = s^2_{ij} \nu_i \]

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III. DOMESTIC MOTOR THIRD PARTY LIABILITY CALCULATION 2014, 3rd QUARTERLY RESULTS

Used triangle basis for IBNR calculation

DMTPL = domestic motor third party liability IBNR = incurred but not reported, IBNER = incurred but not enough reported, BE = best estimate, AY = accident year, RY = reporting year, DY = development year, LC = large claims, VC = variation coefficient, SE = standard error, UL = ultimate loss.

A. AY/RY incurred triangle including LC

B. AY/DY paid triangle excluding LC

A. AY/RY incurred triangle including LC

Used triangulation methods for IBNR calculation

- Standard Chain Ladder (SCL)
- Incremental Loss Ratio Method (ILR)

SCL is a pure factor method, ILR is a pure loss claim method. The premiums are available in a shorter history > 2011_Q3, we use the first column of the incurred triangle as exposure measure.

Result 1 - Total results for ultimate UL and best estimate (BE) IBNR

The two used methods come to the same level: The BE IBNR level is rounded 95 Mio ALL

<table>
<thead>
<tr>
<th>BE</th>
<th>Ultimate Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SCL</td>
</tr>
<tr>
<td>Figures in ALL</td>
<td>869,679,546</td>
</tr>
</tbody>
</table>

Result 2 - The results split into AY show some deviations between the used BE methods in the younger AY 2012 – 2014_Q3, but as already mentioned in total they are on the same level.

C. Large Claims

For (A) AY/RY incurred triangles we made calculations both based on triangles including as well
excluding LC > 4 Mio ALL. These LC are rounded 1% according to the number of claims. Here are the BE IBNR results for comparison:

<table>
<thead>
<tr>
<th>BE</th>
<th>IBNR in ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SCL</td>
</tr>
<tr>
<td>Including LC</td>
<td>95,018,904</td>
</tr>
<tr>
<td>Excluding LC</td>
<td>81,941,658</td>
</tr>
</tbody>
</table>

IV. CONCLUSIONS

We recommend the company to use the results based on incurred triangles including LC because of the following reasons:
- From the pragmatic point of view we avoid the problem how to best estimate the IBNR for LC alone.
- Extraordinary large claims can be treated by exclusion or down weighting of the corresponding link ratios. The necessary information is available since we have both triangles including as well excluding LC.

REFERENCES