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Estimating Claims Reserve In A Non-Life Insurance Company

Kleida HAXHI
Department of Mathematics, Mathematical and Physical Engineering Faculty
Polytechnic University of Tirana
Tirana, Albania
kleida_haxhi@yahoo.com

Brikena XHAJA
Department of Mathematics, Mathematical and Physical Engineering Faculty
Polytechnic University of Tirana
Tirana, Albania
brikena_xhaja11@yahoo.com

***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 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

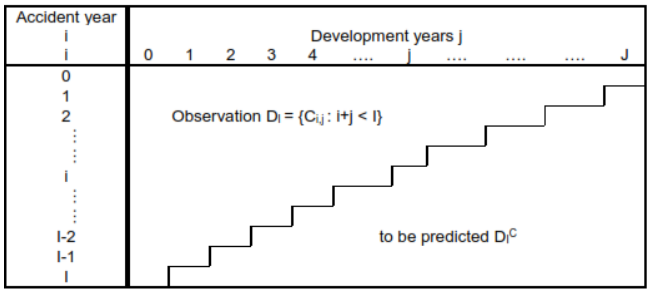
II. CHAIN LADDER METHOD

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 – is the future cash flow (random variable) to be predicted
D_I is the available information at time I
$\hat{X}$ is a D_I measurable predictor for X
The mean square error of prediction is defined by

$$msep_{X|D_I}(\widehat{X}) = E\left[\left(X-\hat{X}\right)^2|D_i\right]$$
$$= Var(X|D_i) + (E[X|D_i]-\hat{X})^2$$

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
- $\{C_{i,j}\ j\geq 0\}$ are Markov chain with

$E[C_{i,j}|C_{i,\ j-1}]=f_{j-1}\ C_{i,j-1}$ and $Var[C_{i,j}|C_{i,\ j-1}]=\sigma^2_{j-1}\ C_{i,j-1}$ for all i, j

Expected ultimate claim $C_{i,J}$ given D_I is

$$E\left[C_{i,J}|D_I\right] = C_{i,I-1}\prod_{j=I-i}^{J-1} f_j$$

The Chain Ladder factor estimators at time I and I+1 are

$$\hat{f}_j^I = \frac{\sum_{i=0}^{I-j-1} C_{i,j+1}}{\sum_{i=0}^{I-j-1} C_{i,j}} \text{ and } \hat{f}_j^{I+1} = \frac{\sum_{i=0}^{I-j} C_{i,j+1}}{\sum_{i=0}^{I-j} C_{i,j}}$$

Best estimate Chain Ladder reserves at time I is:

$$\hat{R}_i^{D_I} = \hat{C}_{i,J}^I - C_{i,I-i} = C_{i,I-i}\prod_{j=I-i}^{J-1}\hat{f}_j^I - C_{i,I-i}$$

Best estimate Chain Ladder reserves at time I+1 is
.

$$\hat{R}_i^{D_{I+1}} = \hat{C}_{i,J}^{I+1} - C_{i,I-i+1} = C_{i,I-i+1}\prod_{j=I-i+1}^{J-1}\hat{f}_j^{I+1} - C_{i,I-i+1}$$

The observable claims development result is CDR

$$\widehat{CDR}_i(I+1) = \hat{R}_i^{D_I} - (X_{i,I-i+1} + \hat{R}_i^{D_{I+1}})$$

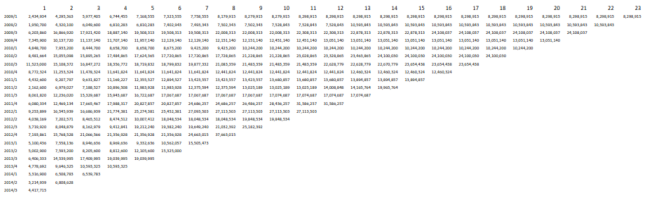
B. Incremental Loss Ratio – Assumptions

v_i is the exposure measure for accident year i
S_{ij} is the incremental payments made in accident year i and development year j, S_{ij} are independent
m_{ik} is the incremental claim ratio in accident year i and development year j [5]

$E[S_{ij}]= m_j * v_i$ i≥1, J≥j
$Var[S_{ij}]= s_k^2 * v_i$ i≥1, J≥j

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

BE	Ultimate Loss	
	SCL	***ILR***
Figures in ALL	869,679,546	870,988,859

BE	IBNR	
	SCL	***ILR***
Figures in ALL	95,018,904	96,328,217

Result 2 - The results split into AY show some deviations between the used BE methods in the younger AY 2012 – 2014_3, but as already mentioned in total they are on the same level.

Result 3 - Volatility of the portfolio and uncertainty of the results
The uncertainty can be expressed by the VC (coefficient of variation) or relative standard error (SE) [2] of the BE, which is the ratio of the (absolute) SE of the BE to the BE: VC= SE of BE / BE

VC SCL = 45% and VC ILR = 38%

By SCL incurred the absolute SE is 45 % of the BE.
By ILR incurred the absolute SE is 38 % of the BE.
There are two significant outliers for older AY and there is a third outlier with smaller amount, but big impact into the BE since this outlier is located in the right corner of the triangle.
Possible options in the incurred link ratios:

- If we exclude the three outliers, then the IBNR (by SCL incurred) decreases from rounded 95 Mio ALL down to 87,5 Mio ALL
- If only the third outlier is excluded, then the IBNR (by SCL incurred) decreases from rounded 95 Mio ALL down to 92,5 Mio ALL

A comparison with the triangles excluding large claims shows that the two significant outliers in the older AY are essentially coming from LC, but the third one (in the right corner of the triangle) not. Essentially the link ratios show only pure volatility, but no significant trends or changes in claim settlement can be observed, that's why the whole history is considered for the IBNR calculation.

Result 4 **-** With AY/RY triangles the "pure IBNR" is calculated, IBNER is not captured.

B. AY/DY paid triangle excluding LC

For the AY/DY paid triangles only SCL is used. The results based on (B) AY/DY paid triangle excluding LC are not considered, the used paid triangle has a history from 2009_Q1 – 2014_Q3. The calculations are done on a quarterly basis. The former result was 66 Mio ALL for IBNR.

Result 1- BE BNR
Based on the (extended) triangle with history from 2009_Q1 – 2014_Q3 by SCL the result is rounded 70 Mio ALL for IBNR. This result is not considering the excluded large claims. This result is for the "whole IBNR" (including IBNER).

Result 2 - Volatility of the portfolio and uncertainty of the results [3]
VC by SCL paid is 35%. The volatility is fully considered in the calculation since no editions of link ratios are done. Like for RY incurred triangles, the link ratios show essentially only pure volatility, but no significant trends or changes in claim settlement are observable, that's why the whole history is considered for the calculation.

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:

BE	IBNR in ALL	
	SCL	***ILR***
Including LC	95,018,904	96,328,217
Exluding LC	81,941,658	76,757,356

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.

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