

Calculation of Medical Liability

- Combination of Statistical Methods, Actuarial Judgment, and Communication

Jed Linfield, FSA, MAAA
AmeriChoice/UnitedHealth Care

Caribbean Actuarial Association
Montego Bay, Jamaica
December 3, 2009

Context

- Health Insurance in the USA
- Benefit plan: comprehensive benefit plan with cost sharing at level that is not deterrent to care
- Calculating monthly liability – Incurred But Not Reported (IBNR)
- Typically, 80% of claims paid within three months

Summary of Methodology

We use the completion factor method for most months and a regression method for the most current two months for our calculation of IBNR

Outline of Completion Factor Method

- Given: Claims Paid-to-date
- $\text{Claims Paid-to-Date} / \text{Completion factor} = \text{Incurred Claims}$
- $\text{IBNR} = \text{Incurred Claims} - \text{claims paid-to-date}$
- Completion factor method uses history of claim payment patterns to determine completion factors

IBNR Methodology

Completion Factor Method

- Still commonly used
- Also called chain ladder or development method
- Often produces poor estimates for most recent months
- Deterministic
 - Produces point estimates of completion factors
 - Since underlying distribution not determined, unable to quantify confidence in ranges of reserve values

Regression Models

- Regression models chosen are representative of models that might be a good fit for IBNR data
- No guarantee that any of chosen regression models would be a good fit

Parameters in Software

- Distributions: Simple, Quadratic, Exponential
- Weekday/weekend factor – can be adjusted by
 - Percent a weekend day cost to weekday
 - Weekend days/holidays per month

Parameters in Software

- User Defined Variable
- One value per month in regression model
- Variable used as
 - Benefit change (e.g. 5% reduction in benefits on January 1, 2006 and January 1, 2007)
 - Factor would be, 1.00 for 2007, 1.05 for 2006, and 1.1025 for 2005)

Actuarial Judgment Guidelines

- Based on actuary's experience
- Well documented
- Reasonable based on data
- Reject models that clearly do not make sense
 - For instance, if the average per member per month (PMPM) values from January 2009 through October 2009 is \$200, we would most probably reject a model that calculates a PMPM value of \$125 for November 2009 even if the statistical values, such as adjusted R-square, are relatively high.

Actuarial Judgment

- Combination of
 - Science - technical
 - Art – communication
 - Craft – useful findings

- From Sam Gutterman, “What is Actuarial Judgment?”, Contingencies, Nov/Dec. 2008, page 88

Method With No Actuarial Judgment

- Automated Actuary – taking the IBNR produced by the computer model and using it as your estimate

Areas of Actuarial Judgment

- Internal Information
 - Prediction Levels vs. Percent Margin
 - Outliers

Prediction Intervals vs. Margin

- Prediction Intervals – Statistical Basis
- Margin – Easier for non-actuary to understand

Prediction Interval Guidelines

- Prediction intervals need to be derived from a statistical distribution.
 - The completion factor method gives a point estimate – therefore, unable to derive prediction intervals from this method
 - Regression models produce prediction intervals

Actuarial Judgment in Determining Prediction Intervals

- Size of prediction intervals is dependent on company's risk profile
- Often prediction interval may be too large for practical business purposes (e.g., if we add 10% to our best estimate of IBNR, we will be 99% sure that our margin is sufficient.)
- In business terms, what does 99% confidence mean?

Identifying Outliers

- Effect on IBNR
- An outlier in one model may not be an outlier in another model
- A \$200,000 unpaid claim may be an outlier in lag 20 but not in lag 2.

Outliers

- Unless you have a good reason, such as an outlier, you do not delete data points
 - Particularly true in a monthly regression model with relatively few points (e.g., 36)
 - We would not take out a whole month's data just because the pmpm calculated for that month is 10% lower than that of other months unless we have some external knowledge to justify its removal

Outliers

Catastrophic Cases

Let's assume that catastrophic claims have a simple distribution

- 1/24 \$750,000
- 23/24 0
- Claims paid 7 months after incurral

Expected value = $\$750,000 * 7 / 24 = \$218,750$

If you reserved \$218,750,
Under-reserved if there was a claim,
Over-reserved if there was not a claim.

Approaches to Handling Catastrophic Cases

- Document assumptions and risk
- Separate catastrophic reserve
- Reinsurance

Coefficient of Variation

Completion Factor Method
Calculation of the Coefficient of Variation

Lag	Completion Factor		
	Mean of Individual Months	Standard Deviation	Coefficient of variation (Std. Dev./Mean)
0	0.03215	0.02548	0.79237
1	0.58789	0.12032	0.20467
2	0.84632	0.06114	0.07225
3	0.92366	0.04414	0.04778
4	0.95917	0.02483	0.02588
5	0.97211	0.02271	0.02336

Number of Variables in Model

- More variables do not necessarily mean a better model.
 - May have minimal increased predictive value with new variable.
 - If multicollinearity exists, you have a worse, or unstable, model.
 - Need to communicate all variables in model.

External Information

- External information – Knowledge about the data that is not specifically shown in the data
- External information that might cause you to remove a month that has a pmpm value that is 10% lower than the other months
 - Benefit design
 - Economics
 - Legislative/regulatory
 - Claim disputes

Simulation

- Key Issues
 - Outliers – Both large claims and negative adjustment
 - Model will not be incorporating all external factors – trend changing over time
 - Number of iterations
 - Time to run
 - Communicating results

Research Paper and Software On-Line

- <http://www.soa.org/research/health/research-stats-hlth-act.aspx>
- Two spreadsheets
 - Regression
 - Simulation

Communication Issue

- You cannot put a confidence interval into a balance sheet.

Restatement and Margin

Incurred Date: December 2008

Estimation Date	Expected Claims	At Upper Bound of 95% Confidence Interval	Length of One-Sided Confidence Interval
December 2008	\$100	\$110	\$10
January 2009 (Recast)	101	109	8
Change	1	(1)	(2)

New Research

- Comparison of Incurred But Not Reported IBNR Methods – by Cabe Chadick, Wes Campbell, and Finn Knox-Seith
- Published by the Society of Actuaries (WWW.SOA.ORG)
- Compared 17 methods and 25 scenarios
- 425 Combinations
- Some relatively low mean errors and standard deviations

Using Multiple Methods In Calculation IBNR

- In calculating monthly IBNR, use multiple methods to derive a range of values for IBNR.
- Based on our example, 3 methods to use are:
 - Weekday/weekend
 - Regression
 - Simulation

Need to add market knowledge for each method

Application of Research

- Annual review of valuation actuary – How do you rate an actuary's ability to calculate IBNR?
 - Statistics
 - Communication

Application of Research

- Health Care Reform in the USA
 - For the estimates of cost for the various reform proposals, what are the confidence intervals for the cost estimates?
 - In addition to a best estimate, what are the low cost estimates and high cost estimates?

Conclusion

- Even with the best statistical methods, actuarial judgment and effective communication needs to be used in the calculation of IBNR.

Questions

- Questions on the presentation?
- How do we apply the conclusion of this presentation to the calculation of insurance liability outside of health insurance?