

GIRO 2009 Workshop D10 Practical Implementation of Granular Reserving

Thursday 8 October, 11:45 to 12:45

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Précis of Presentation

A summary of granular reserving – in particular, how analysing individual policy and claims information can improve overall reserve estimates.

- How to apply the theory into practice;
- The practical problems and how to overcome them;
- Additional insights to be gained; and
- How granular reserving can help with Solvency II.

Introduction

Granular Reserving

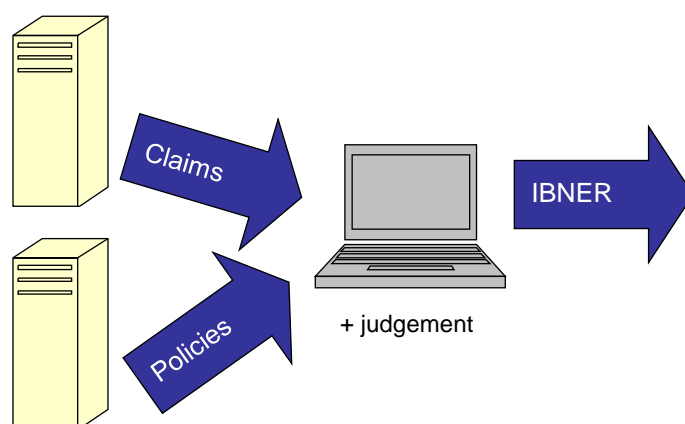
▪ Producing reserve estimates explicitly fitting models to the combination of:

- Policy by Policy database
- Claim by Claim database

▪ In general this results in separate, but connected, models for:

- Pure IBNER
- Pure IBNR due to late exposures
- Pure IBNR due to unearned policies

Introduction



Introduction

IBNER

■ Claims data

- Older claim development driven by claims characteristics including payments to date and case estimates

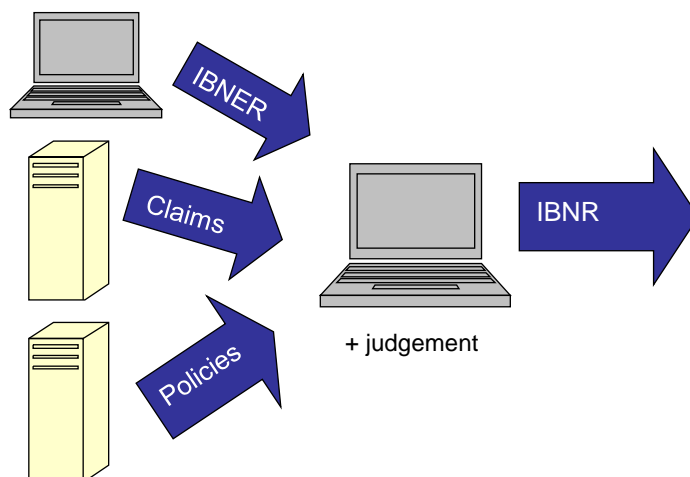
■ Policy Data

- Earlier claims development driven by rating factors
- Limits can come into play for older claims

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Introduction



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Introduction

IBNR

- **Reporting delay:**
 - **Claims data**
 - Claim frequency to date
 - Mix of claims to date
 - **Policy Data**
 - Earned Exposure to date
 - Mix of policies earned

Introduction

IBNR

- **Unearned Exposures:**
 - **Claims data**
 - Drives view of claim cost
 - Mix of claims to date
 - **Policy Data**
 - Unearned Exposure remaining
 - Mix of policies unearned

Why is this “better reserving”?

Better because

- More Data
- Optimise Actual vs Expected
- Identify alternative statistical processes
- Granularity
- Fast Close

Why is this “better reserving”?

More Data

- Traditional techniques are over-fitted.
- Volume of data is of similar order of magnitude to number of parameters.

Why is this “better reserving”?

Optimise Actual vs Expected

- Validation is possible
- As a result of having more observations we can assess how effective:
 - Different models are at predicting claims reporting and eventual settlement
 - Produce unbiased estimates of the errors in the models

Why is this “better reserving”?

Identify alternative statistical processes

- The following are clearly very different processes and have different drivers:
 - Causes of claims
 - Timing and quantum of reporting of claim
 - Timing and quantum of eventual settling of claim

Why is this “better reserving”?

Granularity

- In order to produce useful MI, IBNER and IBNR will often need to be split into sub class.
- This introduces potentially very significant bias and results in wrong decisions being made.
- With reserves at a claim by claim and policy by policy level significant level of bias is removed.

Why is this “better reserving”?

Fast Close

- Modelling automates the process of allowing for mix changes in:
 - Claims
 - Policies
- Enables a potentially much faster close than the process of manually allowing for these at an aggregate level.

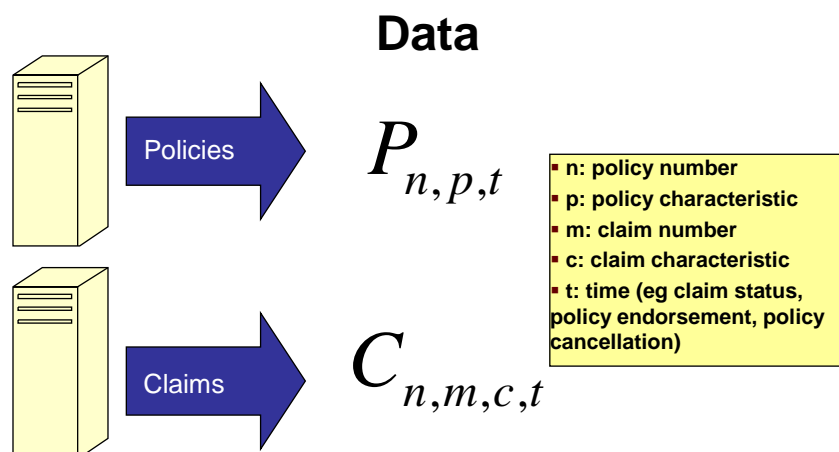
Modelling In Practice



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Modelling In Practice: Data



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Modelling In Practice

Manipulate Data

- Identify anomalies/outliers
- Group of data
- Construct two way/more covariates where appropriate
- Allow for deterministic relationships, eg limits

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Modelling In Practice

Identify Drivers

- Initially one way analyses
- Revisit Grouping of data
- Revisit two way/more covariates

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Modelling In Practice

Construct Model

- In practice starting with something looking like a chain ladder or exposure based approach.
- Use driver analyses to inform structure.
- Usually GLM in nature

Modelling In Practice

Parameterise Model

- If GLM software readily available.

Modelling In Practice

Predict Future

- **Co-integrate time dependent covariate to give expected future values.**

Modelling In Practice

Validate

- **All the analyses need to be set in a validation context to remove problems associated with over-fitting.**

IBNER modelling In Practice

- For IBNER we only use the subset of this data where there are already reported claims.
- $m \geq 0$

IBNER modelling In Practice

Covariate

Response

$$P_{n,p,t < T}$$

$$P_{n,p,T}$$

Model

$$C_{n,m,c,t < T}$$

$$C_{n,m,c,T}$$

IBNR (late reporting) modelling In Practice

- **For IBNR due to late reporting we need to model a frequency and severity component.**
- **For the frequency component it is usually better to model reporting delay explicitly to maximise data available.**

IBNR (unearned exposure) modelling In Practice

- **For IBNR due to unearned exposure reporting we need to model a frequency and severity component.**
- **This is clearly a pricing exercise.**

Practical Problems

- Data
- Exposure information vs claims information
- Case estimates
- Allowing for xs and limit
- Reinsurance
- Volatility structure
- Cointegration
- Trends
- Average Costs

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Practical Problems: Data

- In our experience, this is the biggest hurdle to overcome in implementing these approaches.
- It is nigh on impossible to obtain data that is:
 - Clean
 - Complete
 - Consistent
 - Error free, etc

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Practical Problems: Data

- **Pragmatic compromises need to be made in terms of:**

- What data to use
- How to manipulate it to be consistent
- How to clean it
- What to do with null values, etc

Practical Problems: Exposure Information vs Claims Information

- **IBNER**

- This is essentially a formulaic case estimation model
- When claims are first reported the outcome is likely to be more driven by the policy details, but as claim details become known these grow in influence.
- The model needs to be constructed so as to allow for these kind of effects, if observed.

Practical Problems: Exposure Information vs Claims Information

■ IBNR (late reporting)

- Claims experience can influence late reporting numbers.
- Eg as at year end a cold winter is likely to give a high frequency for motor claims just reported and also influence the number of late reportings.
- This is a chain ladder like effect, but propagates from observations on other policies.

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Practical Problems: Exposure Information vs Claims Information

■ IBNR (late reporting)

- However, if there is no common driver then attaching late reporting frequency to historic claim reportings would introduce noise.
- It is very likely that there is insufficient data within the history to sufficiently test such hypotheses and a judgement as to model structure need to be made.

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Practical Problems: Case estimates

- **Case estimates are in some senses not real data.**
- **There can be a problem in using this information when they are produced in a formulaic fashion, since this can introduce dependency between rating factors.**

Practical Problems: Case estimates

- **Essentially this requires an understanding of if or when the case estimates can be regarded as additional information rather than a function of the other covariates.**

Practical Problems: Allowing for x_s and limit

This can lead to several problems:

- Analytical functional forms for claims development that allow for limits can result in very non-linear structures that are hard to fit.
- They can also create a link between the severity and frequency models, whereby the frequency model is dependent on the severity fit since the higher the severity volatility the higher the probability of hitting the layer.

Practical Problems: Allowing for x_s and limit

- In general a pragmatic approach to dealing with this is to ignore the issue except in so far as to introduce these as covariates.
- If this is done, then care needs to be made in analysing the results, often with some manual intervention so as to make sure that there are not raging inconsistencies.

Practical Problems: Reinsurance

Proportional

- **QS**
 - Clearly relatively easy to deal with.
- **Surplus**
 - Similarly easy, since reserves are on a policy by policy and claim by claim basis.

Practical Problems: Reinsurance

- **Risk xs:**
 - This is a similar issue to the limits issue previously discussed.
 - Clearly mean excess is not the same as excess mean and care needs to be made in interpreting any results.
 - However, the simplistic approach is still preferable to eg net to gross ratio!

Practical Problems: Volatility structure

- The choice of volatility structure is clearly a key model choice.
- The drivers of volatility are difficult to identify, but a pragmatic starting point is those implied by the stochastic formulations of the chain ladder or BF.

Practical Problems: Cointegration

- Care needs to be made in the choice of model, that it is feasible to derive the expected values of the future claims across all the time dependent covariates.
- This can significantly limit the model choice.

Practical Problems: Trends

- Identifying trends within the data and attempting to cater for these within the model is possible in this environment.
- However, this can introduce a real danger of over-fitting through the introduction of the interaction between say policy year and development period.
- With care this can be a powerful benefit, but user beware.

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Practical Problems: Average Costs

- The IBNER model changes the view of the average cost and as a result the view of the IBNR.
- Severity can be modelled by either:
 - Fitting model to expected ultimate costs post fitting the IBNER model.
 - Fitting an opening position for the new reported losses and integrating across the IBNER model.

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Additional Insights

- **Impact of Mix changes**
 - Claims
 - Policies
- **Granularity links easily to pricing**
- **Management Information at any cut of the data**
 - Profitability analyses
 - Historic A vs E and why

Solvency II

Consultation Paper 56

- **Statistical Quality Test**
 - Standards to apply beyond the 'calculation kernel' (e.g. data processing, parameter setting, model validation)
 - Are the modelling techniques up-to date?
 - Are the techniques relevant?

Solvency II

Consultation Paper 56

■ Calibration Standards

- The undertaking shall provide evidence for the credibility of the information used to form the basis for methods... for appropriate criteria such as: consistency; objectivity; competence; and transparency
- At any time the undertaking shall be able to explain and justify in detail its assumptions, taking into account at least: their significance; limitations; the model risk involved; and possible alternative assumptions and their implications.

Solvency II

Consultation Paper 56

■ Validation Standards

- Validation does not only apply to the calculation kernel, but to all the qualitative and quantitative processes of the model including data, assumptions, documentation, model governance and use test.
- Projected results from the model should be tested against experience ('back testing').
- Sensitivity and stress and scenario tests are key tools.

Some Additional Thoughts

- As with all methods it shouldn't be used as a "black box" – need to incorporate judgement
- Performing cross checks under other methods is useful
- Some classes of business are more appropriate than others
- The methods can be extended to create payment patterns consistent with the reserve estimates
- For very large claims (eg hurricanes) it may be more appropriate to treat these outside of the granular model

Conclusions

- Using more of the data available can give significant benefits.
- There are a number of issues to consider in performing these kind of analyses, but they can be dealt with in the main with pragmatic solutions that retain much of the value of the analyses.

Questions

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