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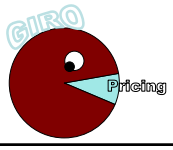
Model validation and monitoring in personal lines pricing

Summary of the GIRO working party

John Berry and Owen Morris
Edinburgh, 8th October 2009

Motivation

- Sophisticated insurers can have dozens of models…
- Aggregators are increasing our reliance on technical models
- A slick monitoring process delivers significant competitive advantage and improves risk management
- Pricing doesn't get the recognition that it deserves!
- (Validation and monitoring are areas where Actuaries can work together)



Workshop agenda

- Introduction
- Tools of the trade
- Validation – (very briefly)
- Monitoring
  - Conversion
  - Claims
- Example model monitoring dashboards
- Discussion

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Questions for delegates

- Q Are you comfortable with your current validation process?
- Q Are you comfortable with your current monitoring process?

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Questions we discussed

???

- How can we monitor the performance of claims models and other models?
- Where can we add value?
  - quickly detect departures between modelled and actual results
  - migrate away from calendar based model refresh/rebuild cycles
  - make suggestions for "technical model MI"
  - risk management

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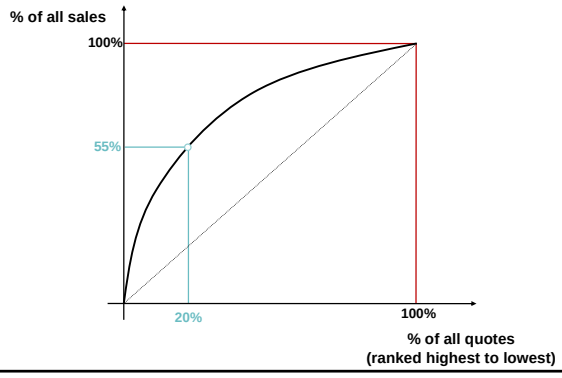
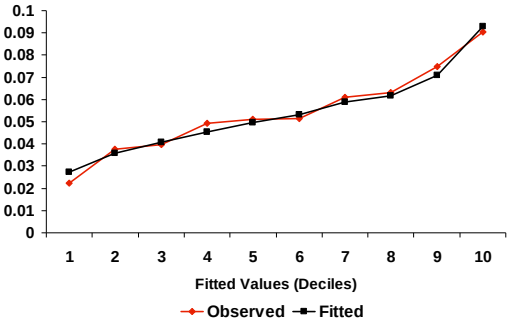
Tools of the trade - Gains Curve



Tools of the trade - Lift Curve



Validation

- Covered well in statistical literature
  - we'll bring out points relating to the use of GLMs in personal lines
- Companies generally have processes to do this (unlike monitoring)?

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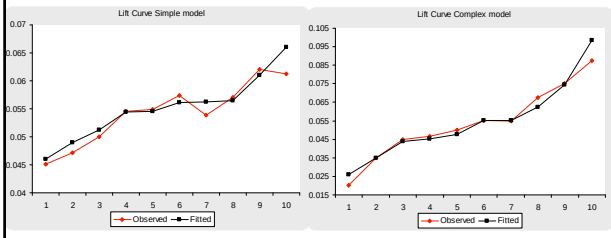
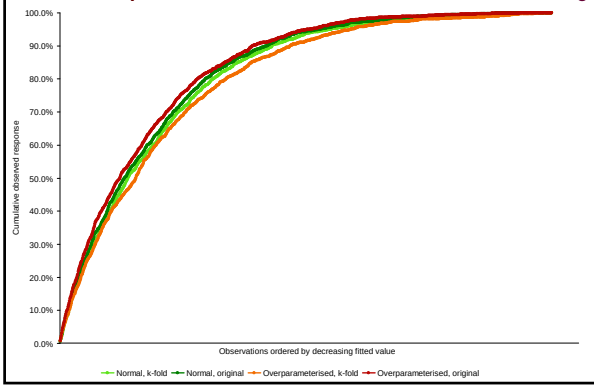
Example 1 – AD frequency model



Example 2 k-fold cross validation to test for overfitting



Propensity/Elasticity Models

Background

- Zurich UK aggregator and telesales conversion data (2008)
- Production strength conversion/price elasticity model(s)
- We're aiming to track "global", as opposed to "segmental" model performance

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Metrics

Desirable properties of model monitoring metrics

- Invariant to changes in volume
- Invariant to changes in average response rate
- Invariant to seasonality
- Suggests financial significance of departures?

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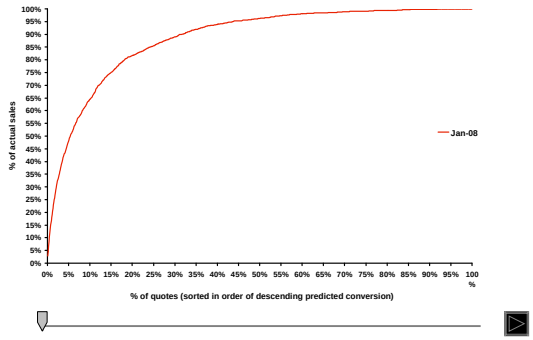
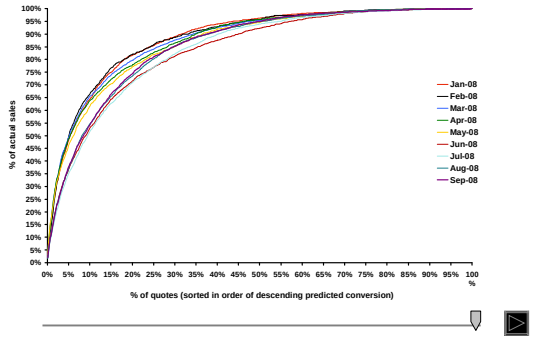
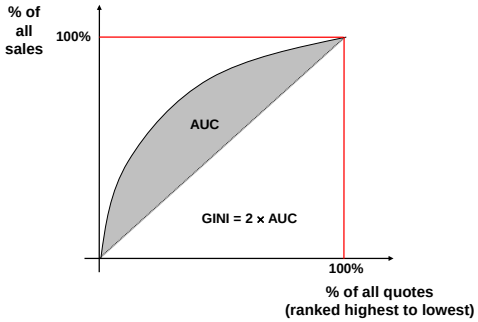
Gains Curves



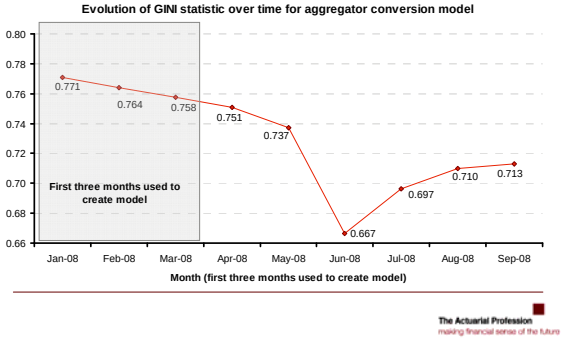
Gains Curves



Gains Curves- GINI Coefficient



GINI coefficient over time



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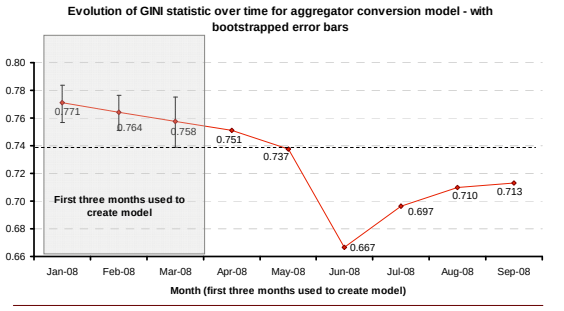
Bootstrap – GINI with confidence intervals



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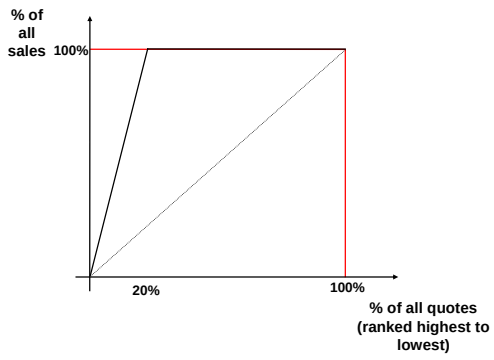
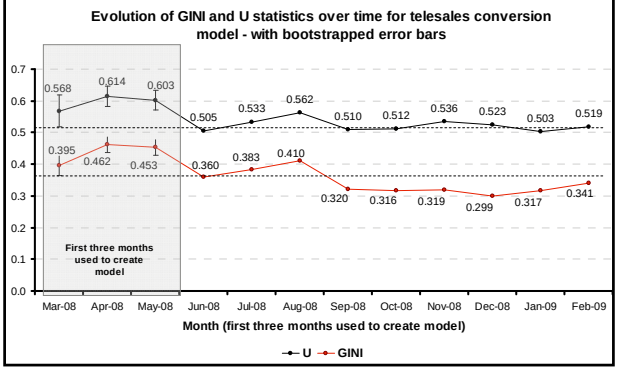
Shortfall of the GINI Coefficient



Telesales example



Summary

Propensity/elasticity models

- Tracking the Gini and/or U statistics gives quick way of assessing whether the model is broken
- Other statistics could be used
- Bootstrap confidence intervals could define thresholds for more detailed review
- Investigations teach you about shelf life of models

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Claims model monitoring

Why are claims far more complex?

- Seasonality
- Frequency *and* severity
- Constantly evolving mix of underlying events
- Getting both the model structure and the inflation rate correct
- Development
- Accident period vs. underwriting period

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Claims model monitoring

Developed data

- BAU technical model monitoring part 1
- Data can be used to refit “production” model

Undeveloped data

- BAU technical model monitoring part 2
- Provides early warnings
- Needs version of model adapted to historical undeveloped data

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Claims models example

Background

- RBSI accidental damage UK motor claims data
- Frequency and severity models built by working party to be of an average standard for UK motor market
- Again, we’re aiming to track “global”, as opposed to “segmental” model performance

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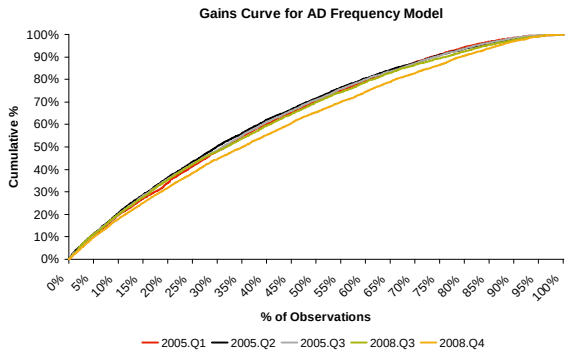
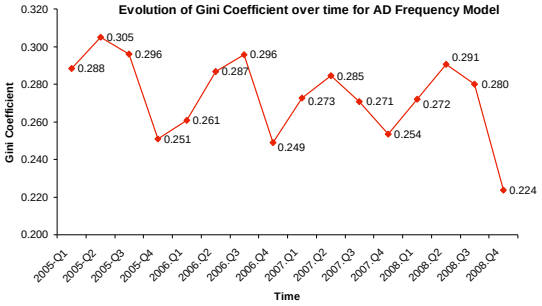
Gains curves for claims data – ??



GINI Coefficient – not so useful here



An alternative model monitoring metric

We'll refer to it as "the deviance based metric"

$$1 - \frac{deviance_{model}}{deviance_{null}}$$

where $deviance_{model}$ is the deviance of the selected model and

$deviance_{null}$ is the deviance of a model containing just a mean parameter.

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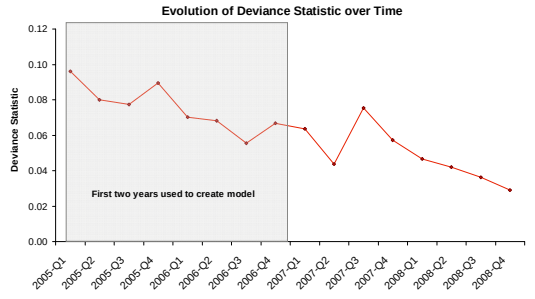
Deviance based metric



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Summary

- No single metric tells the full story
- Need to understand
  - changes in cover (e.g. drift in excess seen throughout UK market)
  - changes in mix of events leading to claims
  - changes in business mix
  - ….and indicators for these should be included on regular model monitoring dashboards

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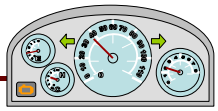
Dashboards



- Dashboards which follow are prototypes based on (disguised) real data
  - They are the output of a semi-automated process
  - Production does not required skilled actuary/statistician
- Circulation
  - Management with overall responsibility for signing off technical models
  - Users of the models
  - Builders of the models
  - Circulated alongside with “master dashboard” listing performance of all models and some measure of “aggregate” lift

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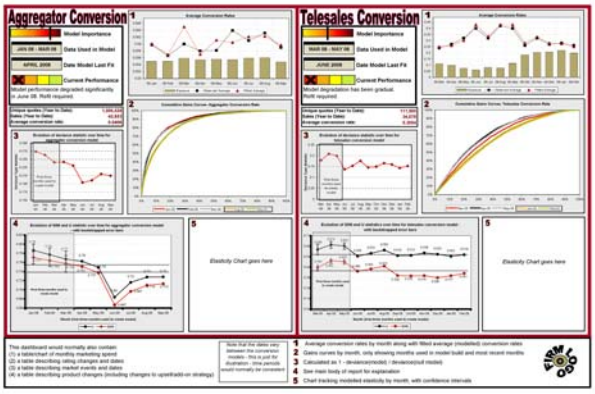

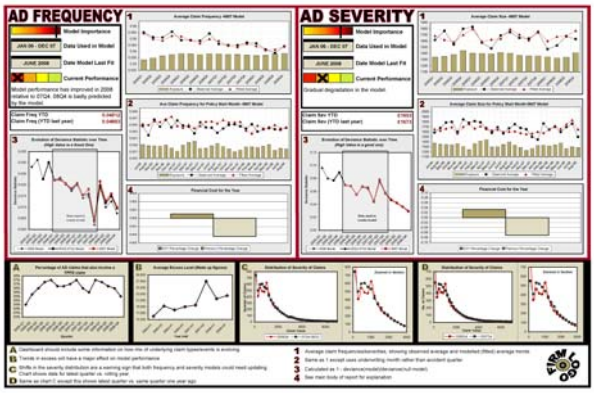

Conclusions

- Possible to use a simple metric to monitor models of propensity
- Situation more complex for claims models
- Dashboards can be developed that:
  - detect departures between modelled and actual results
  - assist in the migration away from calendar based model refresh/rebuild cycles
  - aid risk management
- Approach can be extended to undeveloped claims data

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Members of the Working Party

- John Berry, EMB
- Gary Hemming, Zurich
- Georgy Matov, RBSI
- Owen Morris, AVIVA

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Report… is on the web

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