Personal lines pricing: current issues and opportunities for 2011

Neil Chapman and John Berry, EMB
Agenda

- Introduction
- Bodily injury
- External data
- Underwriting in the web environment
- Retail pricing
Agenda

- Introduction
- Bodily injury
- External data
- Underwriting in the web environment
- Retail pricing
Bodily injury – why are we interested?

- Rise in bodily injury costs has contributed to poor market performance in recent years

Consistent strong yearly increase in BI claims frequency

Bodily injury now approximately 50% of claims cost
What can we do?

- Need for closer links between technical pricing and claims
- Postcode and vehicle classification techniques
- Break down the claims process using wider data
Quality of postcode classification is vital

- Geographic differences in BI claims experience are significant:
- Recent postcode classification is critical
- Need for wide range of external data and spatial smoothing of residuals
- Time weighting to reflect more recent trends
- Benefit of peril rating on private car now greater than cost

Maps removed
How good is ABI 50 for risk models and pricing?

- Useful benchmark
- Public awareness
- Very good predictor of total loss?
- Good predictor of claim frequency?
- Better predictor of AD claims experience than TP?

But...
- does not acknowledge all vehicle attributes
- does not make full use of the 50 groups
- is a one-size fits all vehicle group the best option?
Breaking down the process

Break down the claims process using wider data

What?
– There is a need to understand the trends underpinning “insurance” risk vs. “compensation” risk
  – Split injury into “insurance” vs. “compensation” risk
  – Split into frequency, number of claimants and average cost per claimant

Why?
– More predictive models with different rating factor effects detected
– Allows trending forward of changing mix of relativities more accurately

How?
– AD and PD claim details
– Additional BI claim details e.g. injury type, claimants
– Matches to wider fraud related databases
– Quote and post-sale validation data
<table>
<thead>
<tr>
<th>Secondary Colour</th>
<th>Red</th>
<th>Green</th>
<th>Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuarial Bright</td>
<td>R148</td>
<td>G166</td>
<td>B31</td>
</tr>
<tr>
<td>Slate</td>
<td>R32</td>
<td>G44</td>
<td>B52</td>
</tr>
<tr>
<td>Olive Green</td>
<td>R120</td>
<td>G162</td>
<td>B47</td>
</tr>
<tr>
<td>Bottle Green</td>
<td>R0</td>
<td>G147</td>
<td>B127</td>
</tr>
<tr>
<td>Turquoise</td>
<td>R0</td>
<td>G138</td>
<td>B176</td>
</tr>
<tr>
<td>Aqua Blue</td>
<td>R26</td>
<td>G160</td>
<td>B170</td>
</tr>
<tr>
<td>Pastel Green</td>
<td>R126</td>
<td>G205</td>
<td>B195</td>
</tr>
<tr>
<td>Light Purple</td>
<td>R123</td>
<td>G149</td>
<td>B174</td>
</tr>
<tr>
<td>Purple</td>
<td>R97</td>
<td>G107</td>
<td>B156</td>
</tr>
<tr>
<td>Ecru</td>
<td>R186</td>
<td>G163</td>
<td>B171</td>
</tr>
<tr>
<td>Yellow</td>
<td>R215</td>
<td>G176</td>
<td>B18</td>
</tr>
<tr>
<td>Orange</td>
<td>R213</td>
<td>G135</td>
<td>B43</td>
</tr>
<tr>
<td>Red</td>
<td>R238</td>
<td>G52</td>
<td>B36</td>
</tr>
<tr>
<td>Rubine Red</td>
<td>R226</td>
<td>G1</td>
<td>B119</td>
</tr>
</tbody>
</table>

This colour reference is for screen presentations only.

“Insurance” and “compensation” risk – example BI trends

- Insurance risk BI frequency is flat over 2004 to 2008 whilst compensation risk rapidly increases
- Shift in mix of insurance and compensation risk
  - Consider modelling and projecting separately
“Insurance” and “compensation” risk – example BI trends

- Insurance risk relativities are much steeper than compensation risk by vehicle group
- Shift in insurance/compensation mix would see flattening or relativities if modelled together
“Insurance” and “compensation” risk – example BI trends

Graph removed
More complex trends and interactions may also be stronger

Graph removed
Bodily injury

• So what should the pricing actuary be doing in 2010/11?
  - Data, data, data! What information are we not using?

  • Type of injury
  • Number of passengers
  • Number of claimants
  • Relationship of claimants
  • Accident description
  • And many more…. 
Bodily injury

- So what should the pricing actuary be doing in 2010/11?
  - Models, models, models!

  - Modelling focus is on injury
  - Include latest data in analysis
  - Allow adequate pricing for PPOs
  - Continually monitor model effectiveness
  - Rethink traditional silo approach to claim models
Agenda

- Introduction
- Bodily injury
- External data
- Underwriting in the web environment
- Retail pricing
External data

• “We’ve all done postcode, individual data is becoming the new battleground” – Director of Underwriting

• Increasing interest in using individual and household data to inform pricing and underwriting
Government sources – Council tax band

Pictures of properties removed

Dataset identifies Composite properties too
Government sources – Council tax band

Graph removed
Government sources – Council tax band

Graph removed
Who are you underwriting?

Pictures removed
External data

- Police National Computer - Theft
- Disqualified Directors
- International Security register
- FCPA/FBI Wanted Data
- Accommodation Address
- Watch list intelligence
- CUE – Motor/Household/PI
- High Court Data
- CCJ/DEC Data
- CIFAS Fraud Data
- Criminal Records
- Interpol Wanted Data
- Call ID
- High Court Data
- FCPA/FBI Wanted Data
- Accommodation Address
- Watch list intelligence
- CCJ/DEC Data
- CIFAS Fraud Data
- Criminal Records
- Interpol Wanted Data
- Call ID

*This colour reference is for screen presentations only
Agenda

• Introduction
• Bodily injury
• External data
• Underwriting in the web environment
• Retail pricing
### Underwriting & “proposal risk”

<table>
<thead>
<tr>
<th>Proposal risk</th>
<th>Proposal risk</th>
<th>Proposal risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980s</td>
<td>1990/2000s</td>
<td>Now</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case underwriting, broker-customer relationships</th>
<th>Call centres, panel brokers, expense reduction</th>
<th>Internet, price comparison sites, consumer awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper underwriting guides with detailed underwriting and acceptance criteria</td>
<td>More sophisticated system rating engines</td>
<td>Increased customer price transparency</td>
</tr>
<tr>
<td>Simple system rating engines</td>
<td>EDI</td>
<td>Effect of rating factors</td>
</tr>
<tr>
<td>Significant number of cases referred for manual underwriting</td>
<td>Direct &amp; panel broker call centres with sales incentives</td>
<td>Access to competitor rates</td>
</tr>
<tr>
<td>“Off-screen” rates</td>
<td>Broker-customer face to face interaction much reduced</td>
<td>Ability to “experiment”</td>
</tr>
<tr>
<td>Face to face interaction between brokers and their customers</td>
<td>Reduced manual underwriting</td>
<td>“Financial expert” websites giving “money saving” tips</td>
</tr>
<tr>
<td></td>
<td>Reduced manual validation e.g. NCD</td>
<td>Customer awareness of cover, options and add-ons</td>
</tr>
<tr>
<td></td>
<td>Lag in system driven underwriting rules to adapt to new distribution</td>
<td>Fraud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Further reduced manual underwriting</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Another lag in underwriting capability?</strong></td>
</tr>
</tbody>
</table>
Lewis Hamilton versus the motor underwriter

<table>
<thead>
<tr>
<th>Relation to the policy holder</th>
<th>Date of Birth</th>
<th>Marital Status</th>
<th>First Name</th>
<th>Surname</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Law Partner</td>
<td>1 January 1987</td>
<td>Common Law</td>
<td>Nicole</td>
<td>Sherzinger</td>
<td>Miss</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relation to the policy holder</th>
<th>Amount</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(with Dad)</td>
<td>£2,614.50</td>
<td></td>
</tr>
<tr>
<td>(with common law partner)</td>
<td>£2,300.57</td>
<td></td>
</tr>
<tr>
<td>(with friend)</td>
<td>£2,295.33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>£2,216.10</td>
<td>(reduce mileage by 2k)</td>
</tr>
</tbody>
</table>

*The proposer must be in a Common Law Partnership if Relationship to Proposer is Common Law Partner*
Effective automated underwriting

- Previous shopping data
- Customer quote behaviour

IT System Development

- Individual data validation
- Consistency analysis (multivariate)

Analysis
Individual data validation – mileage example

Ford KA

- 1k
- 2k
- 3k
- 4k
- 5k
- 6k
- 7k
- 8k
- 9k
- 10k
- 11k
- 12k
- 13k
- 14k
- 15k
- 16k
- 17k
- 18k
- 19k
- 20k

0% 5% 10% 15% 20%
Individual data validation – mileage example

Ford Mondeo - Diesel

- 1k  2k  3k  4k  5k  6k  7k  8k  9k  10k  11k  12k  13k  14k  15k  16k  17k  18k  19k  20k

- 0%  5%  10%  15%  20%
Underwriting fraud – consistency analysis

- Subject matter of insurance
- Postcode and socio-demographic
- Selected cover
- Lifestage
Consistency analysis – motor example

- 5 yr old Honda Jazz
- 2 bed bungalow in Bournemouth
- Comp, protected NCD
- 67 year old pensioner

Subject matter of insurance

Lifestage

Postcode and socio-demographic

Selected cover

5 yr old

67 year old pensioner

2 bed bungalow in Bournemouth

Comp, protected NCD

5 yr old Honda Jazz

Secondary colour palette

Primary colour palette

Secondary Olive Green

R120  G162  B47

Secondary Bottle Green

R0  G147  B127

Secondary Turquoise

R0  G138  B176

Secondary Aqua Blue

R26  G160  B170

Secondary Pastel Green

R126  G205  B195

Secondary Light Purple

R123  G149  B174*

Secondary Purple

R97  G107  B156

Secondary Ecru

R186  G163  B171

Secondary Yellow

R215  G176  B18

Secondary Orange

R213  G135  B43

Secondary Red

R238  G52  B36

Secondary Rubine Red

R226  G1  B119

*This colour reference is for screen presentations only
Consistency analysis – motor example

- Honda Civic Type-R
- Comp, protected NCD
- 2 bed bungalow in Bournemouth
- Single, 28 year old, company director

Subject matter of insurance:
- Lifestage
- Postcode and socio-demographic

Selected cover:
- 5 yr old Honda Jazz
- 67 year old pensioner Comp, protected NCD
- Honda Civic Type-R
- Single, 28 year old, company director

*This colour reference is for screen presentations only*
Underwriting fraud – consistency analysis

- Subject matter of insurance
- Postcode and socio-demographic
- Selected cover
- Lifestage

*This colour reference is for screen presentations only*
Consistency analysis - example

1. Model of mileage built using insurer’s quote database

2. Modelled/expected mileage is then compared with declared mileage

3. Various factors derived for consideration in claims models such as ratio of declared to expected mileage

Graph removed
Consistency analysis - example

4. This segment also exhibits better than expected BI frequency

5. Other variables in the cover dimension include Excess, Comp vs. TPFT cover, Class of Use

6. Various techniques exist for “aggregating” weirdness or inconsistency across different aspects of the risk
 Agenda

• Introduction
• Bodily injury
• External data
• Underwriting in the web environment
• Retail pricing
Retail pricing – the landscape

- Optimisation techniques largely embedded
- Precise measurement of customer lifetime value still an issue
- Motor rates up 37.5% (see Confused.com/EMB index)
- Insurers reviewing use of competitor price data
- Pricers required to support multiple brands (often in the same channel)
- More and more customer decision processes are multinomial
Multinomial response data

- Customer conversion used to be considered as a (0,1) process
- Providers are increasingly using multi-brand strategies
- How do we model such conversion data?
More multinomial response data!

Channel of first contact

Choice of add-on bundle

Renewal activity

Bronze/Silver/Gold product offerings
So how do I model it? – Option 1

- Binomial models for:
  - B vs rest
  - C vs rest
- \( P(A) \) derived as:
  - \( P(A) = 1 - P(B) - P(C) \)
So how do I model it? – Option 2

- Binomial models for:
  - A vs rest
  - B vs rest
  - C vs rest
- Results scaled such that:
  - P(A)+P(B)+P(C)=1
So how do I model it? – Option 3

• Binomial models for:
  – A vs B,C
  – B vs C
• Approach is “nested”
From the binomial logit to the multinomial logit

\[ P_n(i) = \frac{e^{\beta'x_{in}}}{e^{\beta'x_{in}} + e^{\beta'x_{jn}}} \]

**Binomial logit**

\[ P_n(i) = \frac{e^{\beta'x_{in}}}{e^{\beta'x_{in}} + e^{\beta'x_{jn}} + \ldots + e^{\beta'x_{mn}}} \]

**Multinomial logit**
An interesting digression…

Random utility theory

Discrete choice models

Multinomial models!

1980s 1990s 2000s

McCullagh and Nelder
Brockman and Wright
Anderson et al

Actuarial perspective
Marketing/economics perspective

1950s-1980s… 1920s
The “independence from irrelevant alternatives”

(Stated loosely)

“The ratio of the probabilities of any two alternatives is unaffected by a change in the characteristic of any other alternative”

• This is a property of the multinomial logit model
• It may not be realistic in some cases
• The property is commonly misunderstood
• Alternative modelling approaches can help to get around the problem
Example - background

- Example is designed to compare various binomial approaches and an approach using a multinominal logit model
- Response variable is the cover level selected by a customer when purchasing motor insurance
- There are four possible cover levels and several hundred thousand observations
Summary

- More and more customer decision processes are multinomial
- Multinomial logit is the most tractable of multinomial models
- Intelligent use of binomial logits can yield a good, sometimes excellent, approximation to a multinomial logit
- The independence of irrelevant alternatives is a key consideration when deciding whether to use a multinomial logit
Closing remarks

- Bodily injury
- External data
- Underwriting in the web environment
- Retail pricing (multinomial models)
Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.
The views expressed in this presentation are those of the presenter.