Enhancements to risk modelling
Personal lines pricing

<table>
<thead>
<tr>
<th>Geographical Classification</th>
<th>Vehicle Allocation</th>
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Enhancements to risk modelling
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Why do we need a geographical classification?

• Risk varies a lot geographically!
  – Differences by claim type

• It’s also changing:
  – Claim composition
  – Customer attitudes
  – Environment
    – Storms
    – Floods

Pictures removed
Why this matters

- Aggregators
- Linking pricing and underwriting
- Changing risk premium composition
- Potential for uplift
<table>
<thead>
<tr>
<th>What drives differences in experience?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood risk</td>
</tr>
<tr>
<td>Storm exposure</td>
</tr>
<tr>
<td>Density of traffic</td>
</tr>
<tr>
<td>Fire station distance</td>
</tr>
<tr>
<td>Map removed</td>
</tr>
<tr>
<td>Driving speed</td>
</tr>
<tr>
<td>Likelihood to exaggerate claims</td>
</tr>
<tr>
<td>Repair cost</td>
</tr>
<tr>
<td>State of roads</td>
</tr>
</tbody>
</table>
Risk assessment

What we want from the classification?
Postcodes – specifying location

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KT</td>
<td>Postcode Area</td>
<td>124</td>
</tr>
<tr>
<td>KT17</td>
<td>Postcode District</td>
<td>3,064</td>
</tr>
<tr>
<td>KT17 1</td>
<td>Postcode Sector</td>
<td>11,598</td>
</tr>
<tr>
<td>KT17 1HB</td>
<td>Postcode Unit</td>
<td>1.78m</td>
</tr>
</tbody>
</table>

We want:

- A balance of a manageable number of areas and exposure in each area...
- …against variation of risk within area
What do we want?

- Retain localised variation
- Predictive
- Graphs removed
- Predictive regionally
Postcoding - framework

- Standard Policy Factors
- Random Noise
- External Geographical Factors
- Residual Spatial Variation
Postcoding - framework

- Standard Policy Factors
- Random Noise
- External Geographical Factors
- Residual Spatial Variation
Mix of Business – Standard policy factors

Map and pictures removed
Postcoding - framework

- Standard Policy Factors
- Random Noise
- External Geographical Factors
- Residual Spatial Variation
GLM geo-demographics

External Geographical Factors

Proportion Unemployed

- Claim Frequency
- Exposure
Postcoding - framework

- Standard Policy Factors
- Random Noise
- External Geographical Factors
- Residual Spatial Variation

These factors contribute to the unpredictable nature of postcoding results.
Spatial smoothing

- Credibility family method
- Can adopt distance based or adjacency based approach
Adjacency-based spatial smoothing
Adjacency-based spatial smoothing
Adjacency-based spatial smoothing
Postcode allocation

External factors

- Household Density
- Proportion Long Term Unemployed
- Proportion Children
- Proportion Owner Occupier
- Mean Income Band
- Profile Group

Spatial variation

- Smoothed Residual

Variation:

- LOW
- HIGH

1

50
Postcode classification – where are we now?

<table>
<thead>
<tr>
<th>Effort required</th>
<th>Loss ratio assessment by district</th>
</tr>
</thead>
<tbody>
<tr>
<td>KT 69%</td>
<td>Basic postcode allocation using external data</td>
</tr>
<tr>
<td>YO 71%</td>
<td></td>
</tr>
<tr>
<td>HU 75%</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

Spatial smoothing of residual effects

So we’re done. Or are we?
Do we have the data to do any better?

- **Enhanced external data**
  - Census data is outdated
    - (last collected in 2001)
  - More providers now have factors and scores at postcode unit level
  - Factual data at individual name and address data is available
    - Individual Credit Scores
    - County Court Judgements
    - Council Tax Band

- Enables more in-depth modelling and assessment of geographic effects

- Assists creation of unit level allocations
Why is the market moving to postcode unit level?

- Significant variation of experience within sectors
- Driven by behavioural effects (motor and home) and events (mostly home)

- Greater differentiation of risks
- Competitive advantage – or avoiding competitive disadvantage
- Increased credibility of external data
Unit level postcode allocations - pitfalls and solutions

Pitfalls

Solutions
Are the unit level results better for motor?

- Methodology for testing results involves hold out sample
- Calculate the percentage difference between the sector “score” and the unit “score”
- Then for each percentage band, calculate the observed relativity on a hold out sample

- Expect higher observed values when the unit allocation has increased the scores
- Results for motor show a moderate improvement

Graph removed
Are the unit level results better for household?

- Applied the same methodology for household
- Results for Buildings and Contents both show significant improvement

- But can we improve our allocations further?
Are the claim types so different?

- Mapping claims experience shows significant differences geographically by claim type

So is there any benefit from separate allocations by claim type or peril?
And are claim type areas better?

- Evidence suggests a separate area for injury on motor adds benefit
- For household, similar benefits have been proved
- But how can we implement them?

Apply claim type areas to claim type risk models
Allow different relativities by claim type for area only
Full peril rating

Increasing IT requirements for implementation
Postcode classification – so where does that leave us?

<table>
<thead>
<tr>
<th>Effort required</th>
<th>Degree of sophistication</th>
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</thead>
<tbody>
<tr>
<td>KT 69%</td>
<td>Full peril rating</td>
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<tr>
<td>YO 71%</td>
<td>Separate areas by claims type</td>
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<tr>
<td>HU 75%</td>
<td>Unit level allocations</td>
</tr>
<tr>
<td>...</td>
<td>Spatial smoothing of residual effects</td>
</tr>
</tbody>
</table>

Basic postcode allocation using external data

Loss ratio assessment by district

Spatial smoothing of residual effects

Use of individual level data

KT 69%
YO 71%
HU 75%
...
Enhancements to risk modelling
Personal lines pricing

Geographical Classification

Vehicle Allocation
Enhancements to risk modelling
Personal lines pricing

Geographical Classification

Vehicle Allocation

Pictures removed
Pictures removed
What is a vehicle allocation?

Pictures removed
Why this matters

• Aggregators
• Linking pricing and underwriting
• Changing risk premium composition
• Potential for uplift
• Interesting!
Car classification – spectrum of approaches

Degree of sophistication

Effort required

ABI 50 classification
The starting point – the ABI 50 vehicle classification

- New vehicles classified according to:
  - Damage and parts costs
  - Repair times
  - New car values
  - Performance
  - Security
- 50 groups in use plus suffixes
- Imported cars and specialised purpose vehicles e.g. kit cars are not classified
- For details see: http://www.thatcham.org/abigrouprating/index.jsp?page=429
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?
Insurer classifications
Insurer classifications
Insurer classifications
Insurer classifications
Postcoding - framework

- Standard Policy Factors
- Random Noise
- External Geographical Factors
- Residual Spatial Variation

40
GLM geo-demographics

Proportion Unemployed

Claim Frequency  Exposure
Spatial smoothing

- Credibility family method
- Can adopt distance based or adjacency based approach

Maps removed

Distance Adjacency

Maps removed

Unsmoothed Smoothed
Car classification – translating the framework

- Standard Policy Factors
- Random Noise
- External Geographical Factors
- Residual Spatial Variation
Car classification – translating the framework

External Vehicle Factors

Performance
Dimensions
Safety
Security
Costs
Bodystyle Classification

Standard Policy Factors

Random Noise

Residual Spatial Variation

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Back to basics

Dimensions

Body style

Safety

Performance

Security

Cost

Brand Appeal

Use
Body style classification

It’s hard!

- No universally adopted system in place
- Many variants to classify
- New bodystyles have emerged
- Some vehicles attempt to defy classification

Hatchback

Cabriolet

Spider

Saloon
Evolution of vehicle make/model
Using external data wisely

- One-way analysis
- Data visualisation
- GLM
- Stepwise regression
- ‘Ratio’ variables
Car classification – translating the framework

- Standard Policy Factors
- Random Noise
- External Vehicle Factors

Residual Spatial Variation

Unsmoothed → Smoothed

Requires a vehicle space...

Attribute 2

Attribute 1
Example adjacencies
Putting it all together

Classifying existing cars

Graph removed

Classifying new cars

Graphs removed
Performance vs. ABI (TP)

Graph removed
Performance vs. ABI (TP)

Graph removed
So where does that leave us?

Spatial smoothing of residual effects

Wider use of external data

ABI code 44 overlays

ABI 50 classification

Effort required

Degree of sophistication

Individual vehicle rating

Cars:
- Ford Mondeo Zetec
- Porsche Boxster S
- Citroen C1 Cool

4% 5% 6% 7%
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.