The Actuarial Profession
making financial sense of the future

Personal lines pricing: current issues and opportunities for 2011

Neil Chapman and John Berry, EMB

12-15 October 2010

Agenda

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

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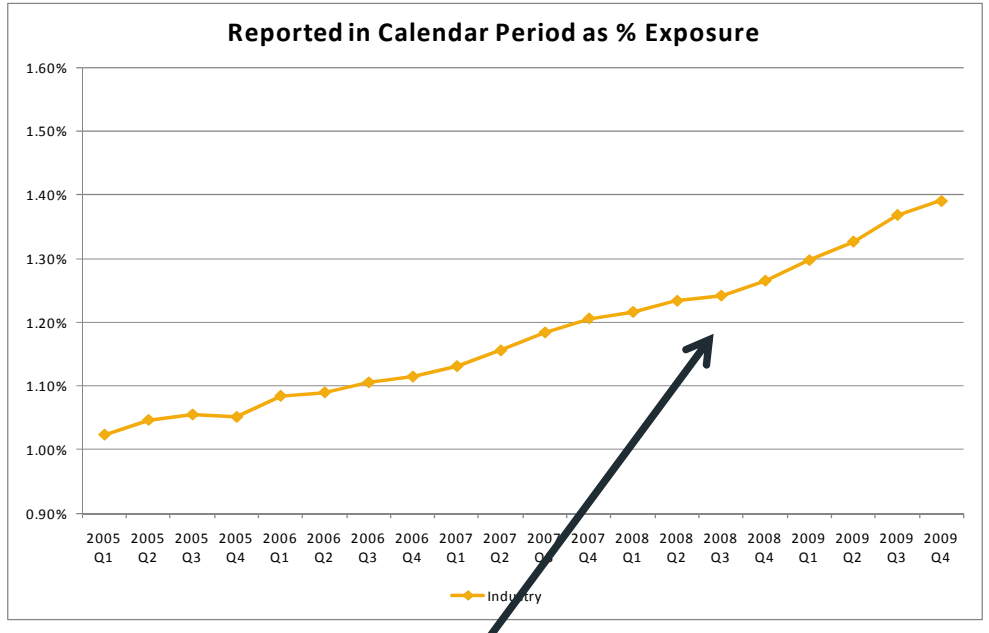
Bodily injury – why are we interested?

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



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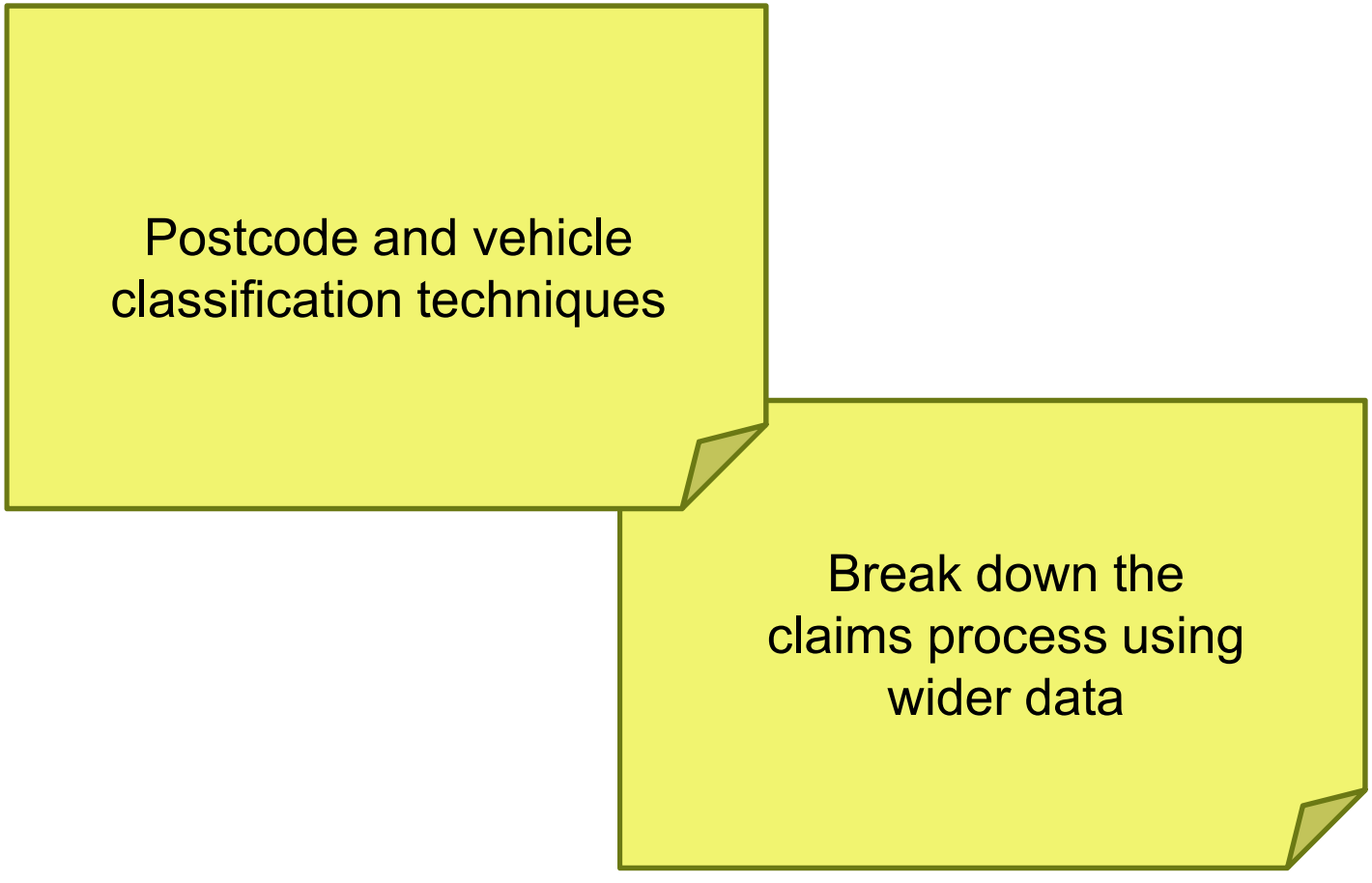
Consistent strong yearly increase in BI claims frequency

Bodily injury now approximately 50% of claims cost

What can we do?



- Need for closer links between technical pricing and claims

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

Postcode and vehicle classification techniques

Maps removed

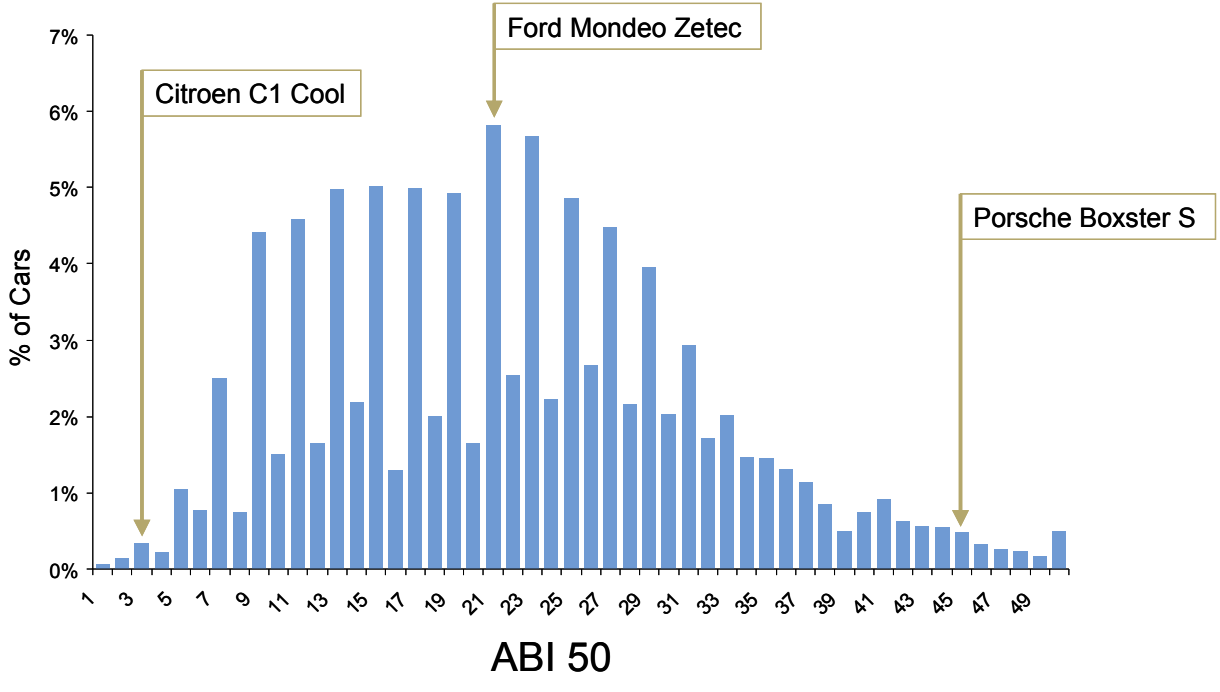
How good is ABI 50 for risk models and pricing?

Postcode and vehicle classification techniques

- 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

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

Graph removed

- 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

Graph removed

- 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?

Picture removed

- 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

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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

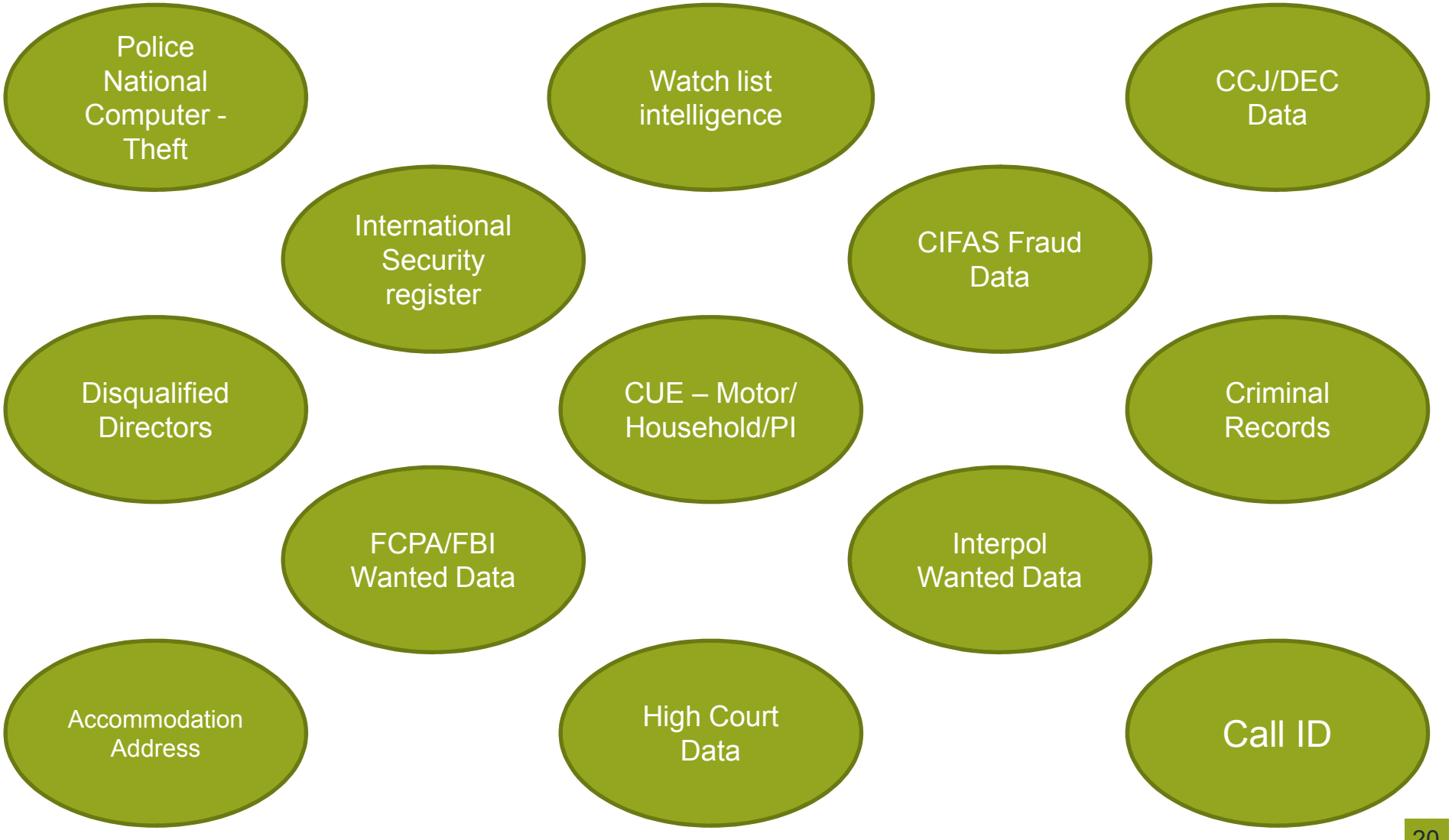
Government sources – Council tax band

Graph removed

Who are you underwriting?

Pictures removed

External data



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Underwriting & “proposal risk”

- Paper underwriting guides with detailed underwriting and acceptance criteria
- Simple system rating engines
- Significant number of cases referred for manual underwriting
- “Off-screen” rates
- Face to face interaction between brokers and their customers

- More sophisticated system rating engines
- EDI
- Direct & panel broker call centres with sales incentives
- Broker-customer face to face interaction much reduced
- Reduced manual underwriting
- Reduced manual validation e.g. NCD
- Lag in system driven underwriting rules to adapt to new distribution

- Increased customer price transparency
  - Effect of rating factors
  - Access to competitor rates
- Ability to “experiment”
- “Financial expert” websites giving “money saving” tips
- Customer awareness of cover, options and add-ons
- Fraud
- Further reduced manual underwriting
- **Another lag in underwriting capability?**

Lewis Hamilton versus the motor underwriter

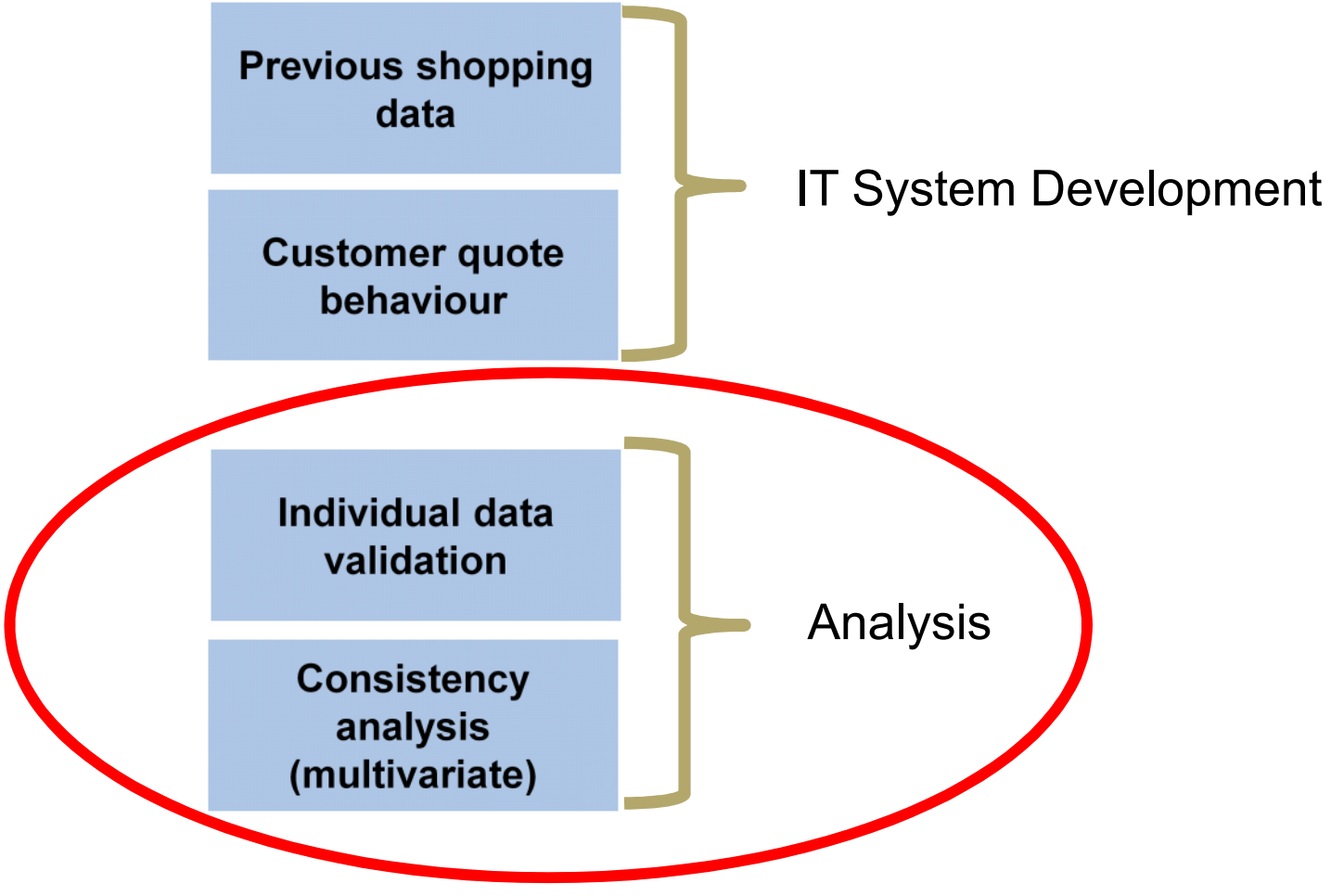
£2,39

£2,614.50 (with Dad)

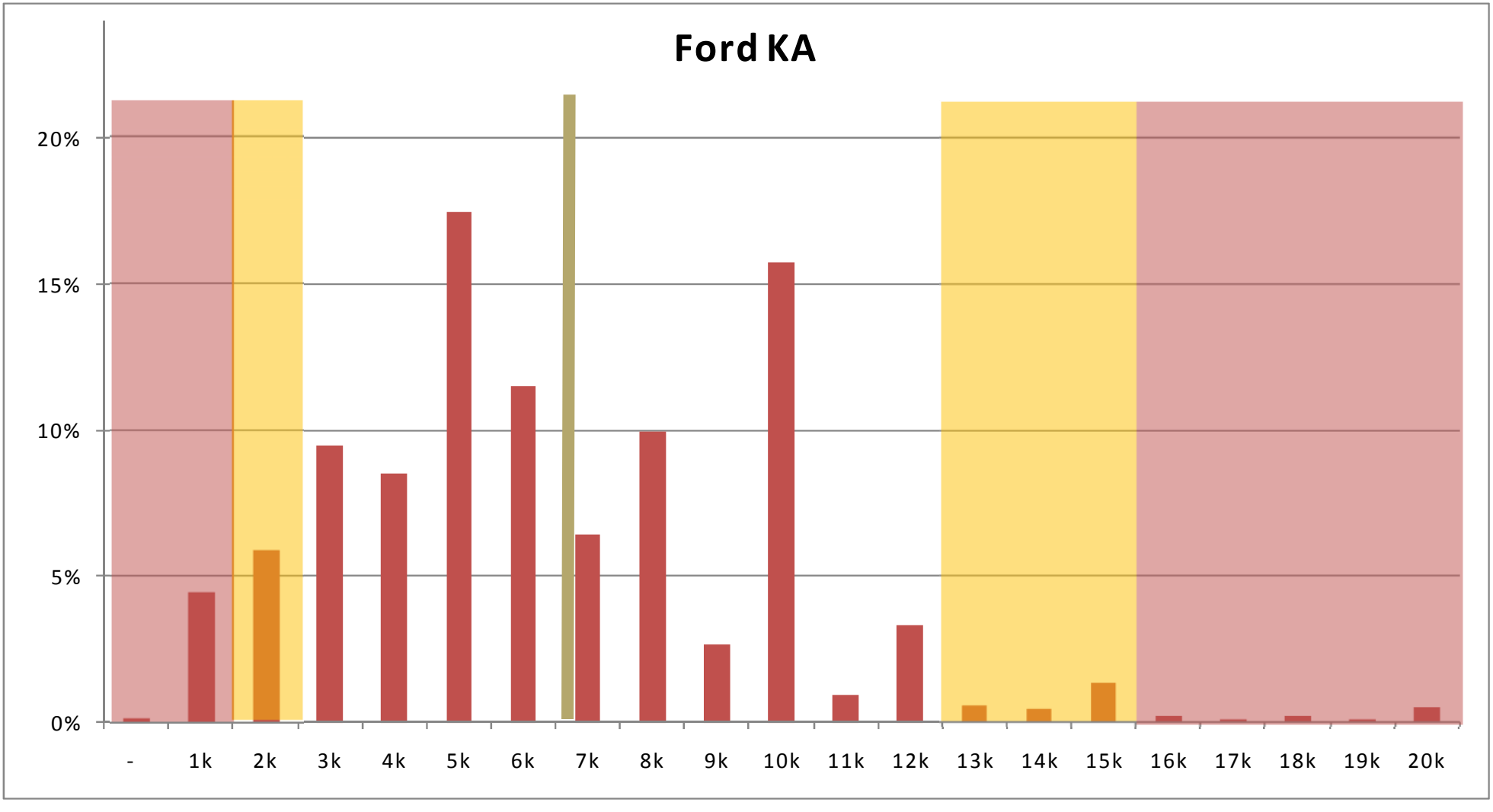
£2,300.57 (with common law partner)

£2,295.33 (with friend) → (reduce mileage by 2k) £2,216.10

Effective automated underwriting



Individual data validation – mileage example



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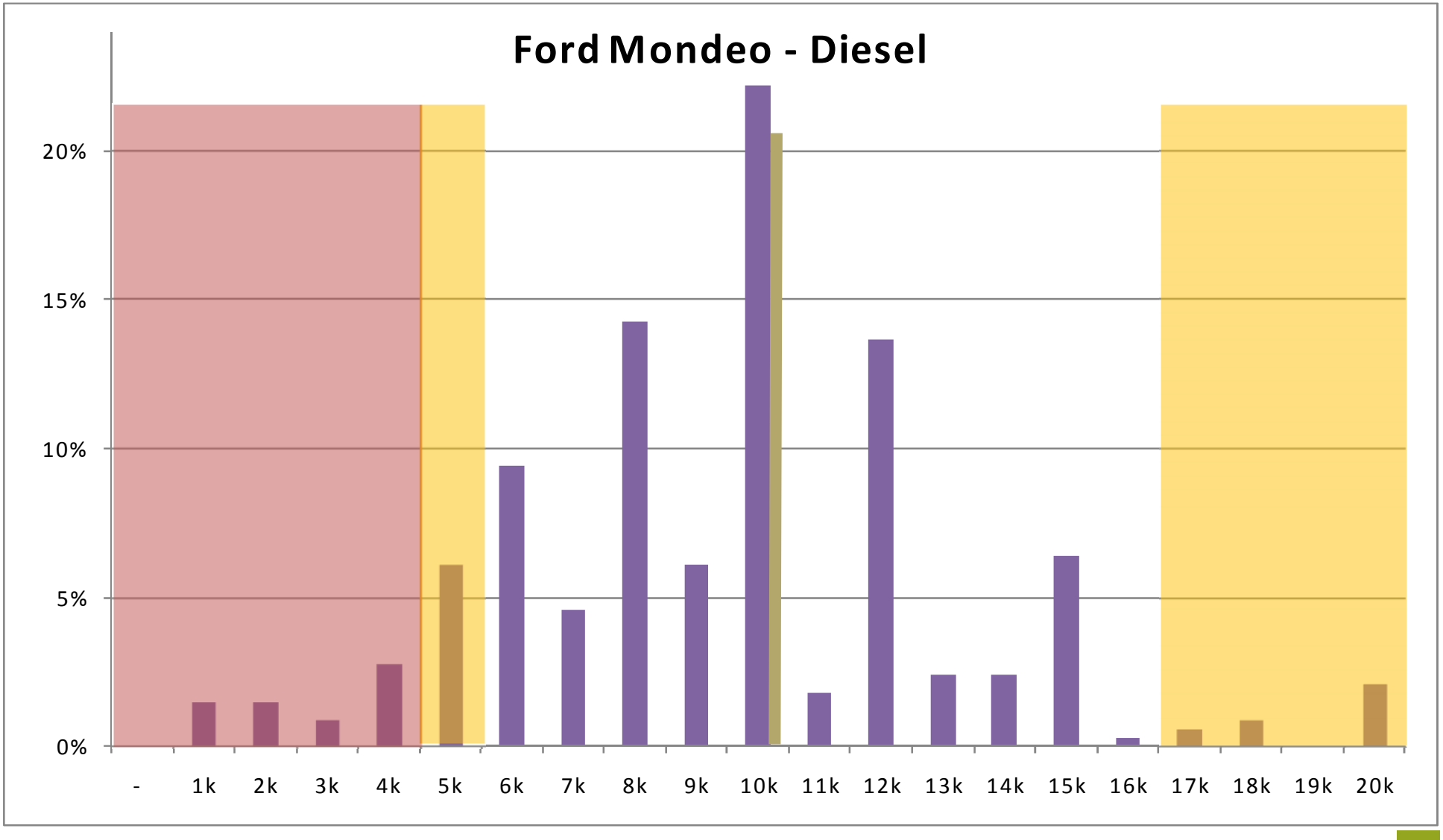
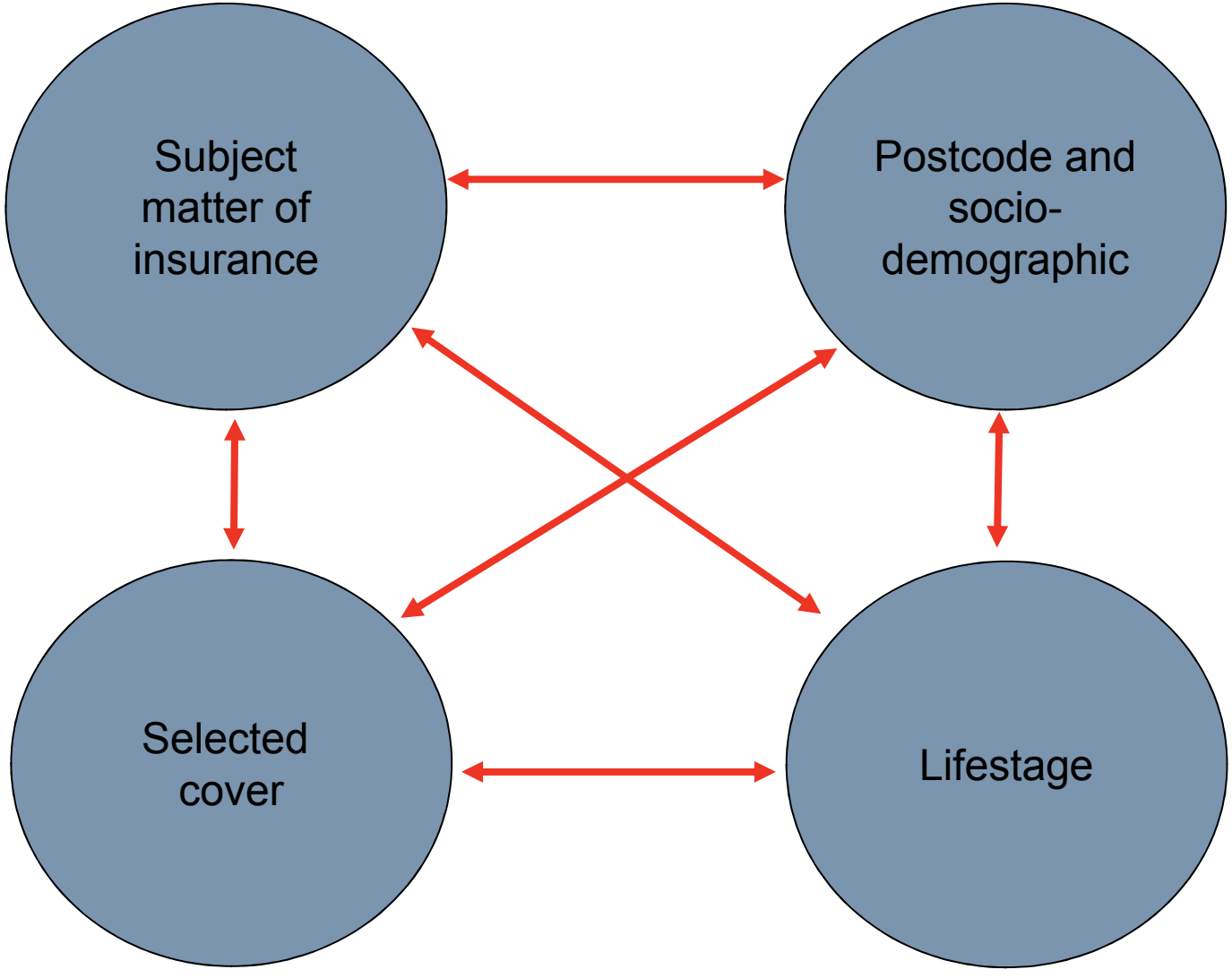
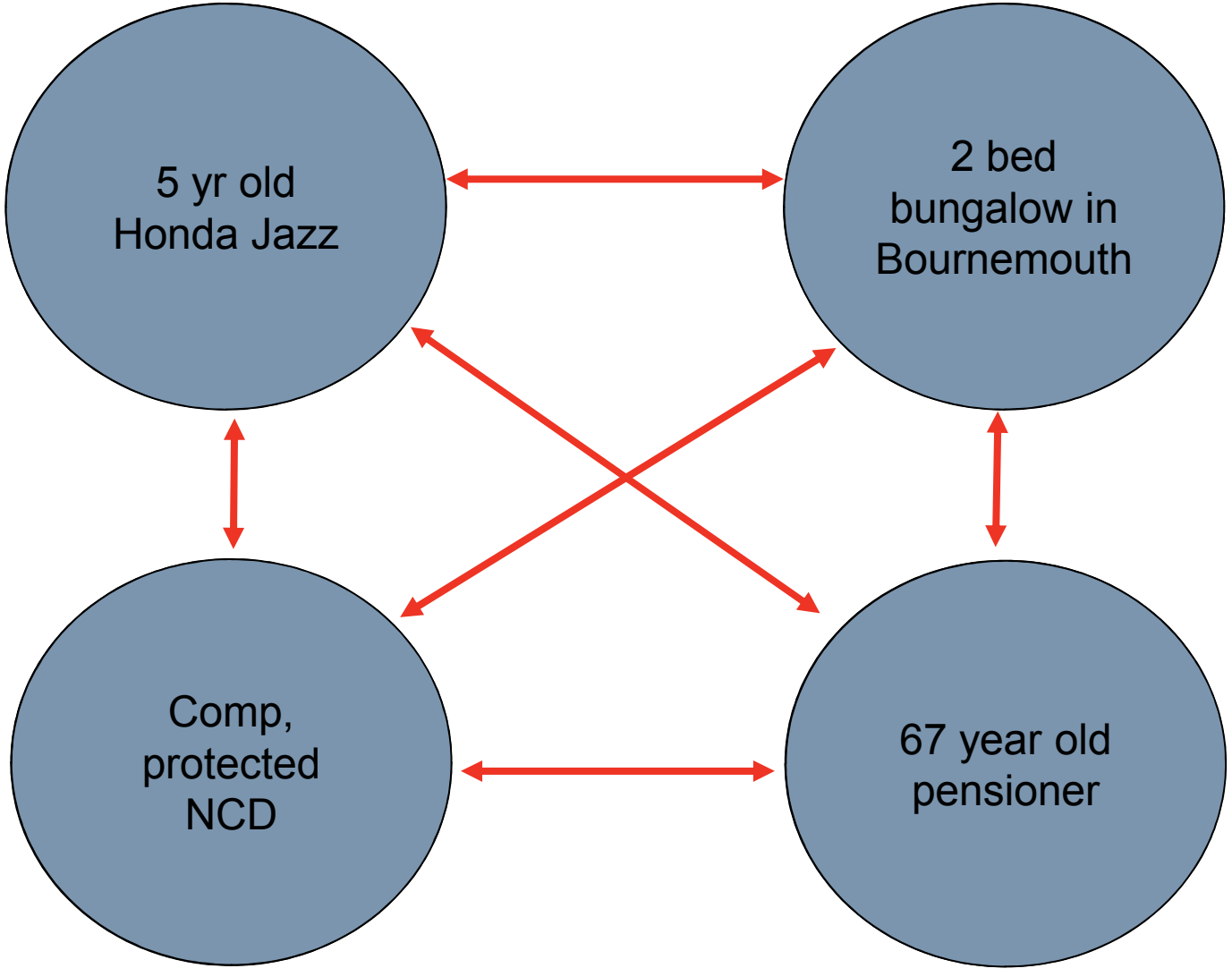


Underwriting fraud – consistency analysis



Consistency analysis – motor example



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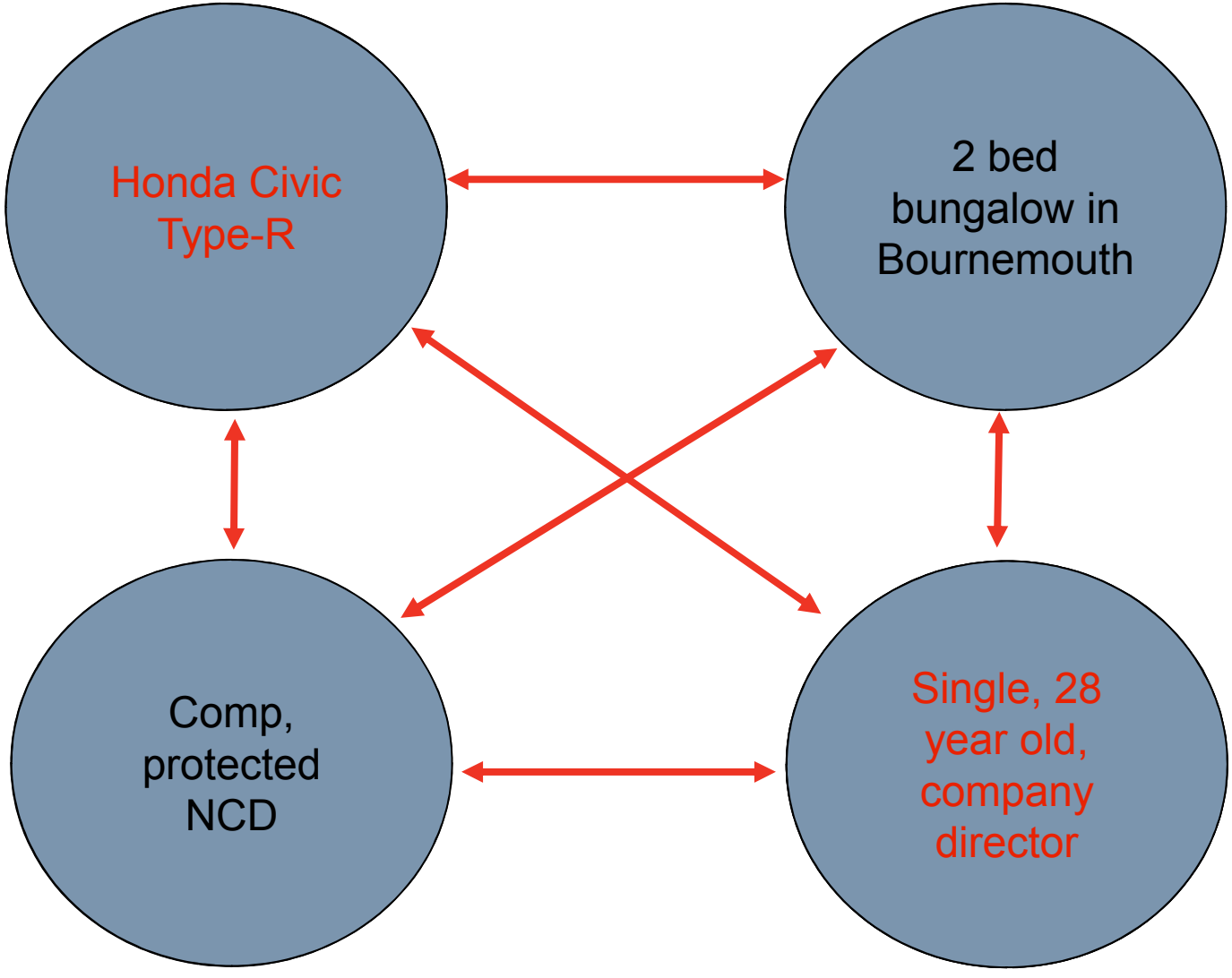

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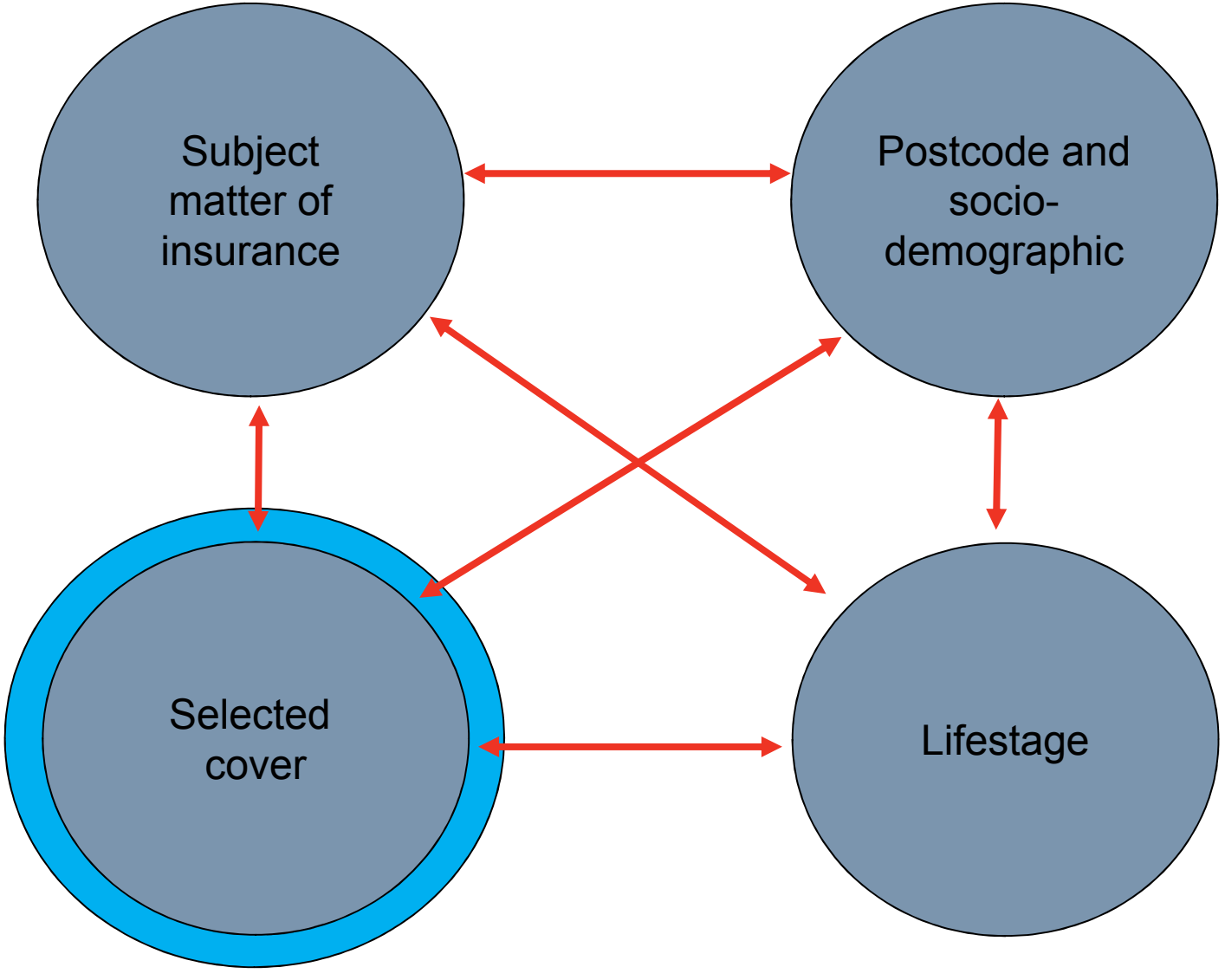
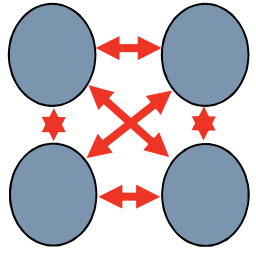


Consistency analysis - example



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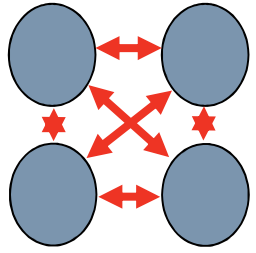
1. Model of mileage built using insurer's quote database
2. Modelled/expected mileage is then compared with declared mileage
3. Various factors derived for consideration in claims models such as ratio of declared to expected mileage

Consistency analysis - example



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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” wierdness or inconsistency across different aspects of the risk

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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

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- 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

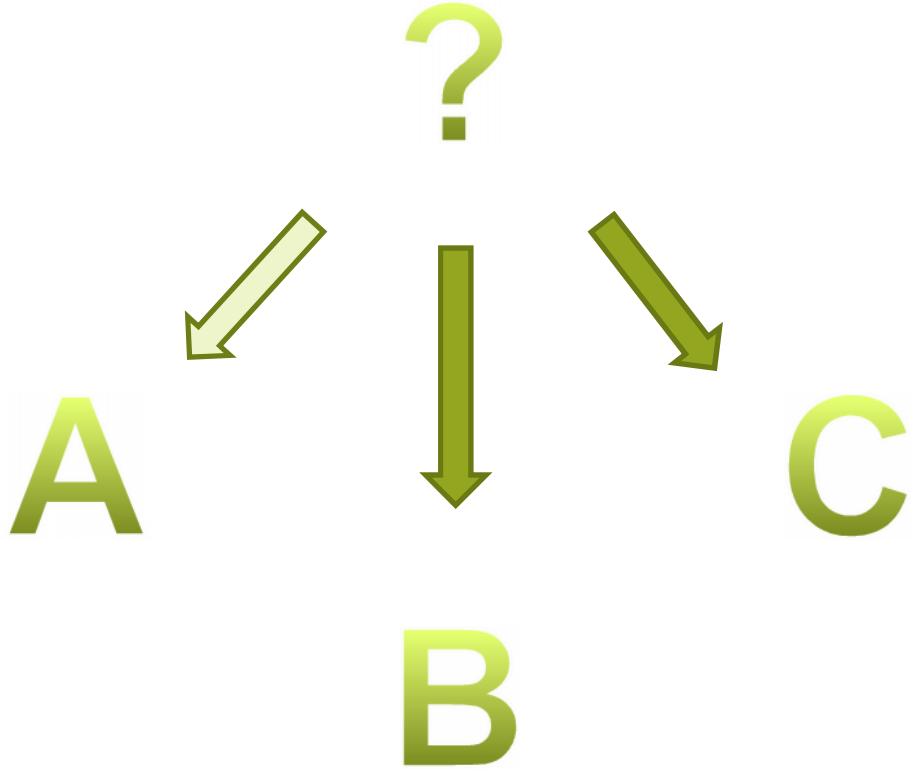
Choice of add-on bundle

Renewal activity

Bronze/Silver/Gold product offerings

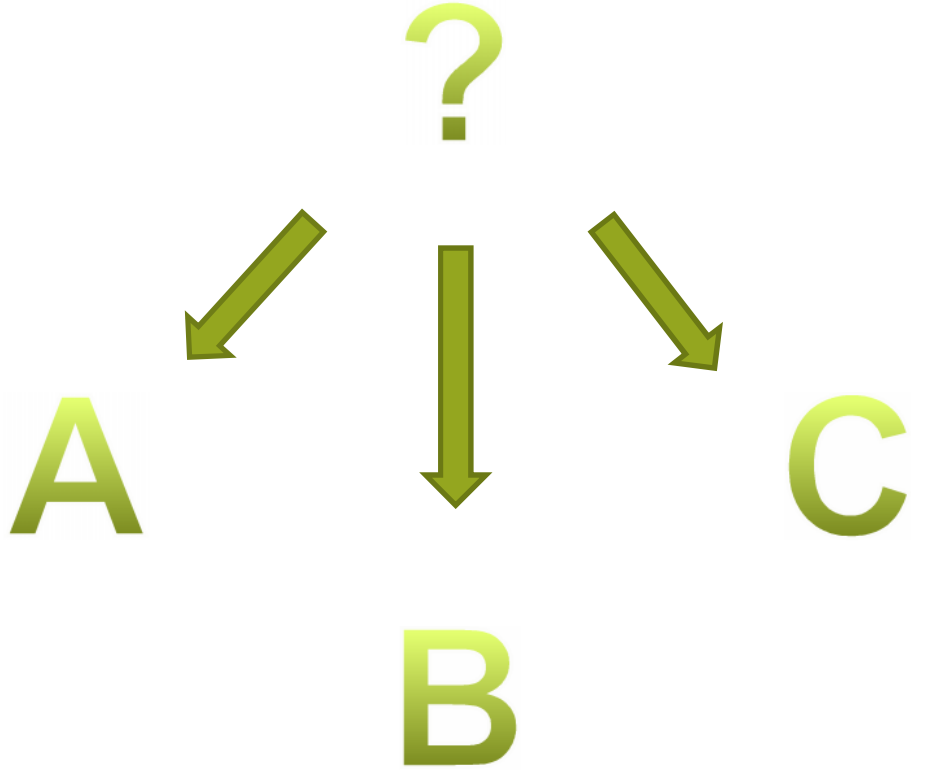
So how do I model it? – Option 1

- Binomial models for:
  - B vs rest
  - C vs rest
- P(A) derived as:
  - P(A)=1-P(B)-P(C)



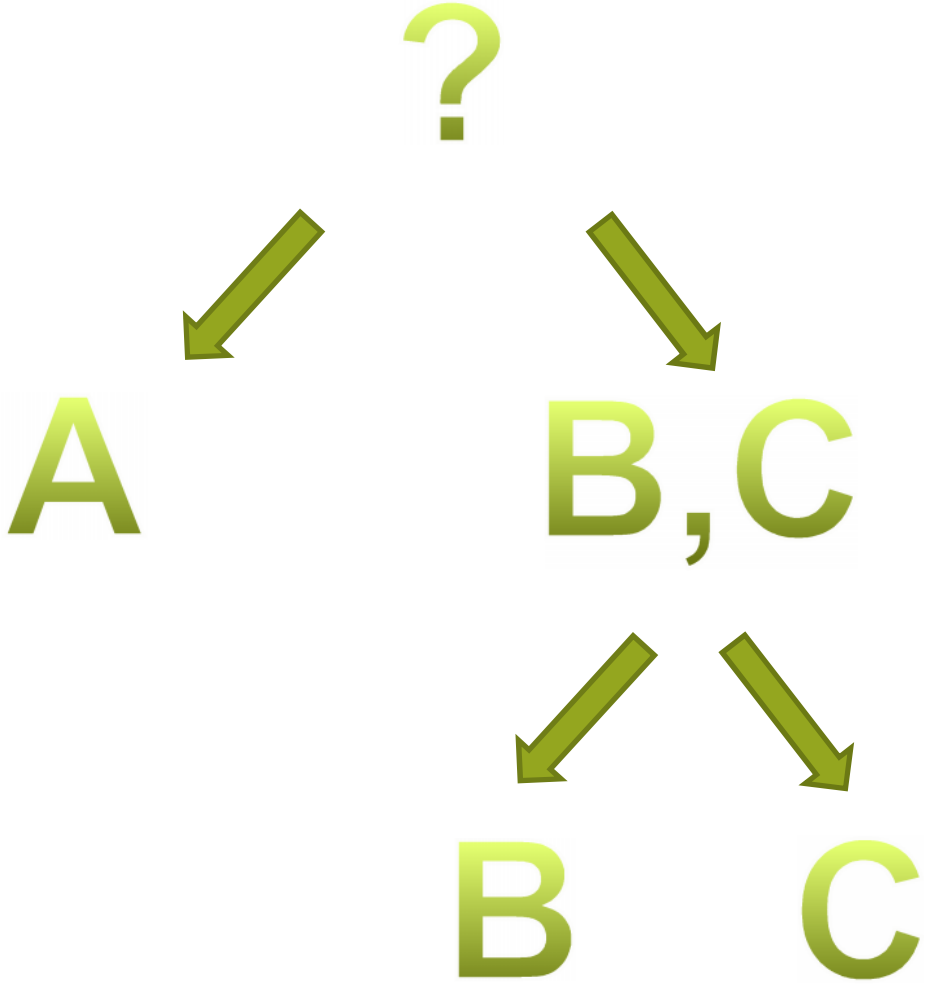
So how do I model it? – Option 2

- Binomial models for:
  - A vs rest
  - B vs rest
  - C vs rest
- Results scaled such that:
  - P(A)+P(B)+P(C)=1

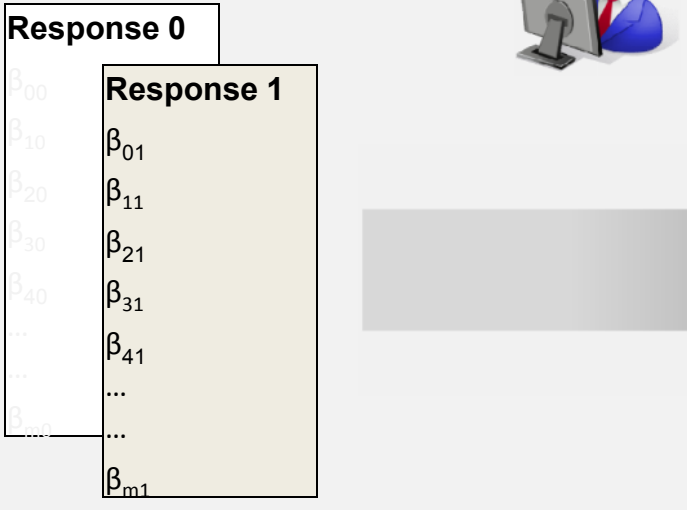


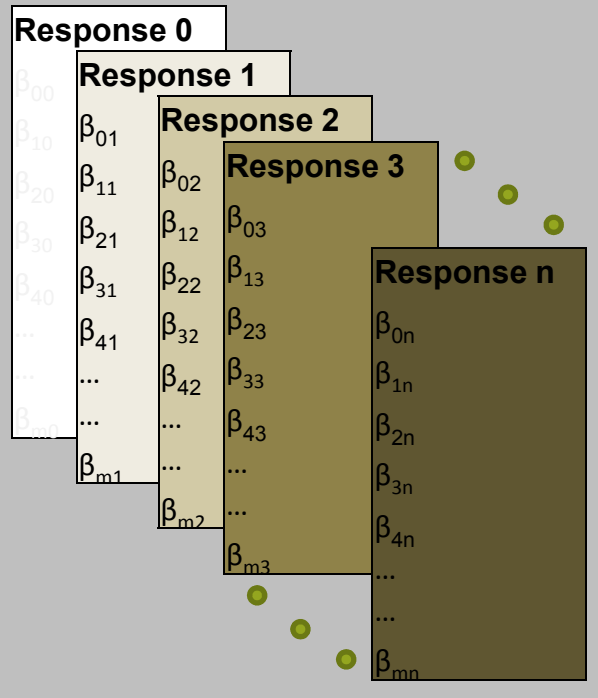
So how do I model it? – Option 3

- Binomial models for:
  - A vs B,C
  - B vs C
- Approach is **“nested”**



From the binomial logit to the multinomial logit





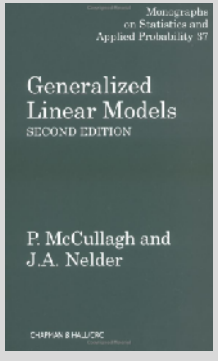
$$P_n(i) = \frac{e^{\beta' x_{in}}}{e^{\beta' x_{in}} + e^{\beta' x_{jn}}}$$

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

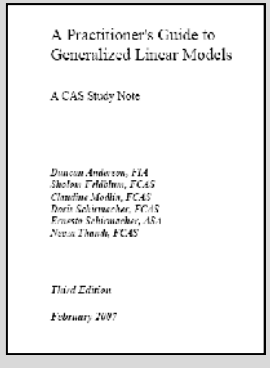
An interesting digression…



McCullagh and Nelder

STATISTICAL MOTOR RATING: MAKING EFFECTIVE USE OF YOUR DATA

Brockman and Wright



A Practitioner's Guide to Generalized Linear Models

A CAS Study Note

Duncan Anderson, FIA
Sholom Feldblum, FCAS
Claudine Modlin, FCAS
Doris Schirmacher, FCAS
Ernesto Schirmacher, ASA
Neeza Thandi, FCAS

Third Edition

February 2007

Anderson et al

Random utility theory

Discrete choice models

Multinomial models!

1980s 1990s 2000s 1950s-1980s… 1920s

Actuarial perspective

Marketing/economics perspective

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 multinomial 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.