



The Actuarial Profession

making financial sense of the future

General Insurance Pricing Seminar – 17 June 2010
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Workshop D1 – Developments in Risk Modelling

Vehicle Classification

What we're talking about today

- “Developments in risk modelling – enhanced bodily injury modelling and vehicle classification”
 - Focus is on vehicle classification, NOT on personal injury
 - Vehicle classification is.... “allocation of **cars** as identified by ABI codes to a manageable number of disjoint ordered groups for purposes of risk analysis and pricing”
 - Rating by vehicle registration will not be considered in this session

Why this matters

- Aggregators
- Linking pricing and underwriting
- Changing risk premium composition
- Potential for uplift
- Interesting!

Agenda

- Vehicle classification approaches – past, present and future
- ABI group rating
- Exploring vehicle similarity
- Lessons from postcode classification
- Technical modelling approach
- Exploring the vehicle/operator problem

Back to 1992 - XR2s, boy racers and joyriding

- In the early 1990s:
 - There were only 7 ABI Groups
 - The first “hot hatches” were the cars of choice for young men
 - There was a recession
 - Computer games, mobile phones, music and TV were (relatively) rubbish
 - Cars were easy to steal
- And so...
 - “Joyriding” became the scourge of middle-England
 - Theft claims on hot-hatches became a major headache for insurers
 - There was pressure for an improved vehicle classification system and so ABI 20 was introduced



Vehicle classification in the 1990s



- Remember the context:
 - Risk GLMs in GLIM 4 (and then Emblem) were pretty basic
 - Computers weren't very powerful
 - Postcodes were a relatively new development in rating
 - Vehicle identification at POS not always automated
- And so...
 - Analysis of vehicle risk relativities was based on standardised claims experience by claim type
 - Vehicles sorted by ABI group, ranked by standardised risk relativity to the group average
 - Look for patterns, discuss with underwriter
 - But major issues with credibility for many vehicles
 - Relatively little deviation from ABI 20 after migration from ABI 7?

Vehicle classification in the 2000s



- Remember the context:
 - GLMs pretty sophisticated, analysis data resources well managed, computers pretty powerful, vehicle identification at POS generally automated
 - Increasing number of commercial sources of detailed vehicle data
 - Dearth of pricing actuarial resource, with extensive priority list
 - Creation of ABI 50 from 1.1.2007, ABI 20 discontinued from 1.1.2010
- And so...
 - Vehicle classification analysis often overlooked by small or busy pricing teams
 - Increased use of Code44 or DVLA vehicle factors directly within GLMs
 - Increased use of non-ABI vehicle classification systems
 - Increased use of claim type-specific vehicle classification approaches

Vehicle classification in the 2010s



- Remember the context:
 - GLMs very sophisticated, analysis data resources well managed, computers very powerful, vehicle identification at POS automated
 - Many commercial sources of detailed vehicle data
 - Dearth of pricing actuarial resource (SII), with extensive priority list
 - Aggregator imperative
 - Postcode classification methodologies and tools well established
- And so...
 - What can we do to improve on ABI 50?

What problem are we addressing?

- A common cause of failure of initiatives in this area is confusion and/or blurring between two problems:
 1. “Vehicle entity group” problem = taking all vehicle-specific data items and reducing to the most effective set of implementable factors along with a vehicle classification
 2. “Vehicle/operator” problem = reducing the aggregate set of vehicle and operator data items to the most effective set of factors, segments, interactions and classifications
- The first problem is easier, and a good step towards solving the second, but may provide lower uplift...
-and so we’re going to look at this first

Why do pricing actuaries struggle with this problem?

- Inaccurate coding of their historic exposure by ABI code
- Identifying the best (and most accurate) external source of vehicle data items
- Defining vehicle “similarity” metrics – what are the most appropriate dimensions and what weights?
- Separating vehicle differences in claims experience from e.g. the effects of differential compulsory excesses
- Aligning the actuarial and underwriting view

ABI code mismatches

- Insurer policy records may be linked to an incorrect ABI Code at POS
- ABI Code 32018002 = Mercedes 280E Auto (Group 15)
 - By validating the VRM the vehicle identified as a Mercedes S Class S280 Auto, ABI Code 32095001 (Group 16)
- ABI Code 35500401 = Nissan Almera GX 1592cc (Group 6E)
 - By validating the VRM the vehicle was identified as a Nissan Almera GX 1392cc, ABI Code 35500202 (Group 5)
- As many as 15% of exposure records may be mis-coded
- As many as 6% of ABI codes may be null

Agenda

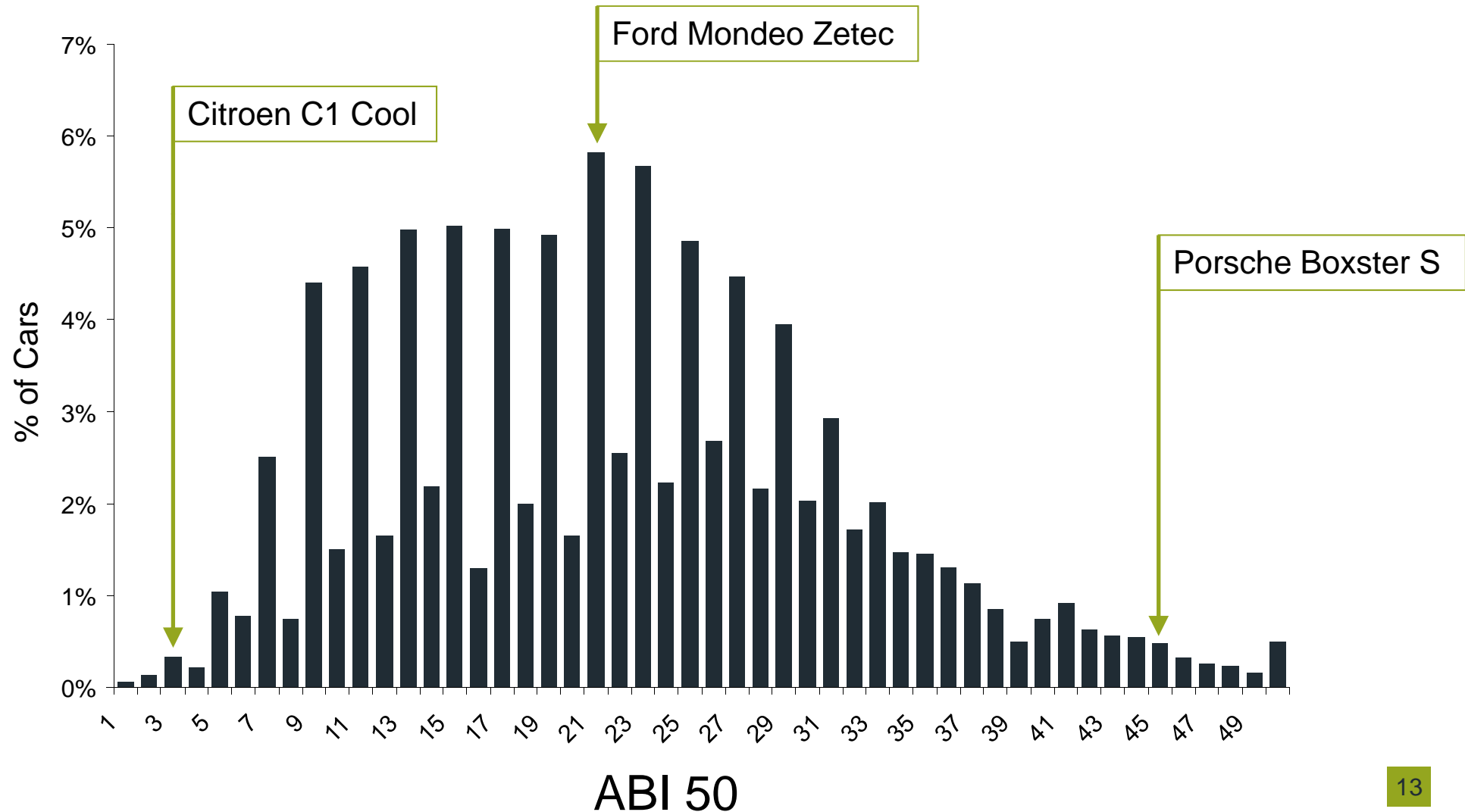
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The starting point – the ABI 50 vehicle classification

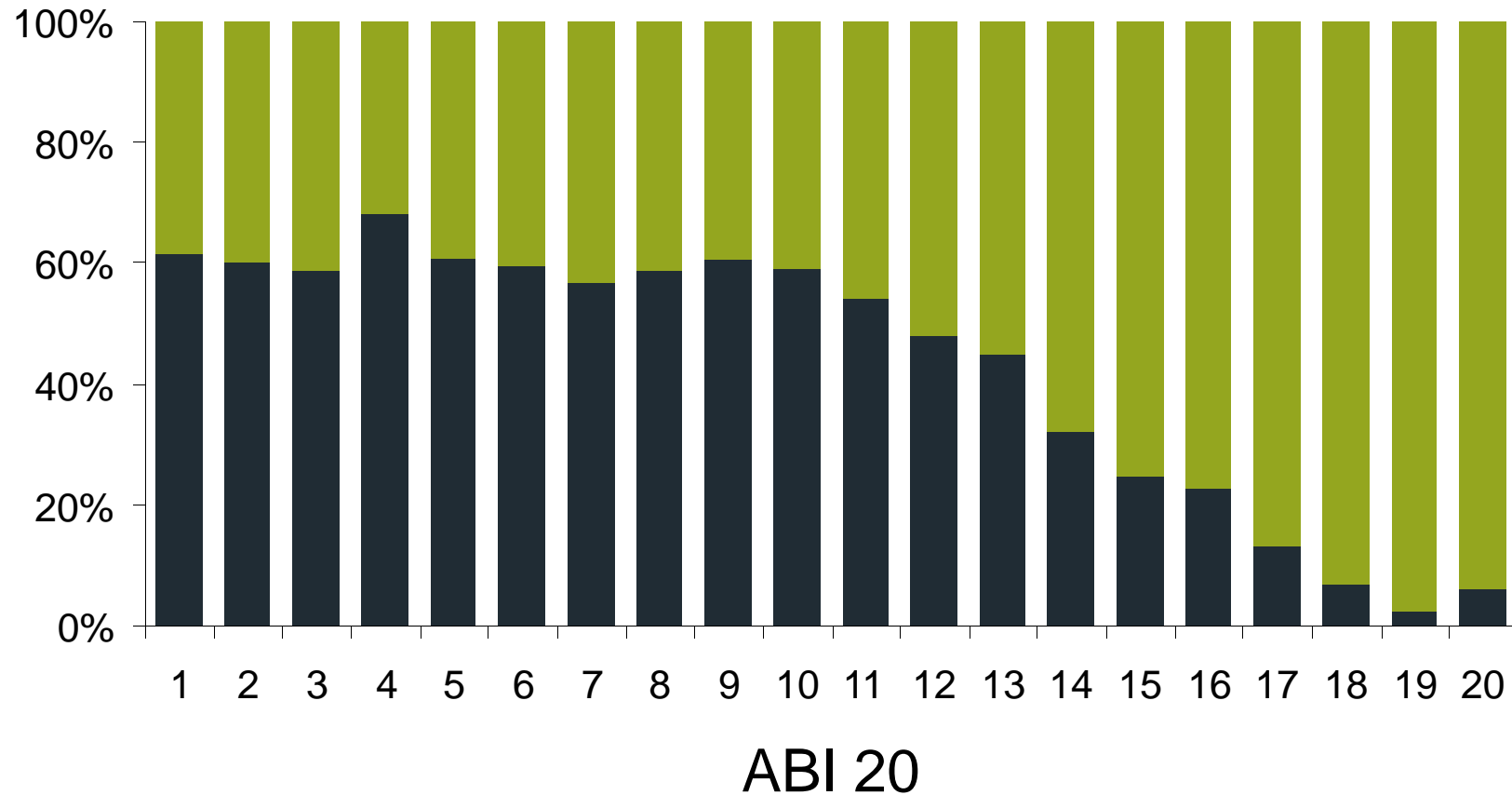
- New vehicles classified according to:
 - Damage and parts costs
 - Repair times
 - New car values
 - Performance
 - Security
- 50 groups in use plus suffixes
- Imported cars and specialised purpose vehicles e.g. kit cars are not classified
- For details see: <http://www.thatcham.org/abigrouprating/index.jsp?page=429>



What is the distribution by ABI 50 group?



How does ABI 50 differ from ABI 20?



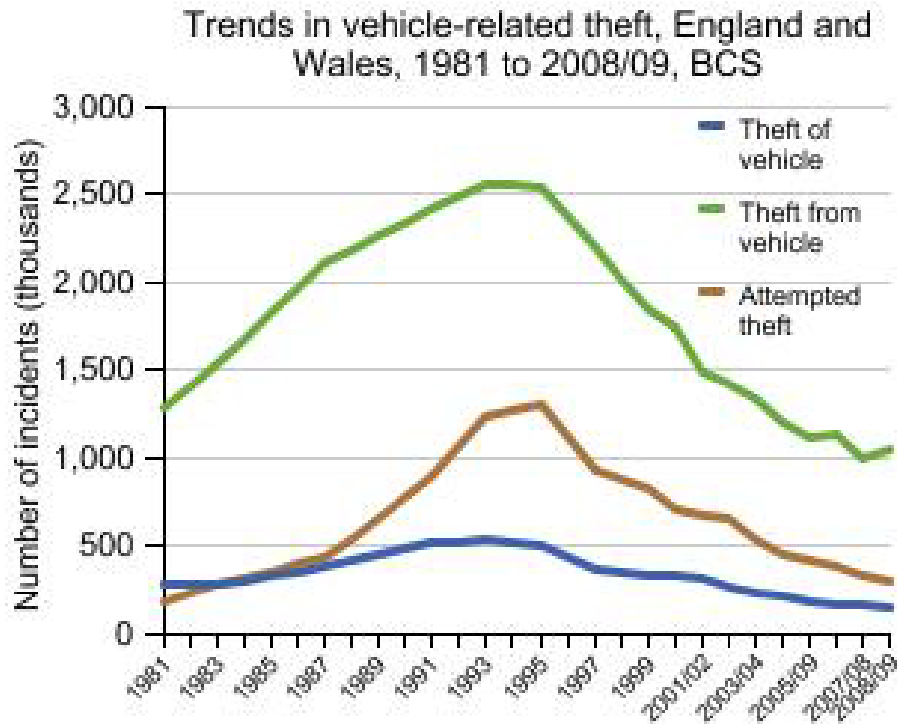
■ $ABI\ 50 = (ABI\ 20 * 2) + 1$ ■ $ABI\ 50 \neq (ABI\ 20 * 2) + 1$

How good is ABI 50 for risk models and pricing?

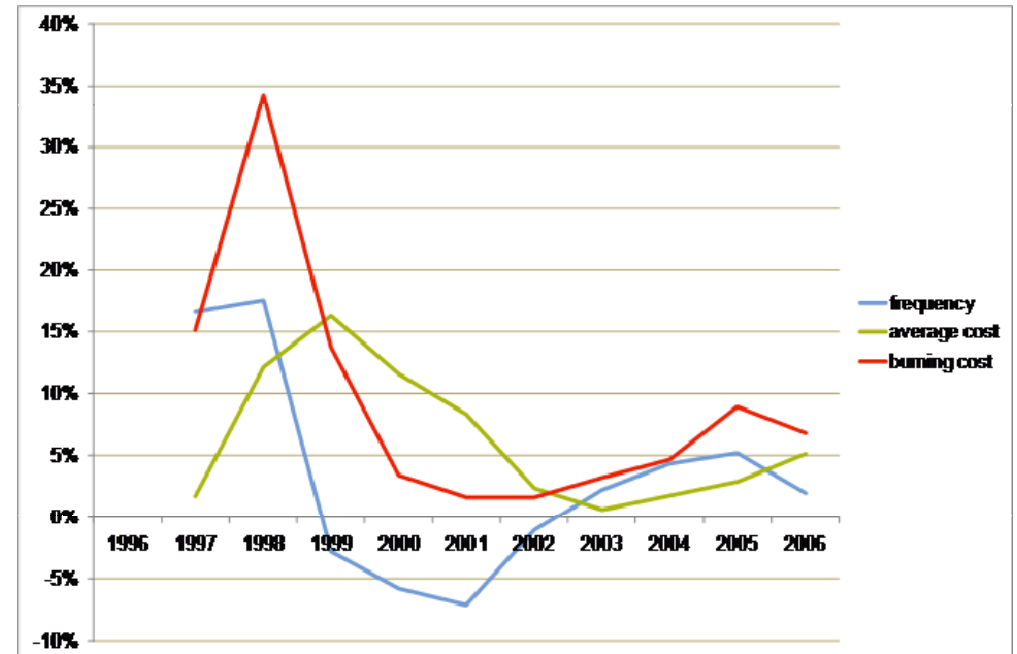
- Useful benchmark
- Public awareness
- Very good predictor of total loss?
- Good predictor of claim frequency?
- Better predictor of AD claims experience than TP?
- But...
 - does not acknowledge all vehicle attributes
 - does not make full use of the 50 groups
 - is a one-size fits all vehicle group the best option?
 - allocations once made are not reviewed
 - manufacturers able to “game the system”?

Vehicle-related theft and personal injury trends

- Theft claims cost has fallen dramatically since the 1990s



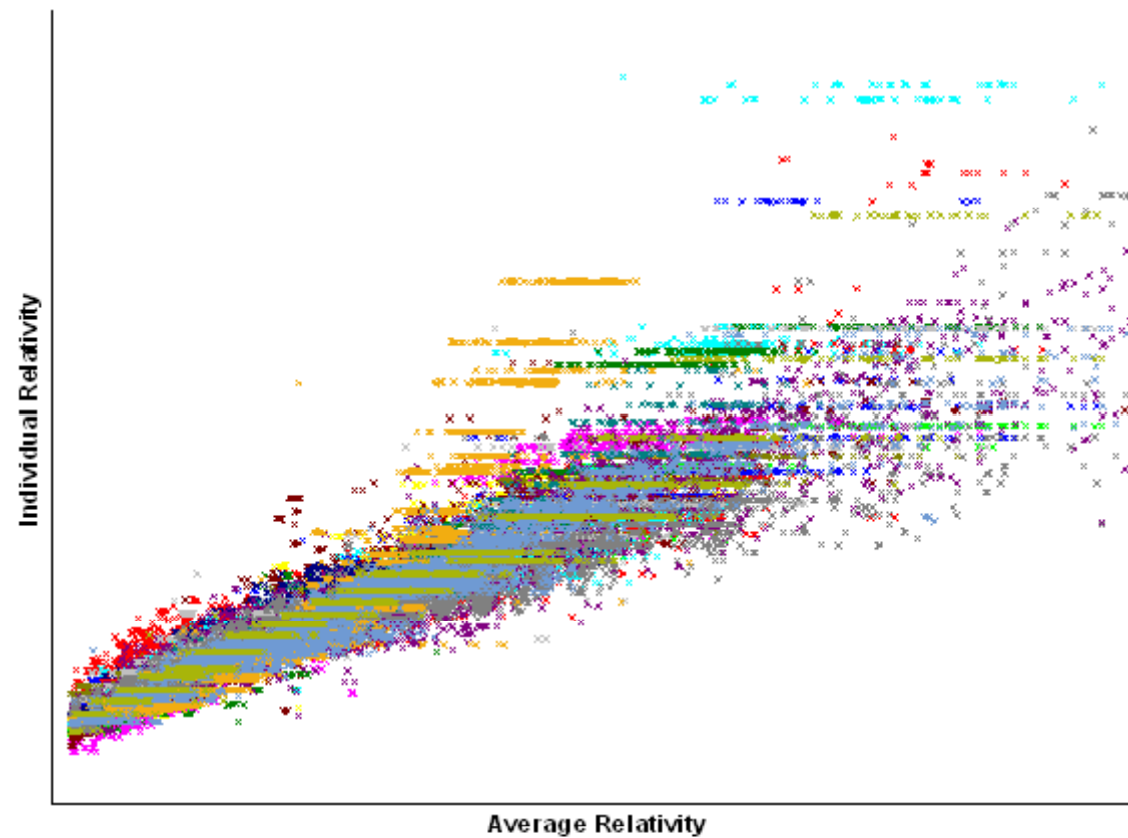
(data source: HO: Crime in England and Wales 2008/9)



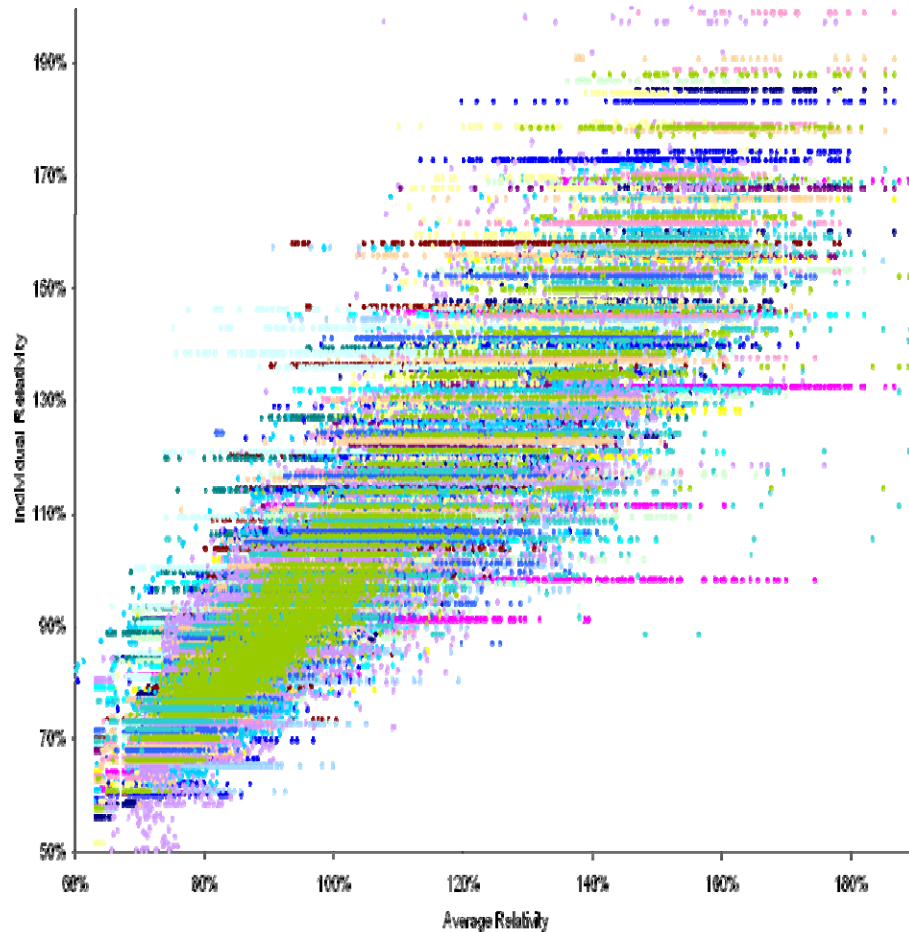
(data source: data published in the IUA and ABI "Fourth UK Bodily Injury Awards Study (October 2007)

-whilst TPBI costs have increased significantly

Insurer classifications

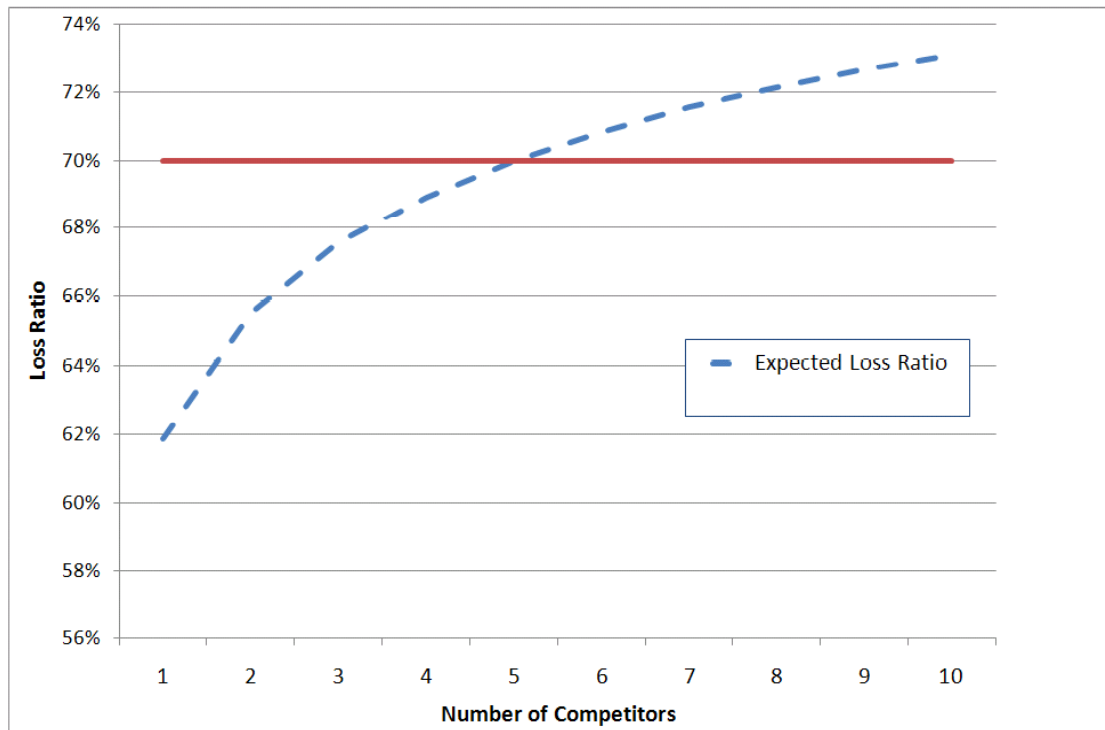


Deviations from ABI group 50



- Deviations are less pronounced than for postcodes, for which there is no industry benchmark
- Some insurers:
 - have an independent vehicle classification
 - use explicit vehicle factor overlays
 - exclude or load for exotic vehicles
 - etc.

The risk and reward balance of deviating from ABI 50



(data source: Winner's Curse GIRO Working Party Paper, August 2009)

- The more competitors the lower the average price and higher the loss ratio
- In the aggregator environment, the force of competition amplifies the risk and reward of deviation from the norm

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- Vehicle classification approaches – past, present and future
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- **Exploring vehicle similarity**
- Lessons from postcode classification
- Technical modelling approach
- Exploring the vehicle/operator problem

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



+0.18m

+0.32m

1976

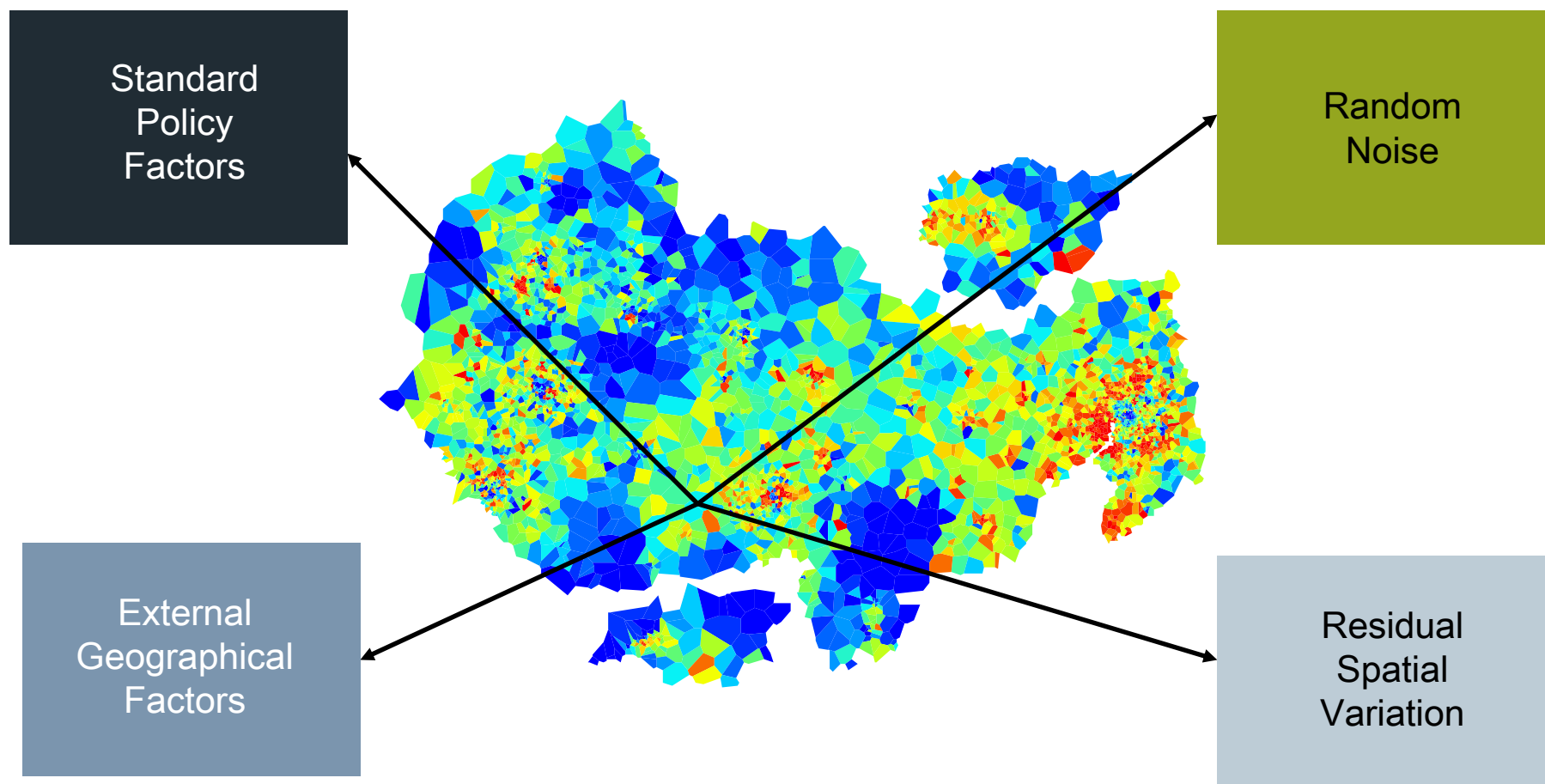
1989

2011

Agenda

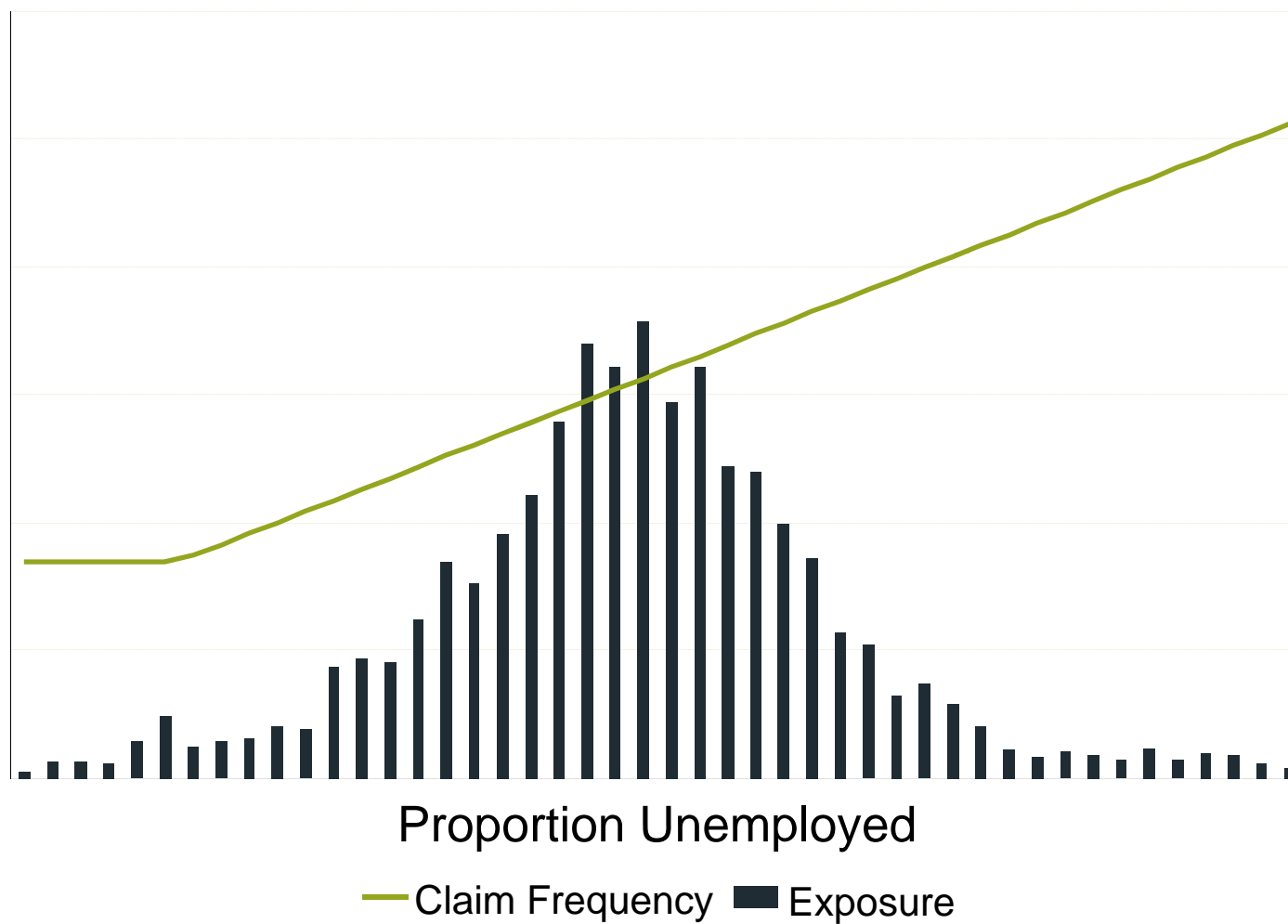
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Postcoding



GLM geo-demographics

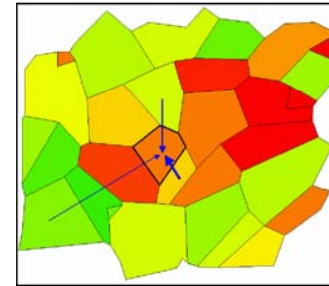
External
Geographical
Factors



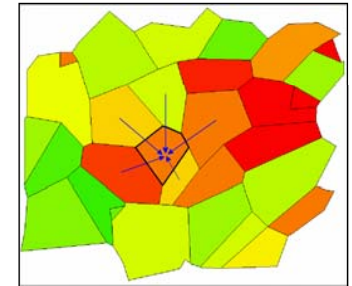
Spatial smoothing

Residual
Spatial
Variation

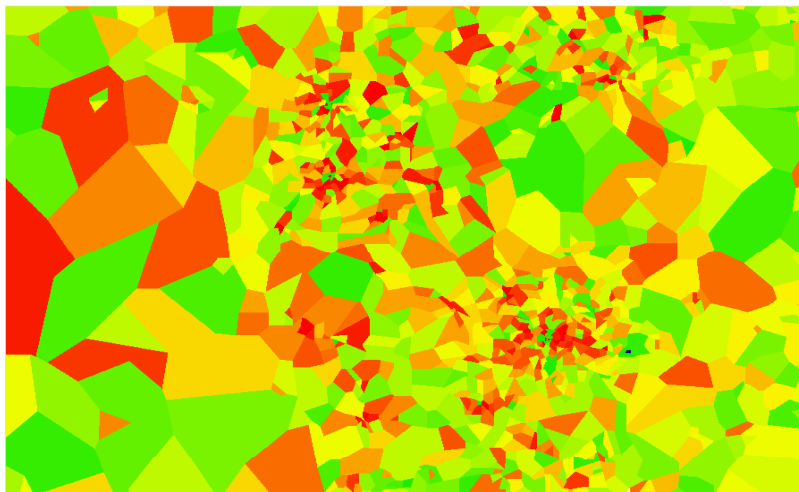
- Credibility family method
- Can adopt **distance based** or **adjacency based** approach



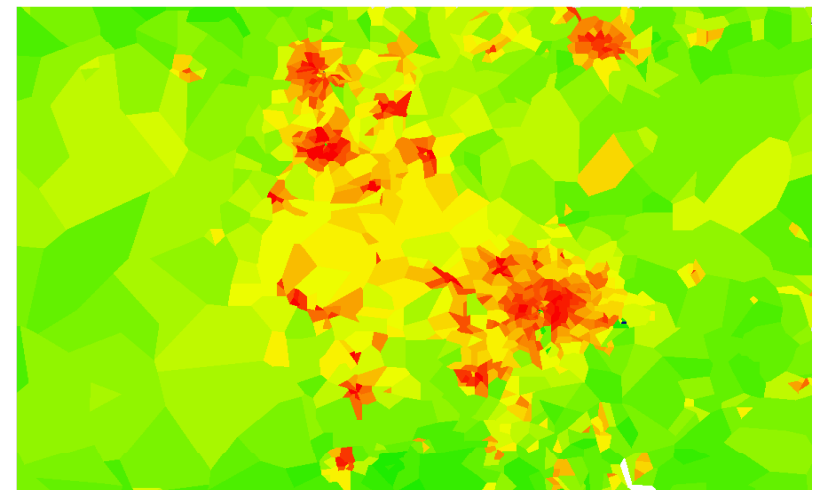
Distance



Adjacency

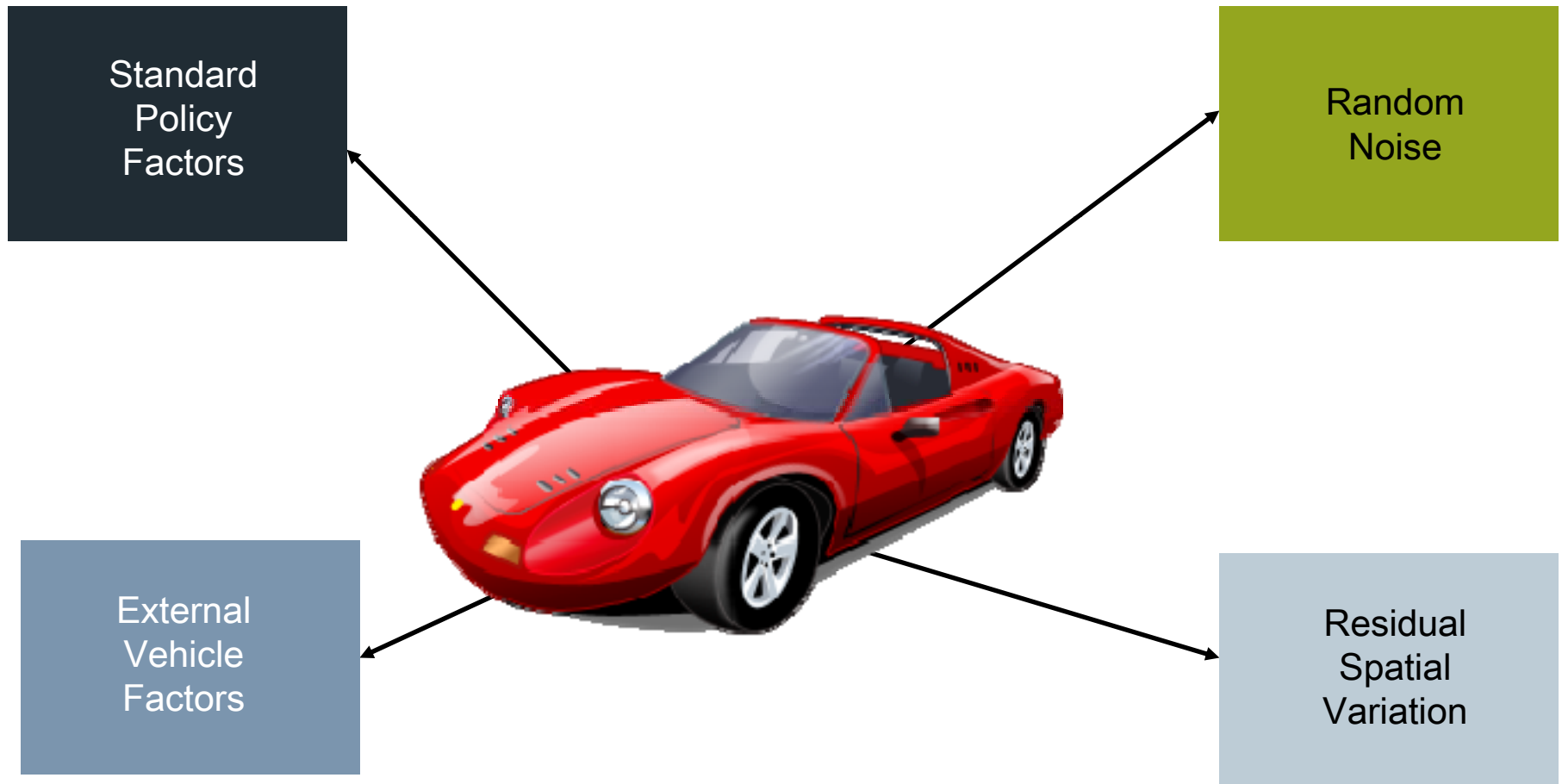


Unsmoothed



Smoothed

Translation to vehicle classification



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Vehicle external data

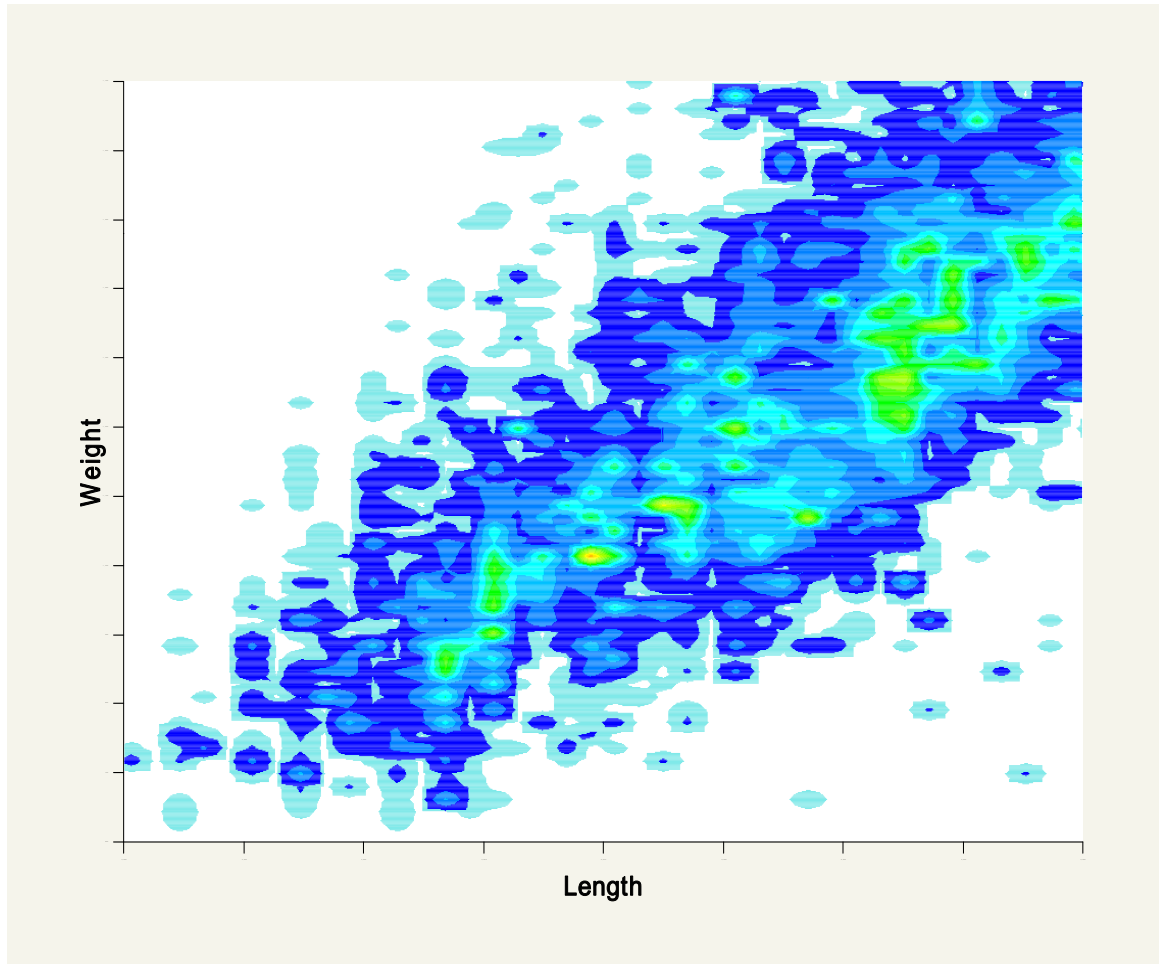
Example Vehicle Attributes

- Performance
 - BHP
- Dimensions
 - Length
- Safety
 - NCAP safety rating
- Security
 - Alarm
- Costs
 - Replacement parts
- Bodystyle Classification

Data Sources

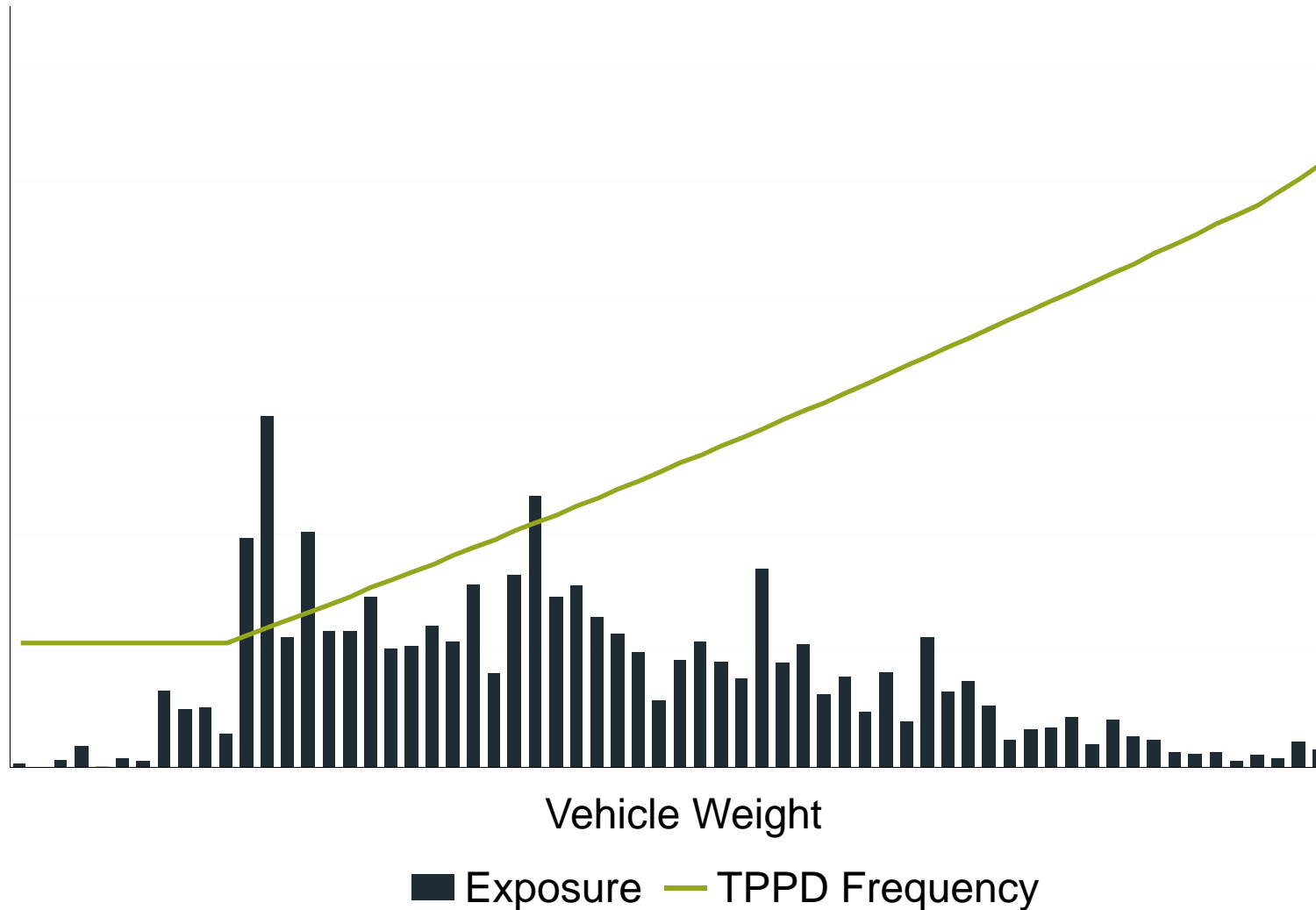
- ABI Code 44
- DVLA
- SoMMT
- Audatex
- Third-parties who collate and cleanse some of the above sources

Using external data wisely

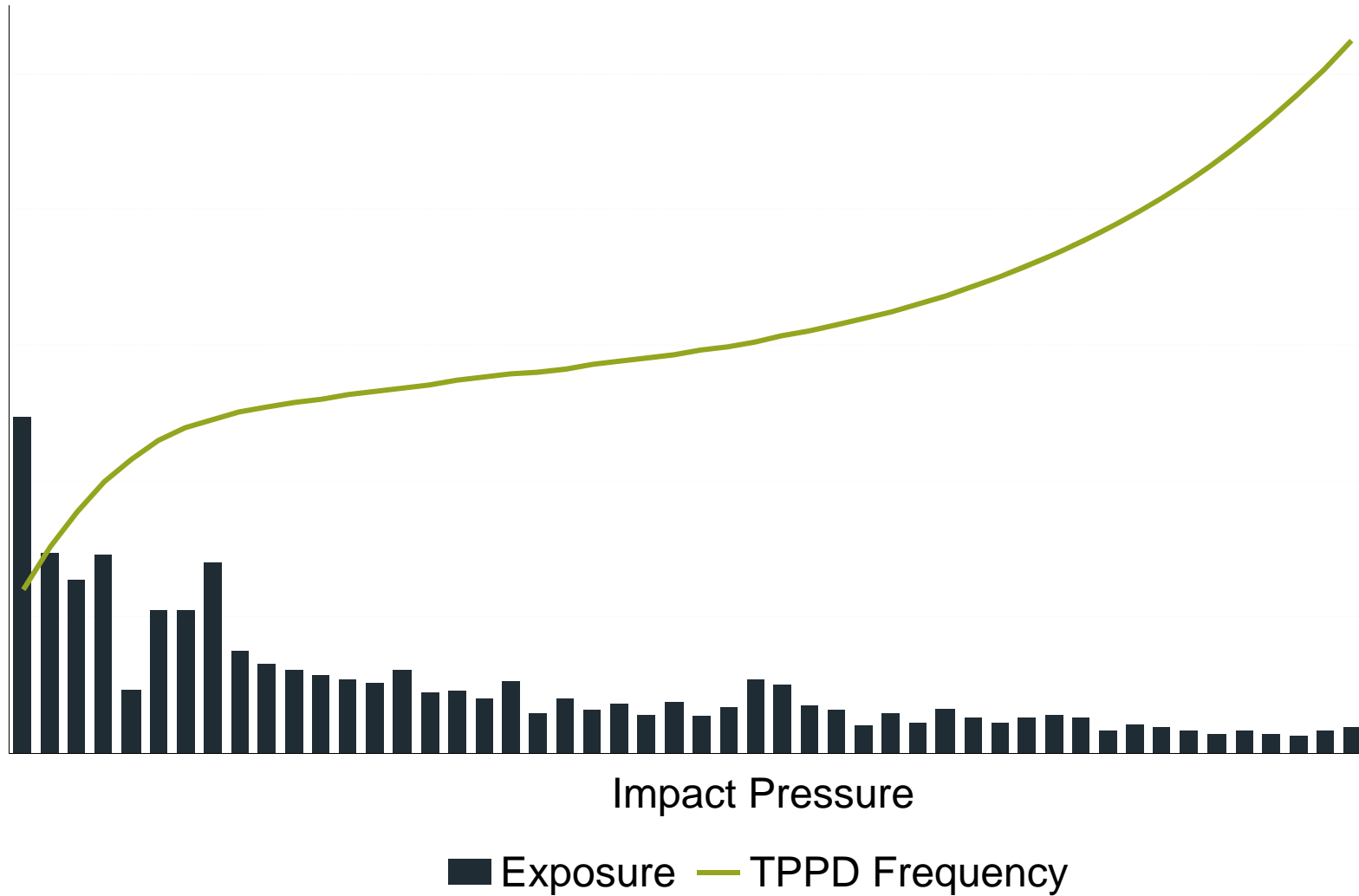


- One-way analysis
- Data visualisation
- GLM
- Stepwise regression
- 'Ratio' variables

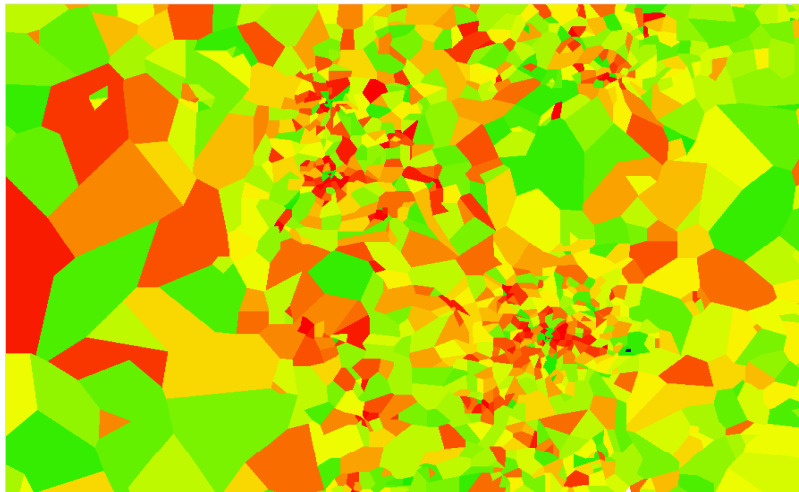
GLM – external factor trend



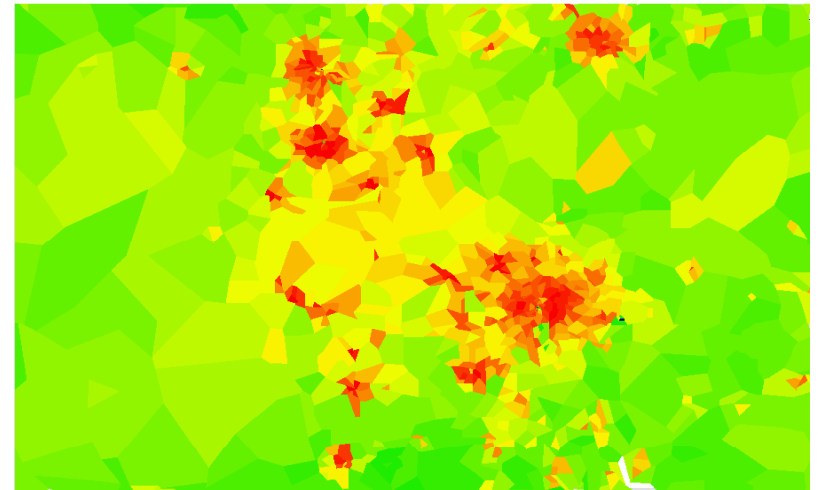
GLM – derived factor trend



Spatial smoothing



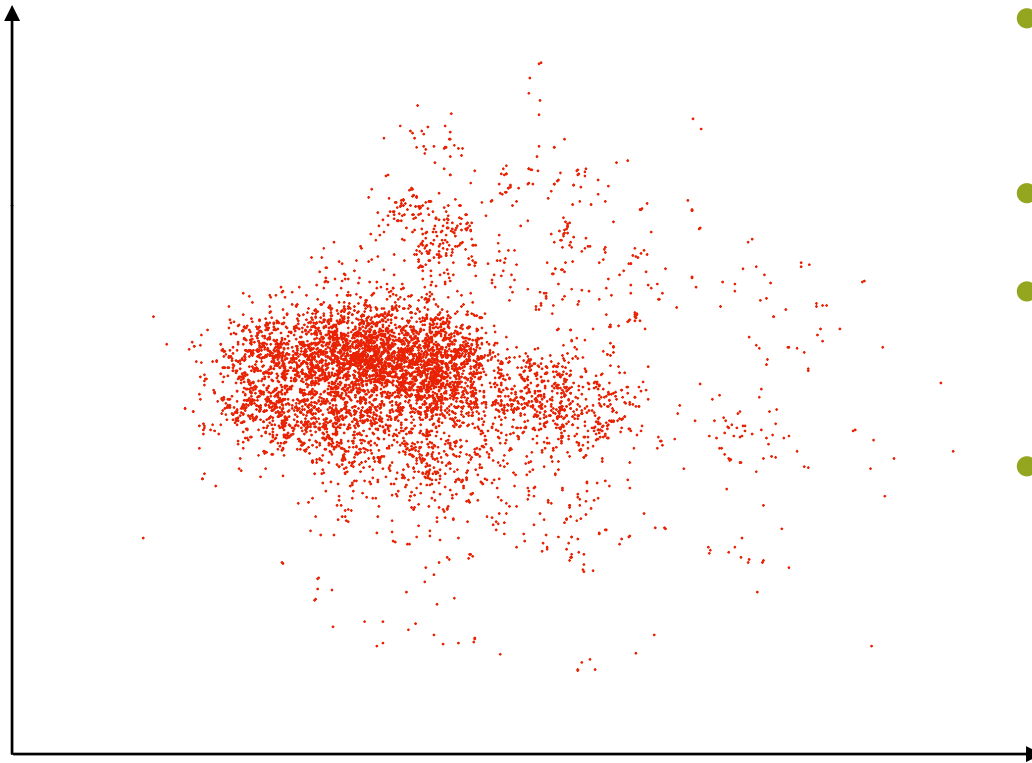
Unsmoothed



Smoothed

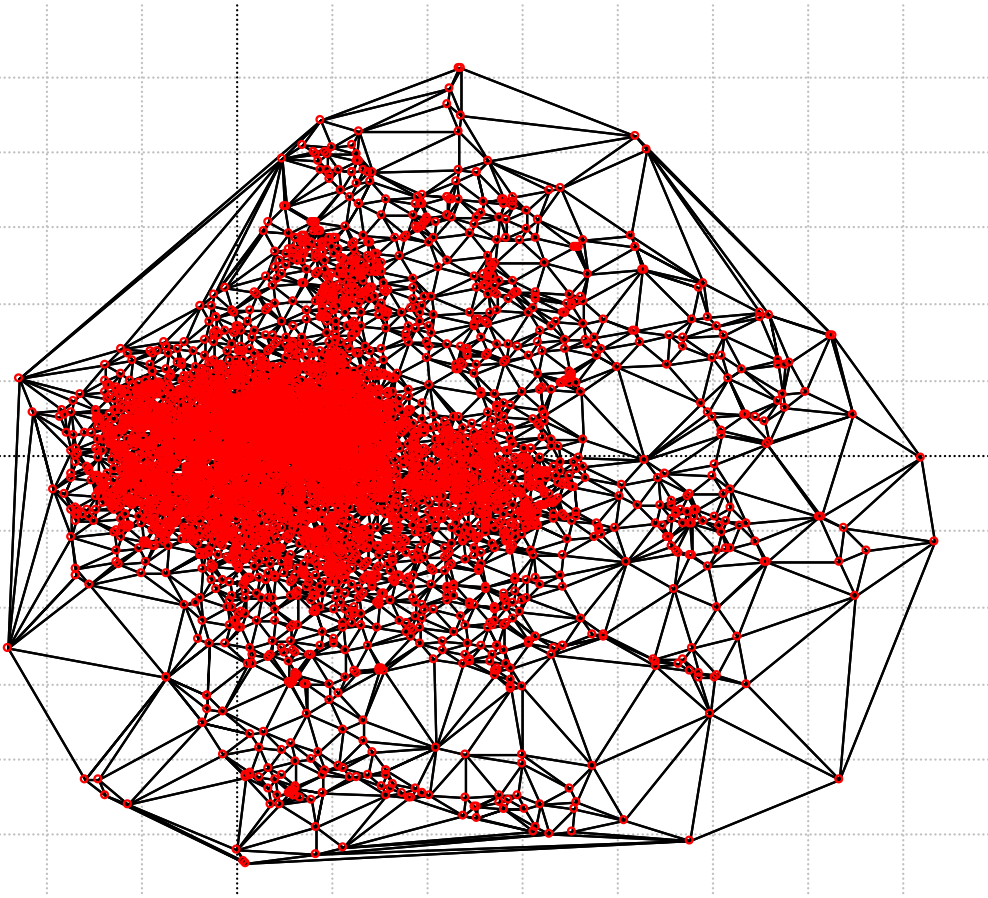
- Relies on location data
- If we can define a co-ordinate system for vehicles...

Vehicle constellation



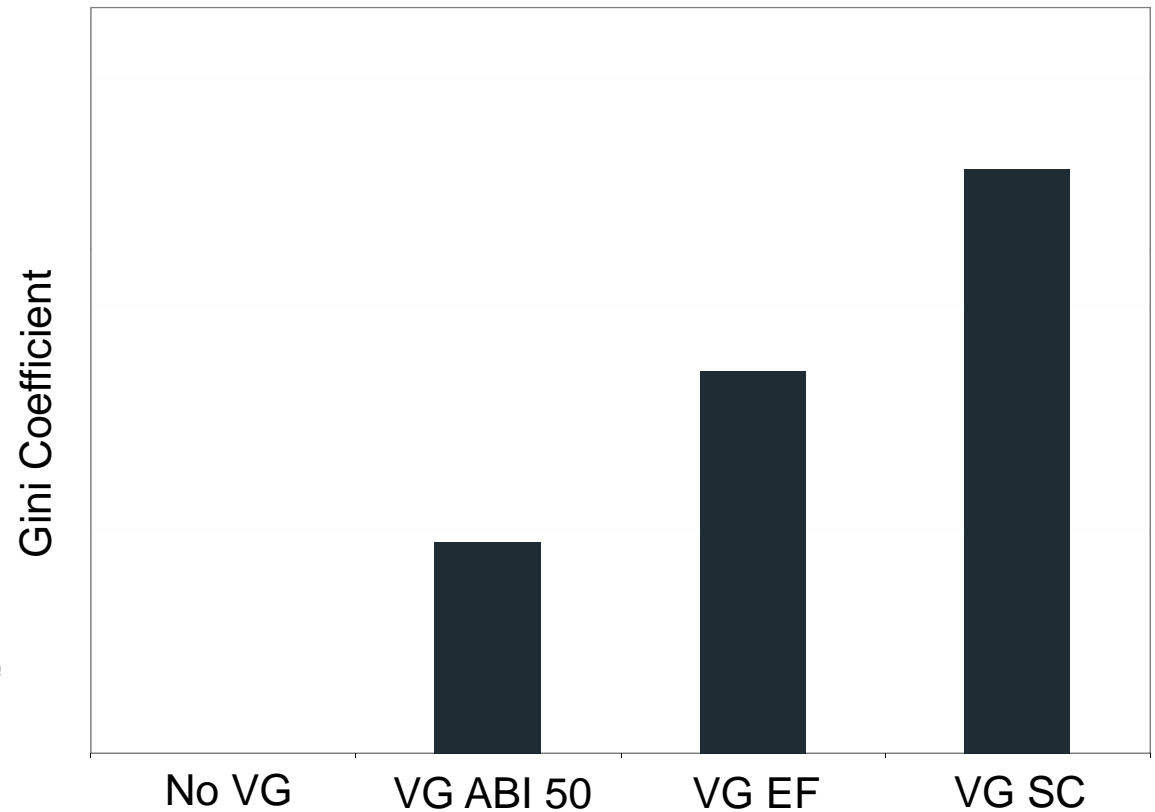
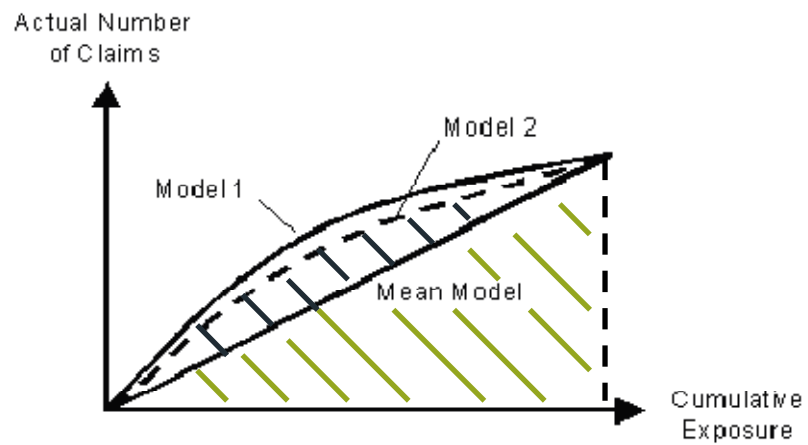
- Select numeric vehicle attributes
- Form a 'space'
- Plot each vehicle against these attributes
- This can be performed in n-dimensions

Vehicle constellation

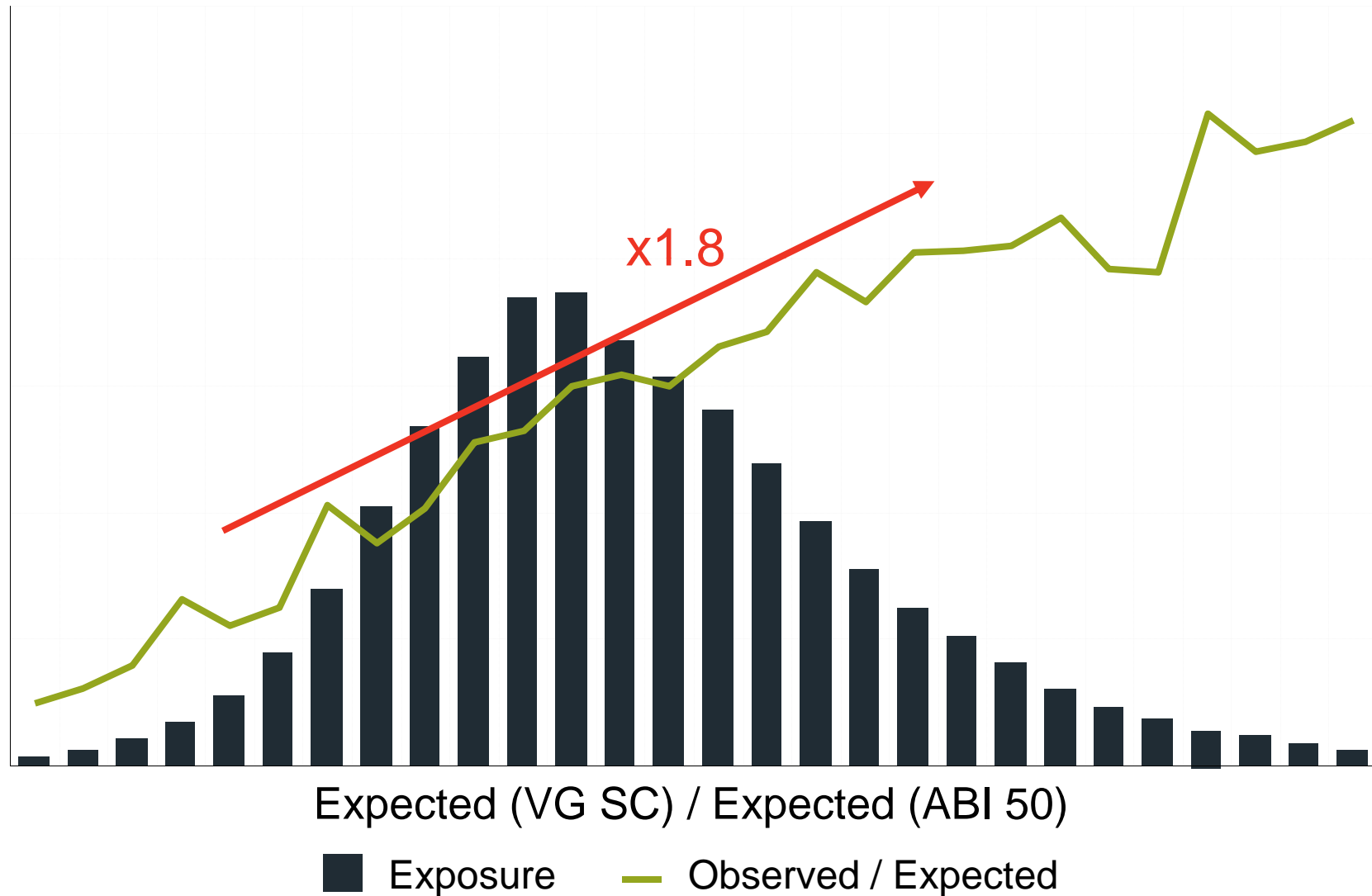


- We can now:
 - calculate distances
 - compute adjacencies
 - perform spatial smoothing

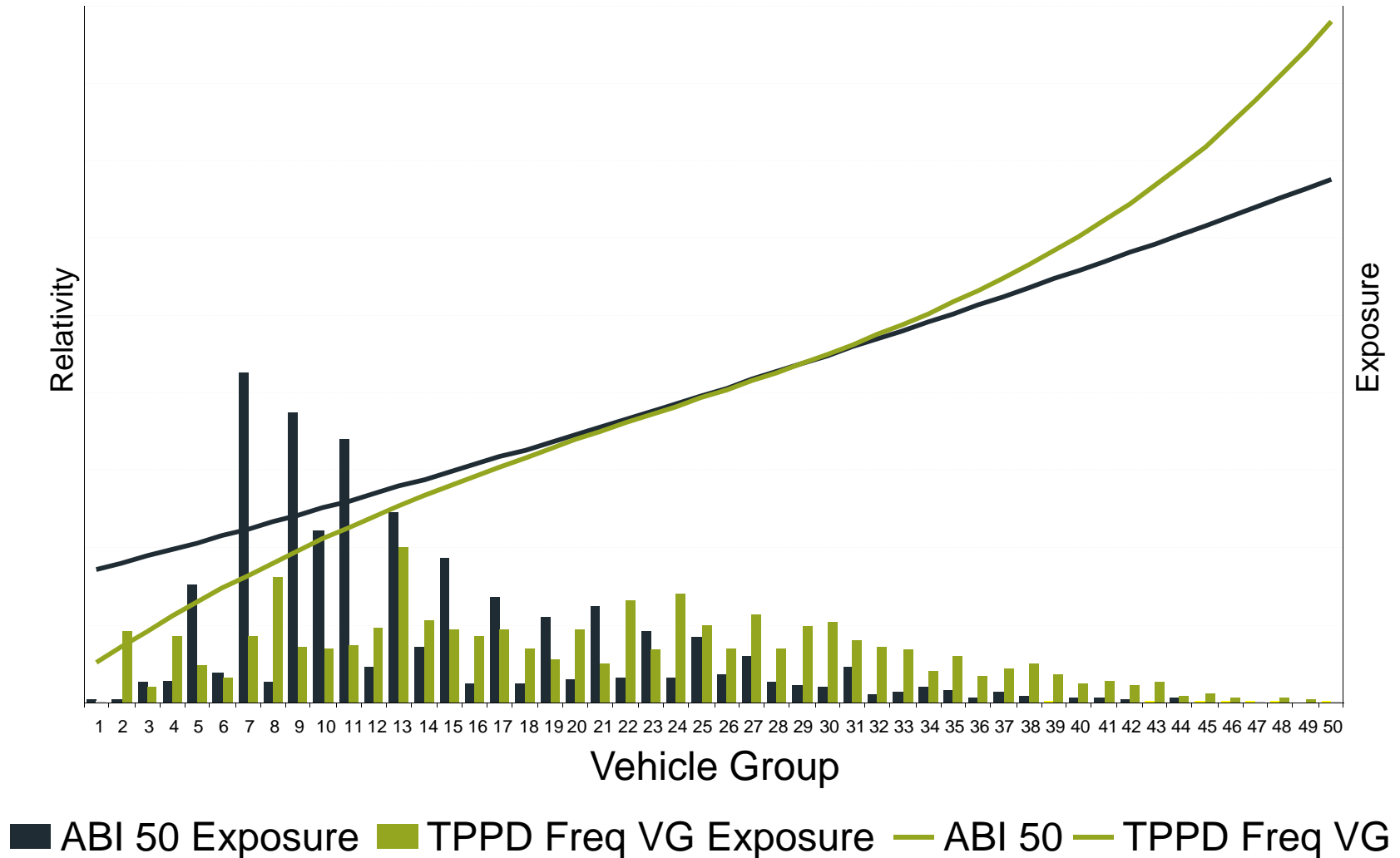
Classification assessment – gains curve



Classification assessment - lift



Performance on TPBI frequency



So what?

- An enhanced vehicle classification approach can deliver more predictive risk models, and so more accurate pricing, and enhanced performance in a competitive market
- Use of explicit vehicle data items, and joint consideration of e.g. body styles, facilitates engagement and communication with underwriters
- The method permits identification/characterisation of groups of vehicles most different from ABI groups, and of “exotic” vehicles
- Vehicle clusters in n-space may provide a basis for an underwriting or risk superfactor framework

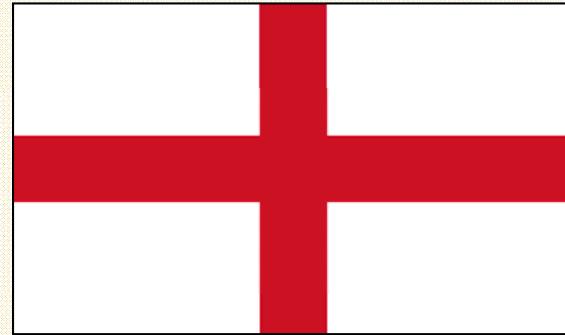
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We interrupt this workshop to bring you some breaking news...

The Actuarial Times

Under new proposals to improve road safety during the summer season when traffic levels on Britain's roads peak, the government has put forward plans under which the stupidest drivers in England will have to identify themselves by displaying distinctive red and white flags on each side of the car. In extreme cases, more than two flags will need to be carried.



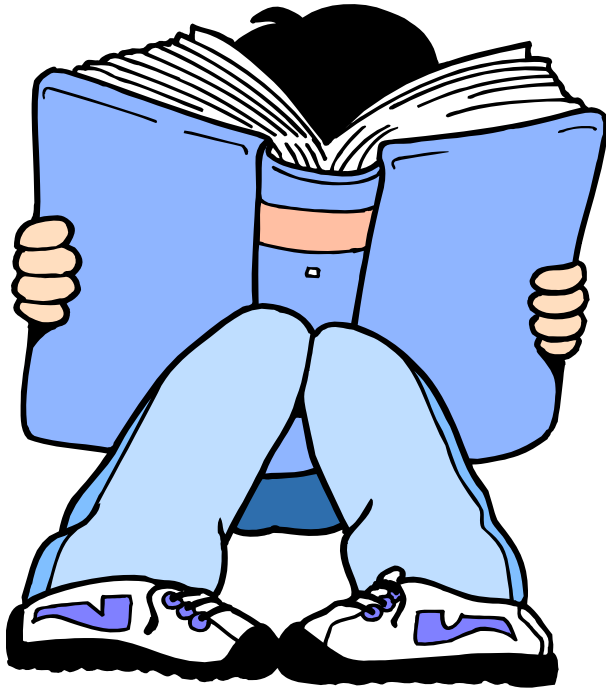
‘This is not discrimination, it is common sense,’ said new Transport Minister Norman Baker MP. ‘Some aggressive young men with brains the size of sweetcorn are a dangerous menace on our roads. With this requirement in place, at least other drivers and pedestrians will be able to see them coming.’

The vehicle/operator problem

- We're not going to say how to solve this, but merely provide some pointers
- Important observations:
 - Different vehicle types attract different types of driver
 - There are strong correlations between the vehicle and operator factors available to risk modellers
 - Often these correlations involve combinations of each of vehicle and operator factors
 - Underwriters commonly think in terms of vehicle/operator

What cars do different occupations drive?

Student



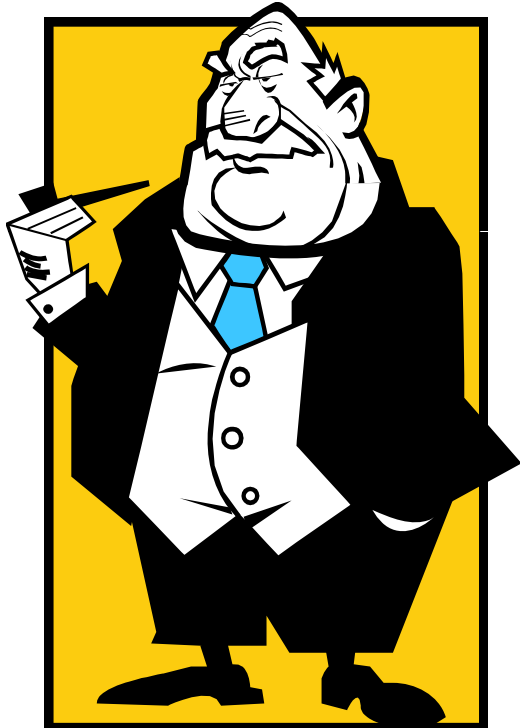
What cars do different occupations drive?

Accountant



What cars do different occupations drive?

Company Director



What cars do different occupations drive?

Hairdresser



What cars do different occupations drive?

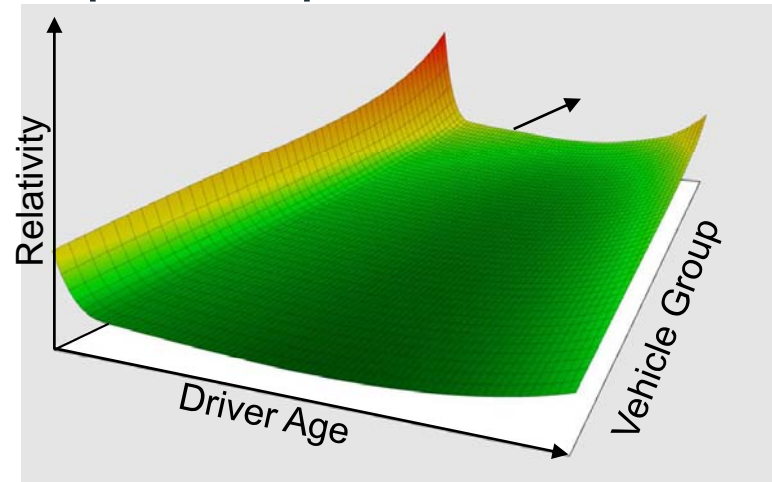
Fortune Teller



Allowing for the vehicle operator relationship

1. Interactions between vehicle group and operator variables:

- Age
- Driver restriction
- Occupation
- Class of use
- Gender etc.



2. Interaction between vehicle group and “operator group”
3. Grand unified classification (vehicle/operator grouping)
4. Segmentation techniques

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.

