The Actuarial Profession
making financial sense of the future

Momentum 2010
Neil Chapman and Graham Wright, EMB

Enhancements to
Risk Modelling
Personal Lines Pricing

9 December 2010

Enhancements to risk modelling
Personal lines pricing

Pictures
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Pictures
removed

Geographical

Classification

Vehicle

Allocation

Enhancements to risk modelling
Personal lines pricing

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Geographical

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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

What drives differences in experience?

Flood risk

Storm exposure

Density of traffic

Fire station distance

Map removed

Driving speed

Likelihood to exaggerate claims

Repair cost

State of roads

Risk assessment

Map
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**What we want from
the classification?**

Postcodes – specifying location

KT   Postcode Area   124

KT17   Postcode District 3,064

KT17 1 Postcode Sector 11,598

Map
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KT17 1HB Postcode Unit 1.78m

We want:

- A balance of a manageable number of areas and exposure in each area…

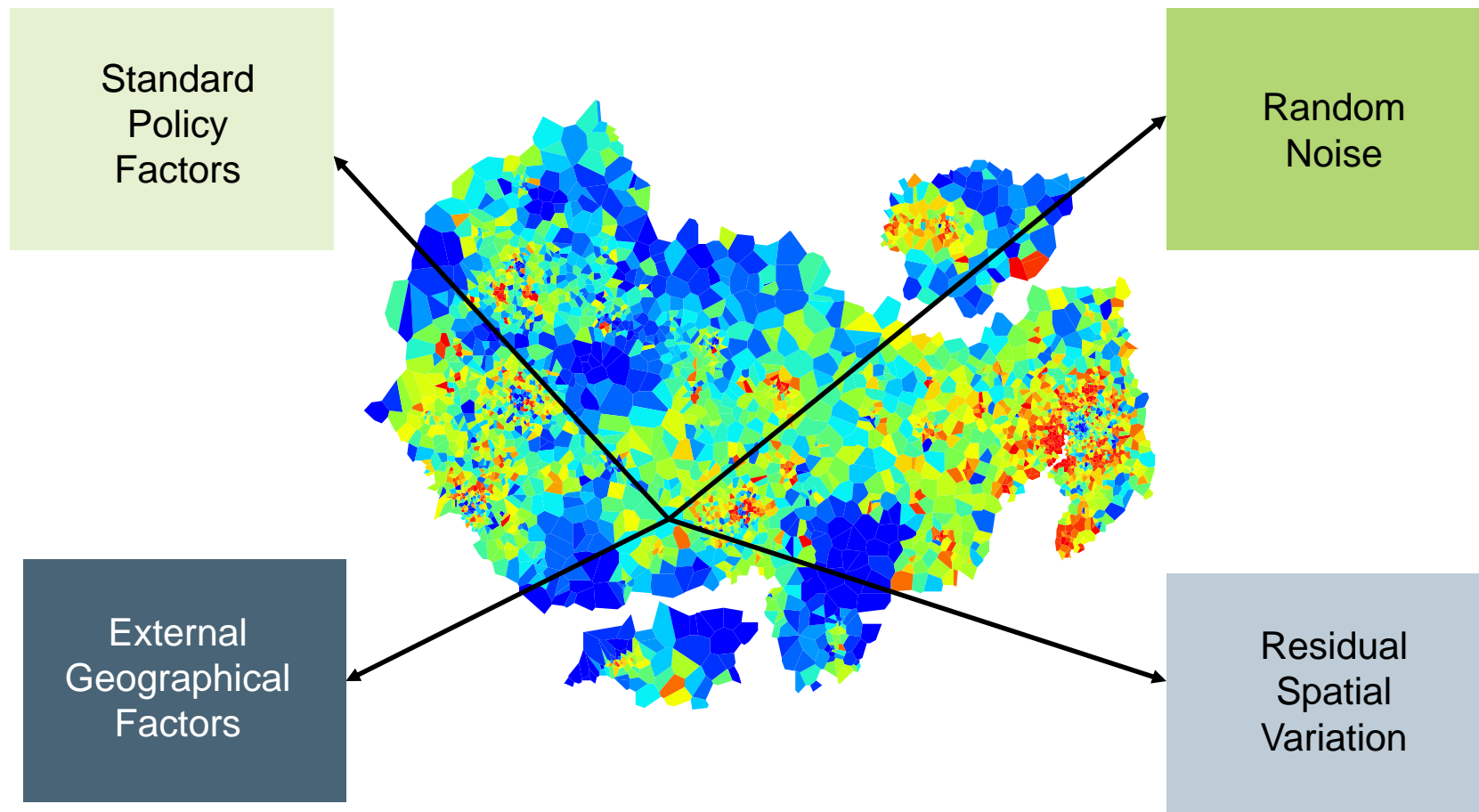- …against variation of risk within area
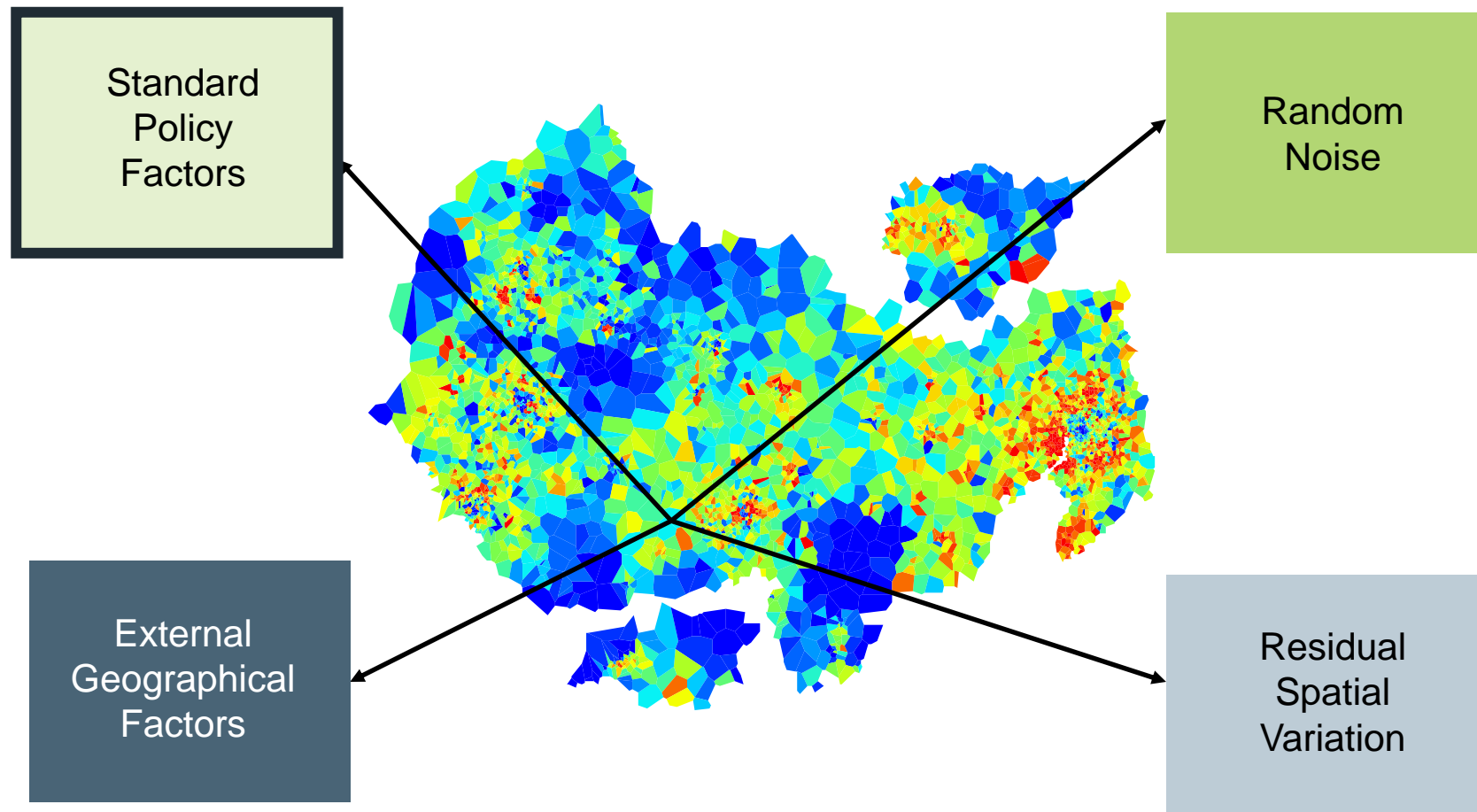
What do we want?

Retain localised variation

Predictive

Graphs
removed

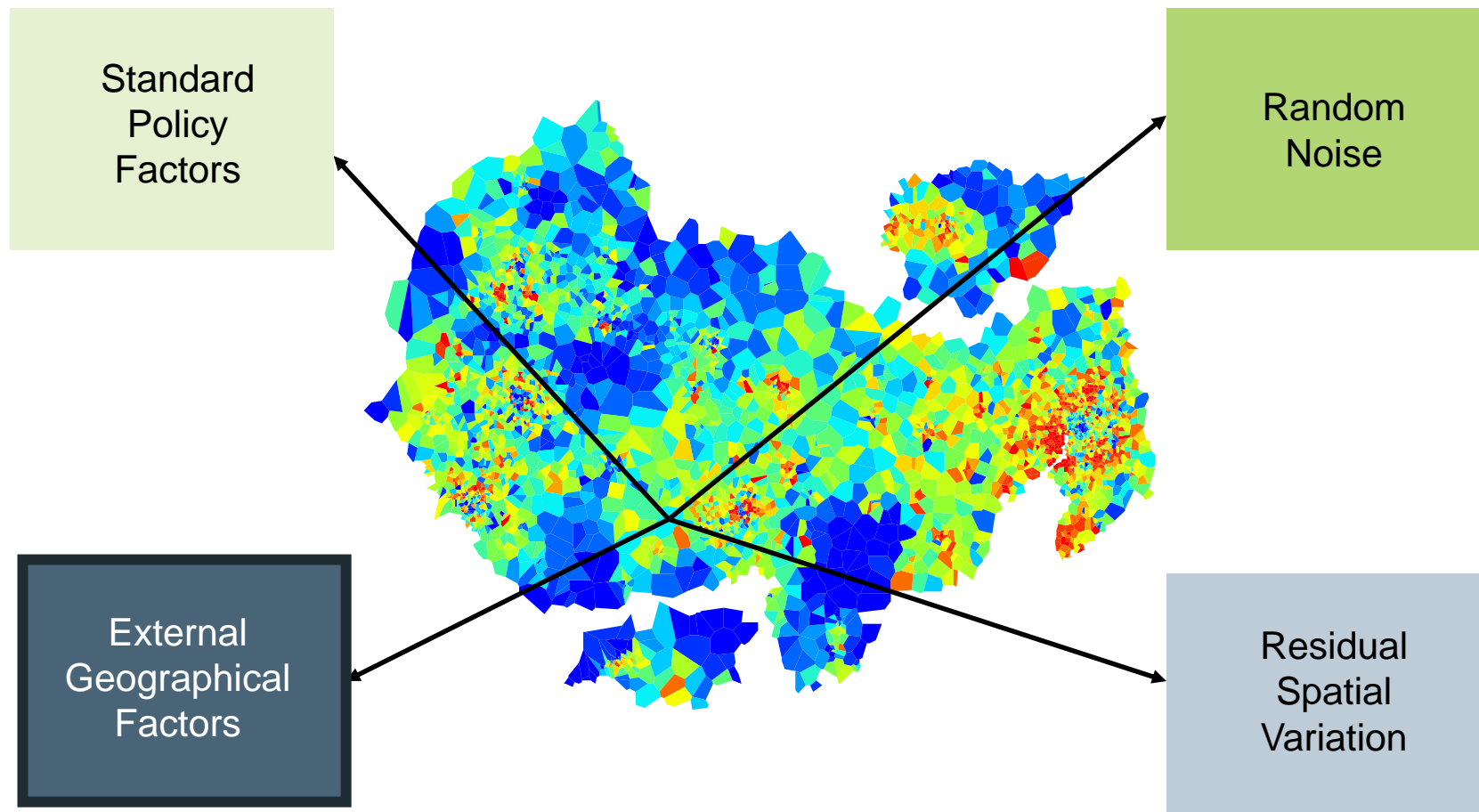Predictive regionally

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
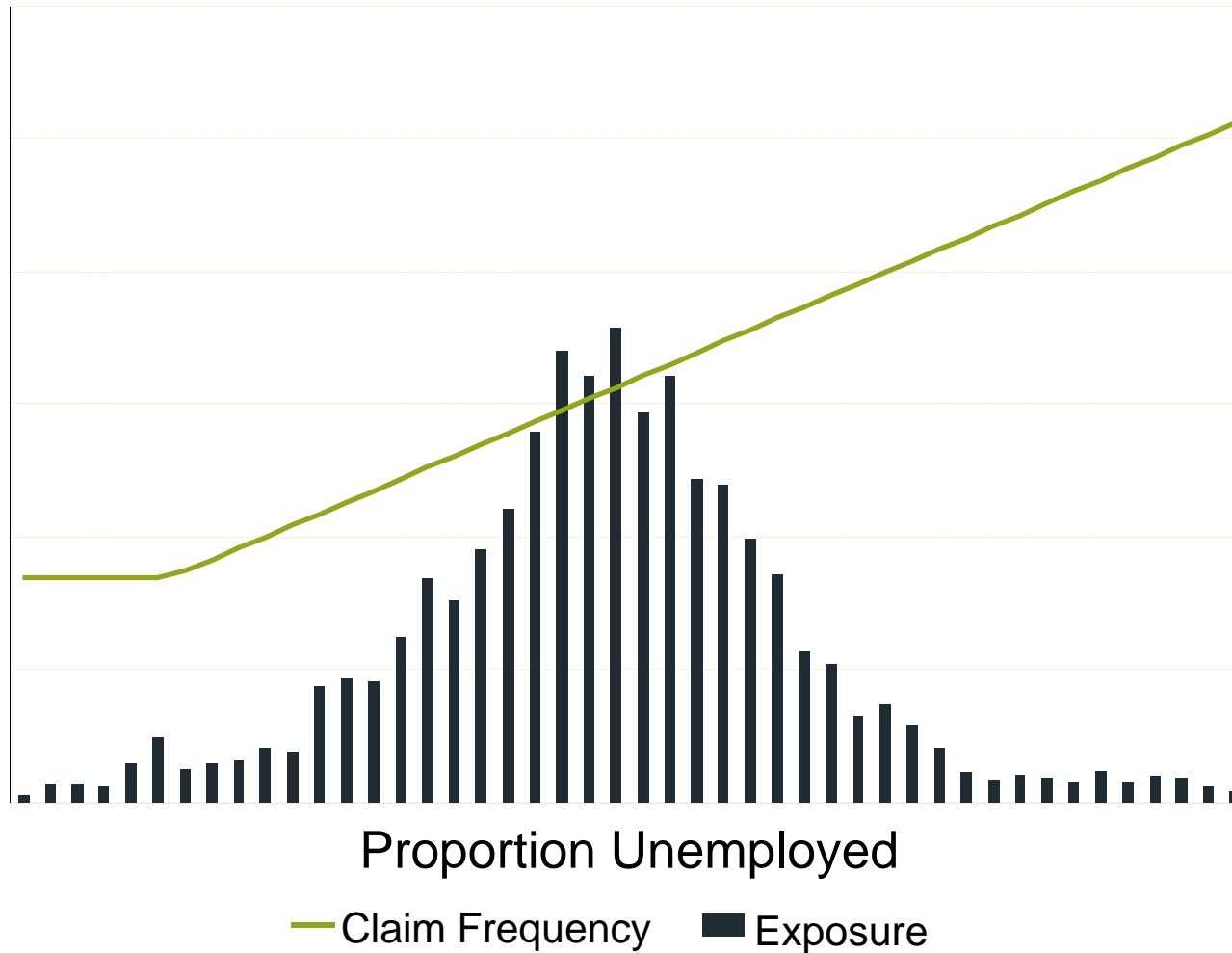
Standard Policy Factors

Random Noise

External Geographical Factors

Residual Spatial Variation

GLM geo-demographics

Proportion Unemployed

—— Claim Frequency   ■ Exposure

Postcoding - framework

Standard Policy Factors

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External Geographical Factors
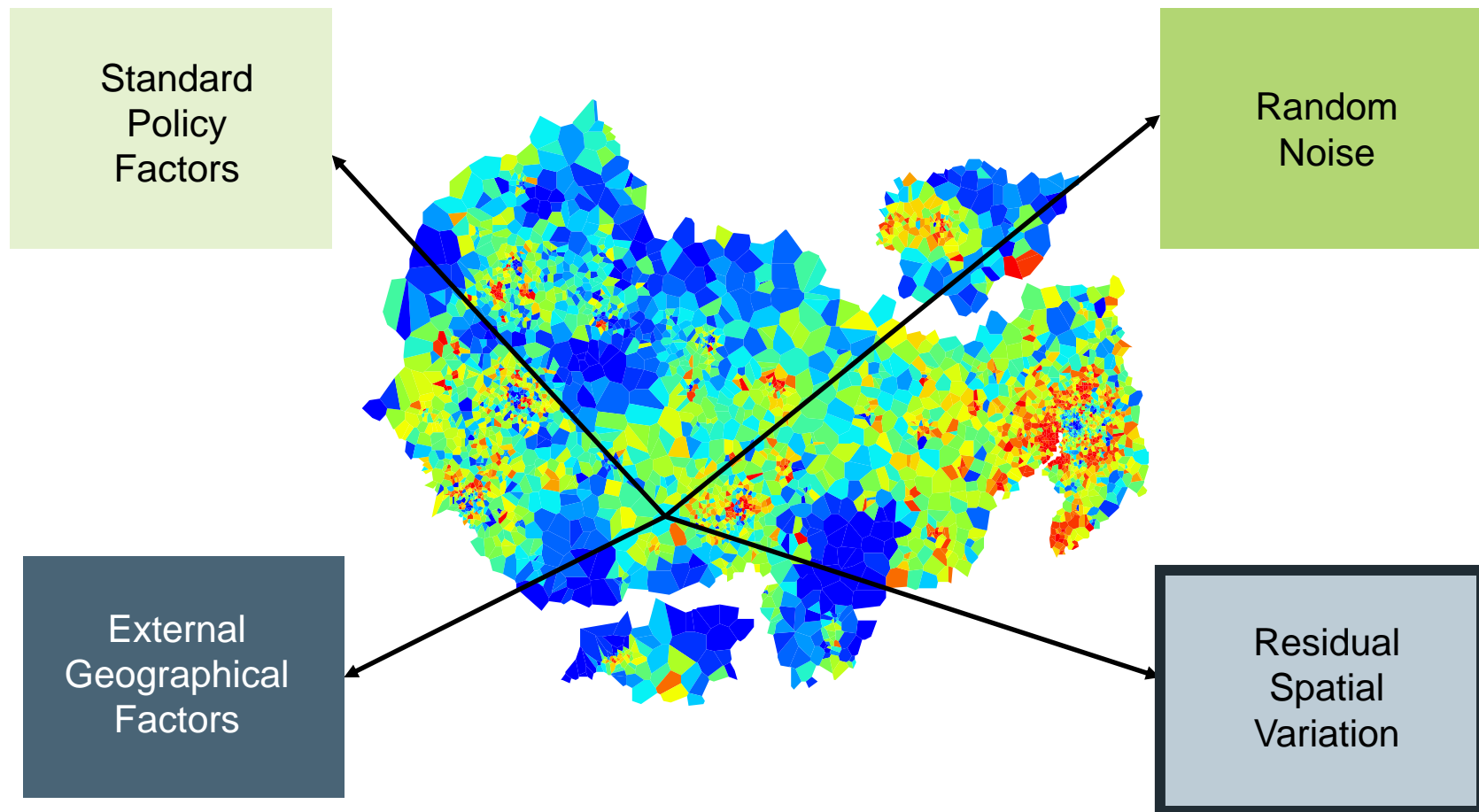
Residual Spatial Variation

Spatial smoothing

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

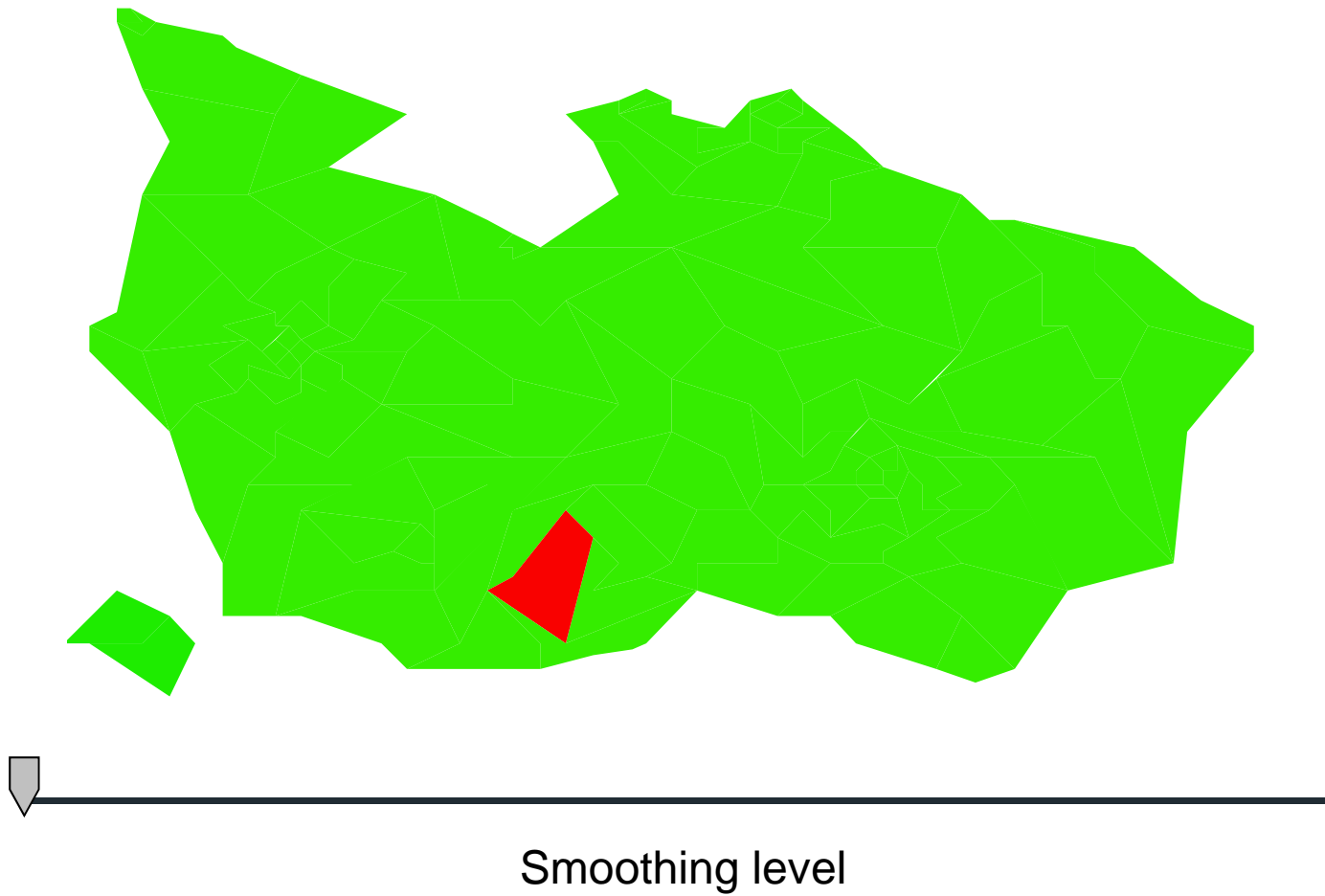Graph
removed

Distance   Adjacency

Graph
removed

→

Graph
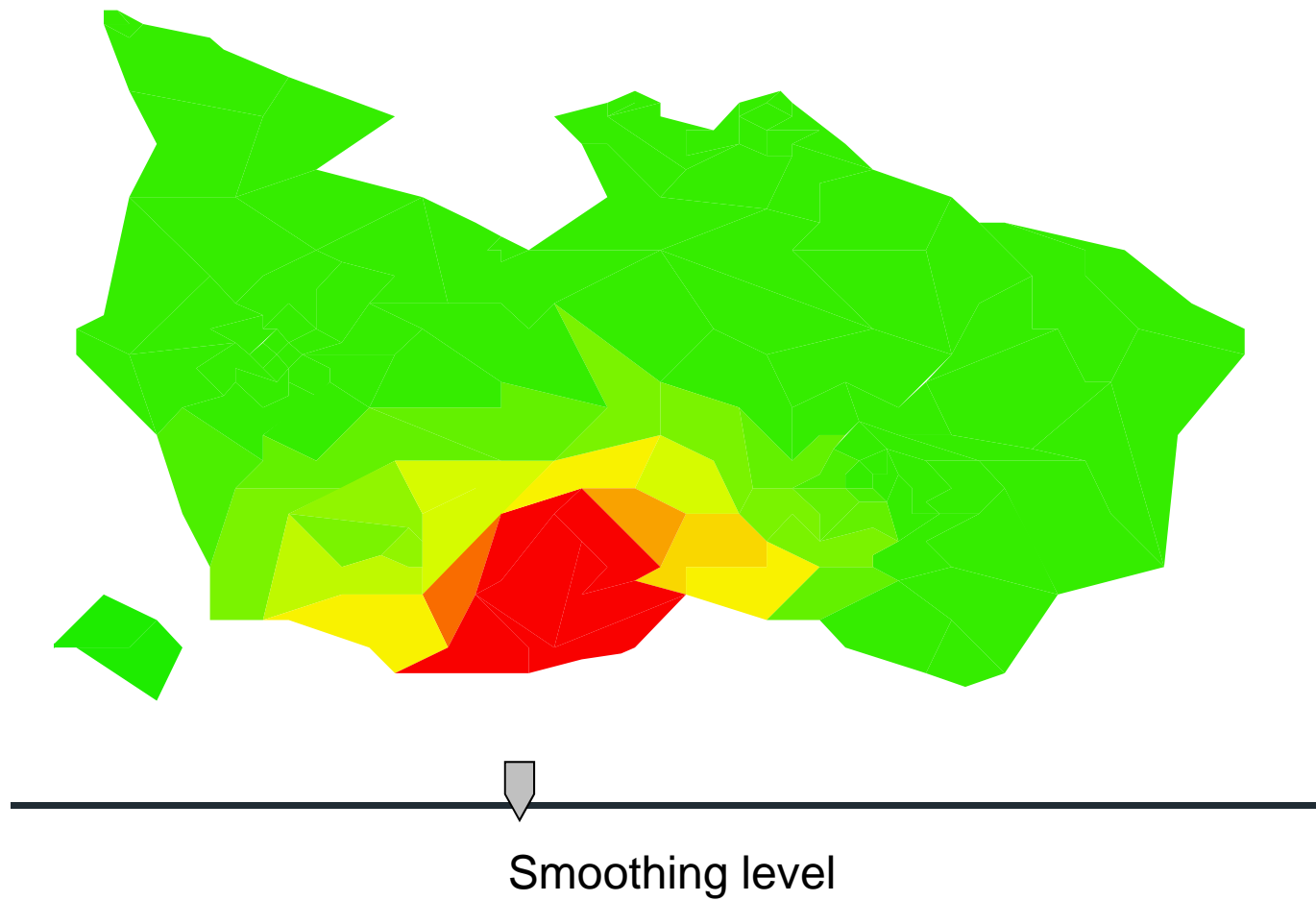removed
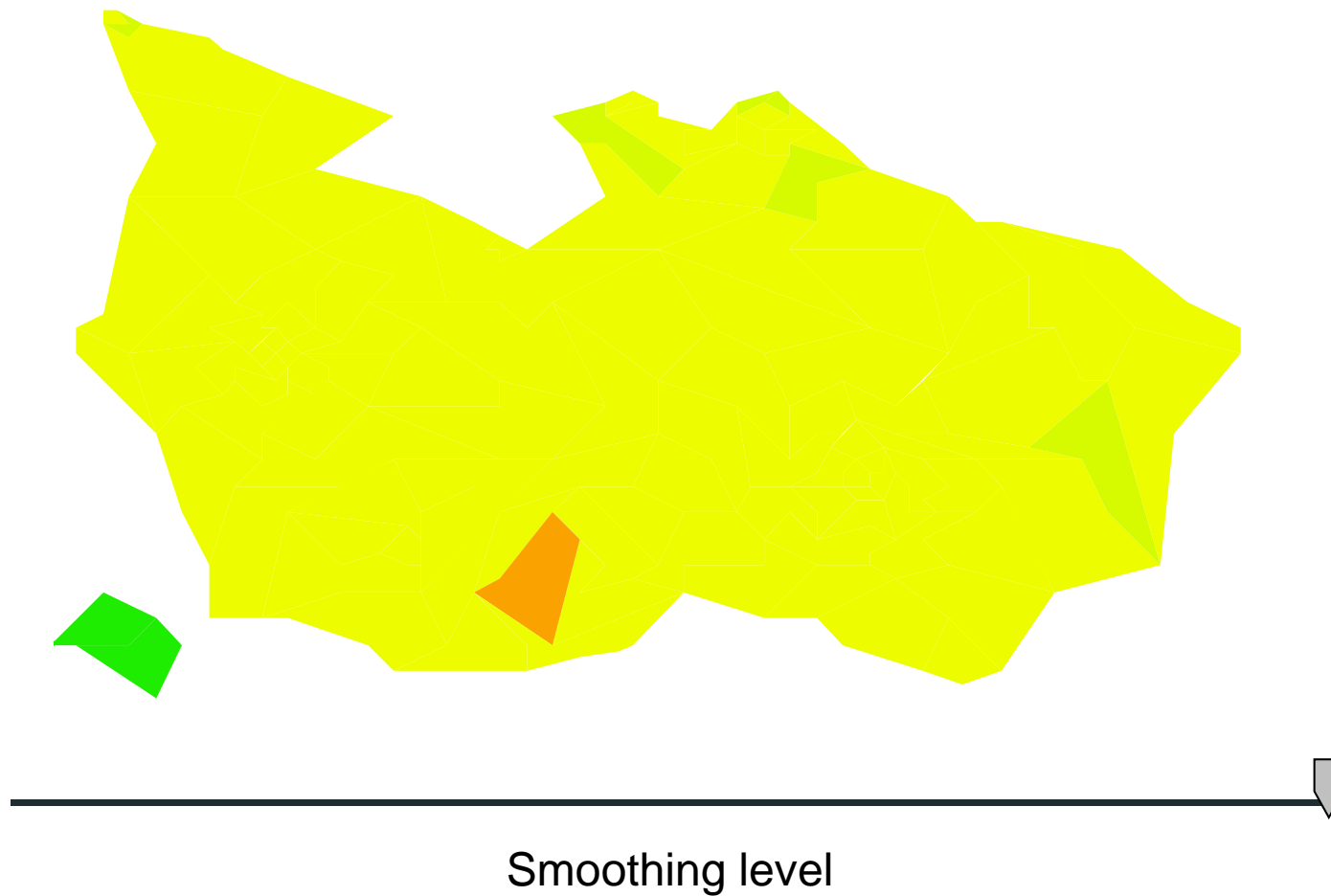
Unsmoothed   Smoothed
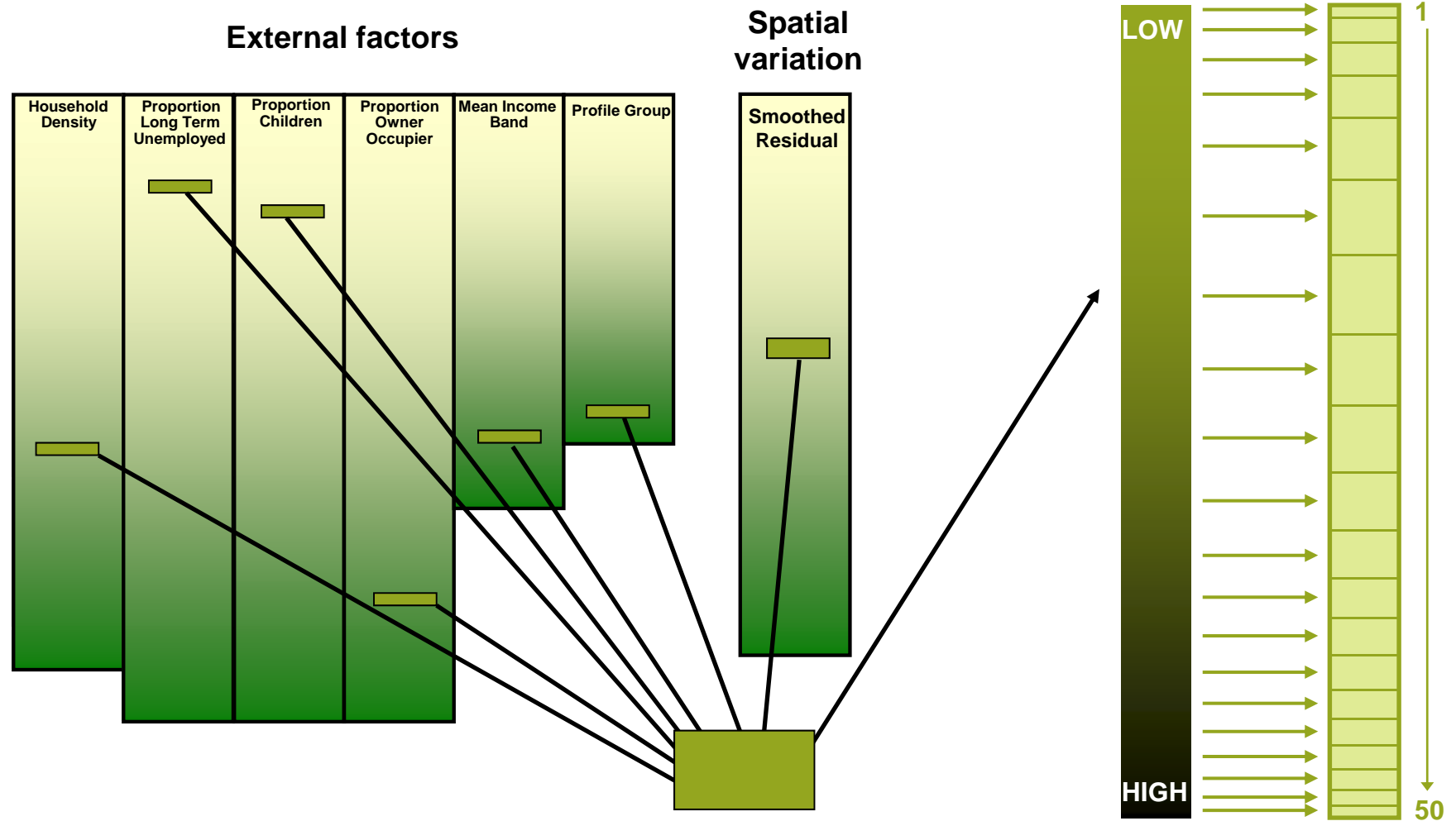
15

Adjacency-based spatial smoothing

Smoothing level

Adjacency-based spatial smoothing

Smoothing level

Adjacency-based spatial smoothing

Smoothing level

Postcode allocation

Postcode classification – where are we now?

KT	69%
YO	71%
HU	75%
…	…

Loss ratio assessment by district

Basic postcode allocation using external data

Spatial smoothing of residual effects

Effort required

Degree of sophistication
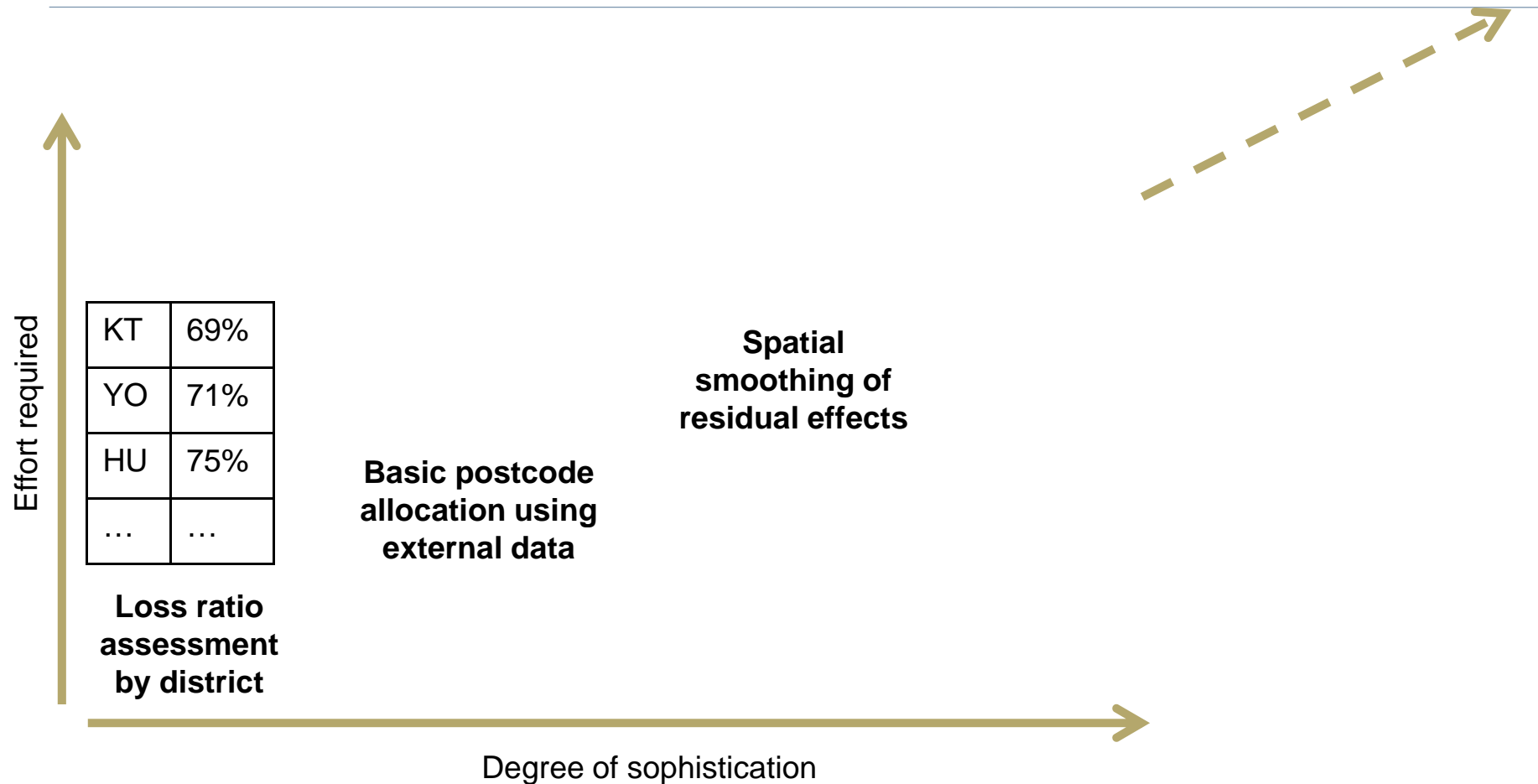
– So we're done. Or are we?

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

Graphs removed

- 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)

Graphs removed

Graphs removed

- – 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

Graph
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- Expect higher observed values when the unit allocation has increased the scores

- Results for motor show a moderate improvement

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Are the unit level results better for household?

Graph
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– Applied the same methodology for household

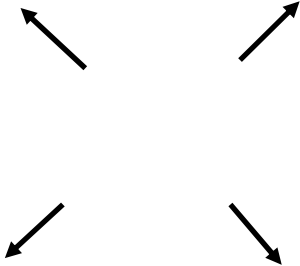– Results for Buildings and Contents both show significant improvement

Graph
removed

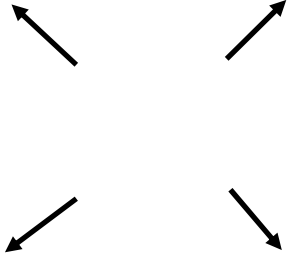– But can we improve our allocations further?

Are the claim types so different?

– Mapping claims experience shows significant differences geographically by claim type

Maps
removed

Maps
removed

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?

Graph removed
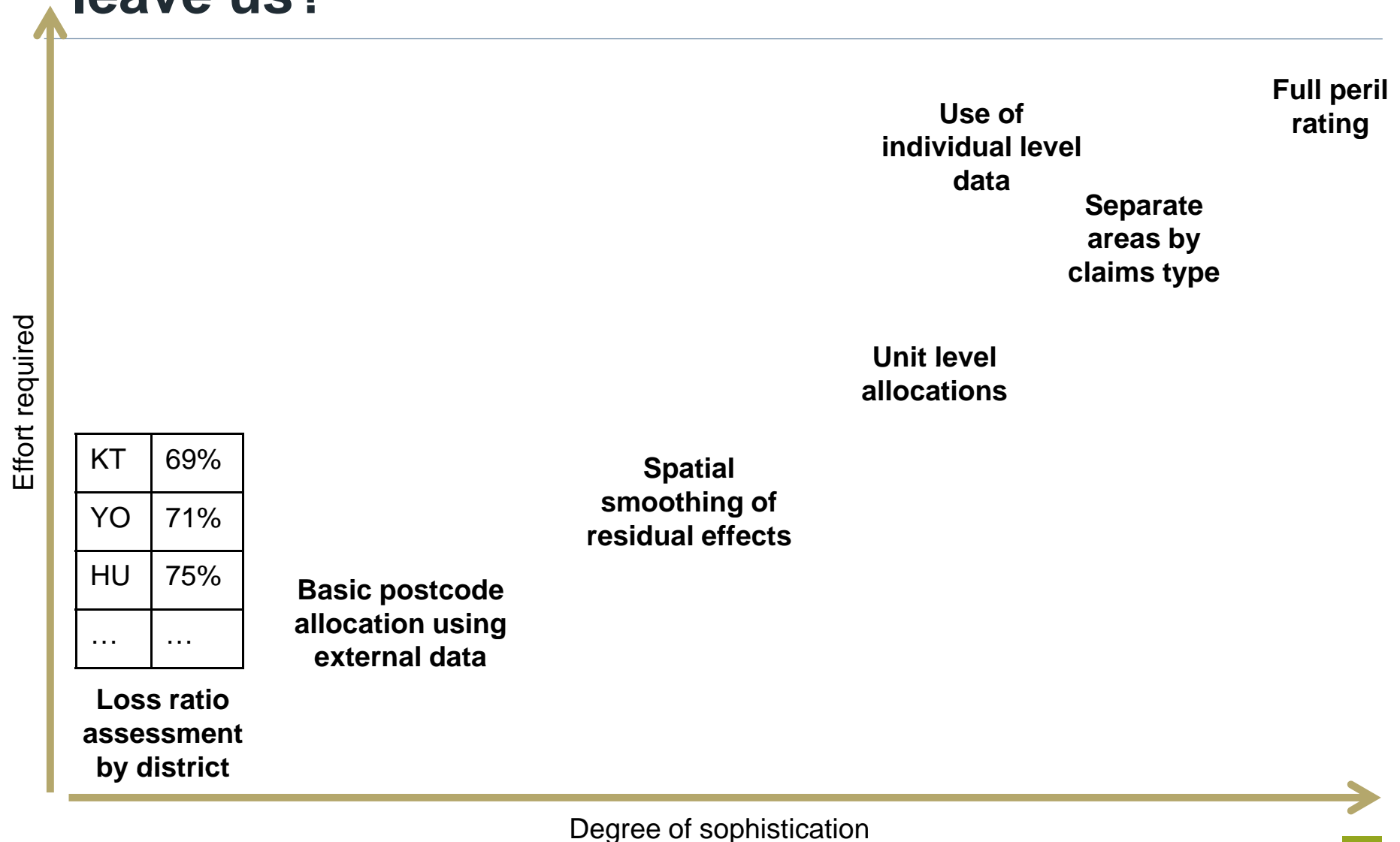
Apply claim type areas to claim type risk models

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?

Effort required (vertical axis)

Degree of sophistication (horizontal axis)

KT	69%
YO	71%
HU	75%
…	…

Loss ratio assessment by district

Basic postcode allocation using external data

Spatial smoothing of residual effects

Unit level allocations

Use of individual level data

Separate areas by claims type

Full peril rating

Enhancements to risk modelling
Personal lines pricing

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Pictures
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Geographical

Classification

Vehicle

Allocation
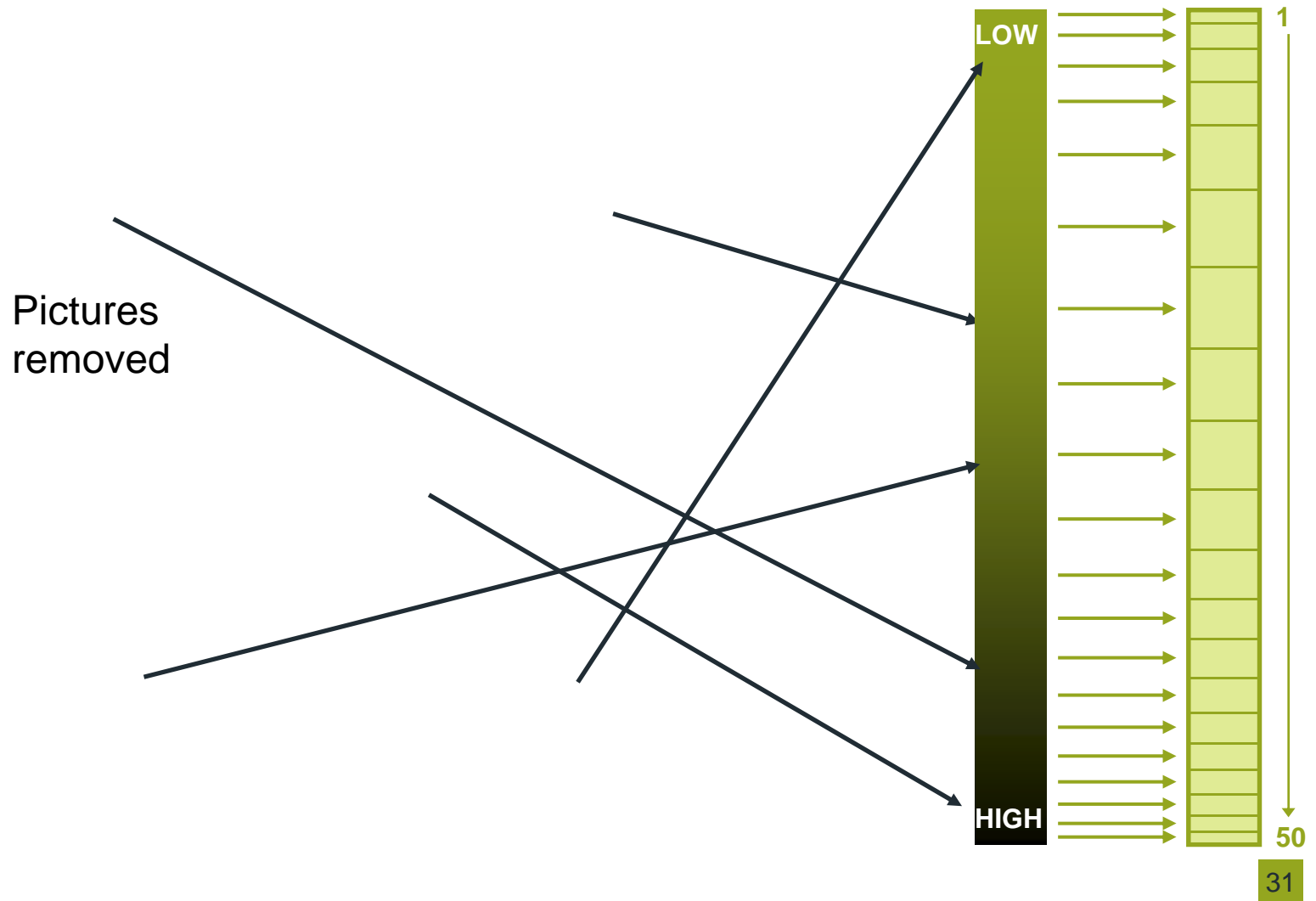
Enhancements to risk modelling
Personal lines pricing

Pictures
removed

Pictures
removed

Geographical

Classification

Vehicle

Allocation

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What is a vehicle allocation?

Pictures removed

LOW

HIGH

1

50

Why this matters

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

Car classification – spectrum of approaches

Effort required

ABI 50
classification

Degree of sophistication
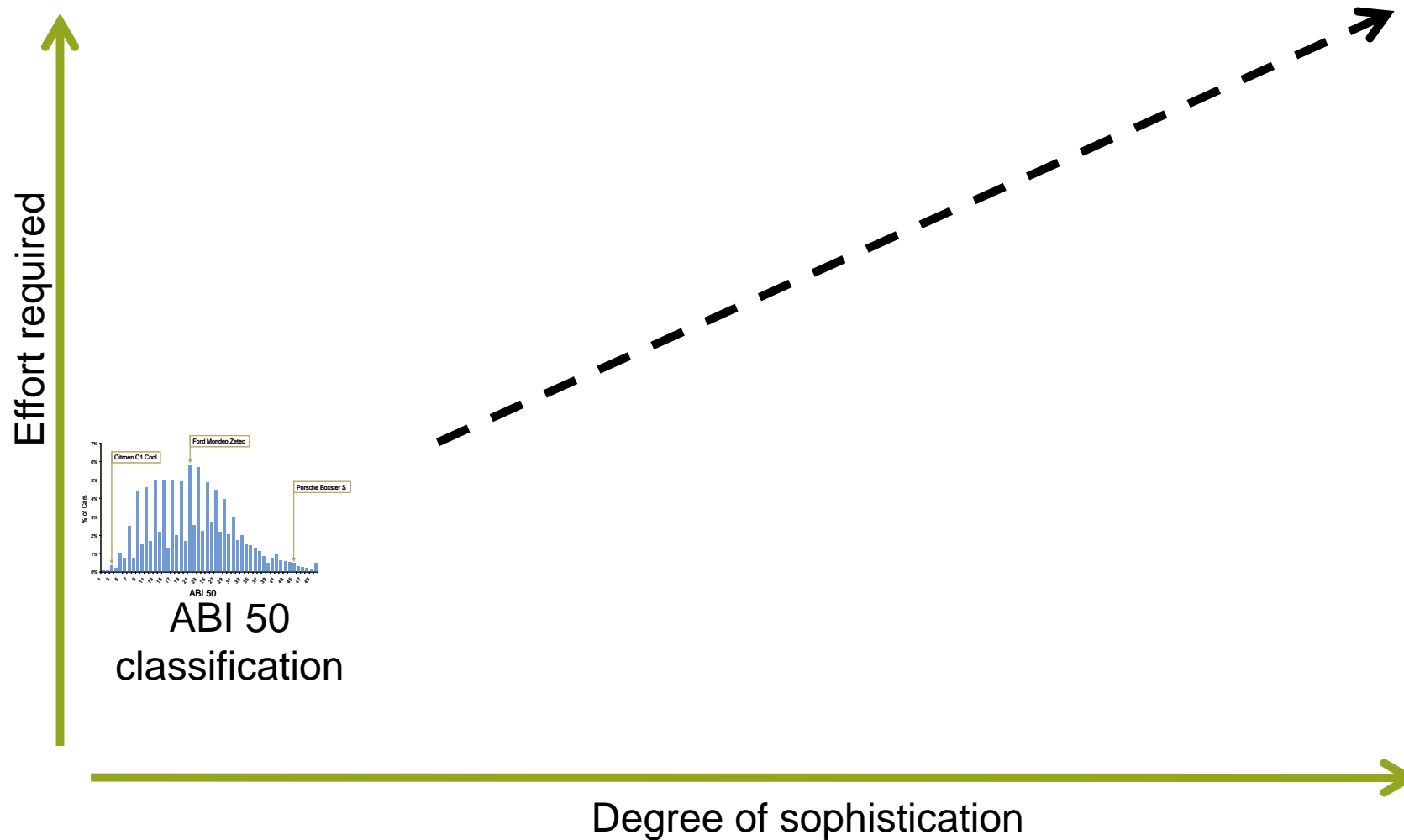
The starting point – the ABI 50 vehicle classification

- 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?

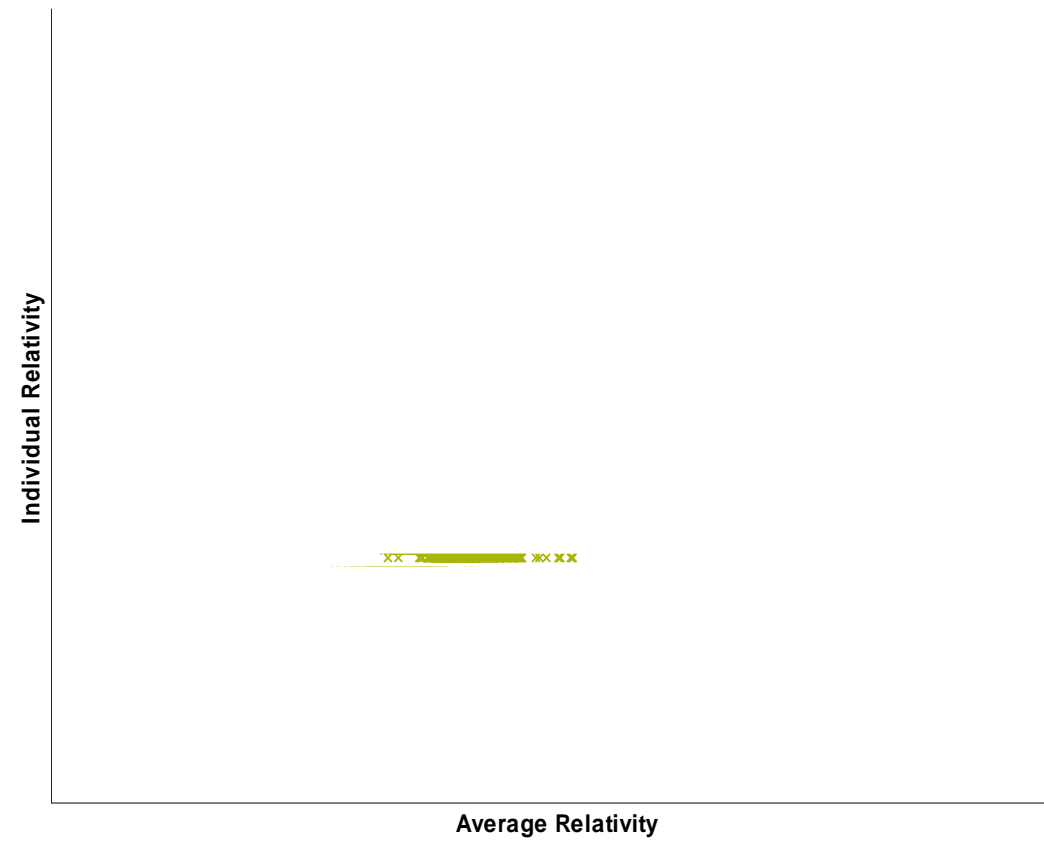- Better predictor of AD claims experience than TP?

But...

- does not acknowledge all vehicle attributes

- does not make full use of the 50 groups

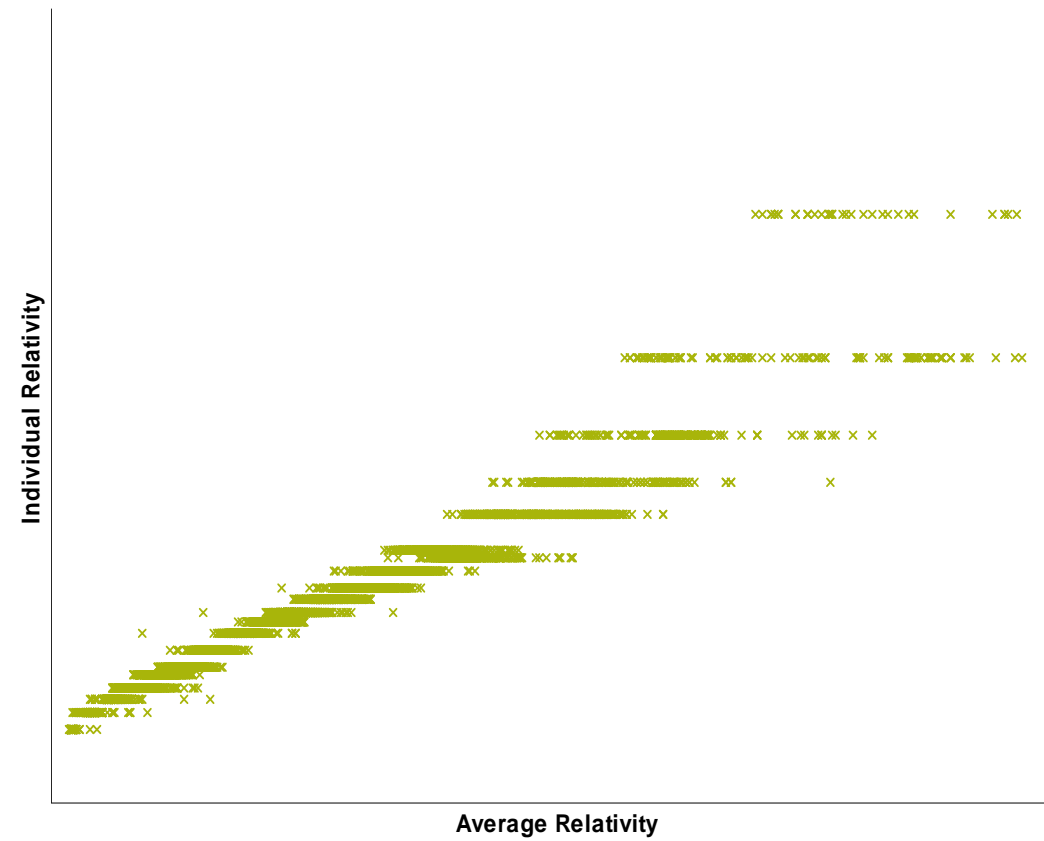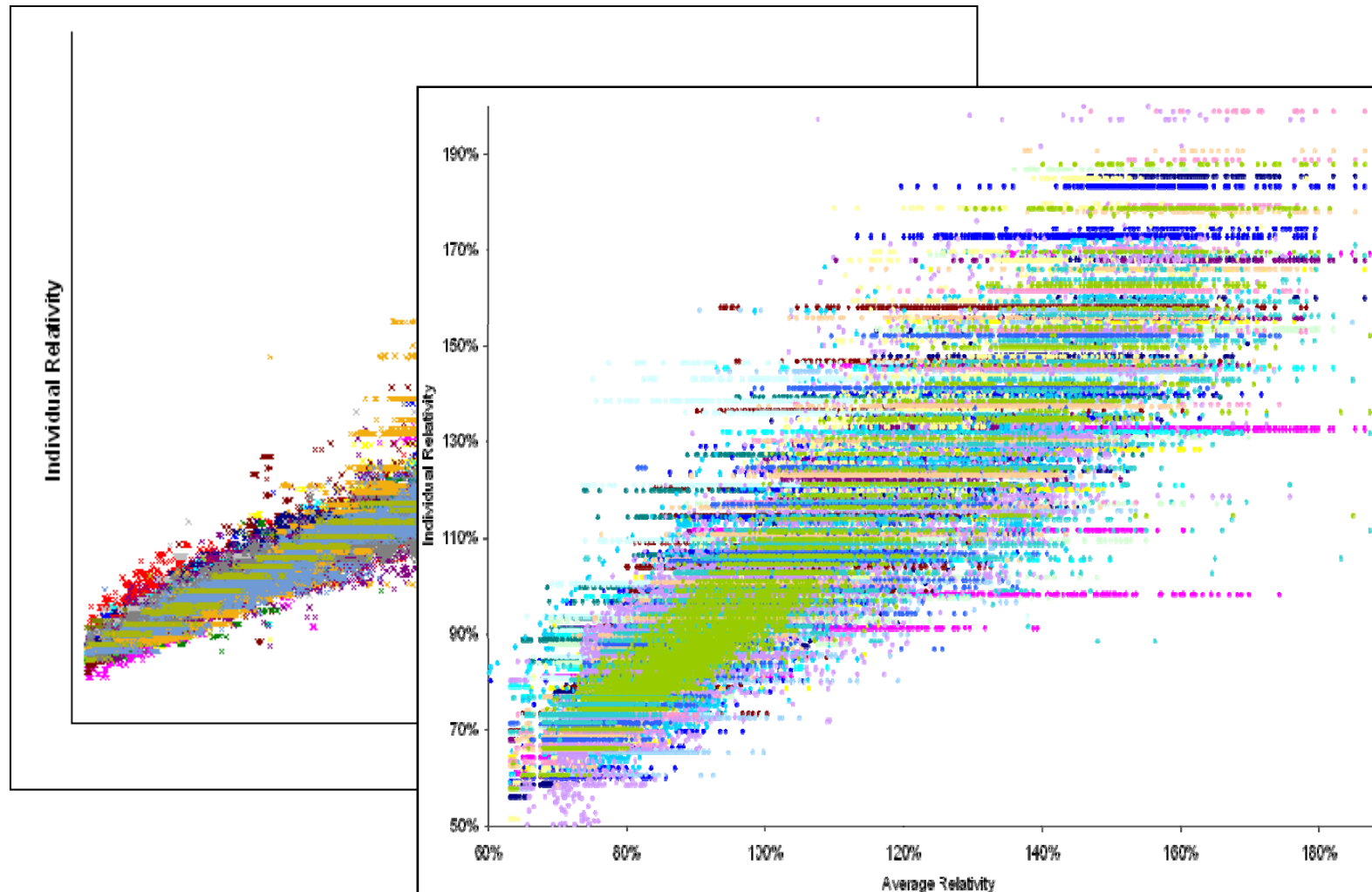- is a one-size fits all vehicle group the best option?
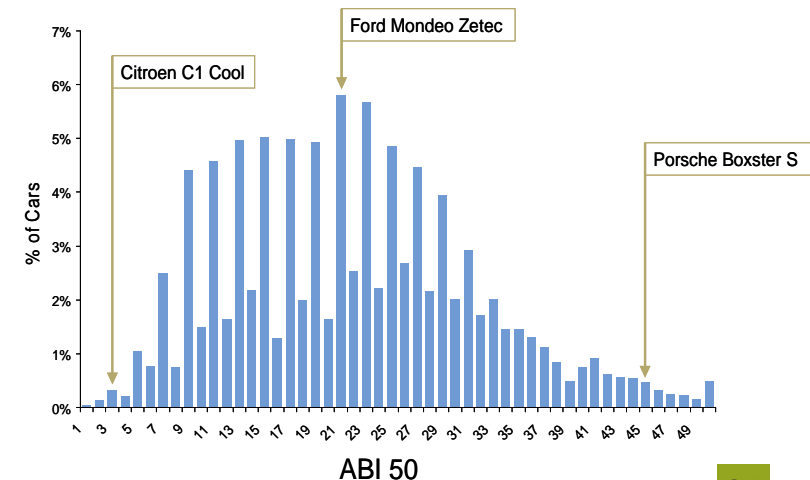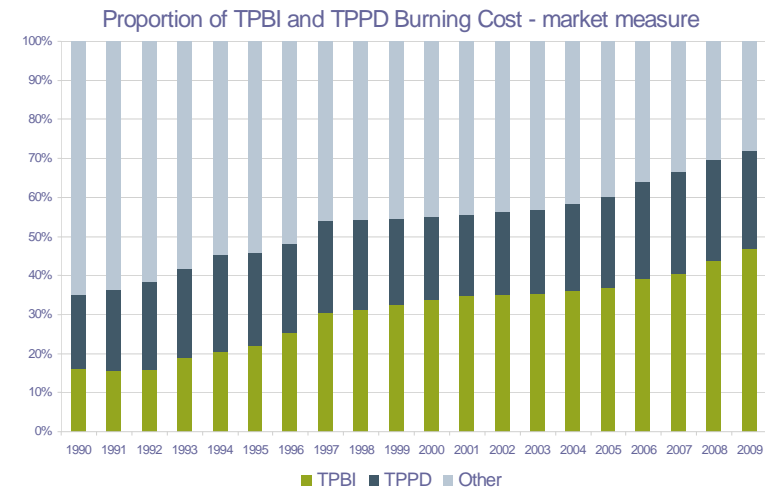
Proportion of TPBI and TPPD Burning Cost - market measure

Insurer classifications
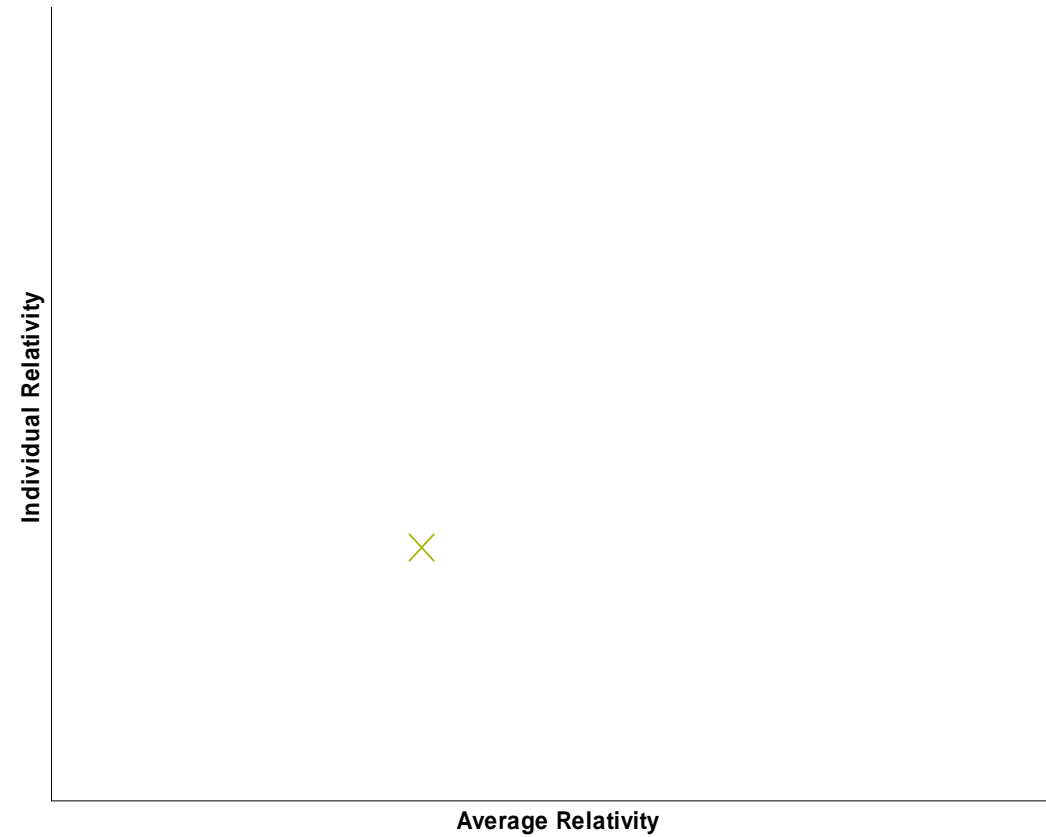
Insurer classifications
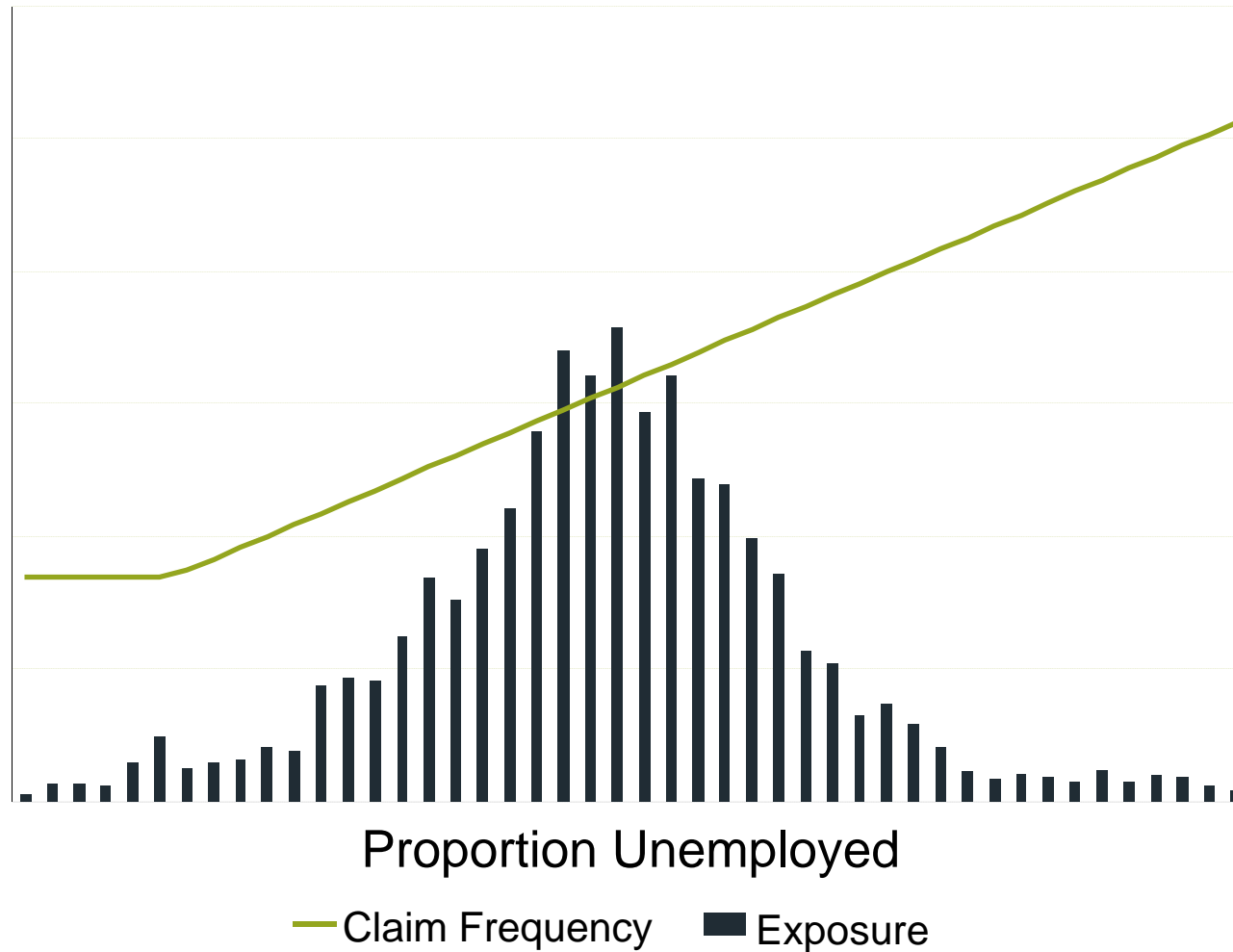
Insurer classifications

Insurer classifications

Postcoding - framework
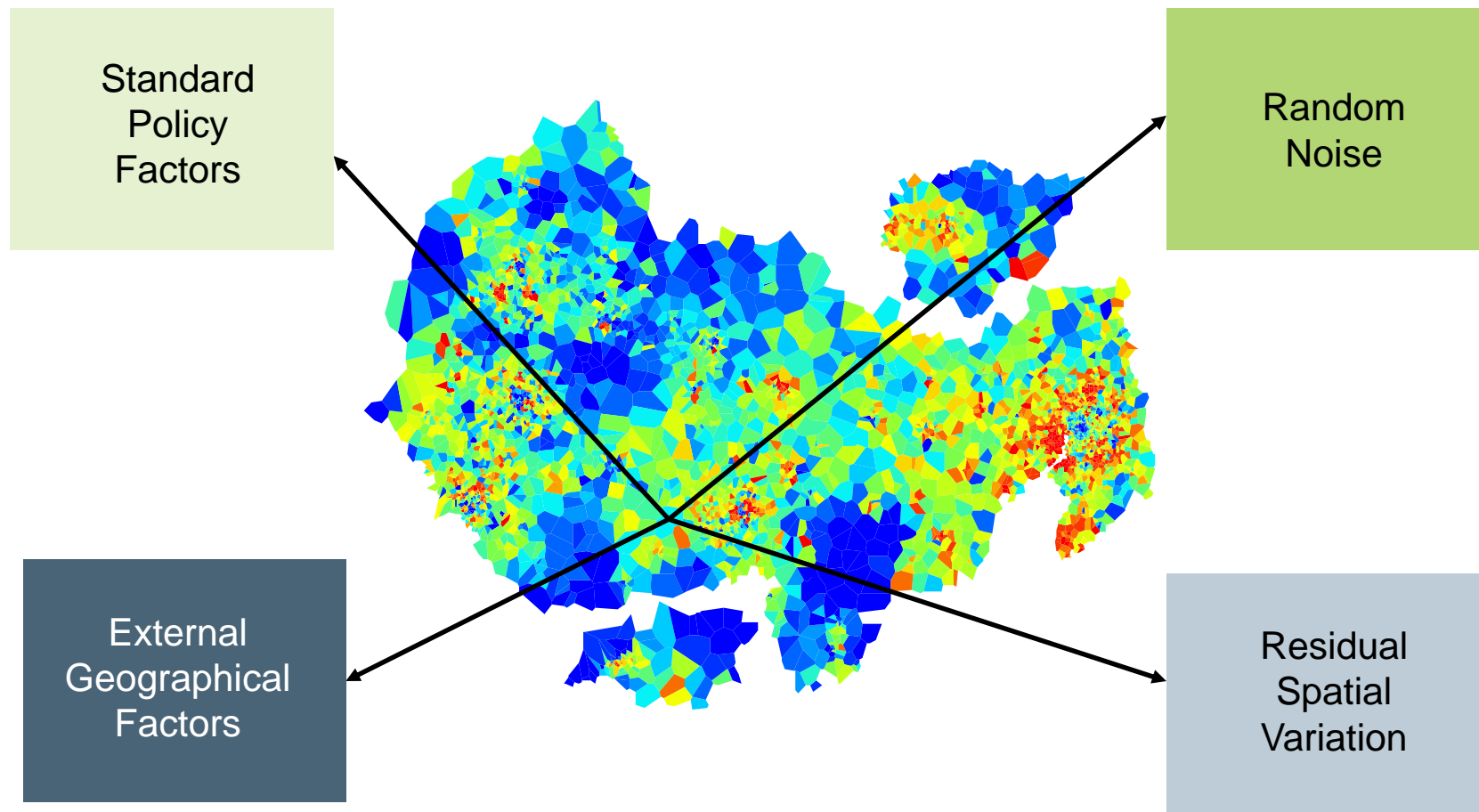
Standard Policy Factors

Random Noise

External Geographical Factors

Residual Spatial Variation

GLM geo-demographics

Proportion Unemployed

— Claim Frequency   ■ Exposure

Spatial smoothing

– Credibility family method

– Can adopt distance based or adjacency based approach
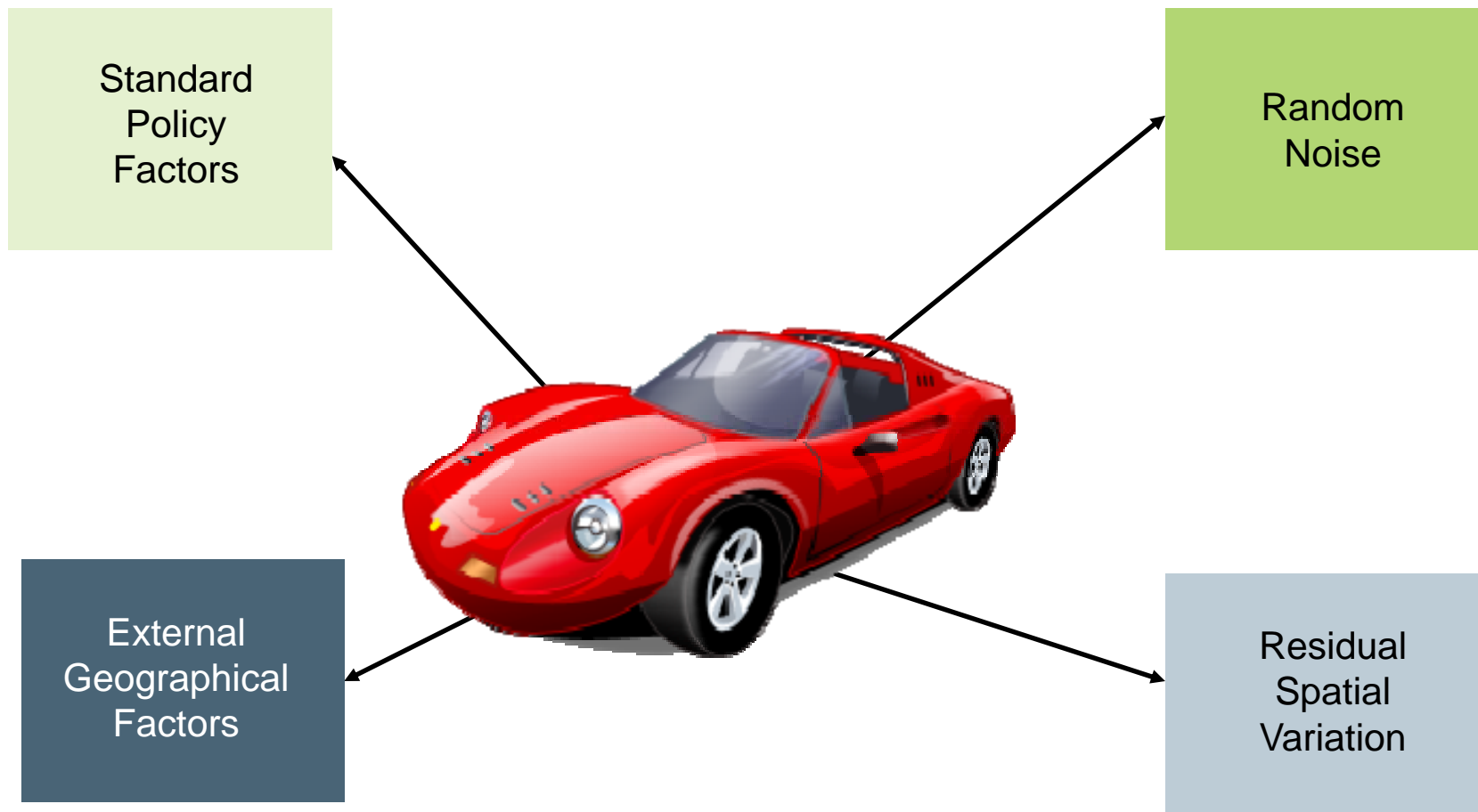
Maps removed

Distance   Adjacency

Maps removed

→

Maps removed

Unsmoothed   Smoothed

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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
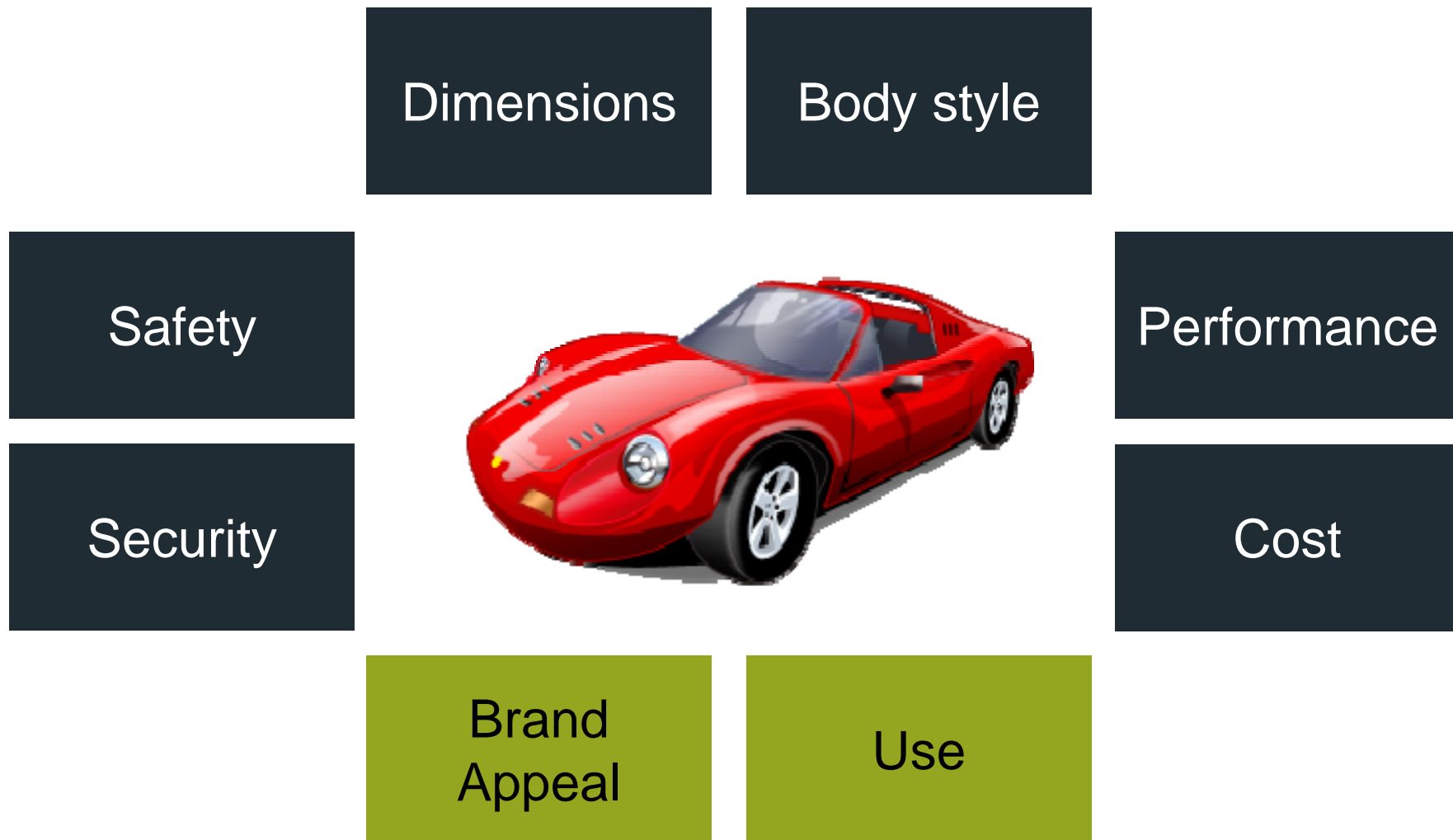Dimensions
Safety
Security
Costs
Bodystyle Classification

Vehicle Weight

■ Exposure — TPPD Frequency
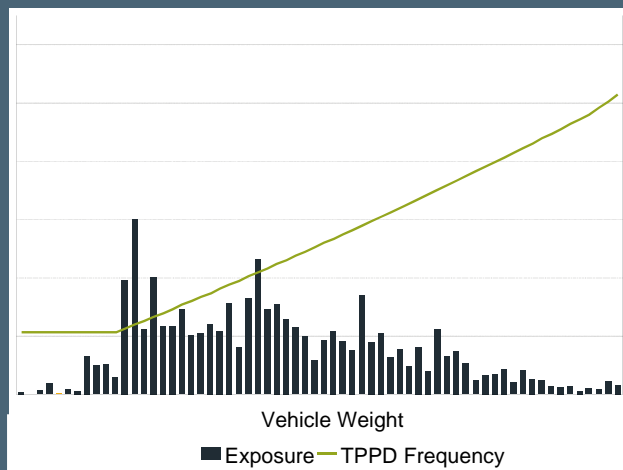
Standard
Policy
Factors

Random
Noise

Residual
Spatial
Variation

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

Save 7 tickets and the next wash is

FREE

Wash £7

Full valet £15

Hand wax £10

"Everlasting Shine" £100

Larger or bad vehicles cost a bit more

Mould-stained hoods renovated and re-proofed £20

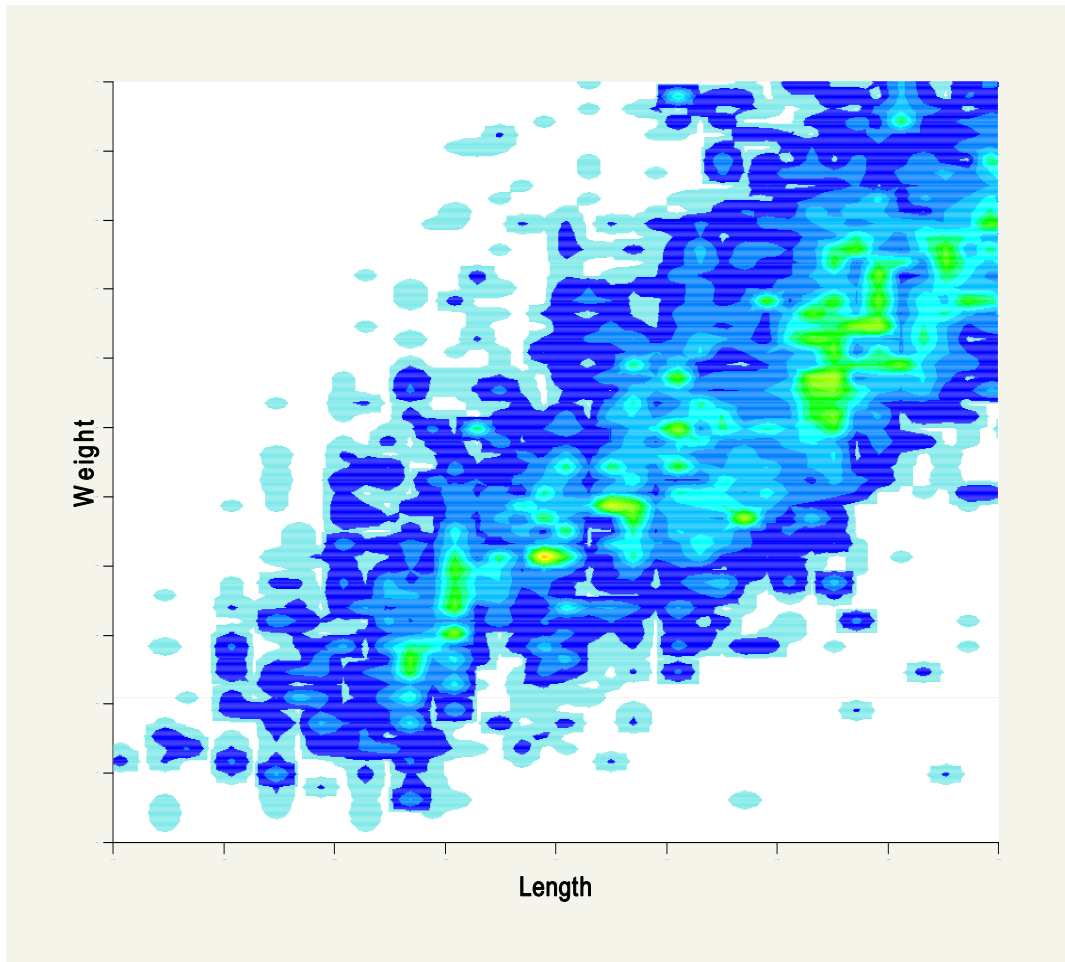Wheels renovated and painted silver £30

Hatchback

Cabriolet

Spider

Saloon
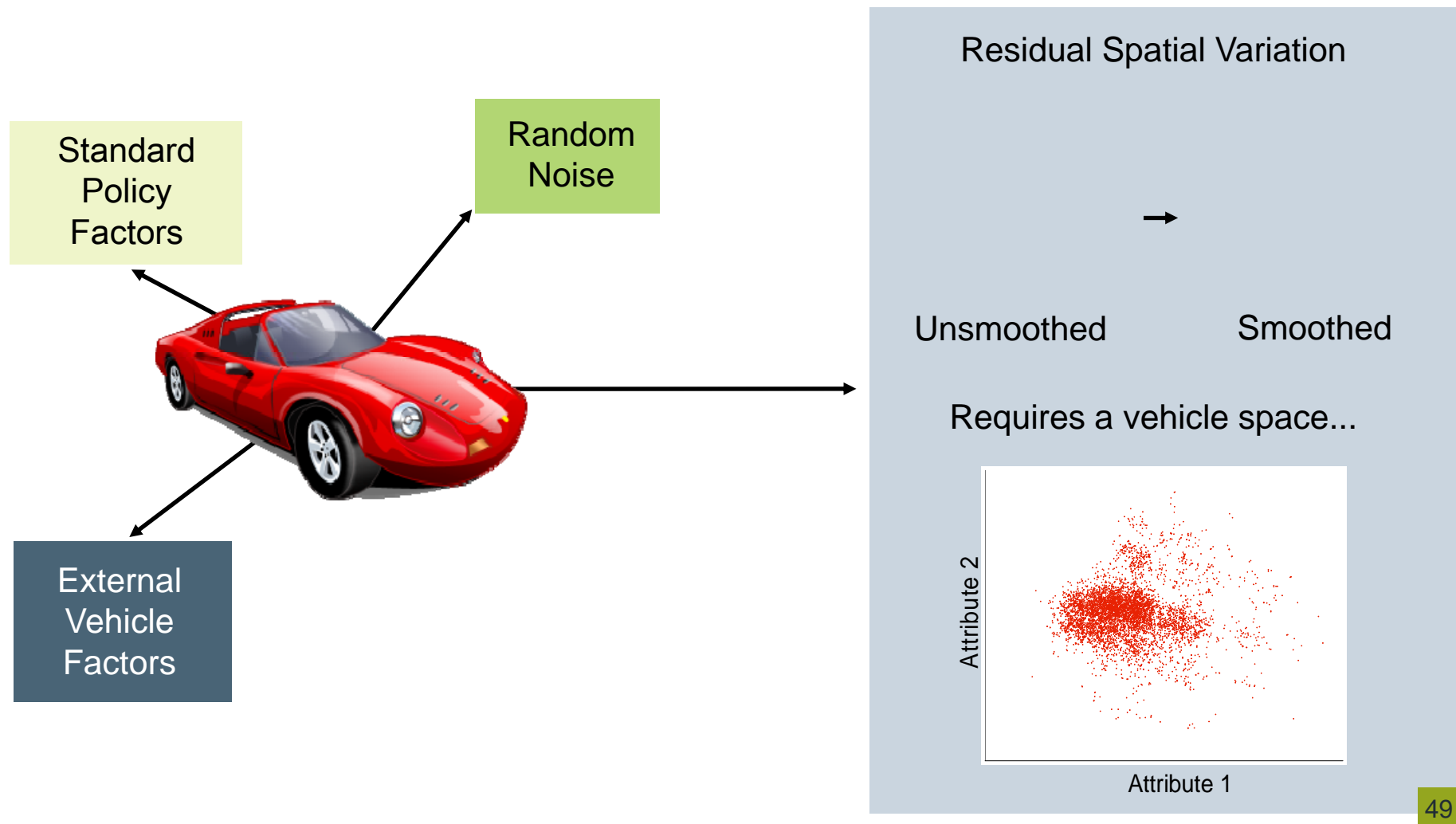
Evolution of vehicle make/model
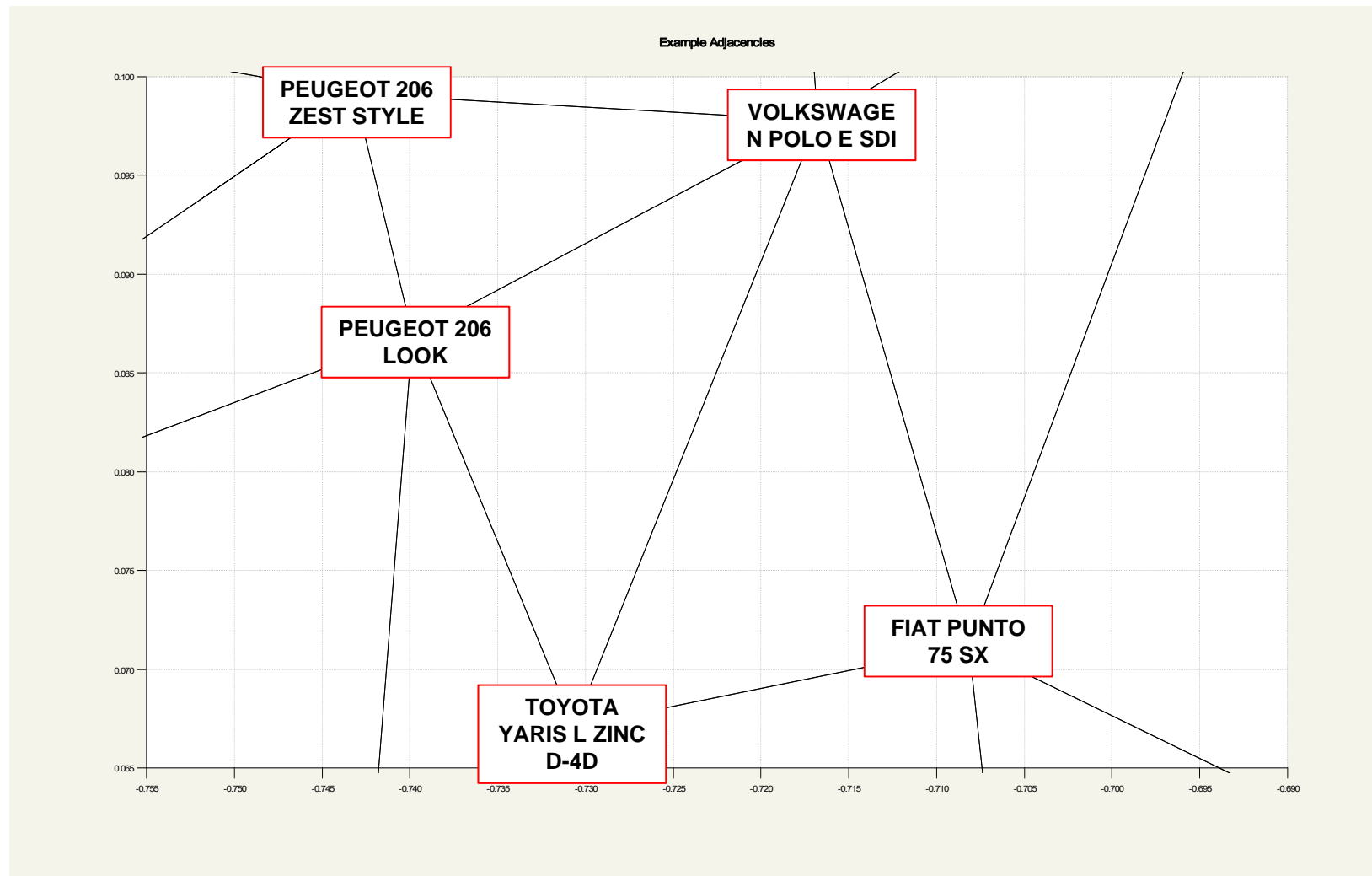
Using external data wisely

- 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

Example Adjacencies

PEUGEOT 206 ZEST STYLE

VOLKSWAGEN POLO E SDI

PEUGEOT 206 LOOK

FIAT PUNTO 75 SX

TOYOTA YARIS L ZINC D-4D

Putting it all together

Classifying existing cars

Graph removed

Graphs removed

Classifying new cars
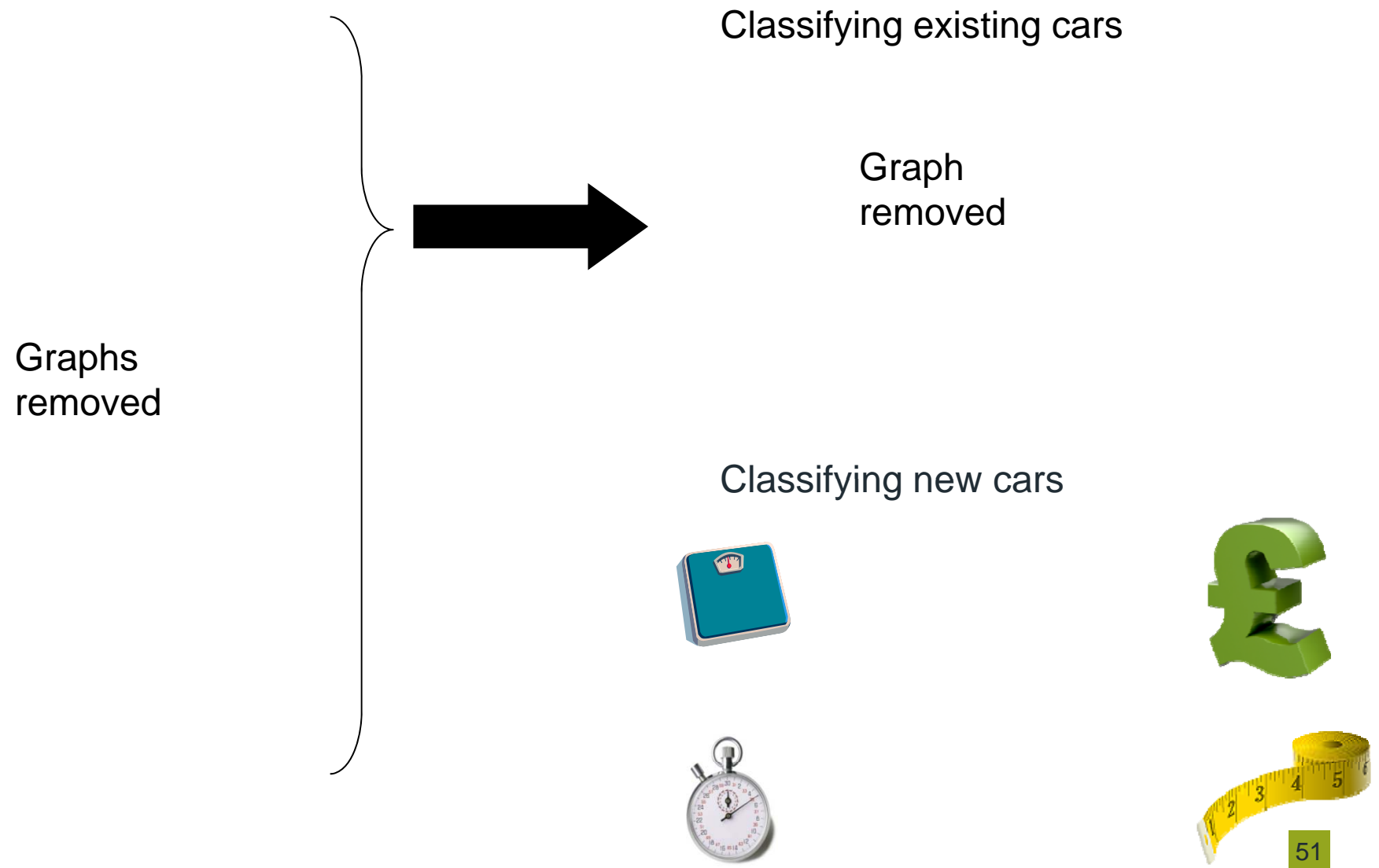
Performance vs. ABI (TP)

Graph
removed

Performance vs. ABI (TP)

Graph
removed

So where does that leave us?

Effort required →

Degree of sophistication →

Individual vehicle rating

Spatial smoothing of residual effects

Wider use of external data

ABI code 44 overlays

ABI 50 classification
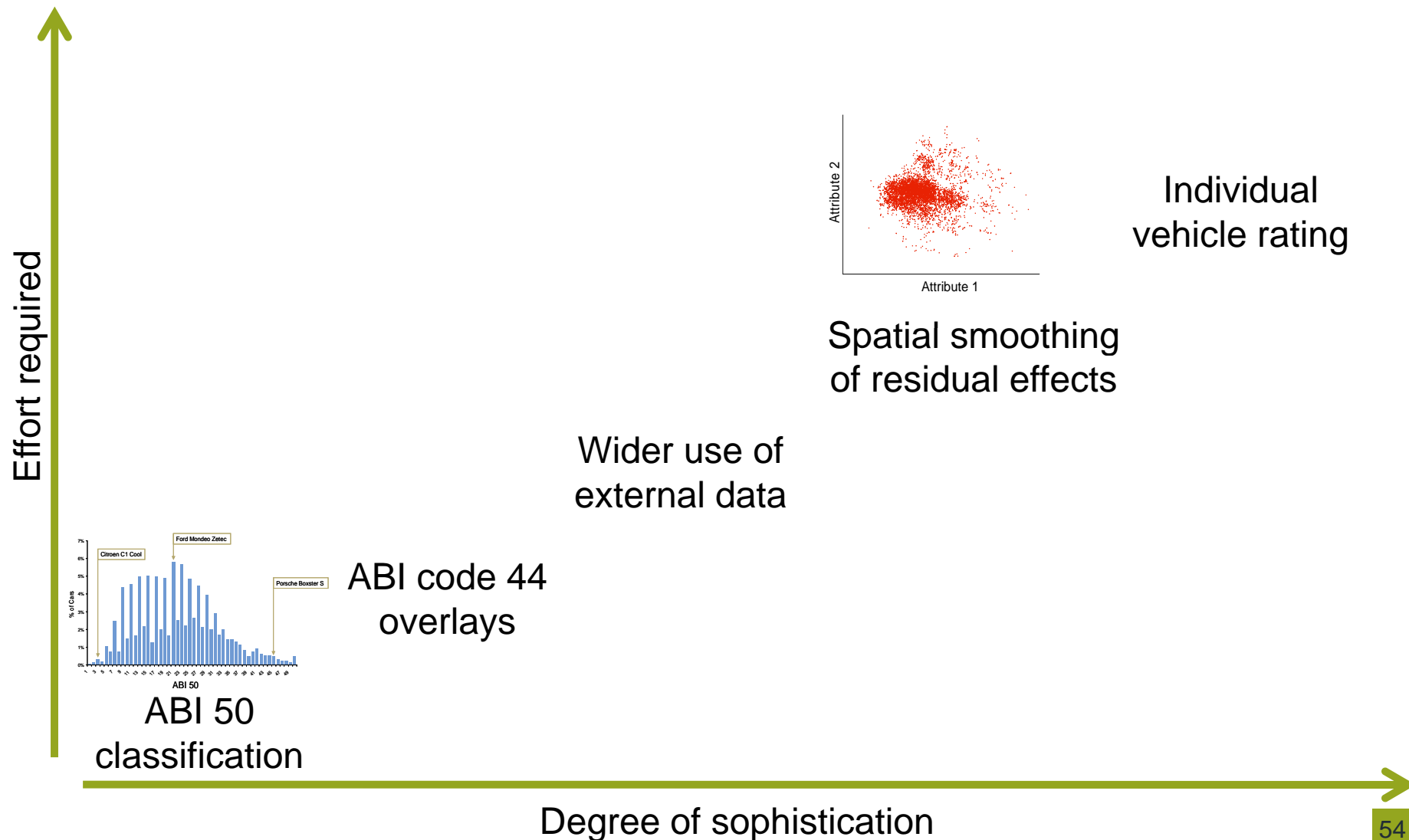
Questions or comments?

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.