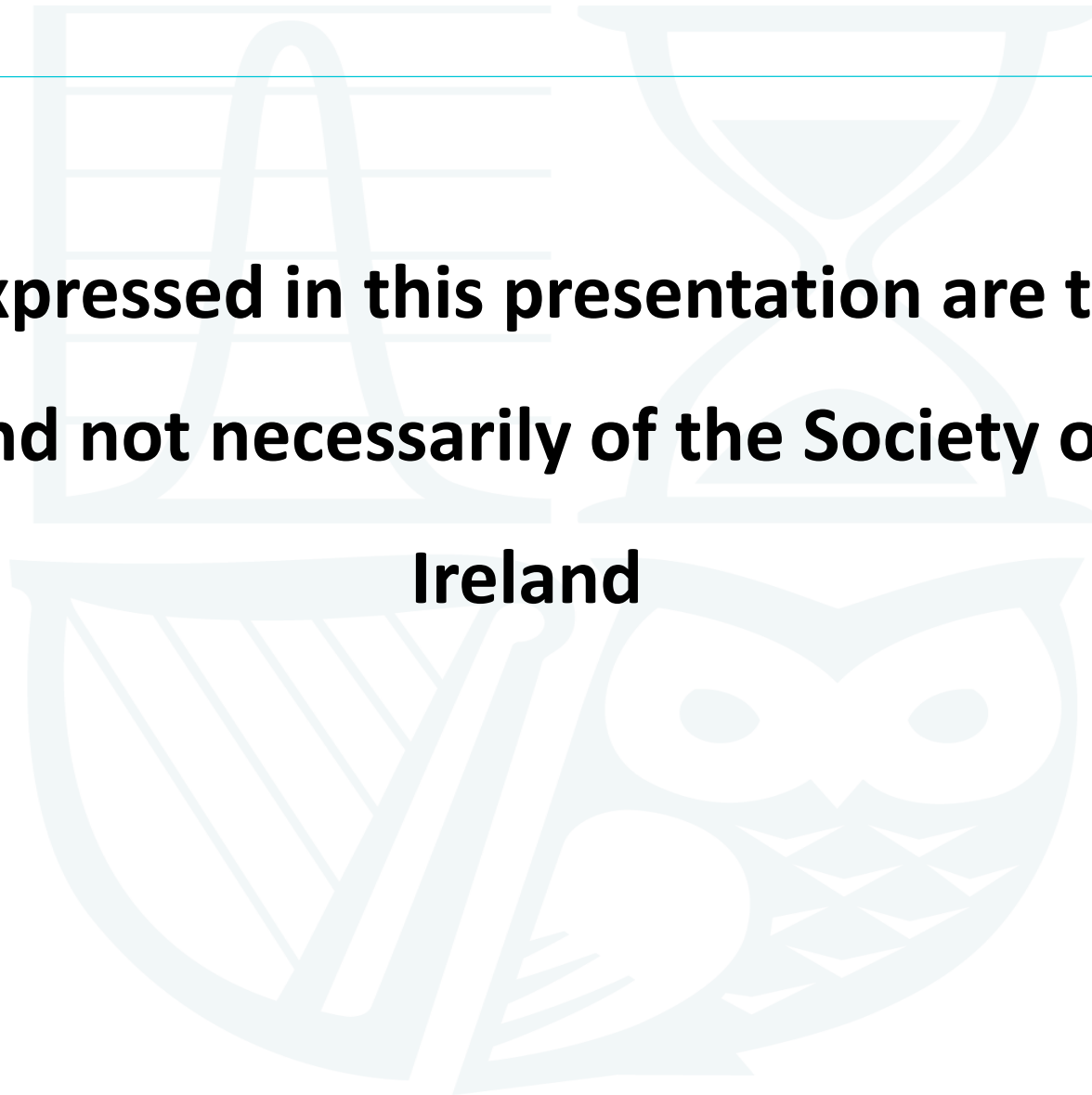# Pricing of Demographic Risk

Derek Ryan, Richard Marshall

Disclaimer

The views expressed in this presentation are those of the presenter(s) and not necessarily of the Society of Actuaries in Ireland

Agenda

What can you control?

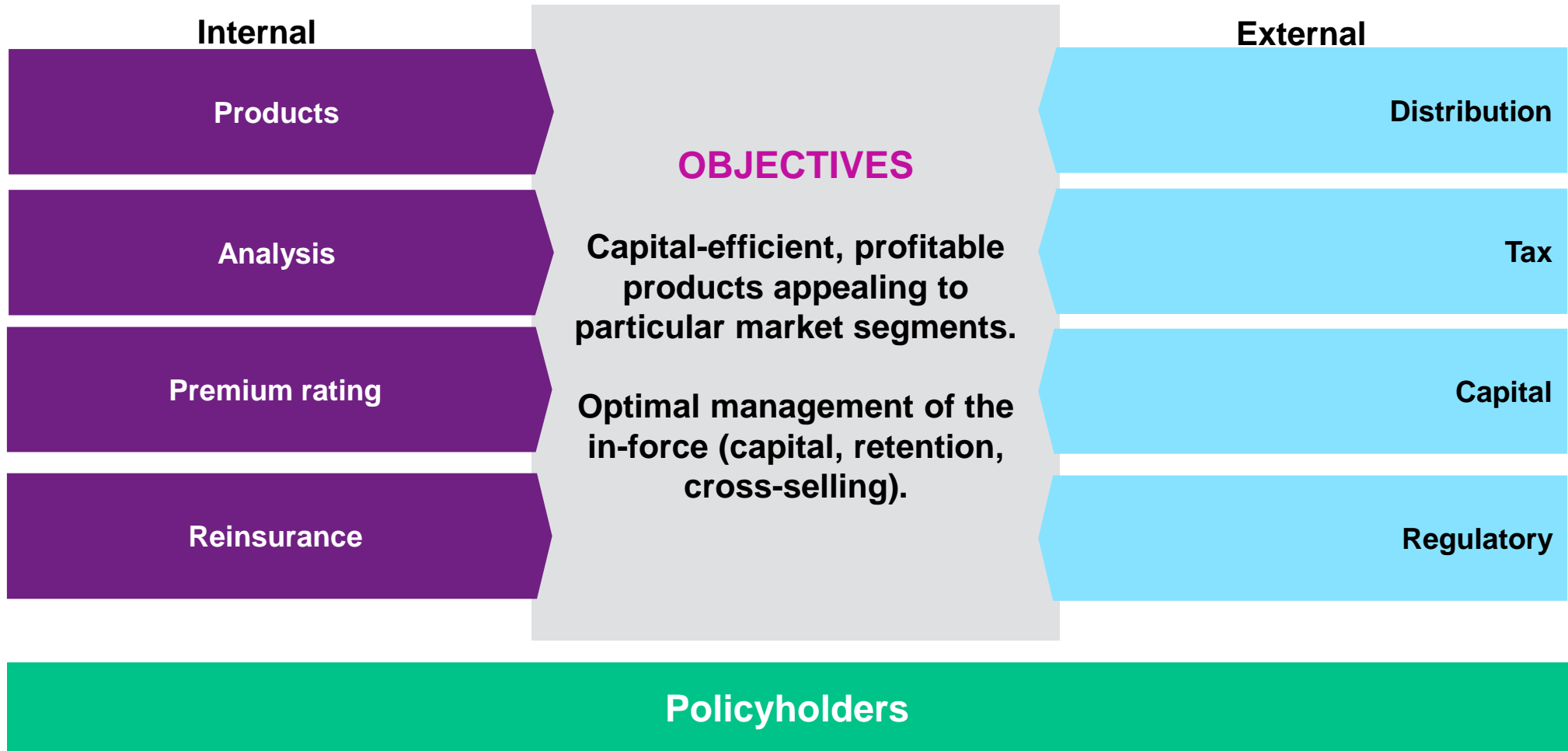Product Trends

Data-driven risk-pricing

Demand models and price optimisation
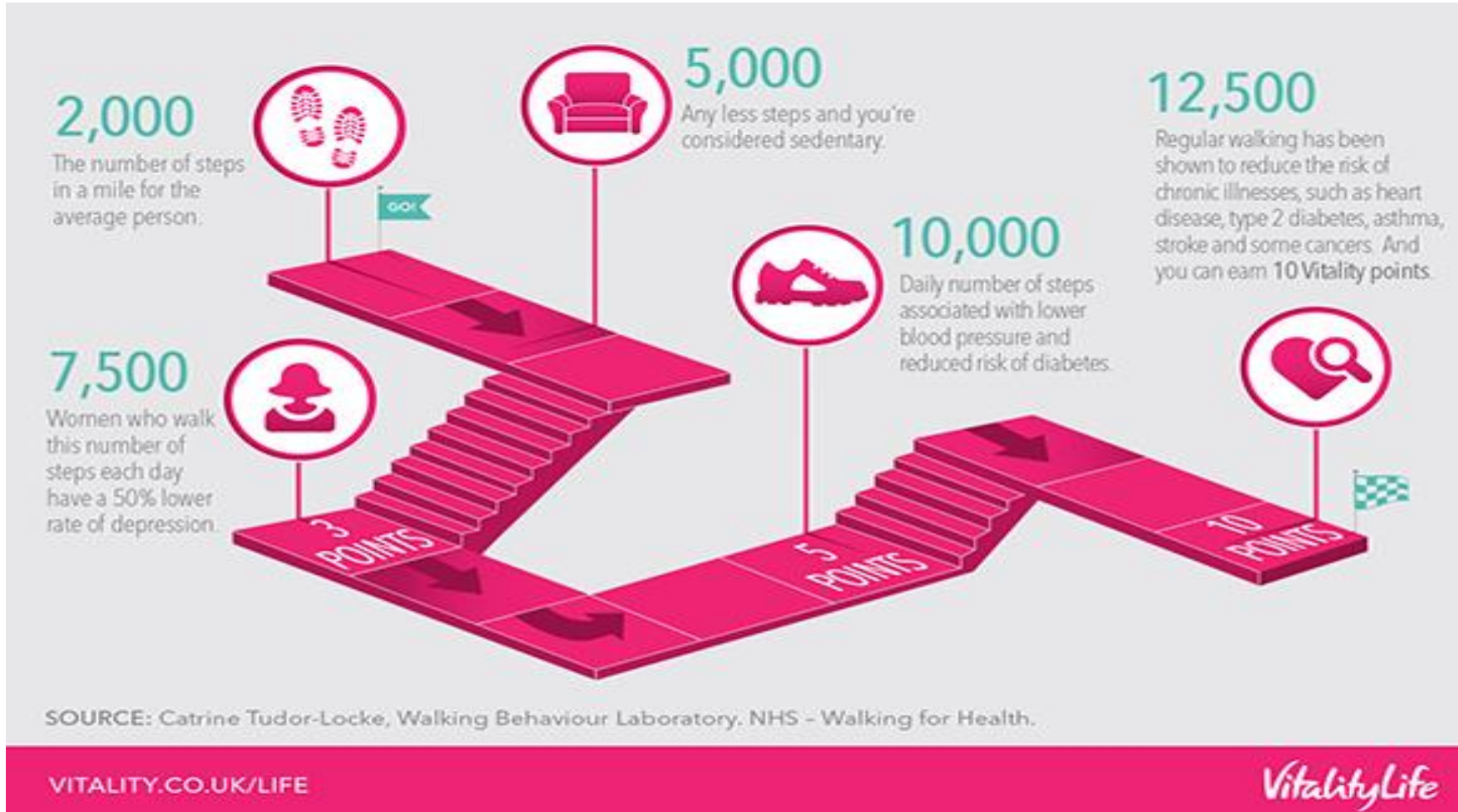
Getting value from reinsurance

What can you control?

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What can an insurer control?

Internal

- Products
- Analysis
- Premium rating
- Reinsurance

OBJECTIVES

Capital-efficient, profitable products appealing to particular market segments.

Optimal management of the in-force (capital, retention, cross-selling).

External

- Distribution
- Tax
- Capital
- Regulatory

Policyholders

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Product Trends

Stepping to health

2,000
The number of steps in a mile for the average person.

7,500
Women who walk this number of steps each day have a 50% lower rate of depression.

5,000
Any less steps and you're considered sedentary.

10,000
Daily number of steps associated with lower blood pressure and reduced risk of diabetes.

12,500
Regular walking has been shown to reduce the risk of chronic illnesses, such as heart disease, type 2 diabetes, asthma, stroke and some cancers. And you can earn **10 Vitality points**.

3 POINTS

5 POINTS

10 POINTS

SOURCE: Catrine Tudor-Locke, Walking Behaviour Laboratory. NHS – Walking for Health.

VITALITY.CO.UK/LIFE

VitalityLife

Protection and wearables

Vitality first UK insurer to partner with Apple Watch

Vitality has introduced Vitality Active Rewards with Apple Watch Series 2

This latest evolution of Vitality Active Rewards enables Vitality members to get an Apple Watch Series 2 from £69 and then fund the remaining balance by getting active.

- "People believe in being rewarded for healthy behavior" (SCOR research)

- Fitter, healthier policyholders?

- Data that could be used at claim underwriting stage?

- Applications for group life – what if insurers encourage firms to issue wearables to employees?

Key idea 1
Design products for users of certain technologies
which encourage, track and reward positive behaviours

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More sophisticated pricing – multi-state models

Base case: 40-year old ex-smoker with high BMI, average socio-economic status, and average blood sugar levels.

What are the effects on term assurance rates of changes to the main rating factors?

Adverse change in characteristics	How many years older does this equate to?
Obese (BMI > 30)	+ 3.3 years
High blood sugar	+ 1.8 years
Blue collar (lowest postcode quintile)	+ 3.6 years
Smoking	+ 6.6 years
Diabetes	+ 12.3 years
Neurological condition	+ 18.5 years

Calculations done in **PulseModel**, a sophisticated multi-state mortality / morbidity model developed by Willis Towers Watson using healthcare data and expert medical opinion.

Targeting and segmentation

Exeter Life "Managed Life"
Insurance for diabetics and those with high BMI

- Diabetes prevalence in EU: 7%
  - 8% in Hungary, 10% in France (Eurostat 2014 data)
  - c. 10% of UK population may be diabetic by 2034.

Royal London
"Diabetes Life Cover"

- Increasing obesity levels:
  - Morbid obesity projected to vary from 4% (Scottish men, 16–24) to 54% (English men, 75+) by 2035. (Keave L. et al)

Key idea 2
Design products for needs of population subgroups

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Other product trends

- Mental health cover (Hong Kong) with "MINDcierge" service

- Streamlined Underwriting (US)

  - Replicates full underwriting process with fewer requirements

  - Underwriting process mostly or fully automated

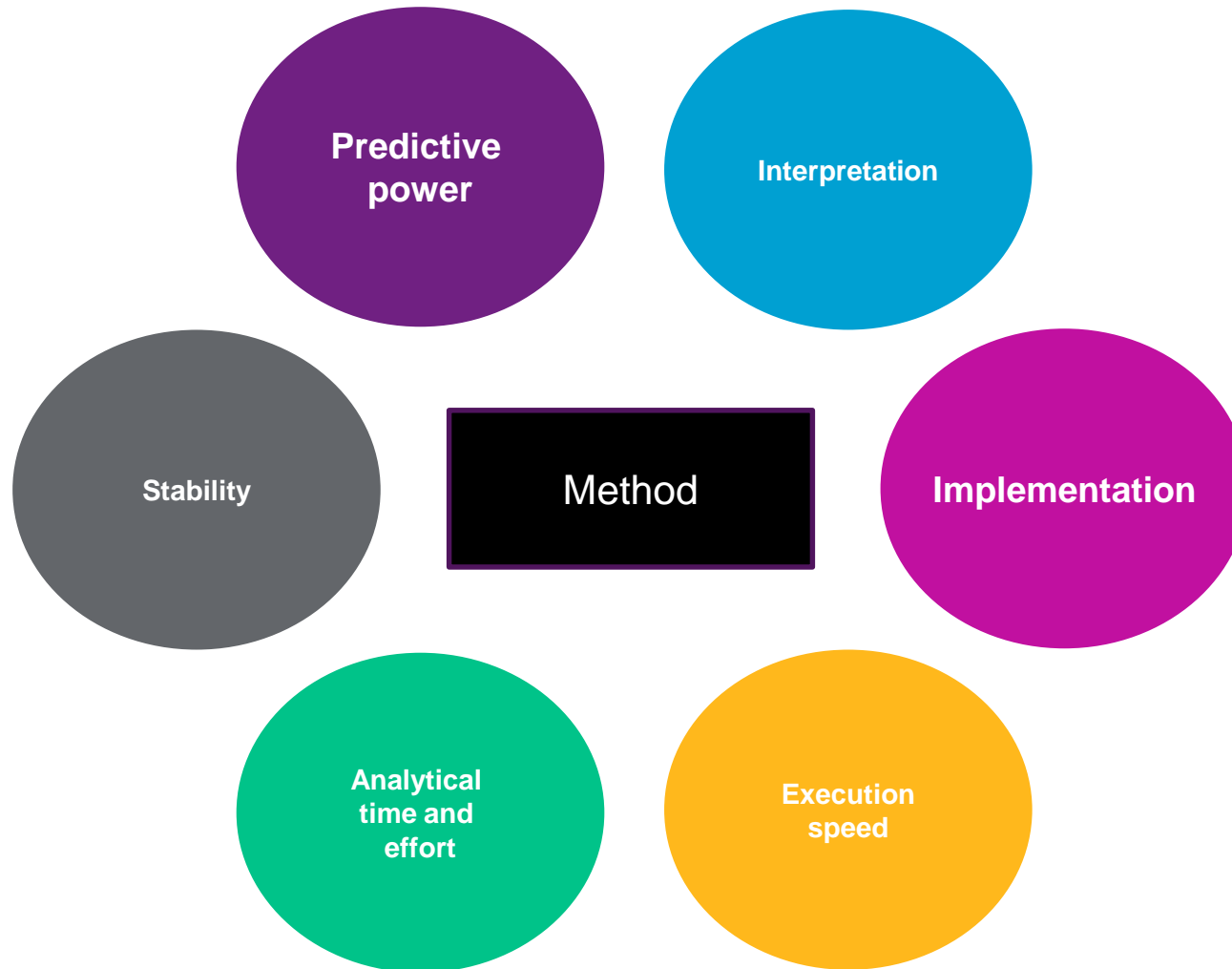 - Relies on new data sources for underwriting information

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Data-driven product pricing

How should we analyse data?

Datasets
- Internal
- External

Multi-factor analysis techniques

Usable pricing tool

Feedback loop
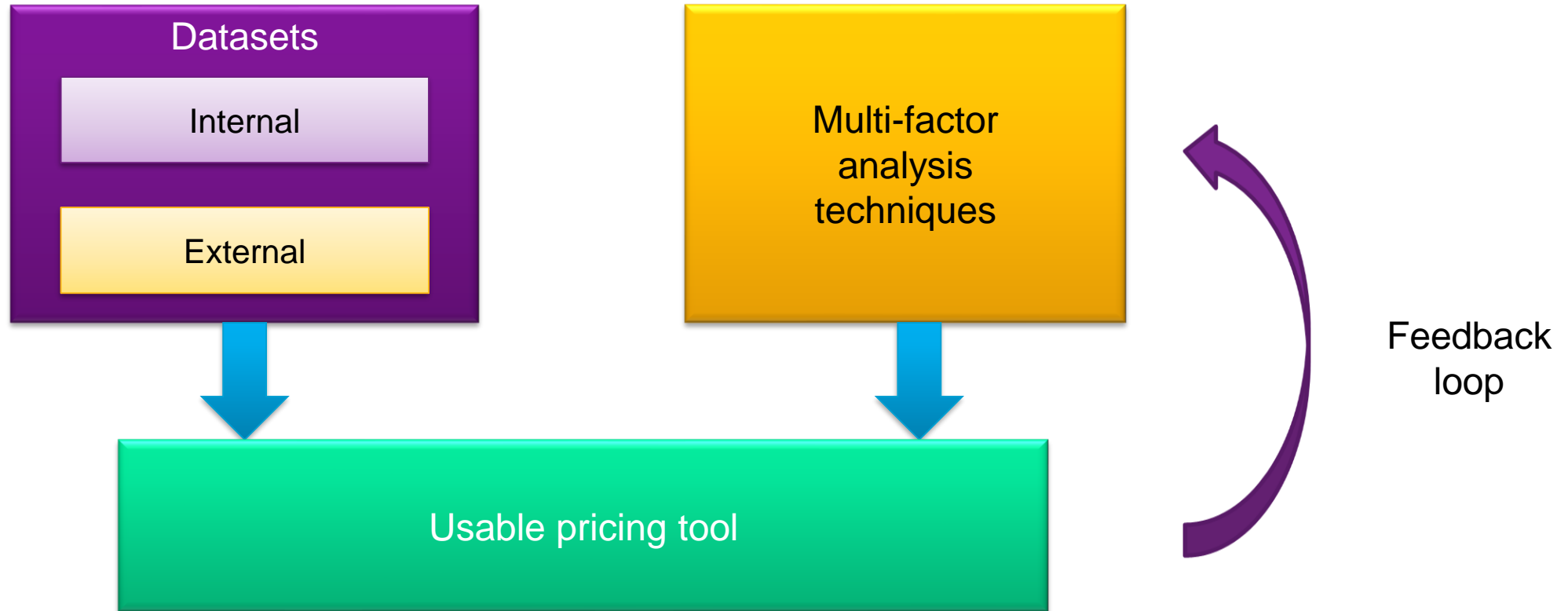
What analytic technique is appropriate?

This depends on our criteria

Comparison – traditional, GLM or 'ultra-GLM'?

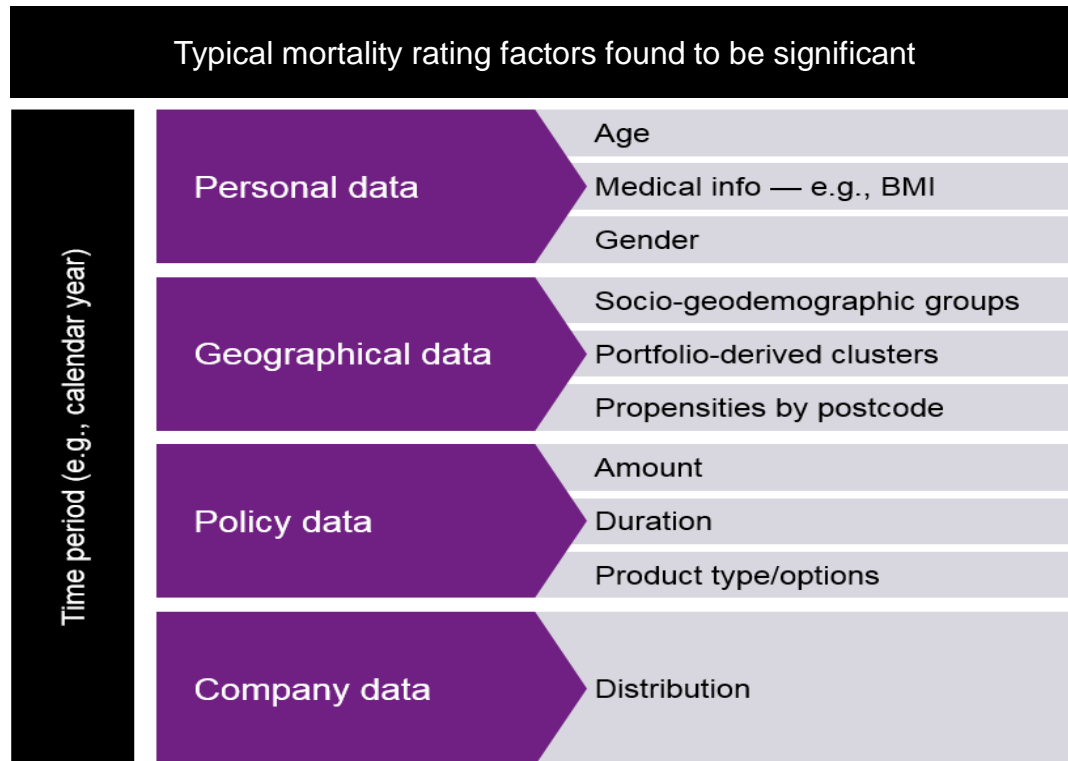Best practice: use GLMs but (for large datasets) look to GBMs for extra insight
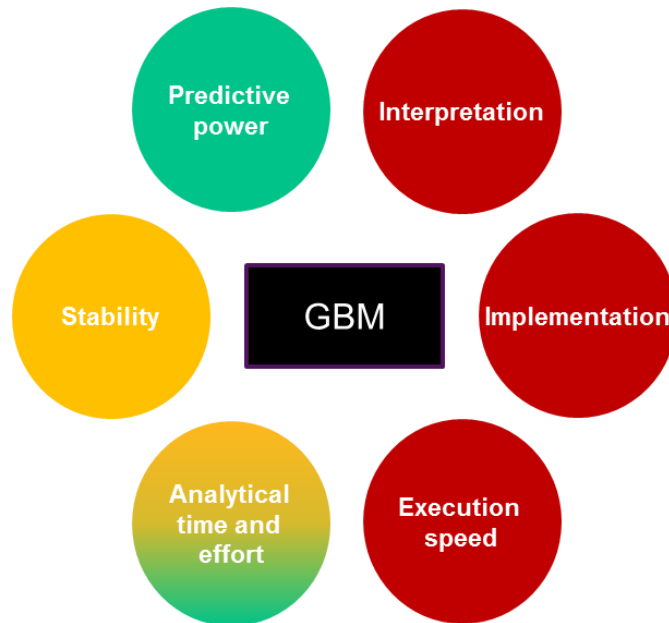
Key idea 3

Select analysis tools to make the most of available data

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Demographic risk – multifactor modelling of mortality

Postcode can be a powerful predictive factor in risk analysis

GLMs have become a standard tool to analyse mortality for annuity, protection and health business.
Insurers can use them to improve pricing structures and minimise selection risk.

Typical mortality rating factors found to be significant

Time period (e.g., calendar year)		
Personal data	Age
	Medical info — e.g., BMI
	Gender
Geographical data	Socio-geodemographic groups
	Portfolio-derived clusters
	Propensities by postcode
Policy data	Amount
	Duration
	Product type/options
Company data	Distribution

The map shows how we have derived postcode mortality effects using GLMs

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Extending analysis to…

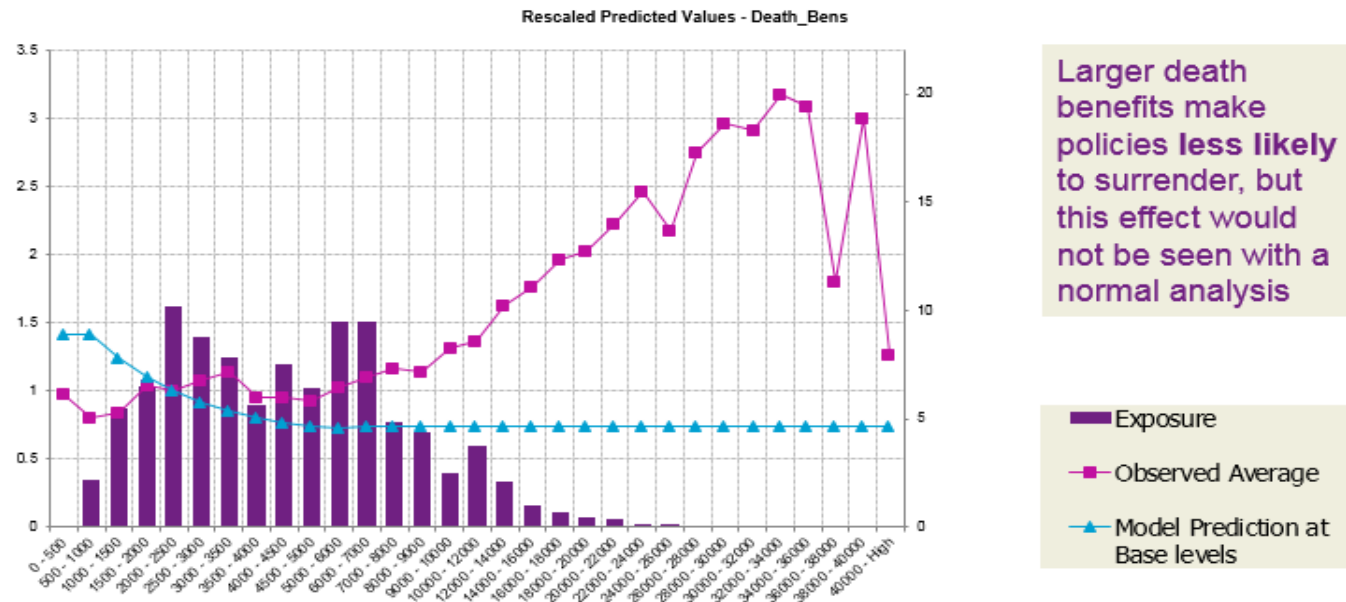… retention rates [Case study 1: Socio-economic effects]

Extending analysis to …
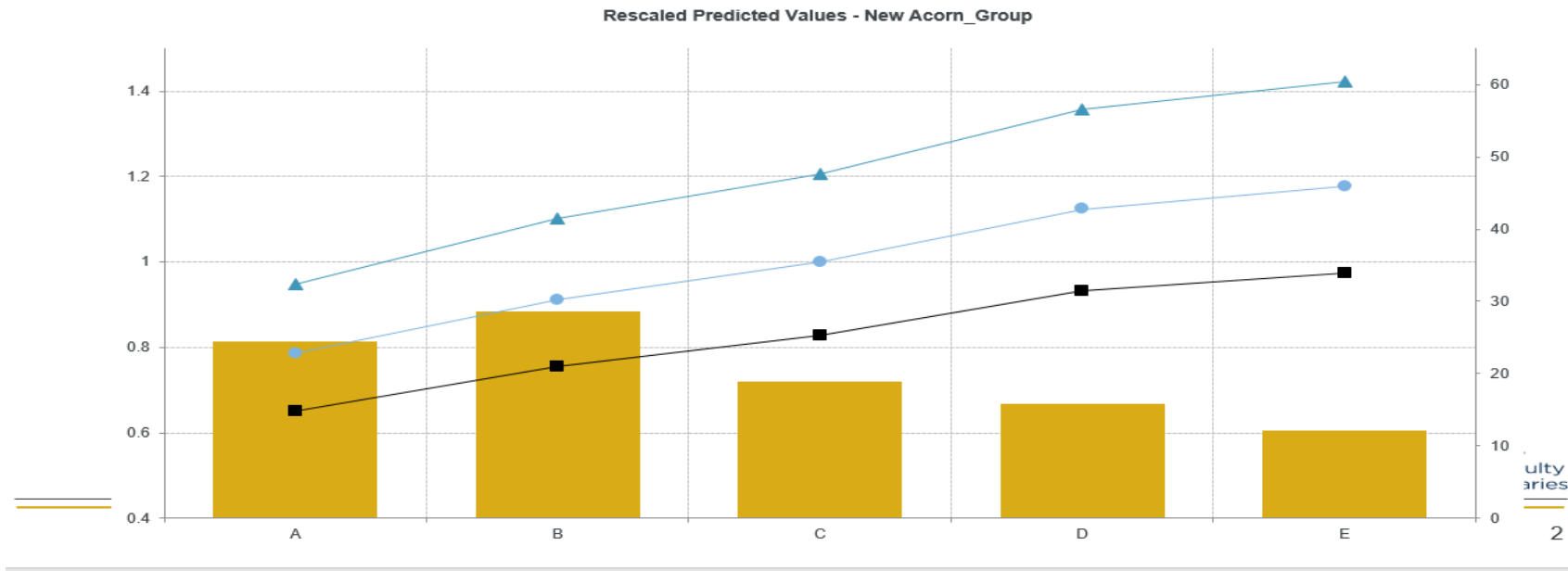
… retention rates [Case study 2: Importance of multifactor analysis]
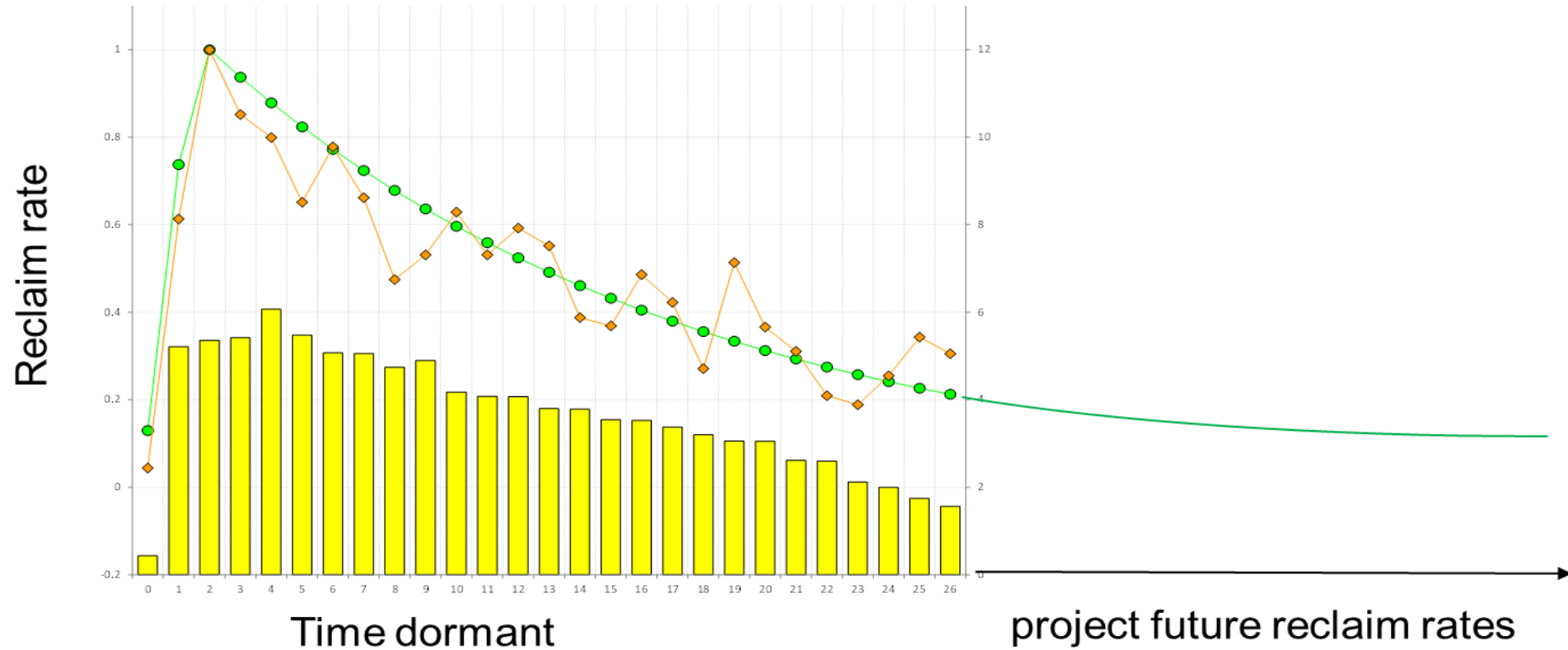

Effect of death benefit on surrender/lapse

(in conjunction with effects of all other factors)

PERSISTENCY ANALYSIS

Rescaled Predicted Values - Death_Bens

Larger death benefits make policies **less likely** to surrender, but this effect would not be seen with a normal analysis

- Exposure
- Observed Average
- Model Prediction at Base levels

Extending analysis to …

… reclaim rates [Case study 3: Dormant bank accounts]

Extending analysis to …

… customer purchasing behaviour

- **Demand models assess the probability of sale as a function of different factors:**
  - Competitive position, age, lifestyle group (from postcode), pot size etc.
  - Relatively simple analysis can add huge value to your pricing structures
  - Demand modelling becoming increasingly important as life pricing becomes more sophisticated
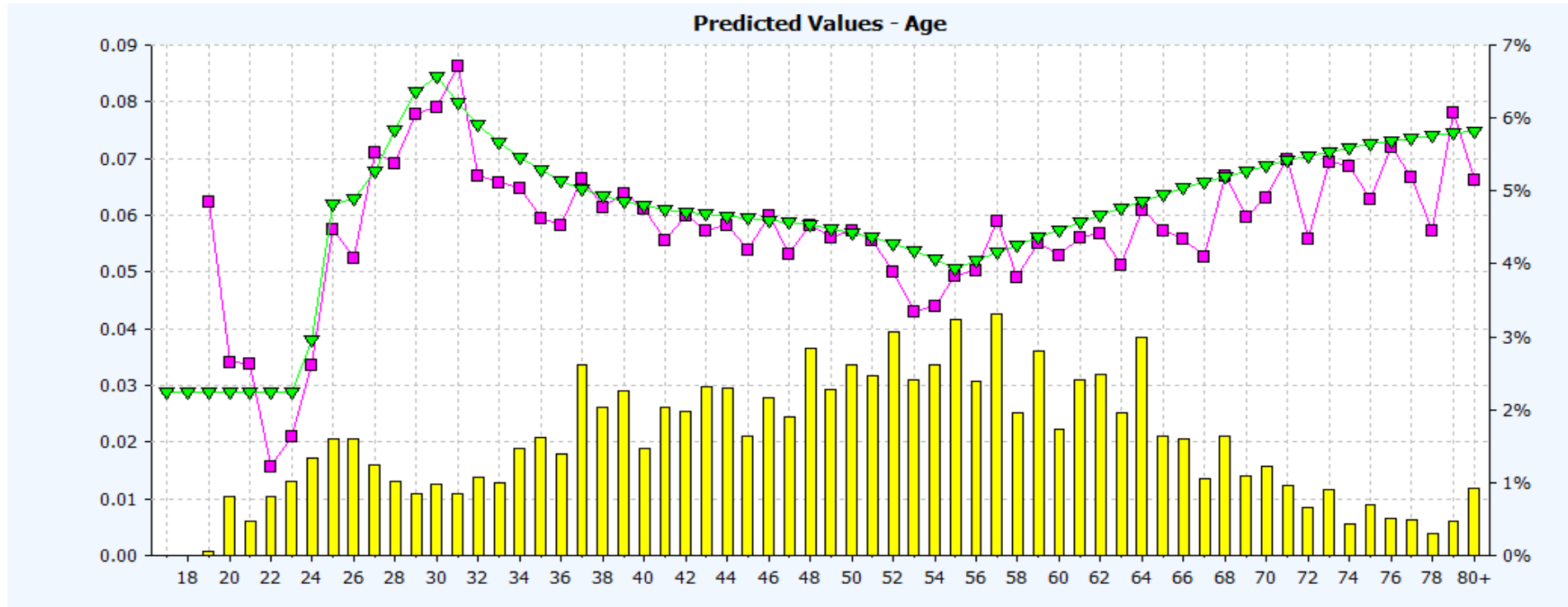- **GLMs are best practice to cope with the number of factors**
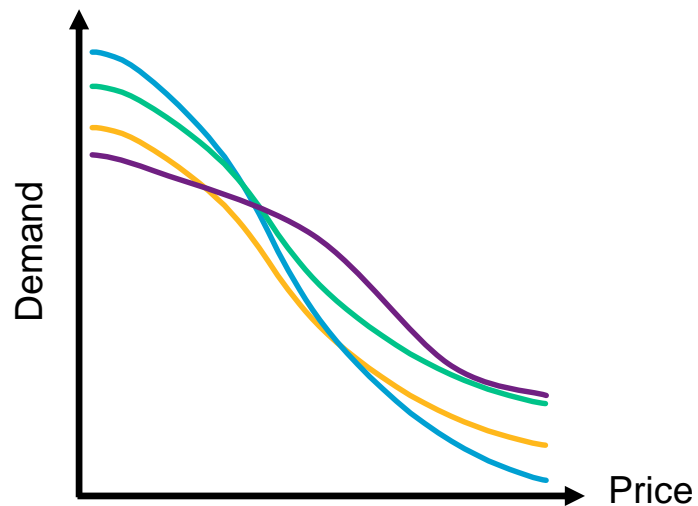
- Randomised price trials can be used within conduct constraints, but are not required

Extending analysis to …
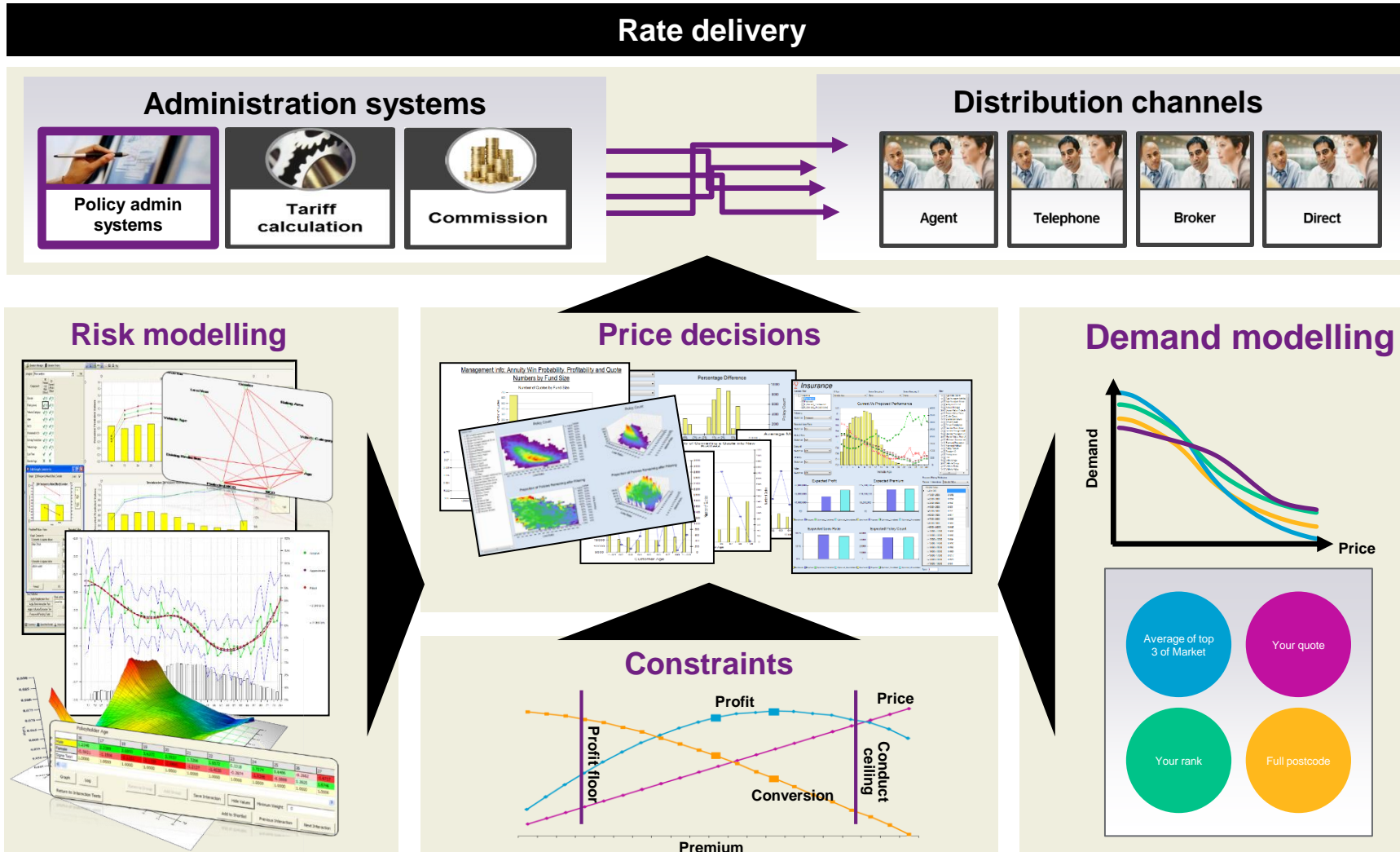
… customer purchasing behaviour

Example output for demand model by age of (prospective) policyholder

Key idea 4
Use analytics to improve understanding of the full customer journey (purchase to lapse/claim), not just risk of claims.

Demand models & price optimisation

Components of sophisticated pricing

Pricing constraints

Understand and implement restrictions on pricing

- Internal objectives

  Maximise profits with a 5% growth in volumes

- Logistical constraints

  The same set of prices for all advisers in distribution network A

- Policyholder fairness

  Maximum profit margin of x% on any product

- Regulatory and legal view

  "Treating customers fairly"

Transforming the pricing process

Agility in getting prices to market
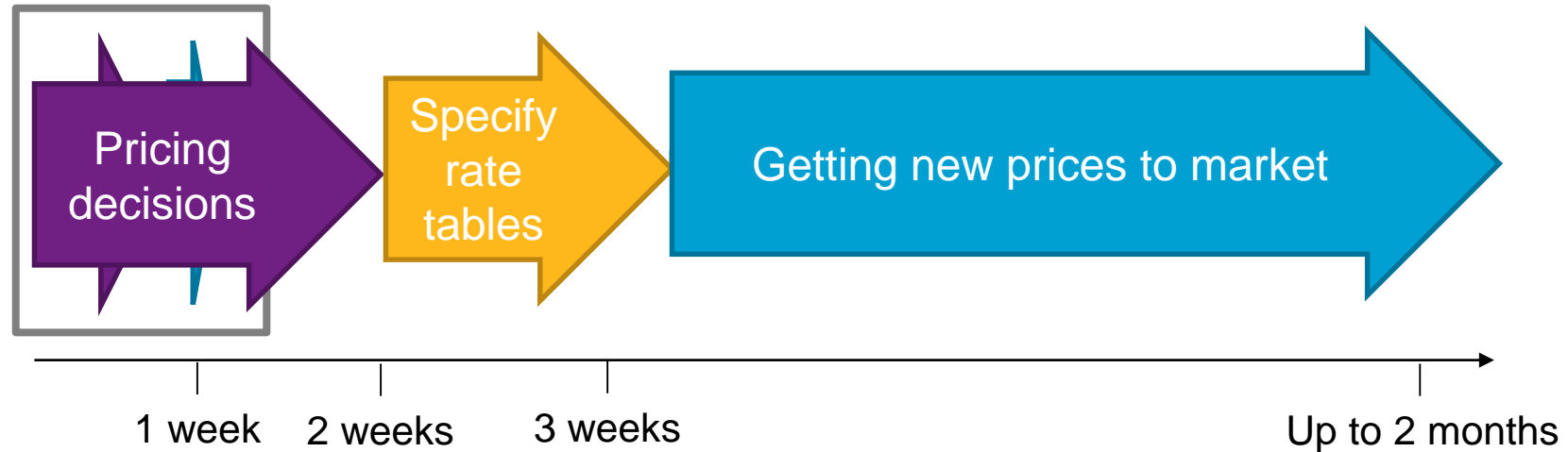
- **More agile pricing decisions**
  - Instant, automated, and bespoke MI
  - Evidence based analysis and predicted impacts
  - Delegated pricing authority
  - No need to separately specify rate tables
- **More agile pricing changes**
  - Speed to market, and ability to add new factors easily
  - "Pricing team takes back control", rather than waiting for IT to take months to change prices
  - Even in a market with slow, infrequent price changes, quick reprices allow you to dance around the competition

We typically see **performance uplift** of between

1% and 5%

of Gross Written Premium at unchanged or higher business volumes
in non-life business

Emerging life experience demonstrates an increase in revenue of

2%-5%

of annual premiums from initial implementations,

with the potential for up to **10%**

Key idea 5

Use agile pricing to get ahead of / keep pace with competitors

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Getting value from reinsurance

The value of reinsurance

Services vs. needful – both are valuable

Services

Needful Reinsurance

Product Development

Underwriting Manual

Market Insights

Profitability

Volatility

Solvency

- Services
  - Do you know what you're paying?
  - Do you need what you're getting?
  - Are you happy with the balance?

- Needful reinsurance
  - What are you trying to achieve, in terms of metrics?
  - What impact is reinsurance having on these metrics?
  - Are you explicitly linking the two?

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The value of reinsurance

The issue isn't that we can't model something so complex, because we can.

Powerful modelling software, e.g. WTW's 'Risk Agility' suite	Easy to look at 1-in-200 stochastic simulations to determine required capital
	How does this change without reinsurance?
	How does it change under different mixes of quota share and surplus treaties? (No need to change proportion reinsured)

What are we chasing? Profit? Solvency? Low volatility?
What can we tolerate for each of these?
What effects do various reinsurance structures have on these?

We need to answer these questions and then select reinsurance to **optimise the various metrics within our identified tolerance**.

Catastrophe risk cover

Nat. Cat.	War / Terrorism	Pandemics (big or small)

- Need to consider more than just death claims:
    - Sickness / medical costs
    - P&C losses – travel, business disruption
    - Market risks – asset values
    - Loan defaults (esp. banking groups)
    - Operational risks

- We kid ourselves: "Not a threat in 2018"
- Or muse that "if it hits, we'll go bust, but so will all our competitors", so ignore the risk

- Focus on 1-in-200 detracts from smaller events

Reinsurers protecting themselves:
e.g. Swiss Re (Vitabonds)
ILS/RGA (VIF monetization)

More life insurers protecting themselves as well…

e.g. catastrophe cover for infectious diseases within
3-month periods.

Actively manage your reinsurance programme

- How up to date are your reinsurance rates and manuals? E.g. the thinking on diabetes

- Useful to benchmark against other reinsurers

- Do the reinsurance rates reflect trends in your market?

- How does your own experience compare to your reinsurance rates?

Key idea 6

Know what reinsurance you need and what you're paying for and review on a regular basis

Summary

Recapping the key ideas from this session

- Design products for
    - the needs of population subgroups
    - users of technologies – encouraging, tracking and rewarding positive behaviours
- Design products allowing granular pricing, with features to appeal to consumer groups

- Select analysis tools to make the most of available data.
- Use analytics to improve understanding of the full customer journey (from purchase to eventual lapse/claim), not just risk of claims.

- Use agile pricing to get ahead of / keep pace with competitors

- Know what reinsurance you need and what you're paying for and review on a regular basis

Questions?