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# Dynamic Policyholder Behaviour

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Chief / Senior Actuaries' Workshop
Wednesday 5 October

06 October 2016

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# Introduction


06 October 2016

# Regulation (Solvency II Delegated Acts)

***Article 26 – Policyholder behaviour***

When determining the likelihood that policyholders will exercise contractual options, including lapses and surrenders, insurance and reinsurance undertakings shall conduct an analysis of past policyholder behaviour and a prospective assessment of expected policyholder behaviour. That analysis shall take into account all of the following

a) how beneficial the exercise of the options was and will be to the policyholders under circumstances at the time of exercising the option;

b) the influence of past and future economic conditions;

c) the impact of past and future management actions;

d) any other circumstances that are likely to influence decisions by policyholders on whether to exercise the option.

The likelihood shall only be considered to be independent of the elements referred to in points (a) to (d) where there is empirical evidence to support such an assumption

# Regulation (more)

- Article 31 – allow for ‘dependency between two or more causes of uncertainty’
- Article 32 – take into account ‘all factors which may affect the likelihood that policy holders will exercise contractual options or realise the value of financial guarantees.’
- Article 34 – ‘insurance and reinsurance undertakings shall use a method to calculate the best estimate for cash flows which reflects such dependencies.’

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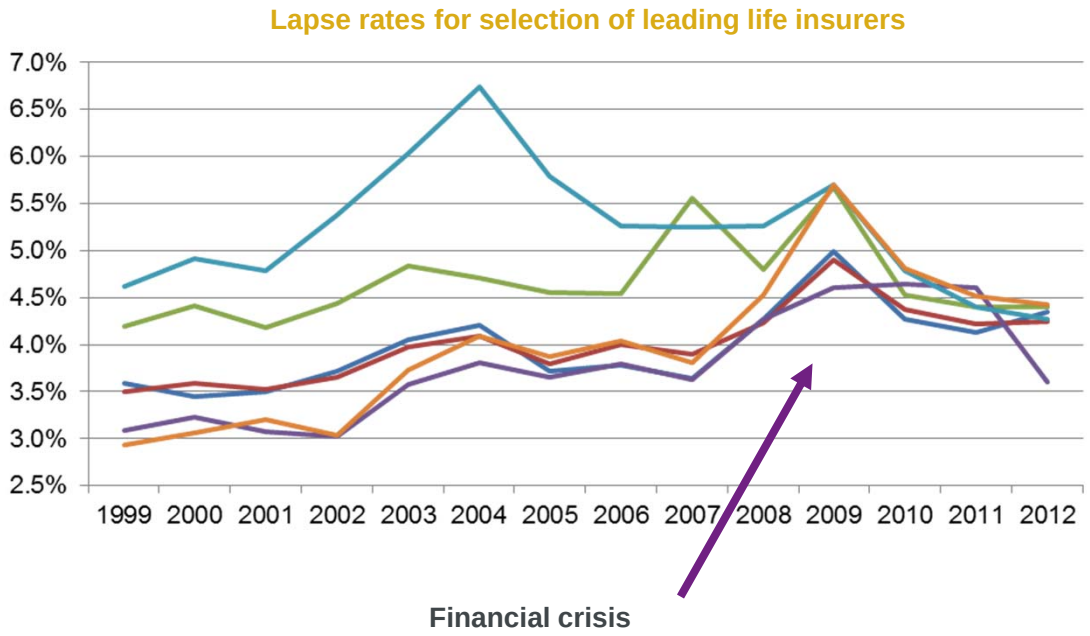
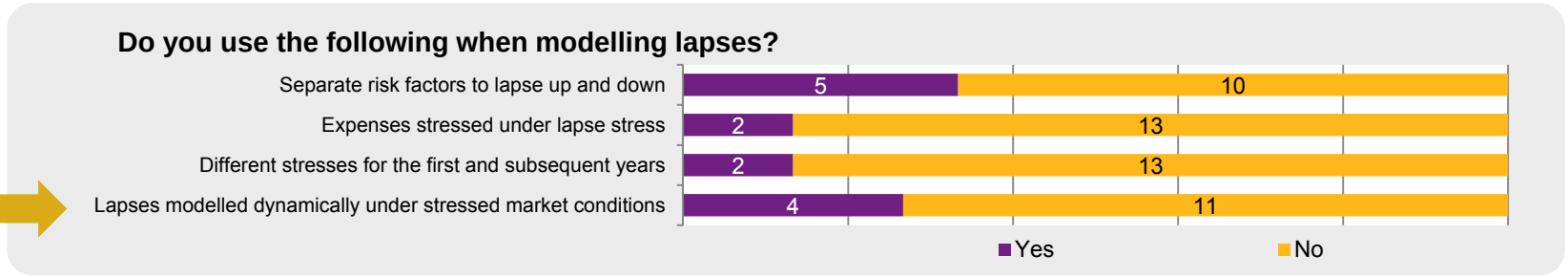
# Dynamic policyholder behaviour – does it exist?

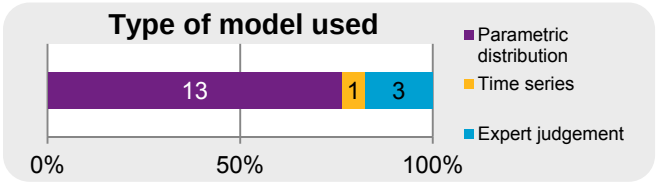


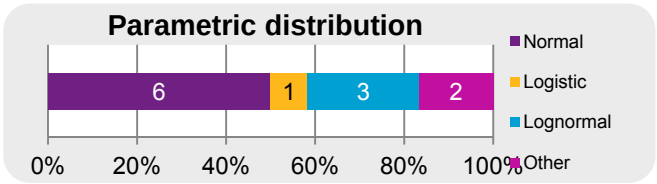

Source: WTW research and annual reports

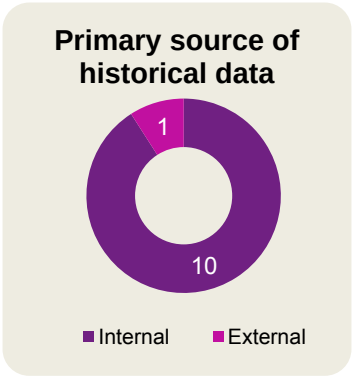
# Willis Towers Watson Risk Calibration Survey 2016

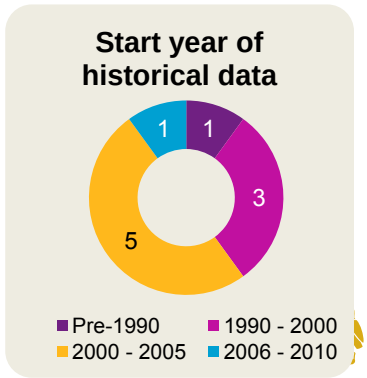



**15** of **17** firms have separate risk factors for lapse and mass lapse

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# Other reasons to model behaviour better

More granular assumption setting of lapse/surrender behaviour can improve

- Accuracy of cash flows (unmodelled heterogeneity leads to drift over time)
- Accuracy of pricing assumptions (and minimisation of adverse selection risk)
- Understanding of policyholder behaviour
- Targetting of profitable customers (ie marketing)

*Generally ties in with a more 'customer-centric' view*

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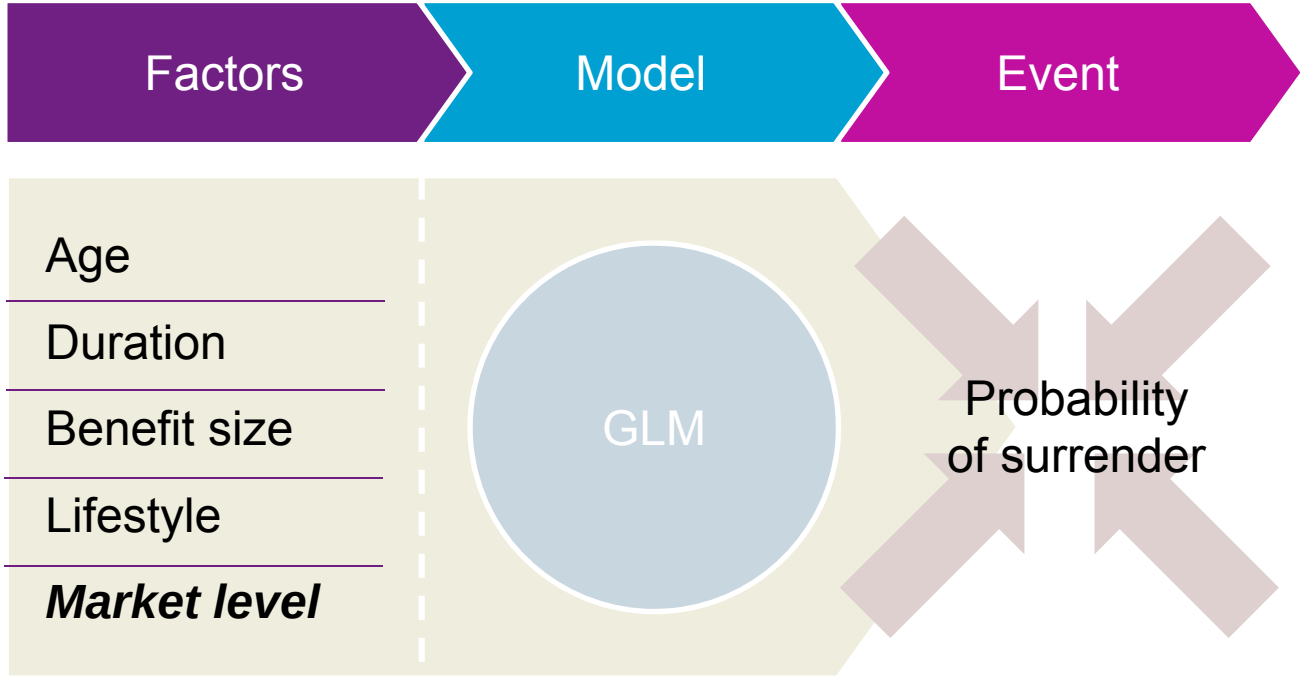
# What is a GLM?



# GLMs — typical structure

1. What the maths means in practice (example):
   *Probability of surrender in year =*
   *Base level for observed population* ×
   *Factor 1 (based on duration)* ×
   *Factor 2 (based on postcode group)* ×
   *Factor 3 (based on amount)* ×
   *Factor 4 (based on age)* …
2. Each factor is a series of multiplicative coefficients
3. All factors are considered simultaneously, allowing for correlations in the data automatically
4. The GLM finds the factor coefficients that will best fit the data
5. Method allows for the nature of the random process involved, and provides information about the (un)certainty of the result
6. Robust and transparent — a standard technique for many years in GI, and over five years in life
7. For surrender analyses, common to use a different mathematical form (logit transform)

| Postcode Group | Multiplier |
|---|---|
| Group A | 0.86 |
| Group B | 0.92 |
| Group C | 1.00 |
| Group D | 1.04 |
| Group E | 1.16 |

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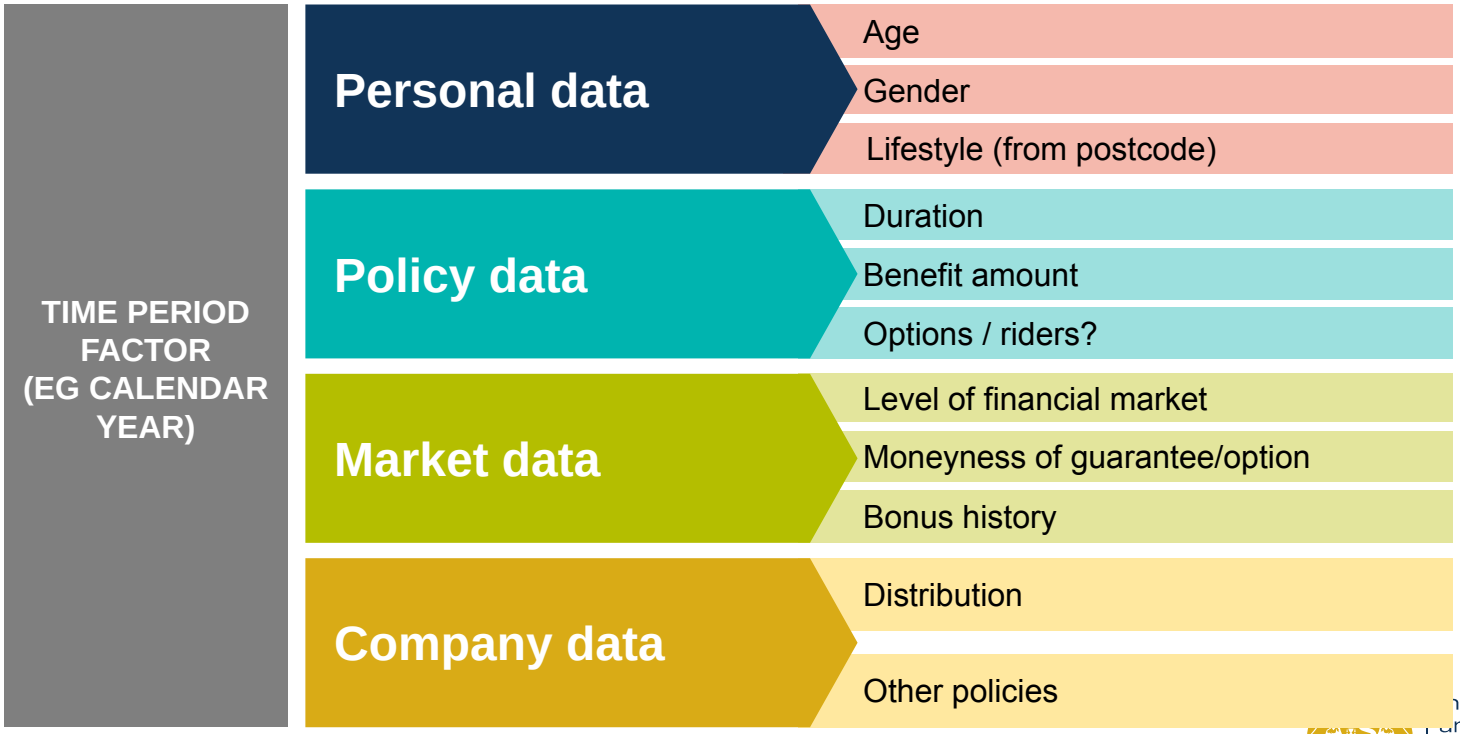
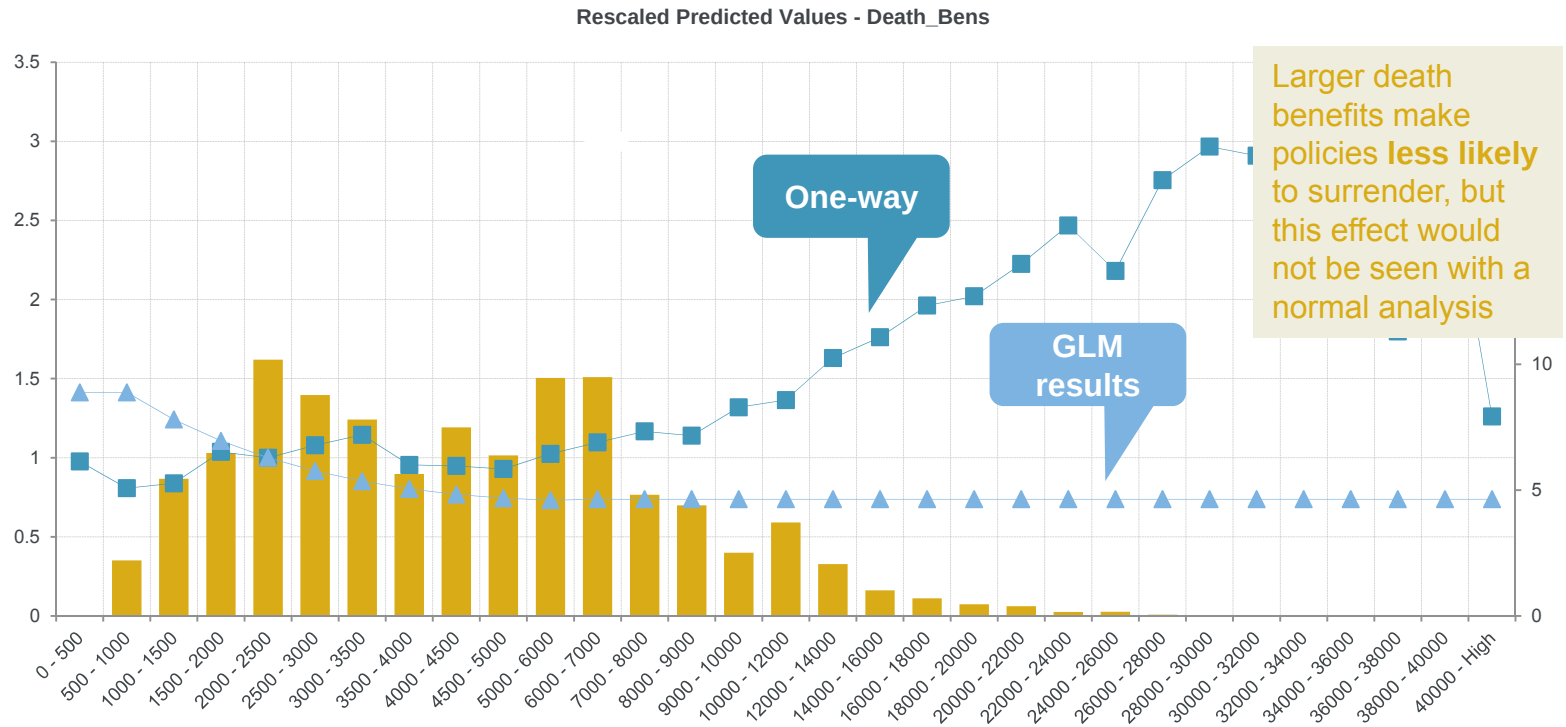
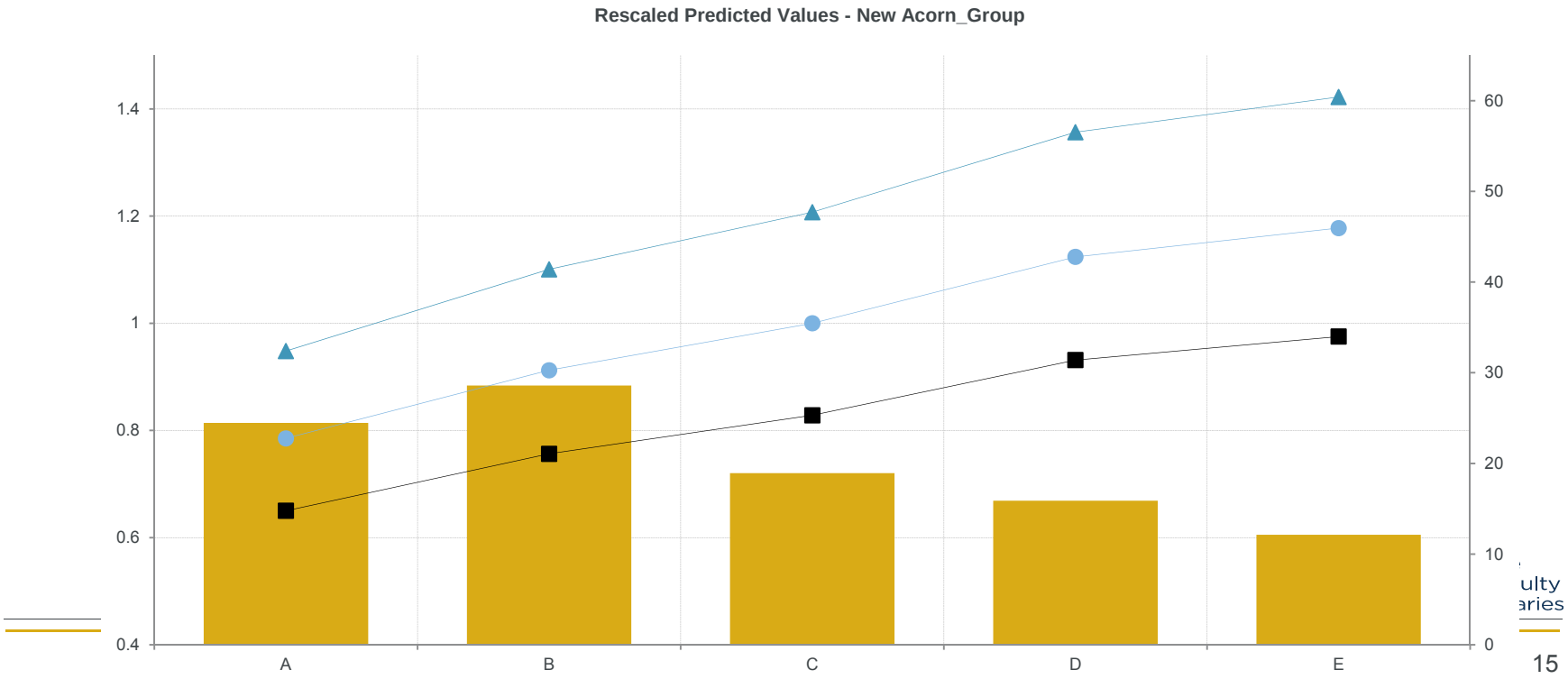
# Factors typically found to be predictive



# Effect of death benefit on surrender/lapse
(in conjunction with effects of all other factors)



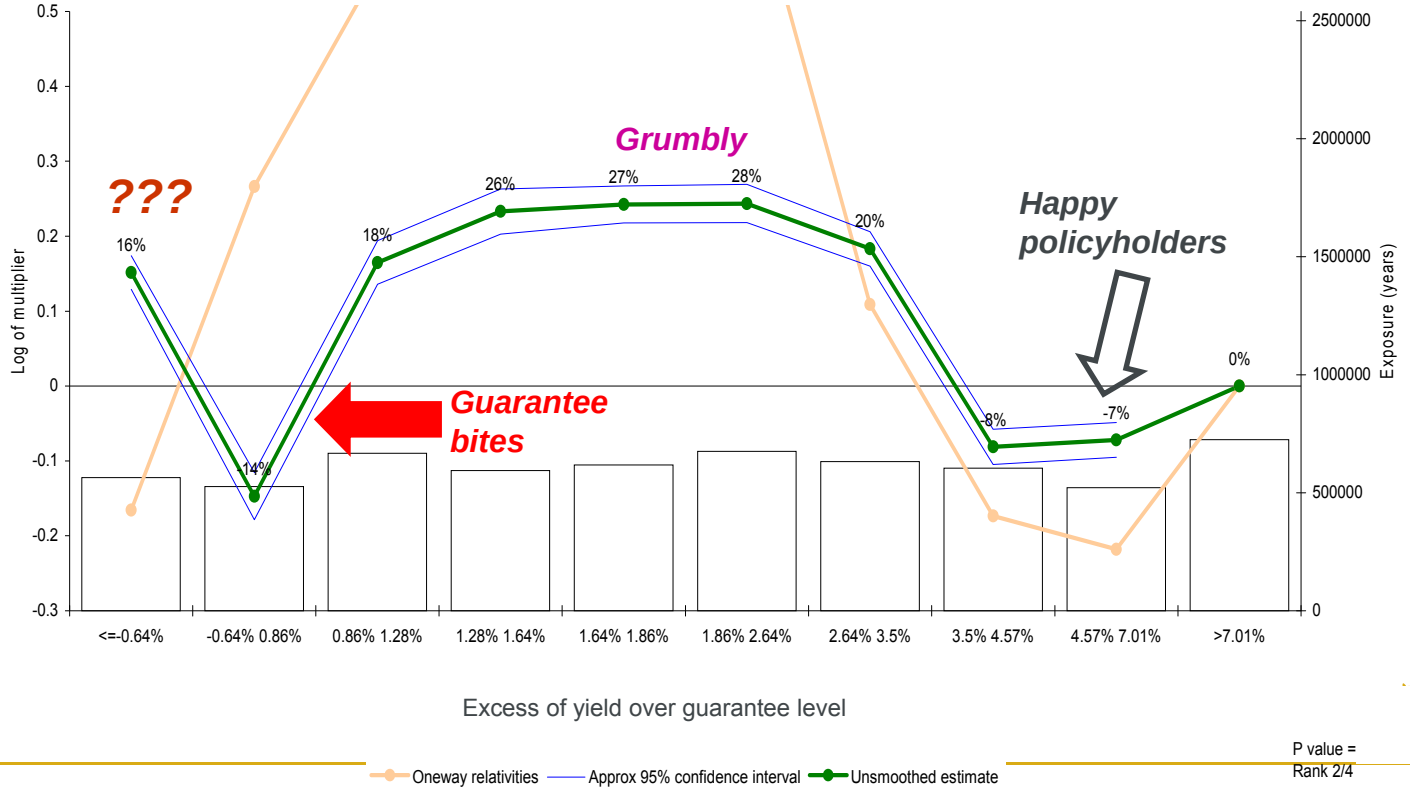
# Effect of Acorn Lifestyle groups on surrender/lapse



# Incorporating external data

- We can incorporate external data and investigate its usefulness in creating a predictive model
- For instance, we can define a factor based on the difference between the declared fund yield of the insurer in each year and the guarantee attaching to the products
- This example relates to a block of savings business analysed over a 15-year period
- Later, we see how market returns in each year can be used

# Incorporating external data (2)

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# Predicting retirement age

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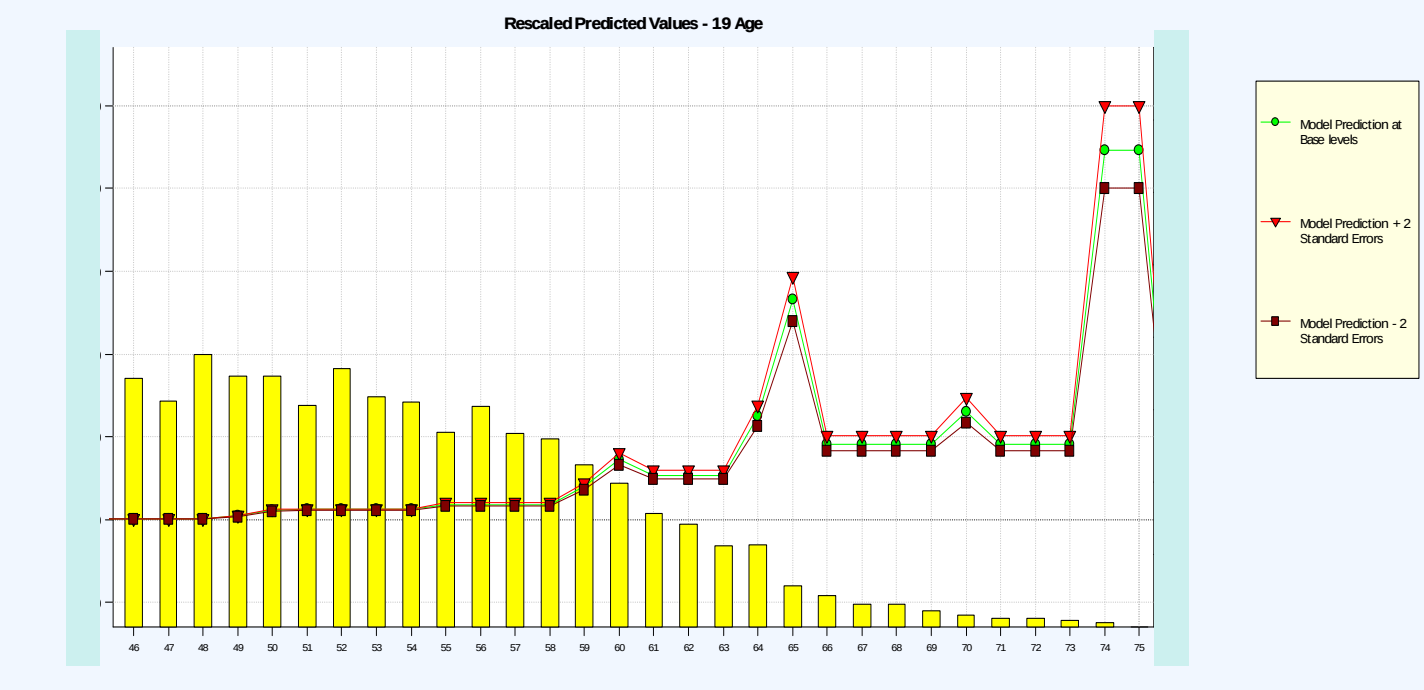
# Case study

- The following slides show some indicative results from a recent project investigating the influence of factors on at-retirement policyholder behaviour
- Examples of factors found to be predictive: gender, age, policy type, policyholder wealth, time since last payment to the policy, calendar year (and various others)
- The influence of financial markets (looked at in terms of equity markets and bond yields) was borderline predictive
- Slides are shown with axes / values ‘blued out’

# Age


Rescaled Predicted Values - 19 Age
Model Prediction at Base levels
Model Prediction + 2 Standard Errors
Model Prediction - 2 Standard Errors
46
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75

# Comparison against market measures (1)

- GLM results for calendar year compared against a range of plausible market measures
  - First graph shows a straight comparison (so an interesting result would be market lines with similar or opposite trend to green GLM line)
  - Second graph shows ‘GLM result / market index’ so an interesting result would be a generally horizontal line
- The relationships were also considered allowing for time lags (these showed no difference in predictiveness)

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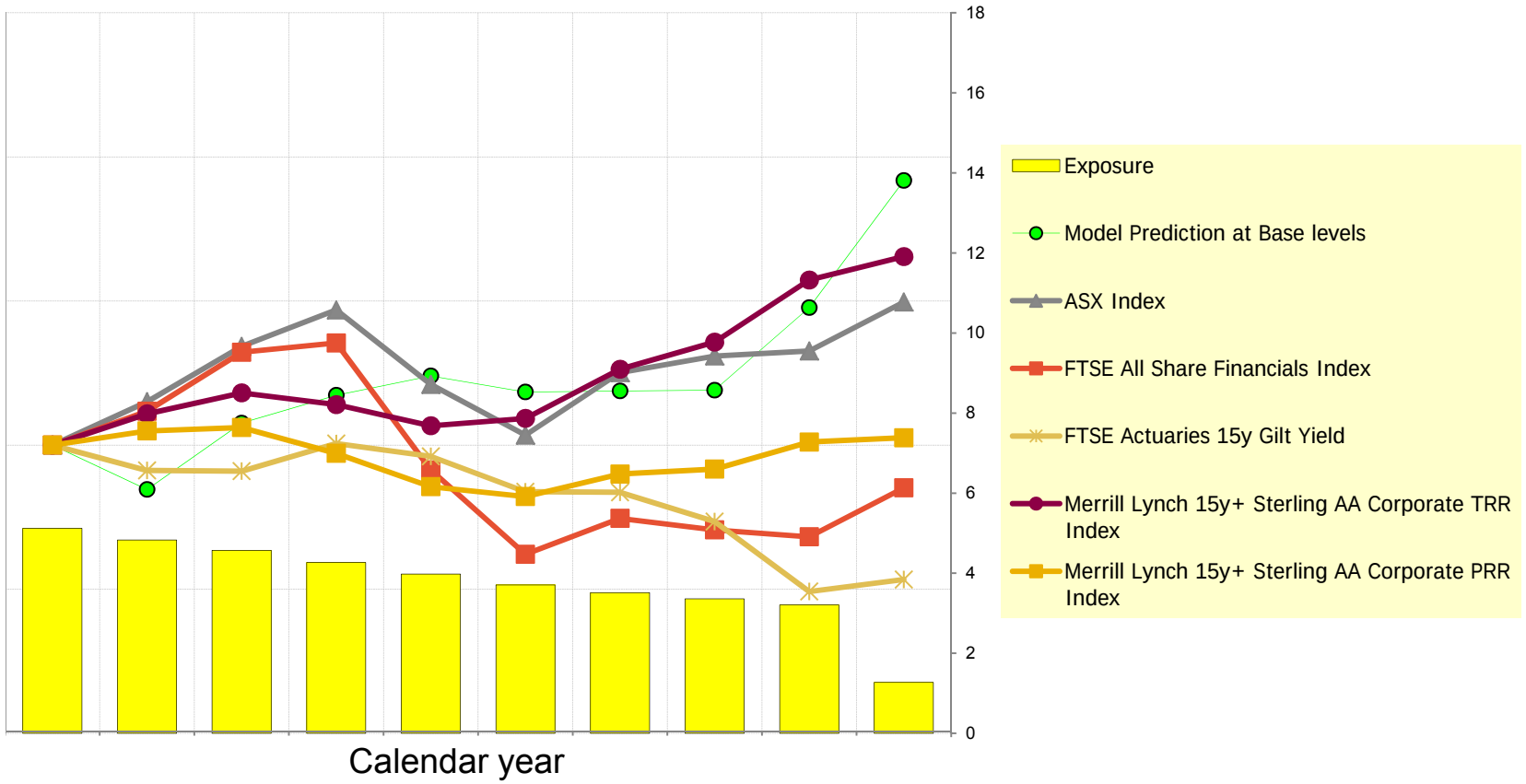
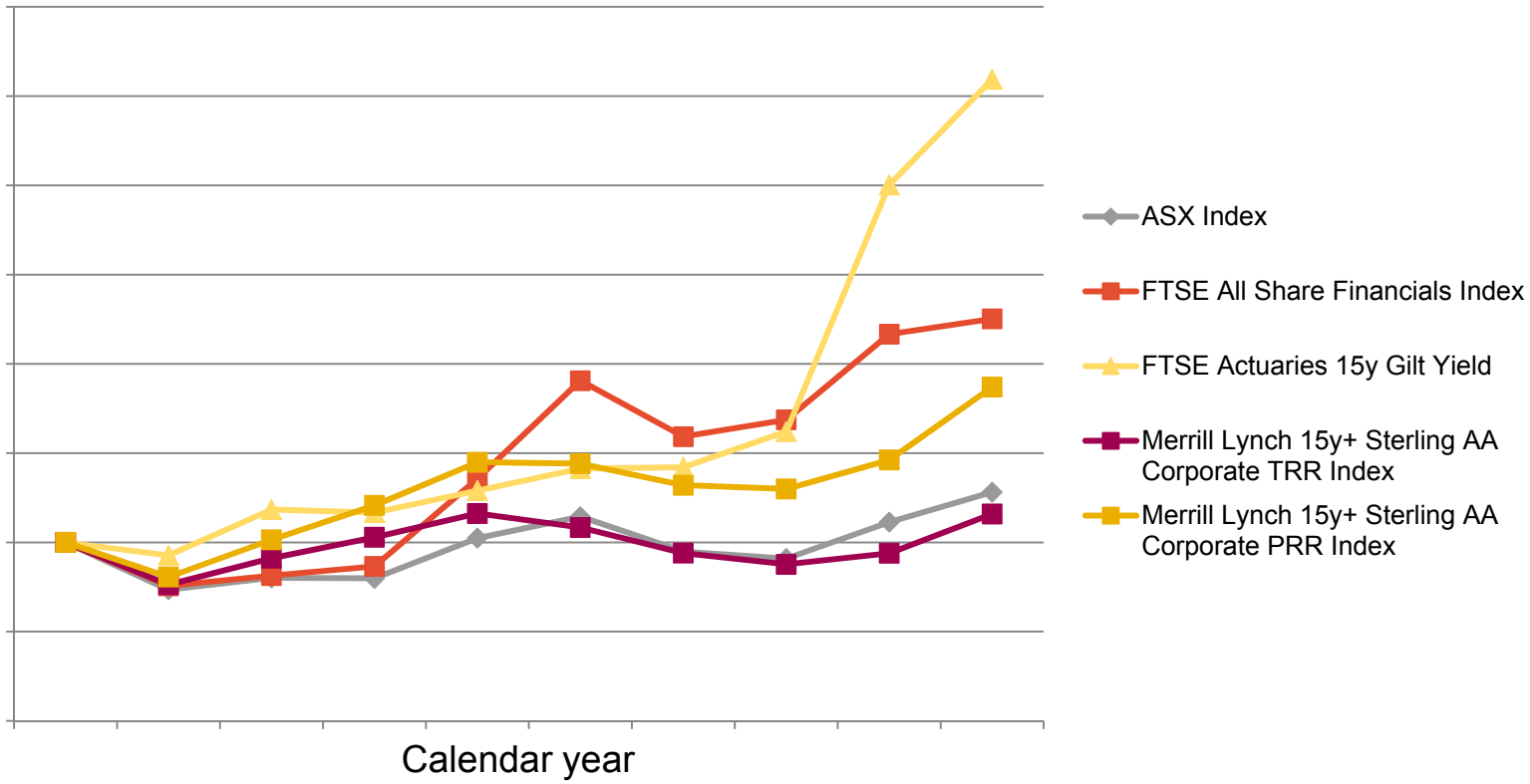
# Comparison against market measures (2)



# Comparison against market measures (3)



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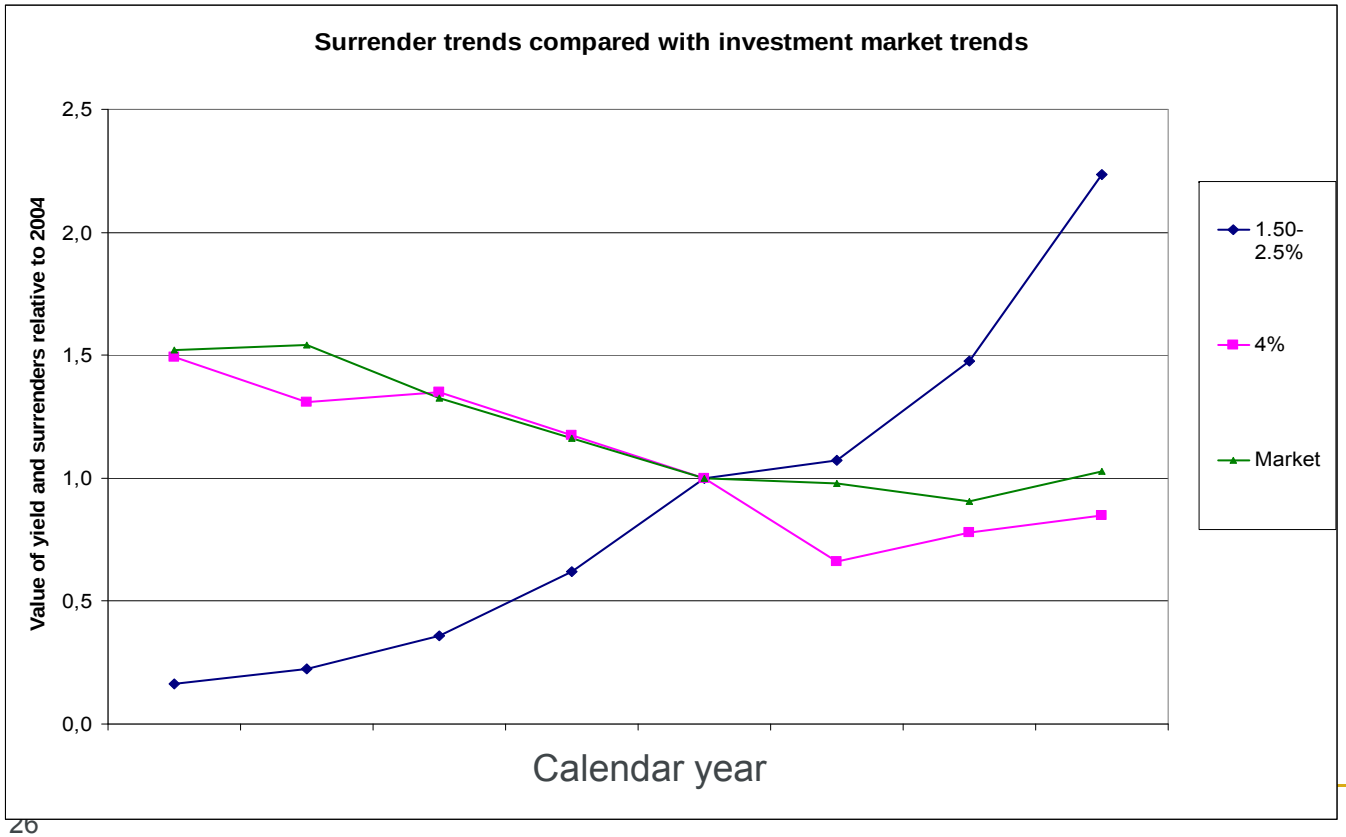
# Dynamic policyholder behaviour

- An interaction (dependency) relates to how one risk factor varies according to the level of another (different from correlation)
- The ability to model interactions in GLMS can assist in understanding how policyholder behaviour varies with market movements
- The following graph uses the *product guarantee * calendar year of exposure* interaction to show how the surrender rate seems to vary according to high or low guarantee levels
- We superimpose a graph of relevant bond yields

# Dynamic policyholder behaviour (2)



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# What does a dynamic policyholder behavior assumption look like?

- From the previous case study / graph:
  - For low guarantees, market decreases lead to increased surrenders in a fairly linear manner
  - For high guarantees, market decreases seem to lead to decreased surrenders – presumably because policyholders value their guarantees more
- These relationships could reasonably give us the following dynamic adjustments to projected policyholder surrender rates to use in stochastic models:
  - for high guarantee products, multiply rates by {yield / 3.6%}
  - for low guarantee products, divide by  3 * {yield / 3.6%}
  - sensible to add floors/caps to these algorithms (reduced effect beyond the limits)

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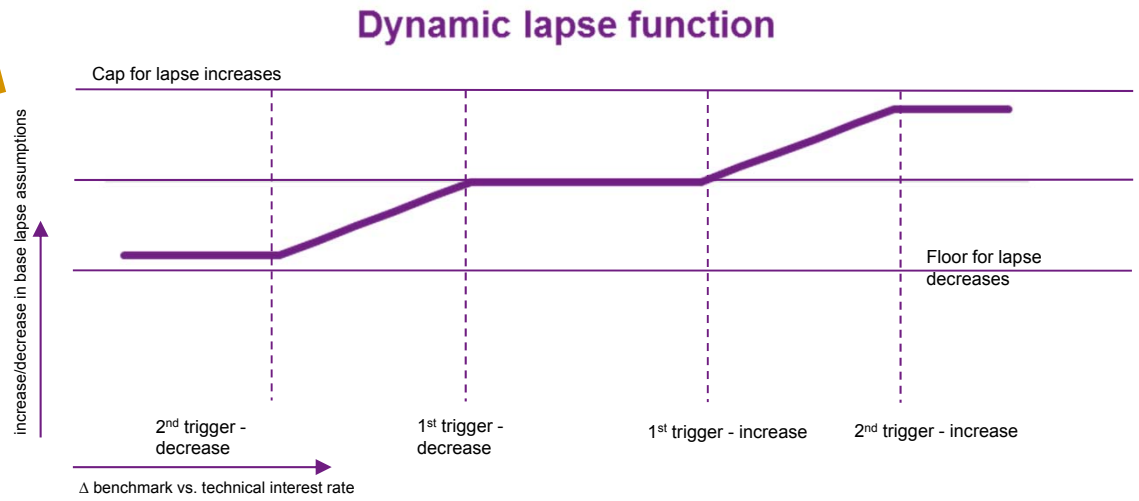
# What does a dynamic policyholder behavior assumption look like? (2)

Example (Non-UK)




**Triggers**

- level of interest rates
- profit sharing rates compared to competitors
- level of equity index
- financial strength of an insurer

**Usage**

- in selected markets (Germany, Austria, France, Italy) – common market approach for with-profit business

# Questions

# Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.

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