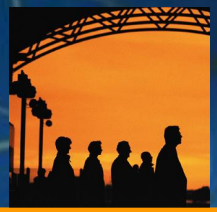
Non-traditional applications of predictive modeling

2005 CAS Seminar on Predictive Modeling

James Tanser FIA

Watson Wyatt Worldwide



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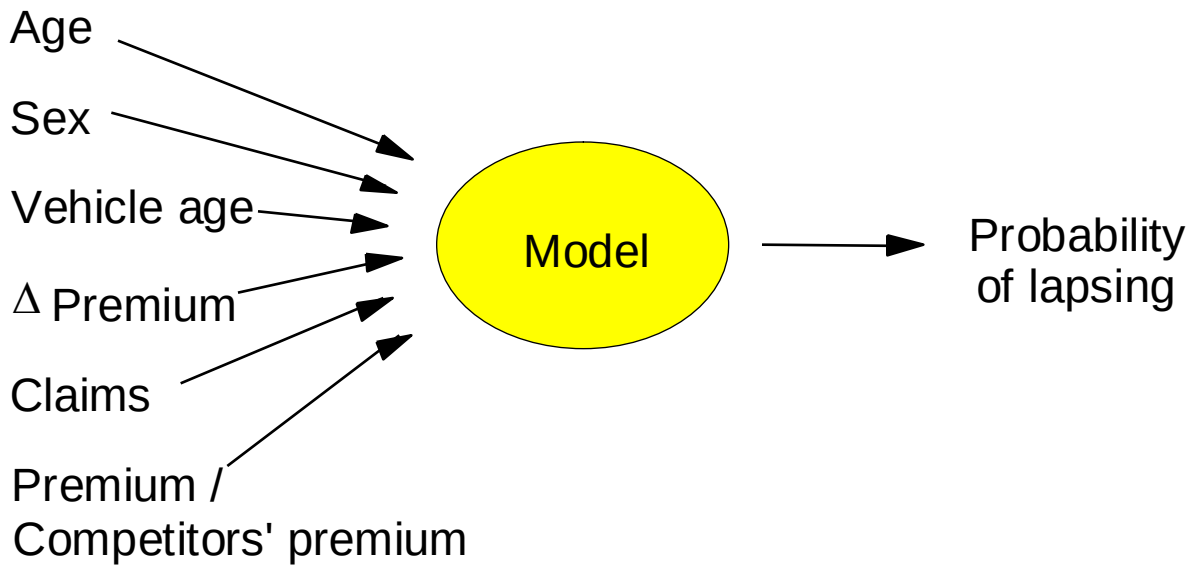
Topics

- Retention and conversion
- Scores
- Sales channel analysis

Modeling lapses

- Who are they
  - age, sex, vehicle age etc
- What you've done to them
  - proposed change in premium
  - service
- What others have done to them
  - competitors' premium

Modeling retention

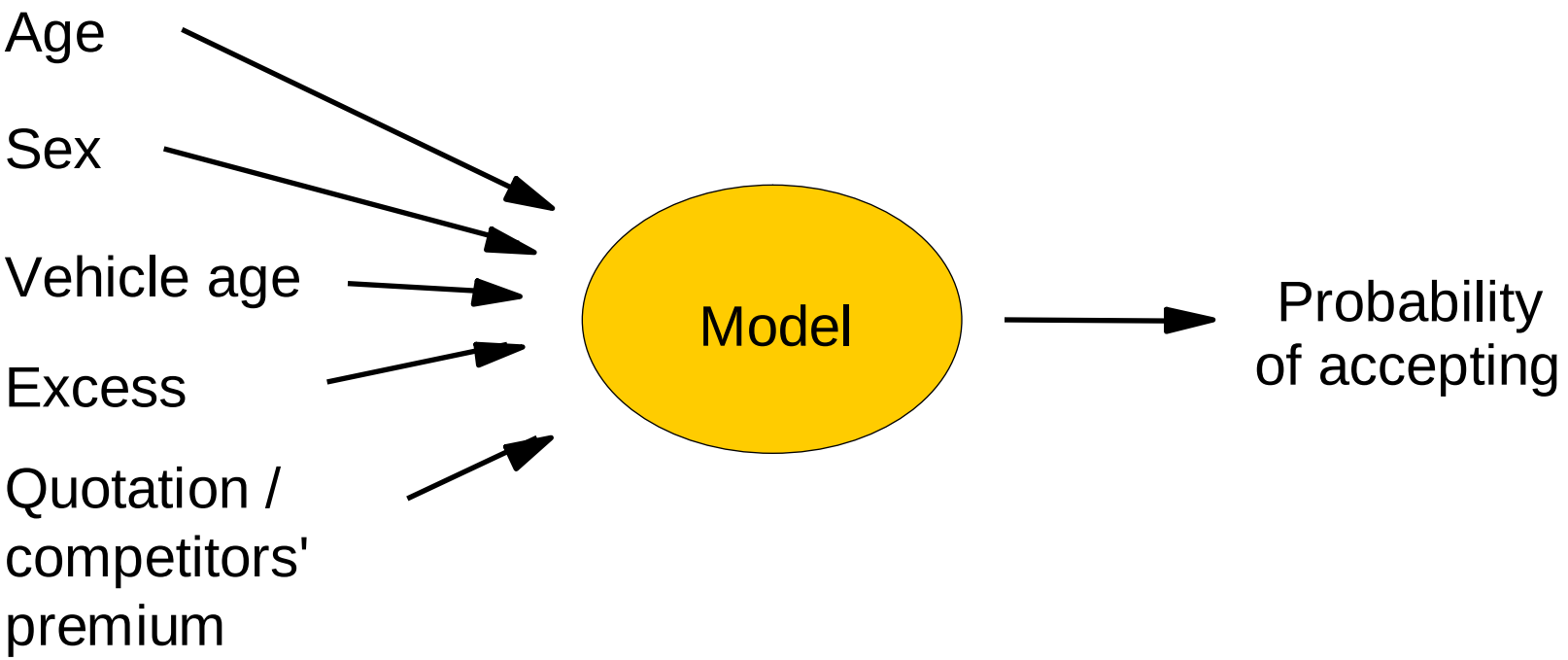


- Model
  - normal factors
  - payment method
  - NCD expectation
  - source
  - claims history
  - other products held
  - change in cover

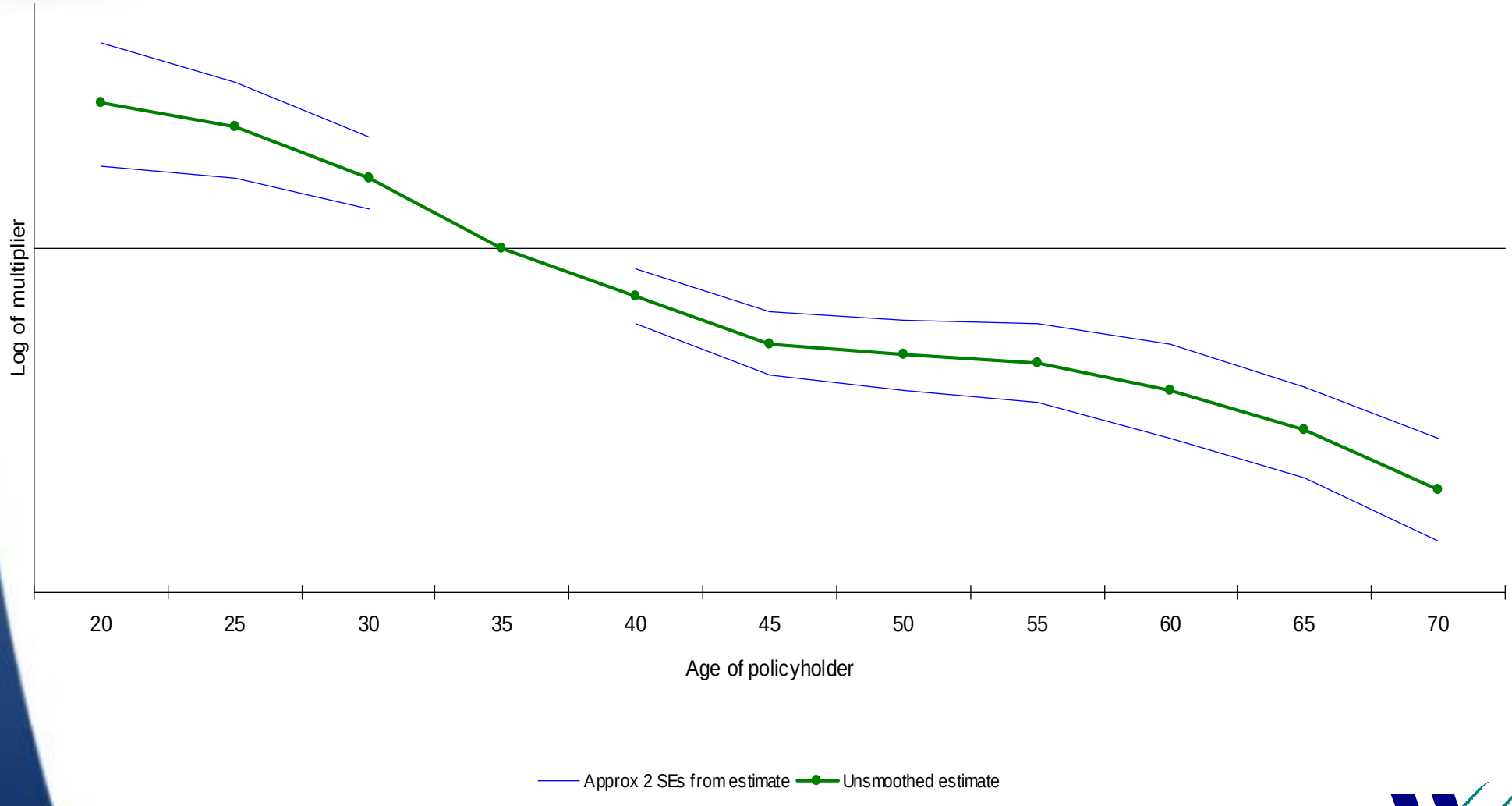
  plus…
  - change in premium
  - competitiveness

Modeling new business rates

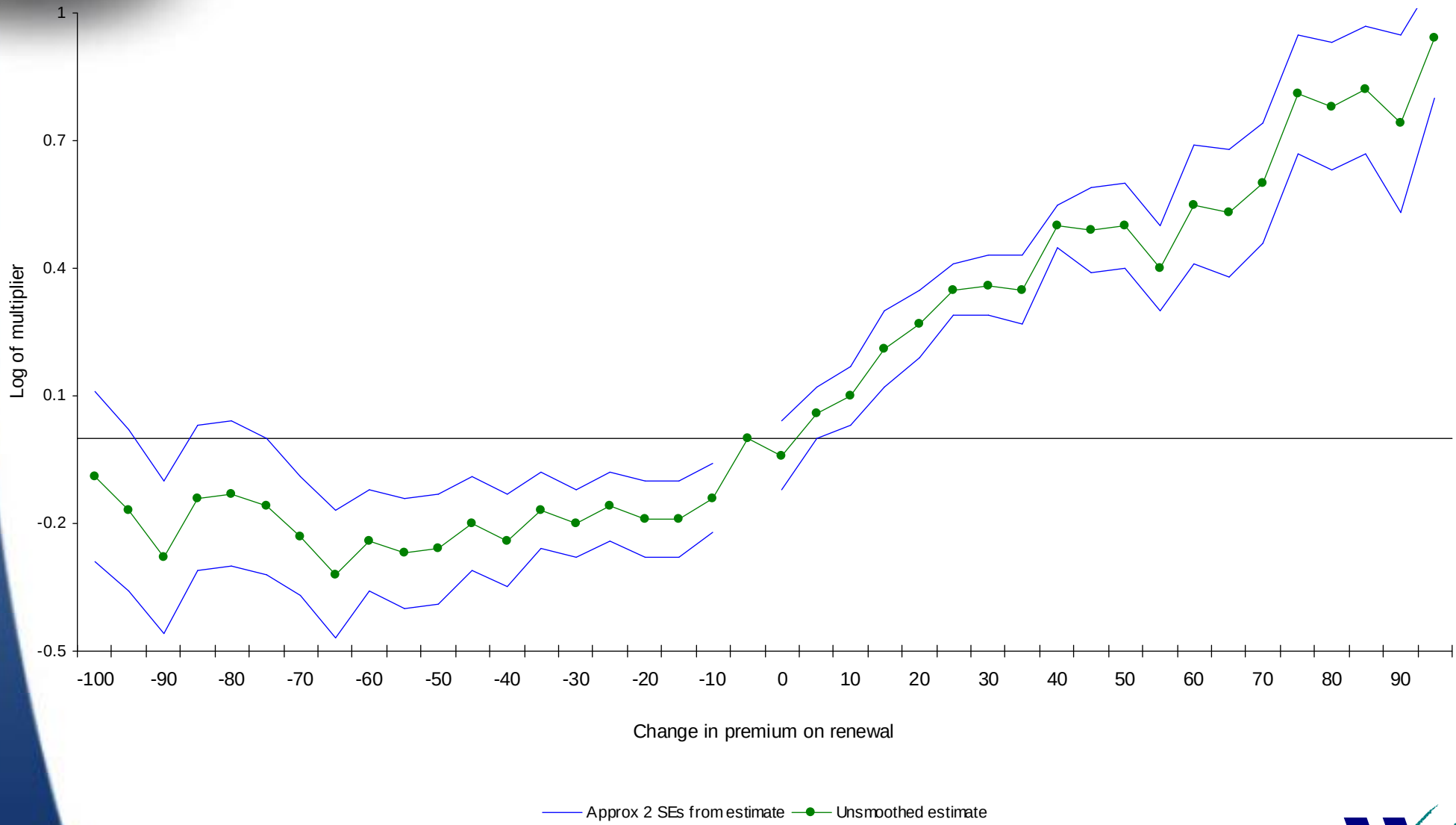
- If details of individual quotes known, can be modelled in similar way
- Otherwise approximations required



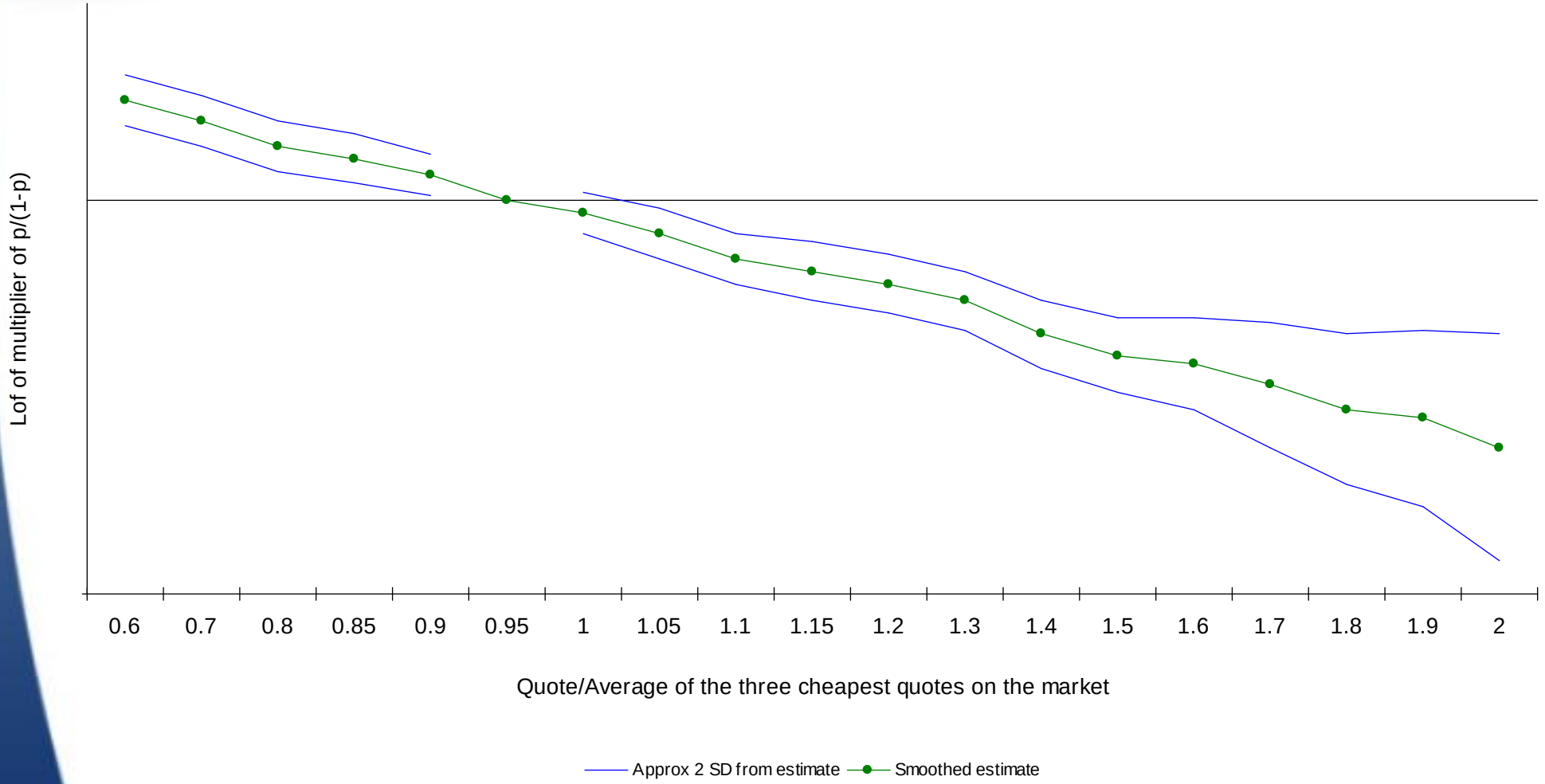
Effect of age of policyholder on lapses



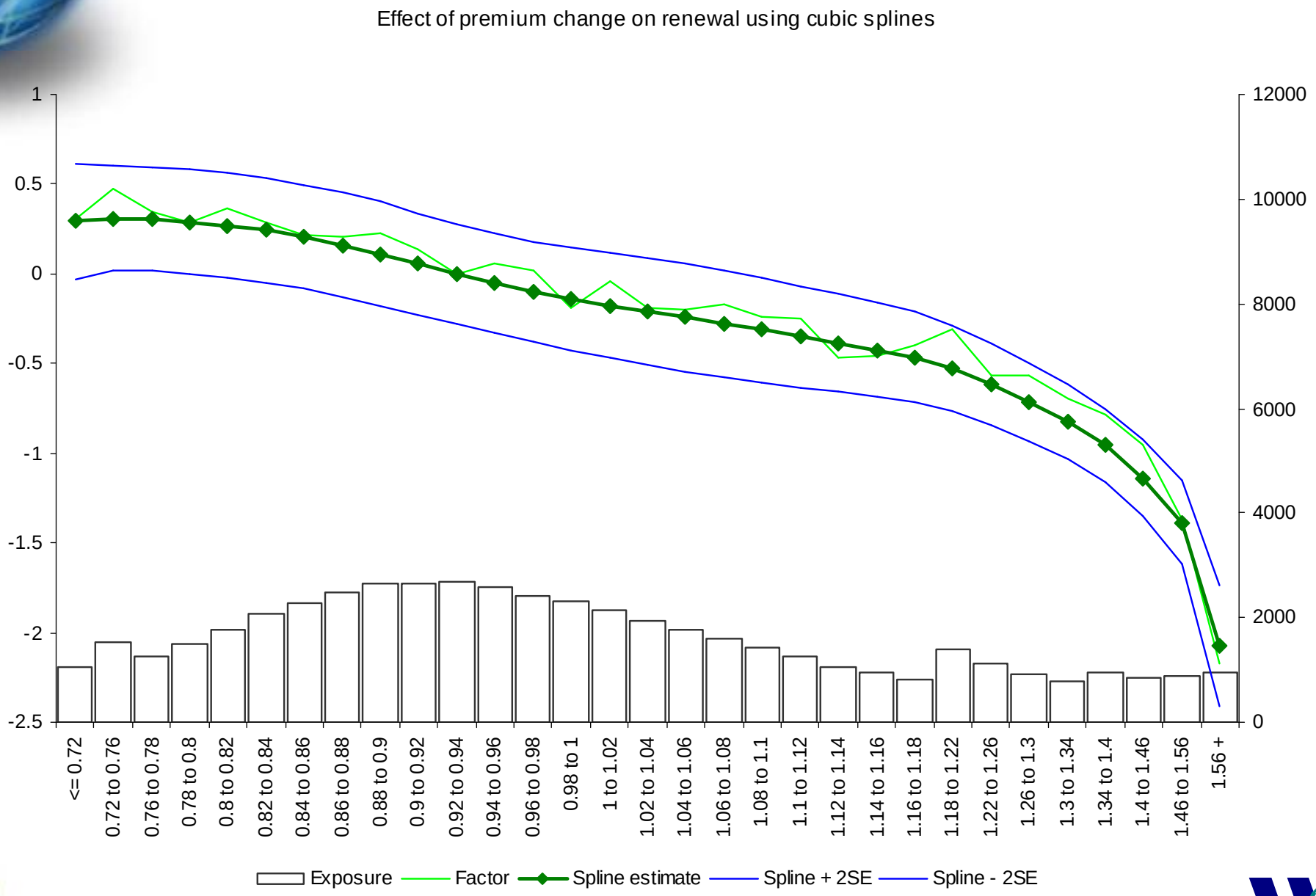
Effect of premium change on lapses



Effect of competitiveness on new business



Splines

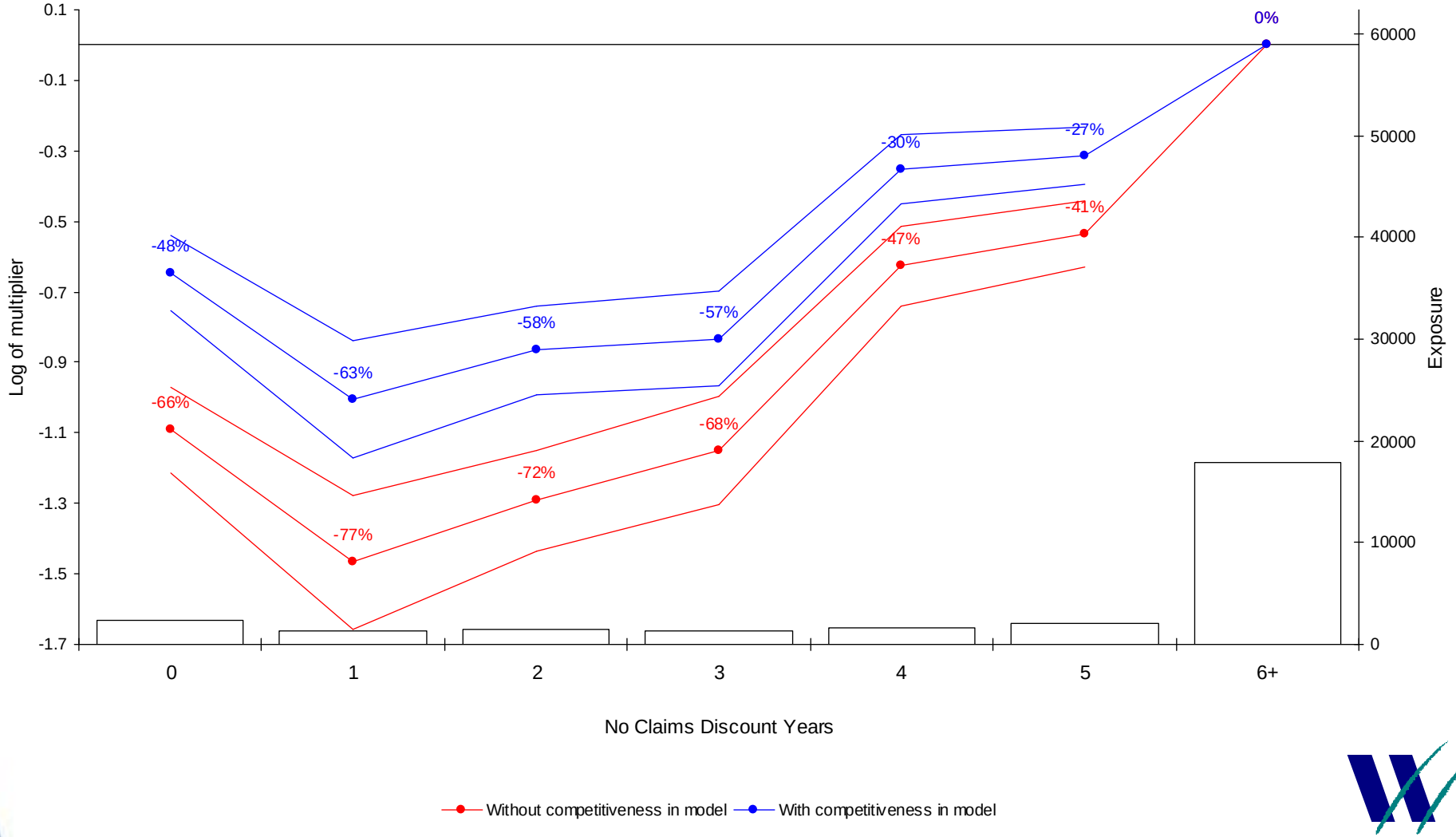

Effect of premium change on renewal using cubic splines
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
12000
10000
8000
6000
4000
2000
0
<= 0.72
0.72 to 0.76
0.76 to 0.78
0.78 to 0.8
0.8 to 0.82
0.82 to 0.84
0.84 to 0.86
0.86 to 0.88
0.88 to 0.9
0.9 to 0.92
0.92 to 0.94
0.94 to 0.96
0.96 to 0.98
0.98 to 1
1 to 1.02
1.02 to 1.04
1.04 to 1.06
1.06 to 1.08
1.08 to 1.1
1.1 to 1.12
1.12 to 1.14
1.14 to 1.16
1.16 to 1.18
1.18 to 1.22
1.22 to 1.26
1.26 to 1.3
1.3 to 1.34
1.34 to 1.4
1.4 to 1.46
1.46 to 1.56
1.56 +
Exposure
Factor
Spline estimate
Spline + 2SE
Spline - 2SE

Modelling in practice
Retention modelling

- Model choice
  - theoretically logistic most appropriate
  - if lapses are low (or results are not going to be used numerically), Poisson acceptable and easier to understand
- Beware premium
  - GLM shows effect *all other factors being equal* - for varying premium all other factors are never equal
  - consider fitting separate models for different premiums bands
- Competitiveness
  - superimposing models with and without competitiveness measure will show what effects are simply price related

Separating price effects from other effects

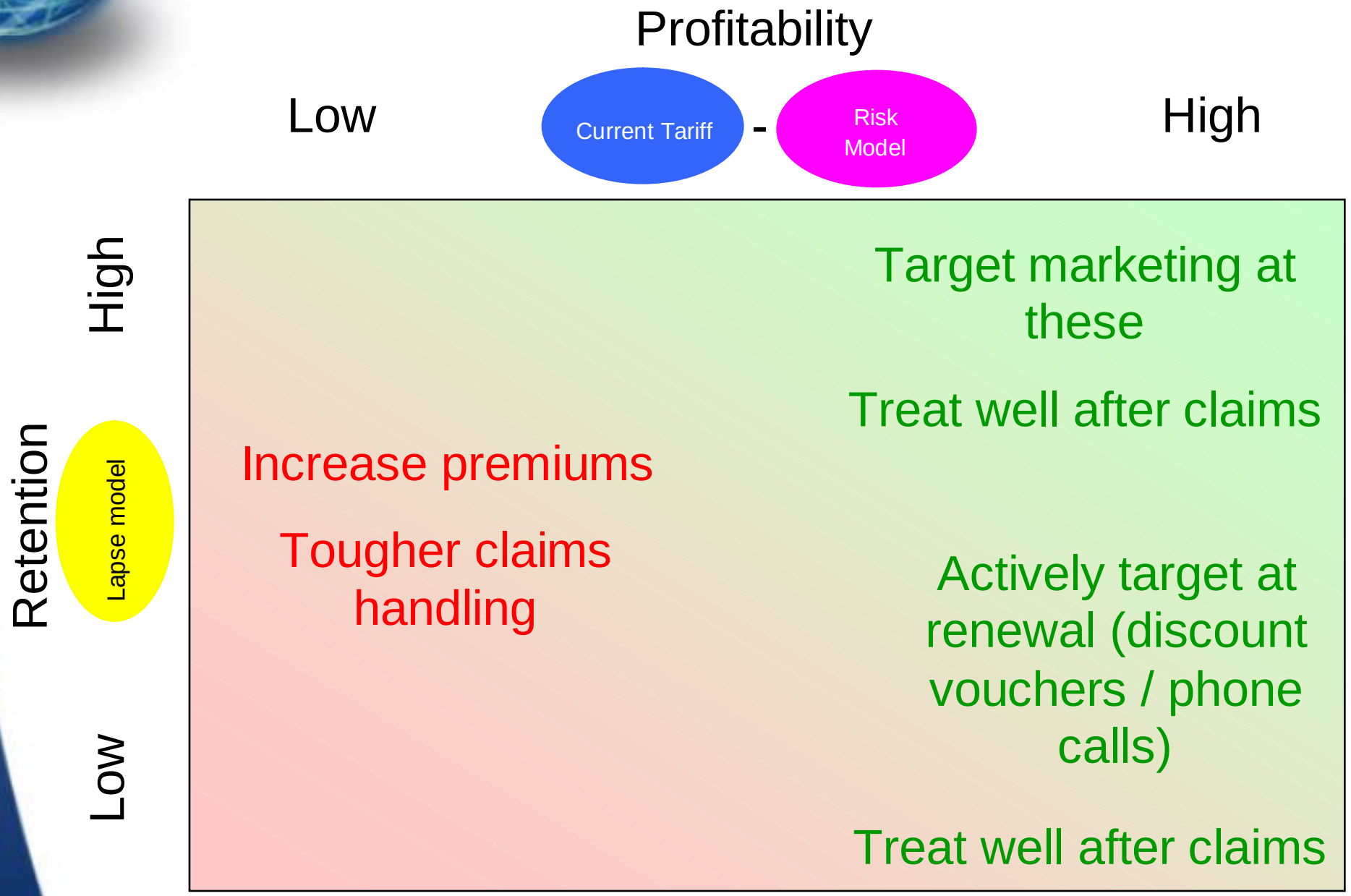
- Superimposing models with and without competitiveness will show extent to which effects are simply price related



Why model lapses / new business?

- Qualitative management decisions
  - marketing strategies
  - renewal campaigns
- Simple lifetime loadings
- Modelling
  - simple lifetime modelling
  - detailed impact modelling
  - detailed lifetime modelling

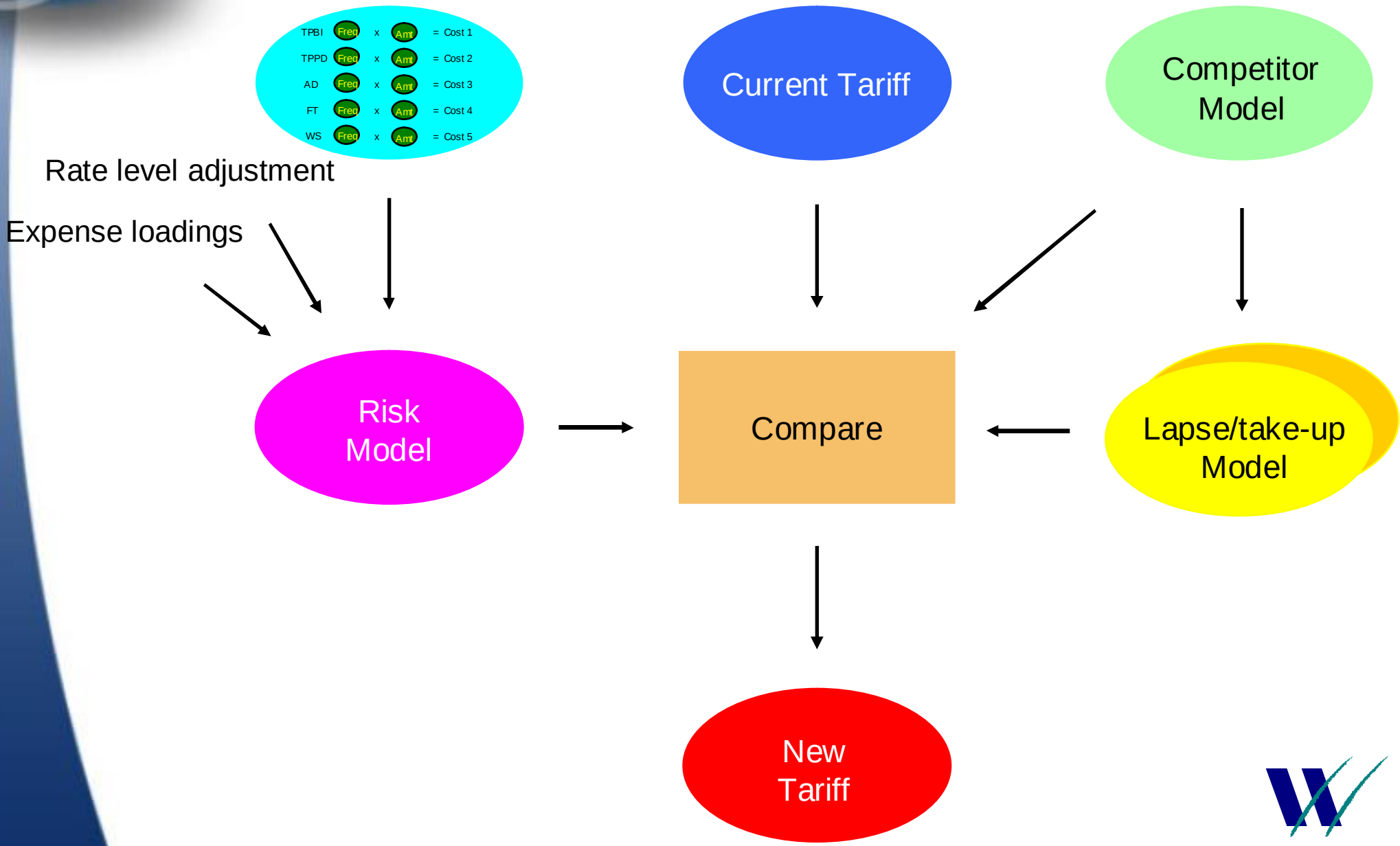
Customer value



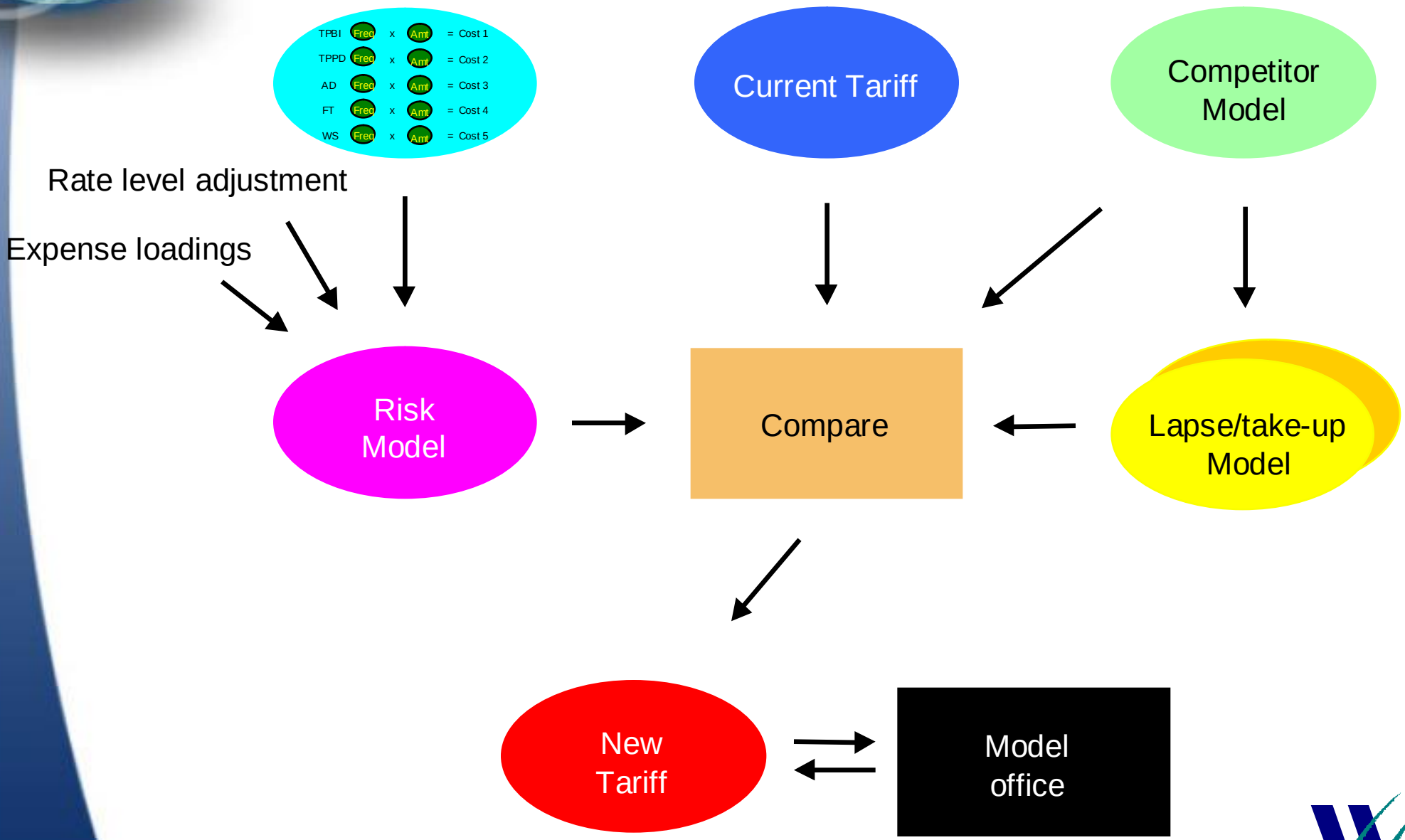
Lifetime loadings

- Expenses per policy
  - acquisition 100
  - renewal 30
- Expected lifetime
  - young 2 years
  - old 5 years
- Lifetime expense loadings
  - young (100 + 1 * 30) / 2 = 65
  - old (100 + 4 * 30) / 5 = 44

The premium rating process



The premium rating process

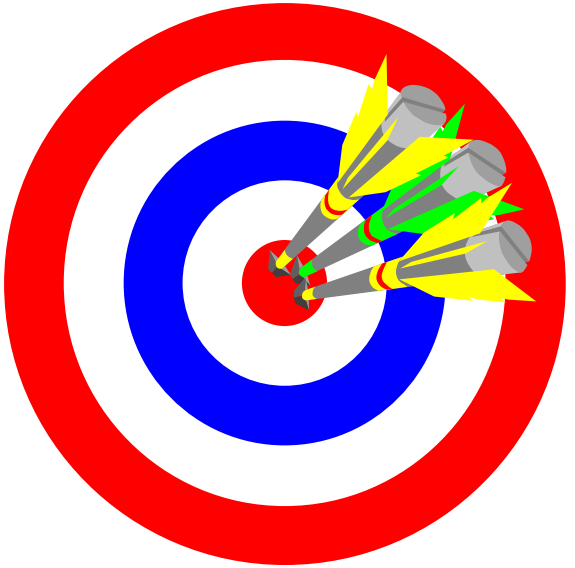


Topics

- Retention and conversion
- Scores
- Sales channel analysis

Profitability scoring

- Construct profitability score based on expected loss ratio
- Profitability score can then be used to target sections of a portfolio



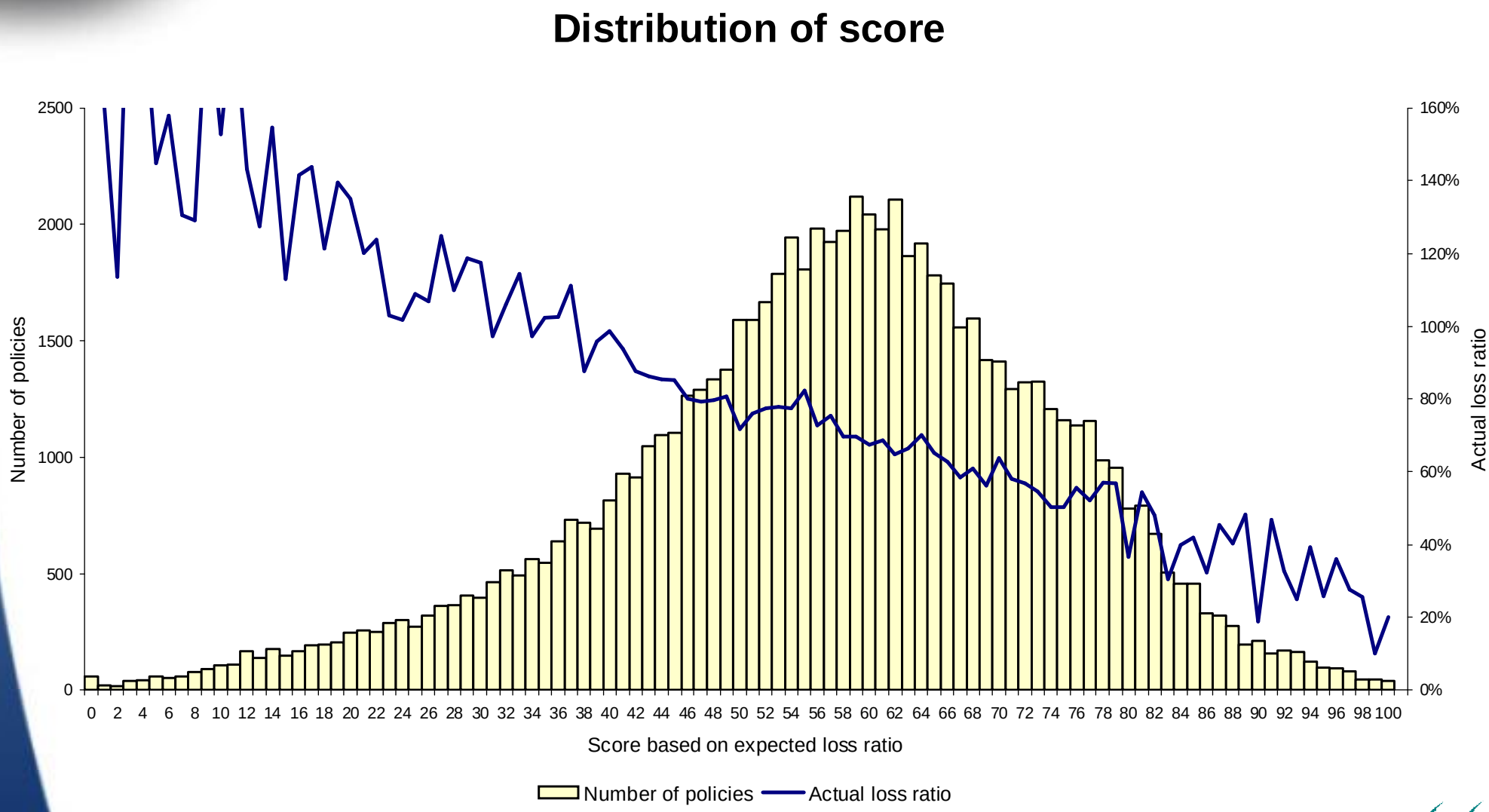
- Expected loss ratio can be modeled using a risk premium model offset by current premium rates
- Expected loss ratio can be banded into discrete bands if desired

Generalised linear models

$$E[\underline{Y}] = \underline{\mu} = g^{-1}(\mathbf{X}.\underline{\beta} + \underline{\xi})$$

$$Var[\underline{Y}] = \phi.V(\underline{\mu}) / \underline{\omega}$$

Profitability scoring



Profitability scoring

- Target marketing
  - Use external geodemographic data to identify segments likely to be profitable
- Broker compensation
  - Bonus related to average score based on non-tariff factors
  - Especially useful in heavily regulated states
- Point of sale cross selling

Topics

- Retention and conversion
- Scores
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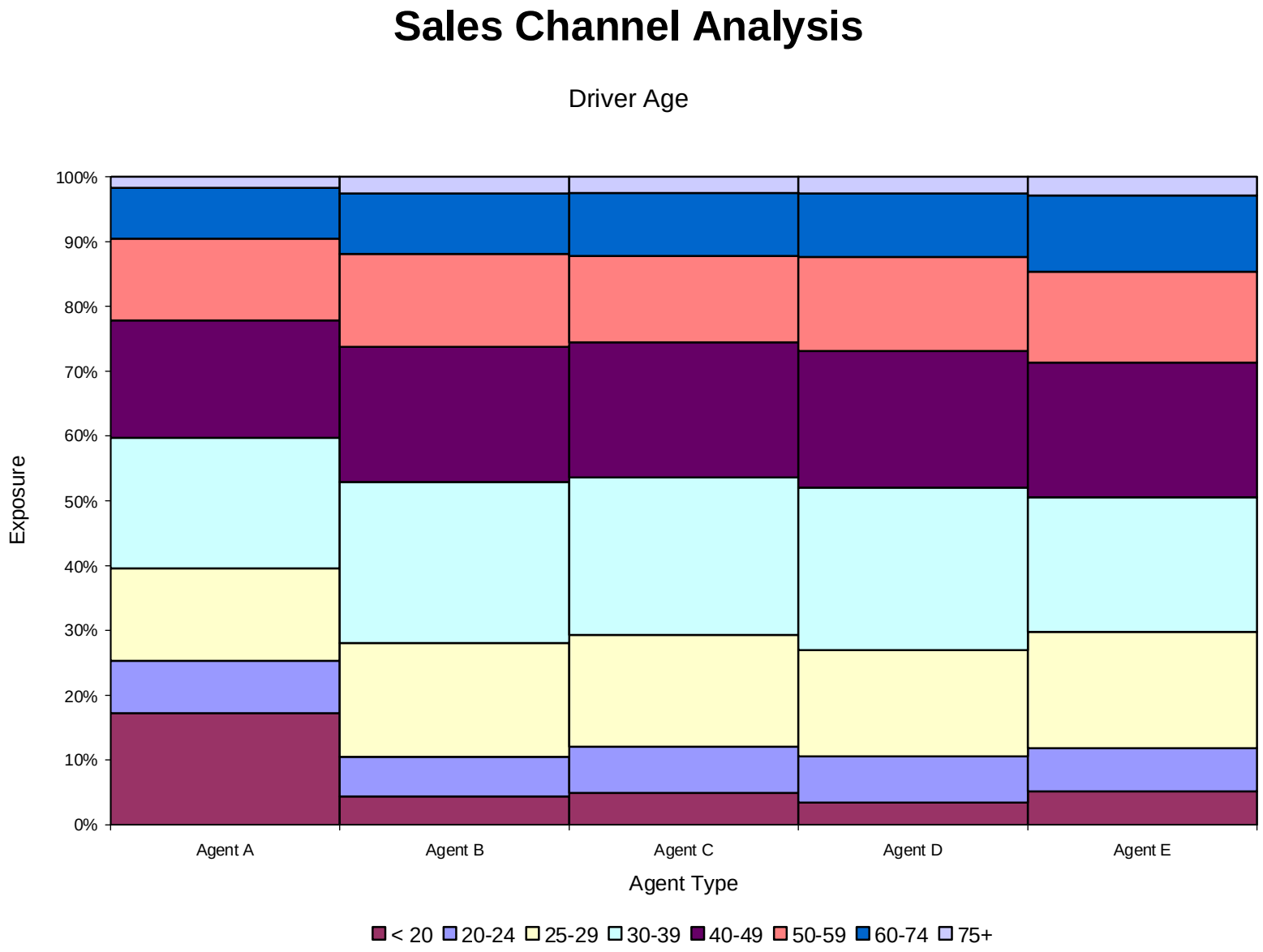
Sales channel analysis

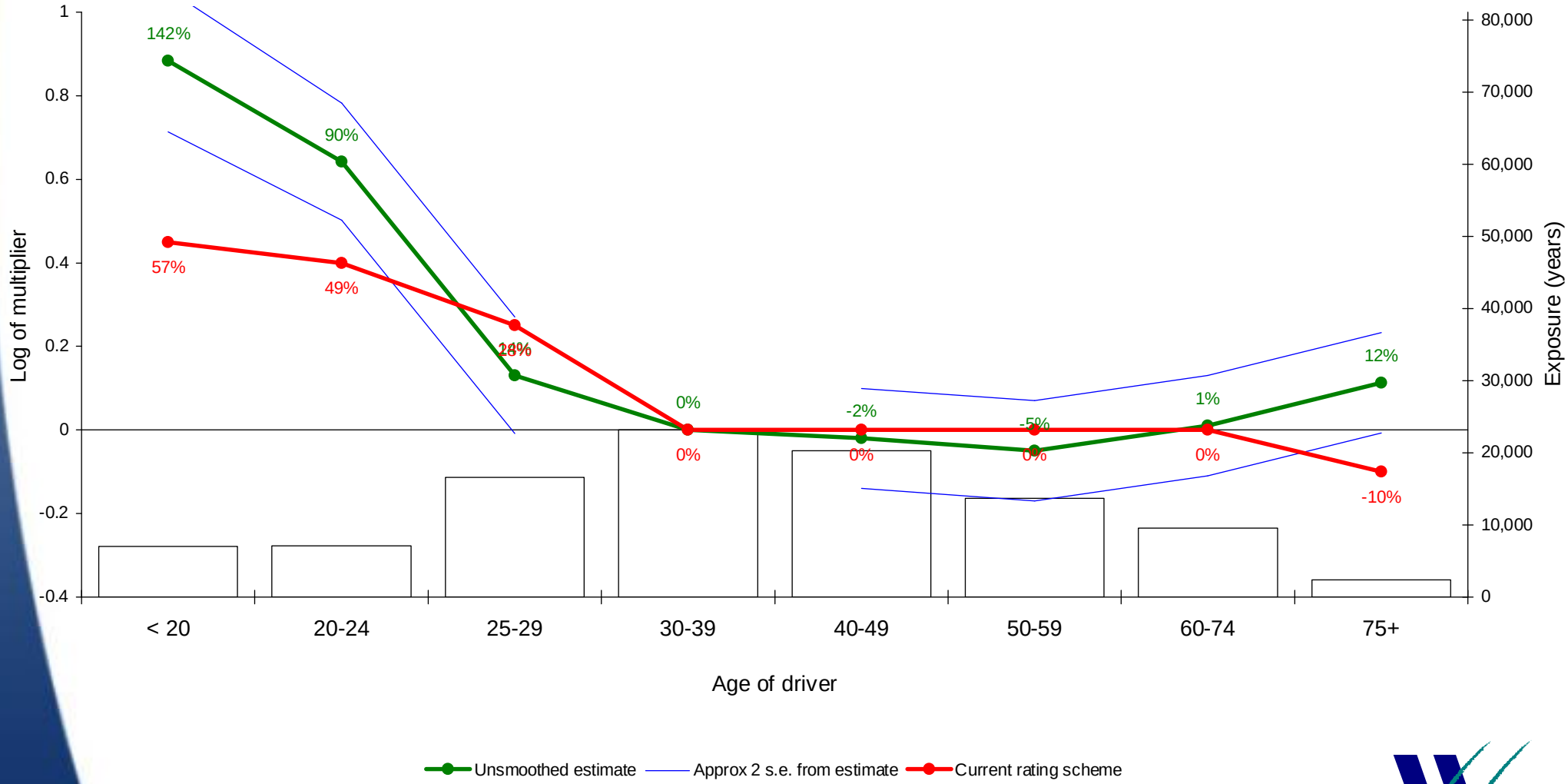
- GLMs can help distinguish between effect on profit of
  - mix of business written through a particular channel
  - effect of channel itself
- Simply compare one-way for channel with GLM for channel - the rest results from mix of business

Identifying mix of business

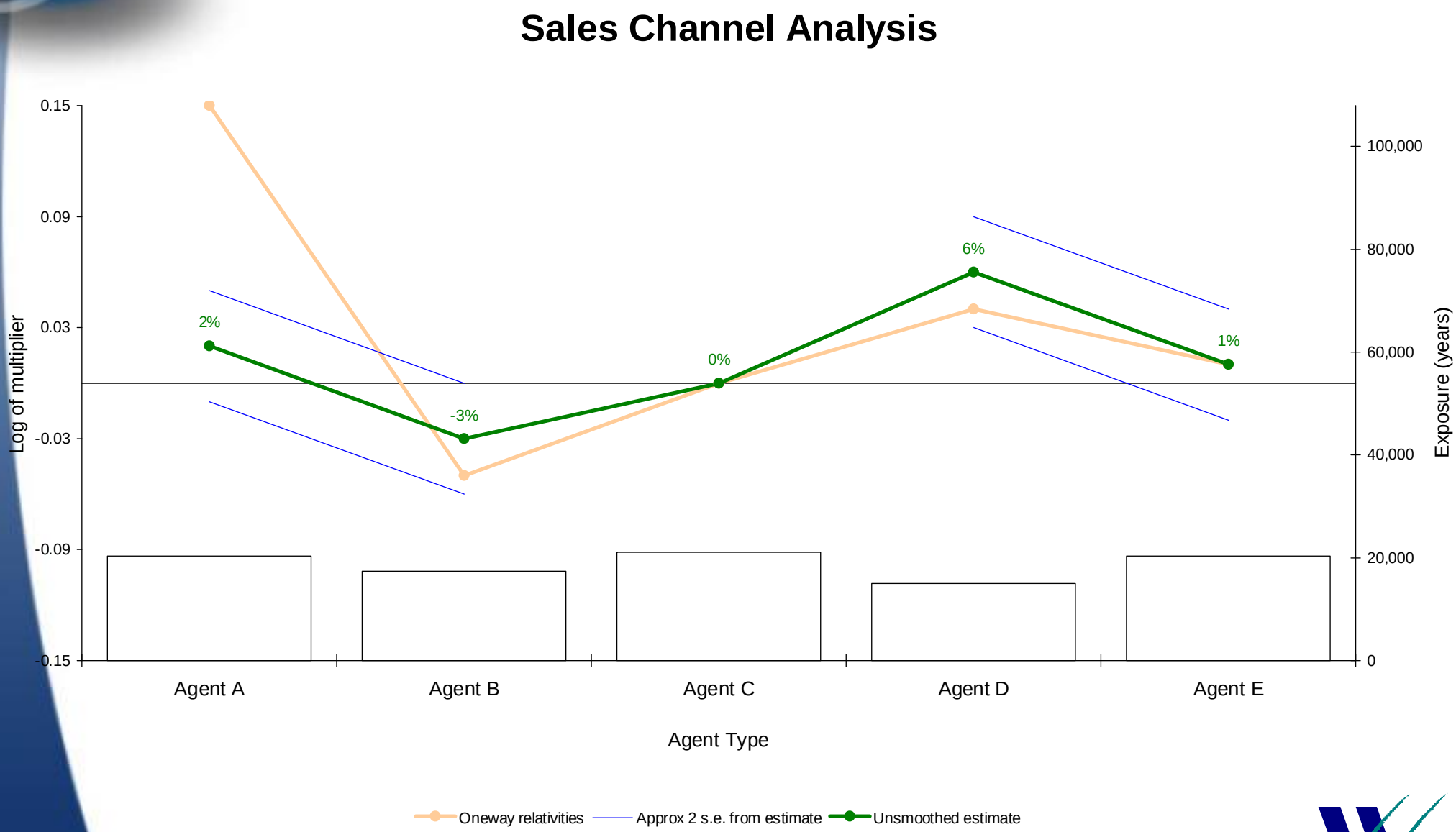


Identifying cross-subsidies

Sales Channel Analysis



Compare one-way to GLM



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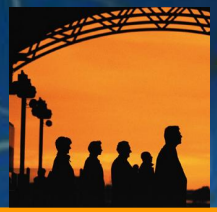

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