SPE3

Policyholder Retention and its Impact on Pricing

2005 CAS Seminar on Ratemaking

Claudine Modlin, FCAS

Watson Wyatt Insurance & Financial Services, Inc

WWW.WATSONWYATT.COM/INSURANCE

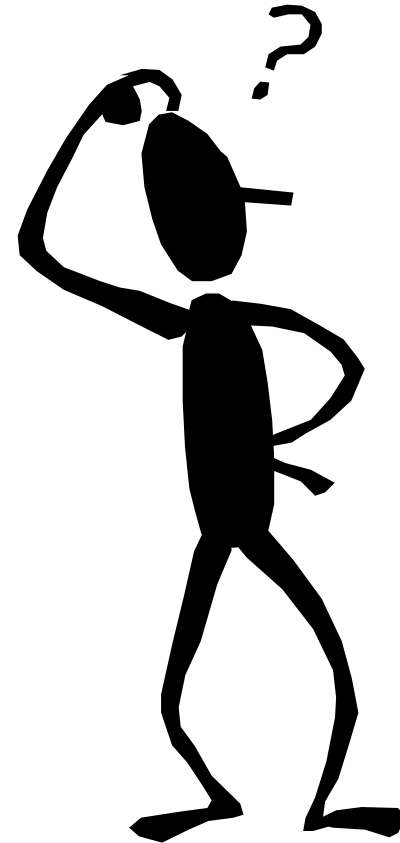Watson Wyatt
Worldwide

Retention analysis

- What to measure

- What to consider

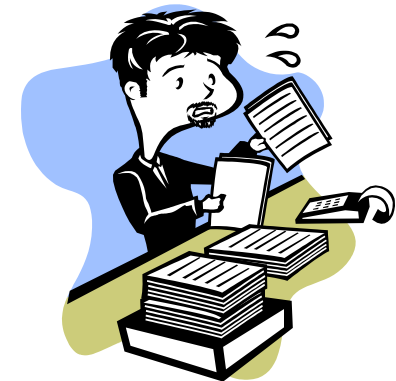- Practical tips

- Why do it

Retention analysis

- **What to measure**
- What to consider
- Practical tips
- Why do it

Data required

- Individual policy (or quote) level
- Offer & resulting accept/lapse
- Policy characteristics
- Rate change information
- Period during which rates changed
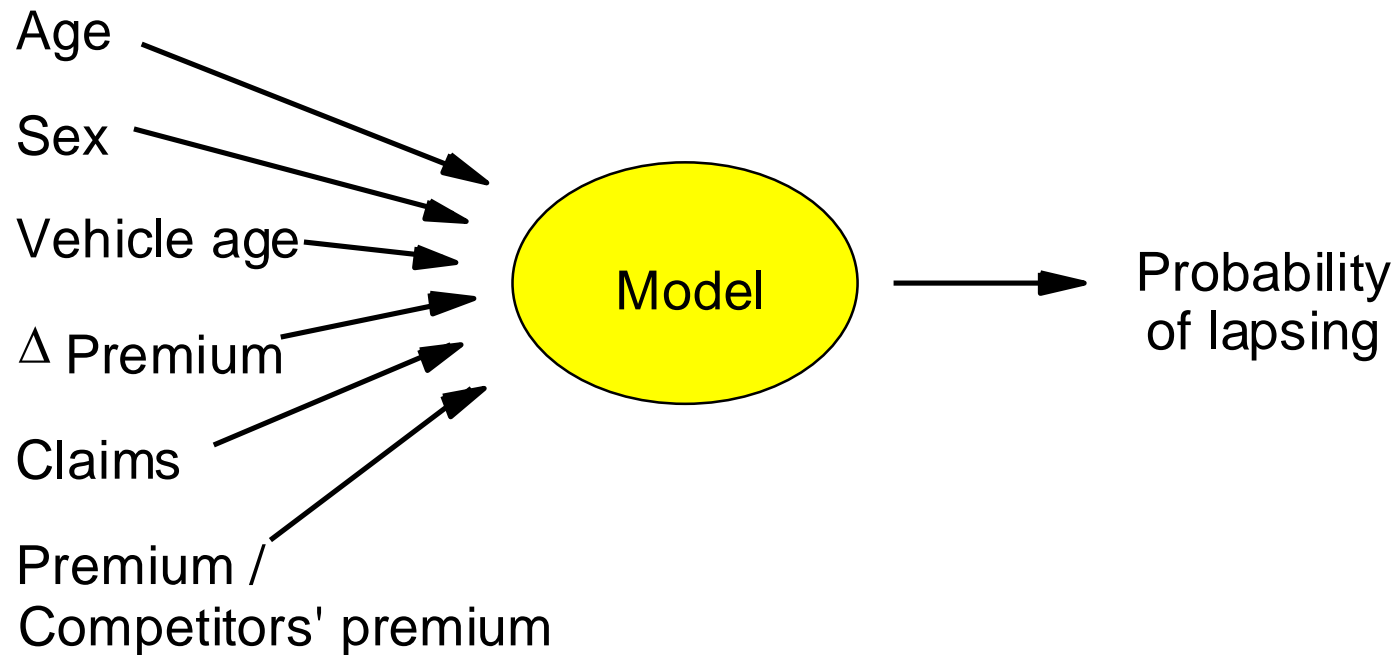
Generalized linear models

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

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

- Consider all factors simultaneously
- Allow for nature of random process
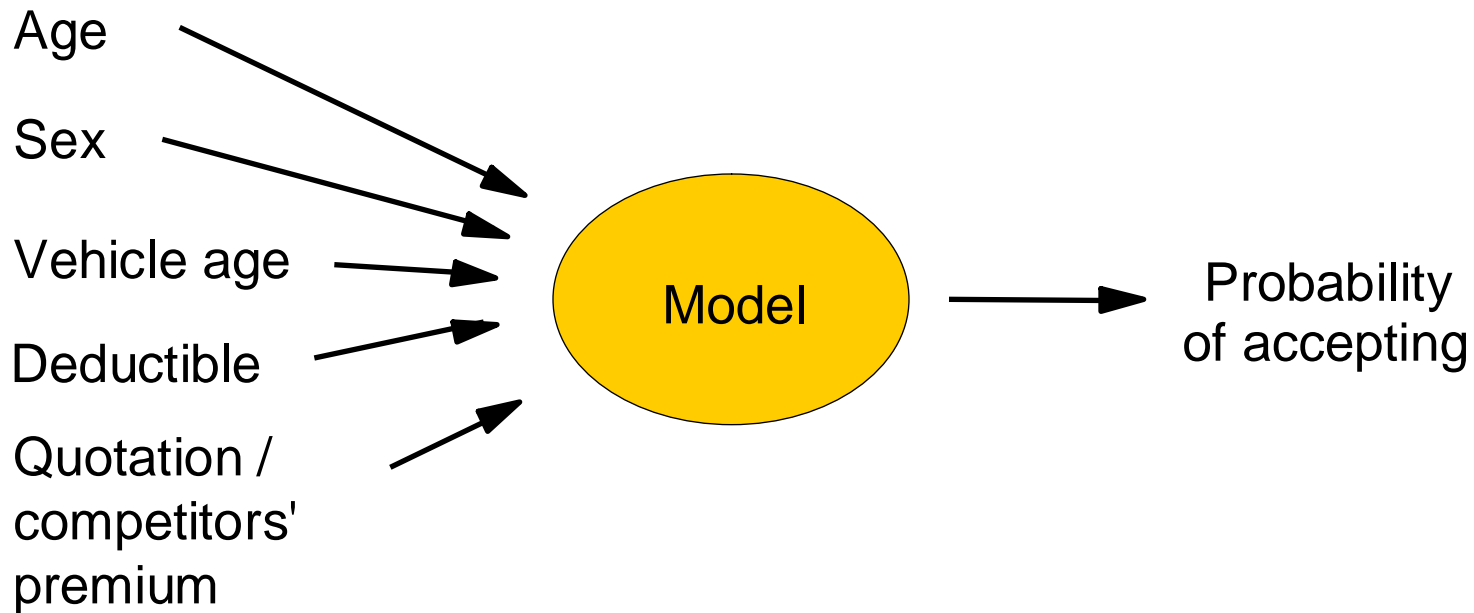- Provides diagnostics
- Robust and transparent

Modeling retention

- Most companies have data on renewal offers

Age

Sex

Vehicle age

Δ Premium

Claims

Premium /
Competitors' premium

Model

Probability
of lapsing

Modeling new business rates

- If details of individual quotes known, can be modeled in similar way

- Otherwise much simpler analysis is all that can be undertaken

Age

Sex

Vehicle age

Deductible

Quotation / competitors' premium

Model

Probability of accepting

Retention analysis

- What to measure

- **What to consider**

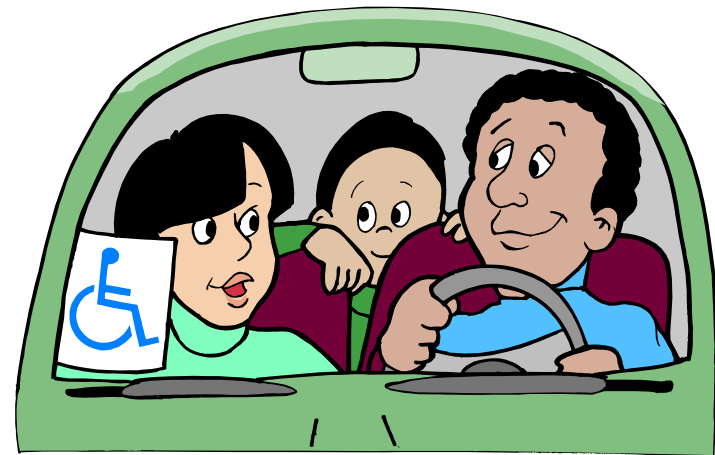- Practical tips

- Why do it

What to consider

- Who are your customers

- How do you connect

- What have you done to them
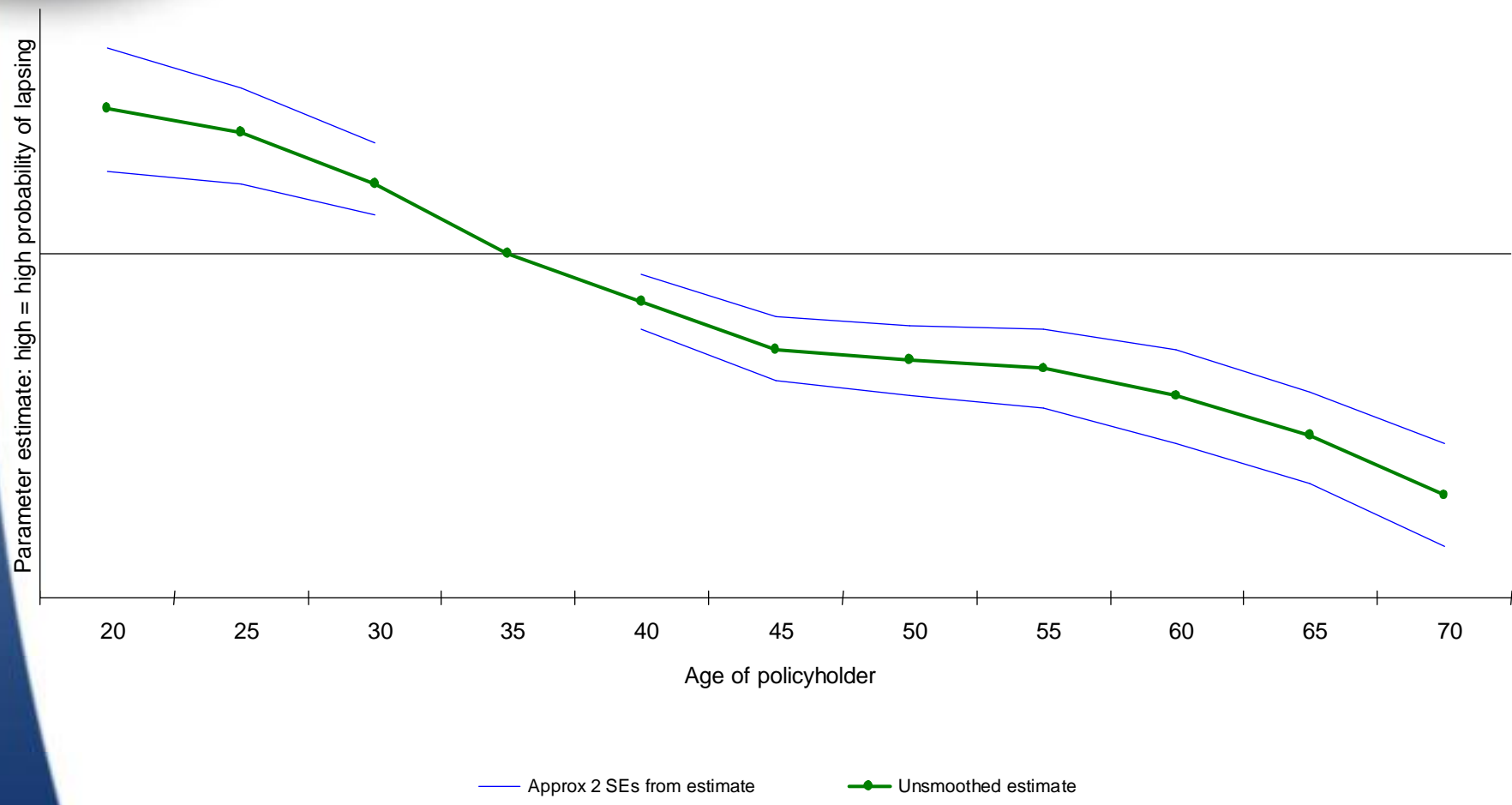
- What have others done to them

Who are your customers?

- Age of policyholder

- Age of car

- Claims history

- Other rating factors

- Endorsement activity

Effect of age of policyholder on lapses

Parameter estimate: high = high probability of lapsing

Age of policyholder

Approx 2 SEs from estimate — Unsmoothed estimate
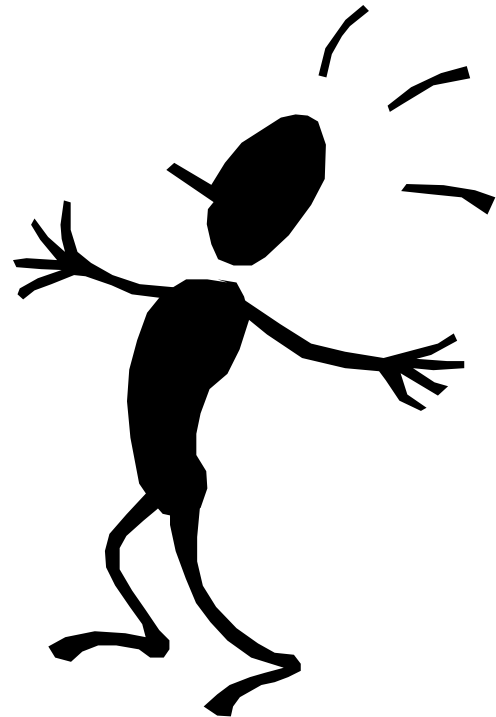
How do you connect with them?

- Distribution channel
- Payment plan
- Other products held
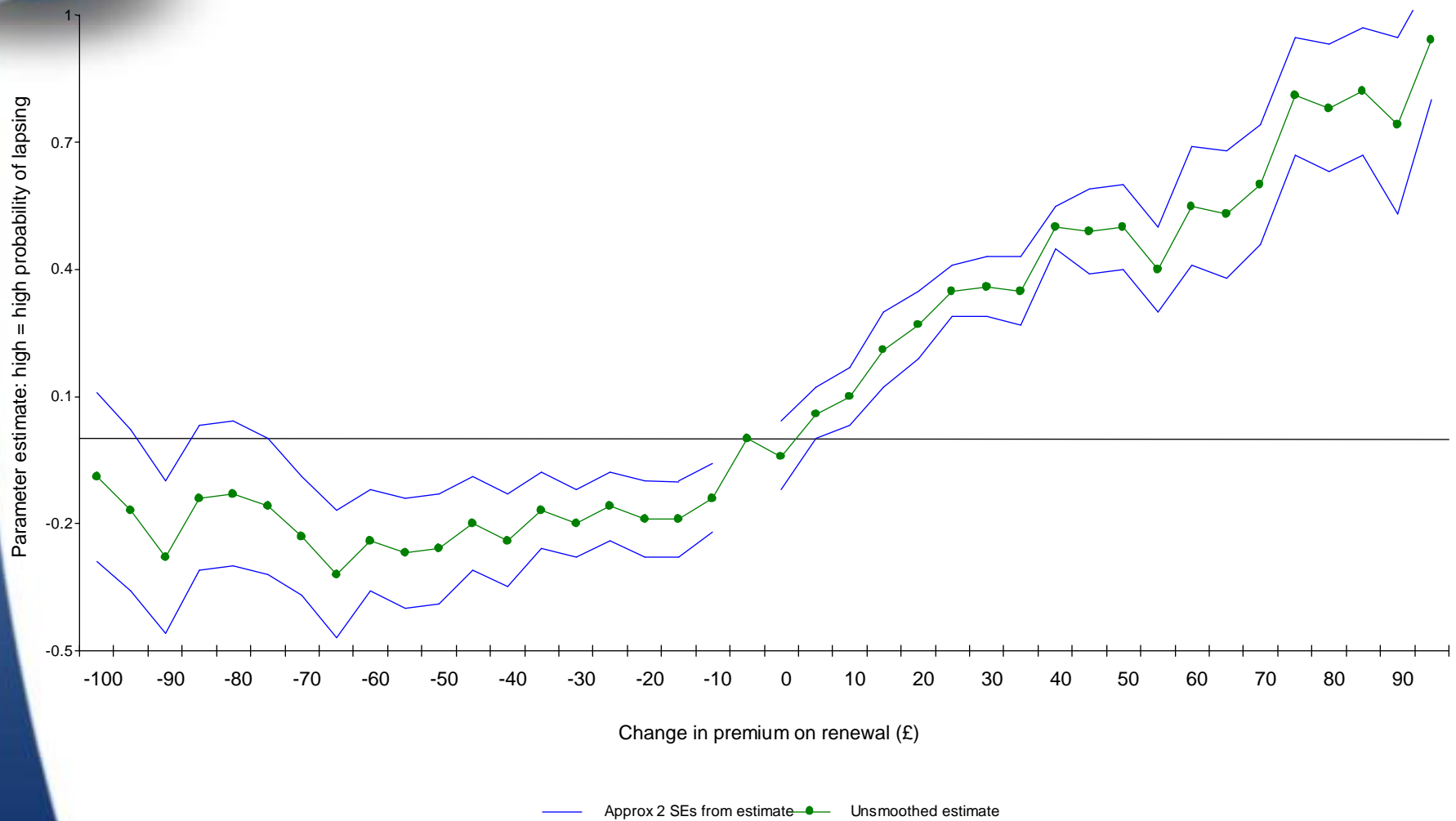- # years with company

What have you done to them?

- Rate change
- Claims service
- Agent service

Effect of premium change on lapses

What have others done to them?

- Competitors' premium

- Product differentiation
  (probably not applicable to personal lines)
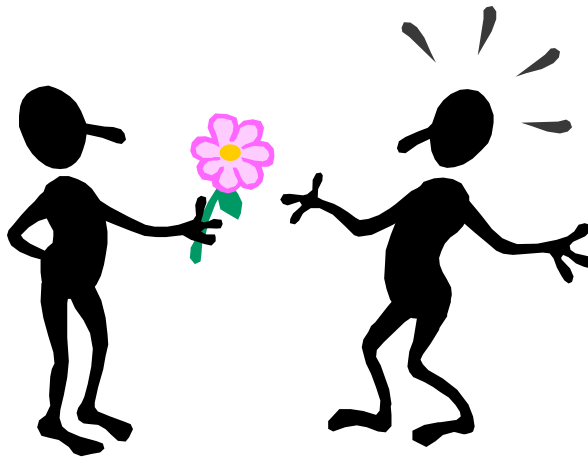
Competitive indices

- For modeling, required at individual policy level
- Sources of competitor info
  - rate manuals
  - comparative rating software
- Measures
  - index (comparing to one competitor or averaged across several)
  - rank of quote relative to competitors
- Challenges
  - tier criteria
  - point in time
  - cost

Effect of competitiveness on new business

Parameter estimate: high = high probability of quote being accepted

Quote/Average of the three cheapest quotes on the market

X-axis values: 0.6 0.7 0.8 0.85 0.9 0.95 1 1.05 1.1 1.15 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2

Legend: Approx 2 SD from estimate   Smoothed estimate
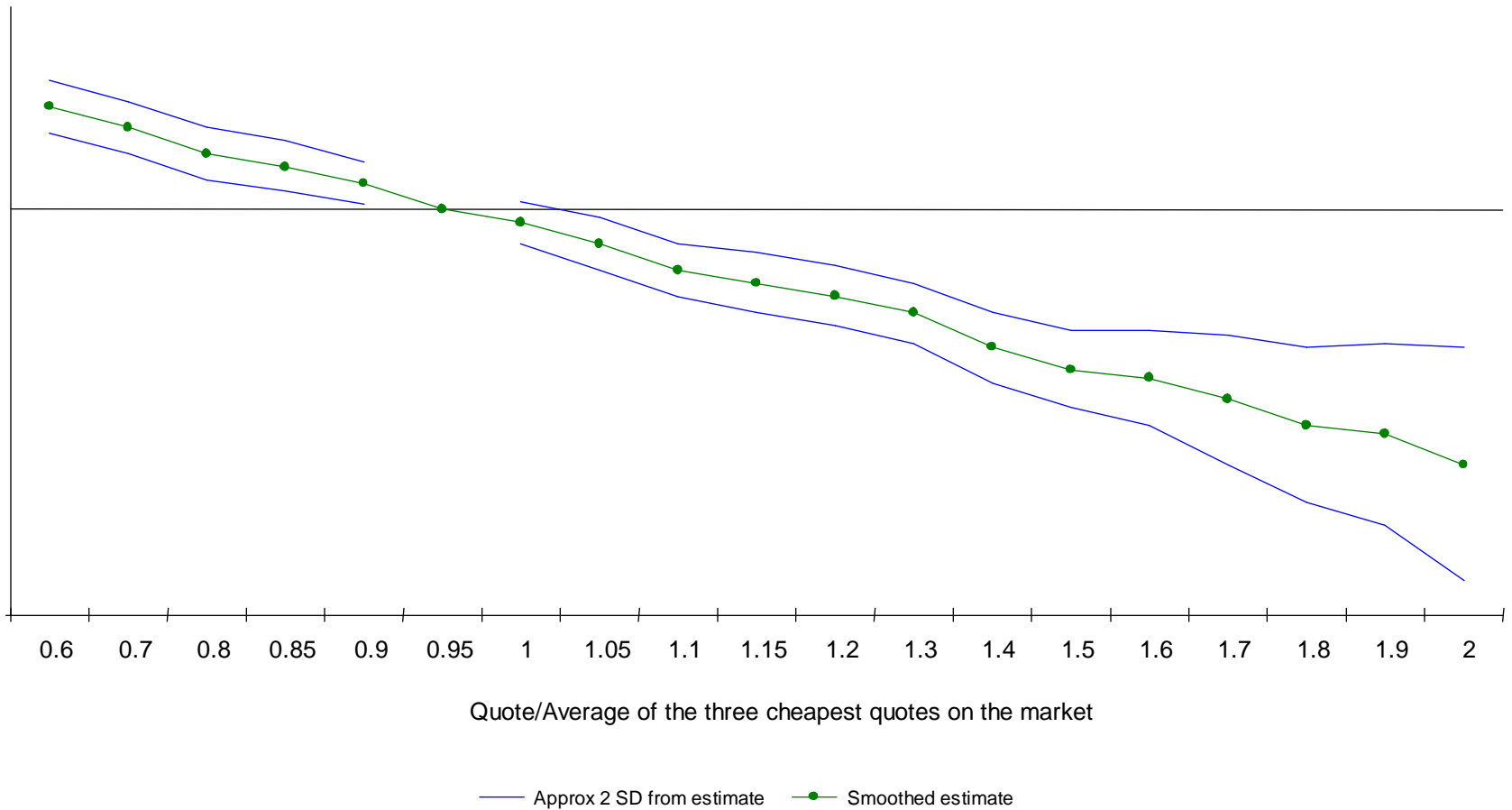
Retention analysis

- What to measure

- What to consider

- **Practical tips**

- Why do it

Statistical assumptions

- A logistic model is most appropriate
  - considers log(p / [1-p]) and binomial error
  - maps [0,1] to [-∞,∞]
  - invariant to whether you measure lapse/renew

- If lapses are low and results not to be used directly, a Poisson multiplicative model can help
  - theoretically wrong (can predict multiple lapses), but:
  - easier to understand
  - can superimpose one-way results more easily

Practical tip on competitiveness

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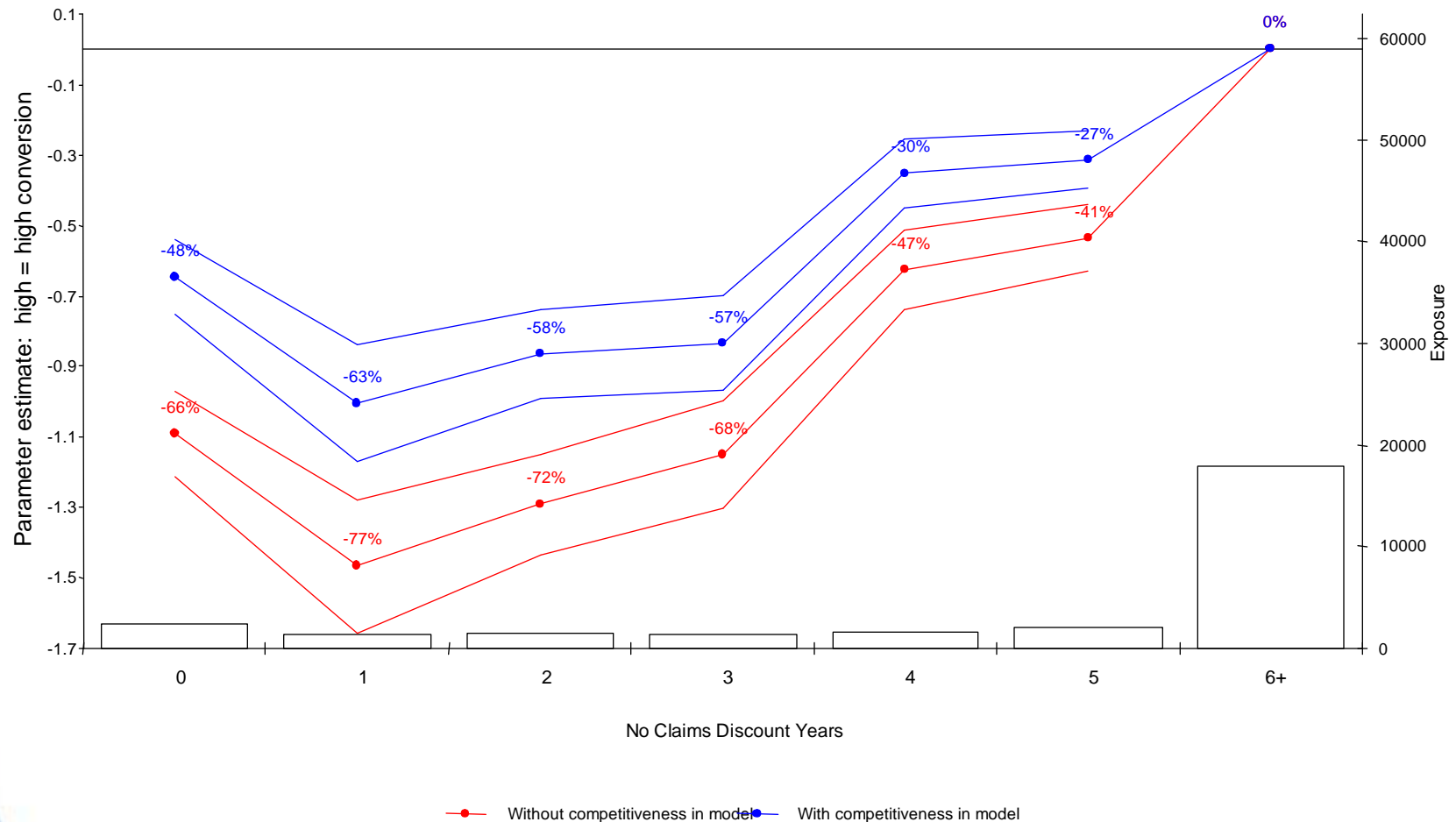
Beware absolute premium

- GLM shows effect *all other factors being equal*

- For varying premium all other factors are never equal

- Results, while statistically correct, can be hard to interpret, for example adding premium size can reverse the multivariate result for age of driver

- Consider fitting separate models for different premiums bands

Measuring rate change

- Best to have more than one rate change in data

- Investigate % change and $ change

- Suggest fit rate change as a categorical factor and then model with polynomials if appropriate
  - some results are straight lines in logistic space, some are clearly not

Beware expectations

- Customer expectations of premium change
  - try to isolate rate change from risk criteria change which affects premium
  - consider premium change adjusted for change in risk criteria (ie new rates for new risk / old rates for new risk)

Retention analysis

- What to measure

- What to consider

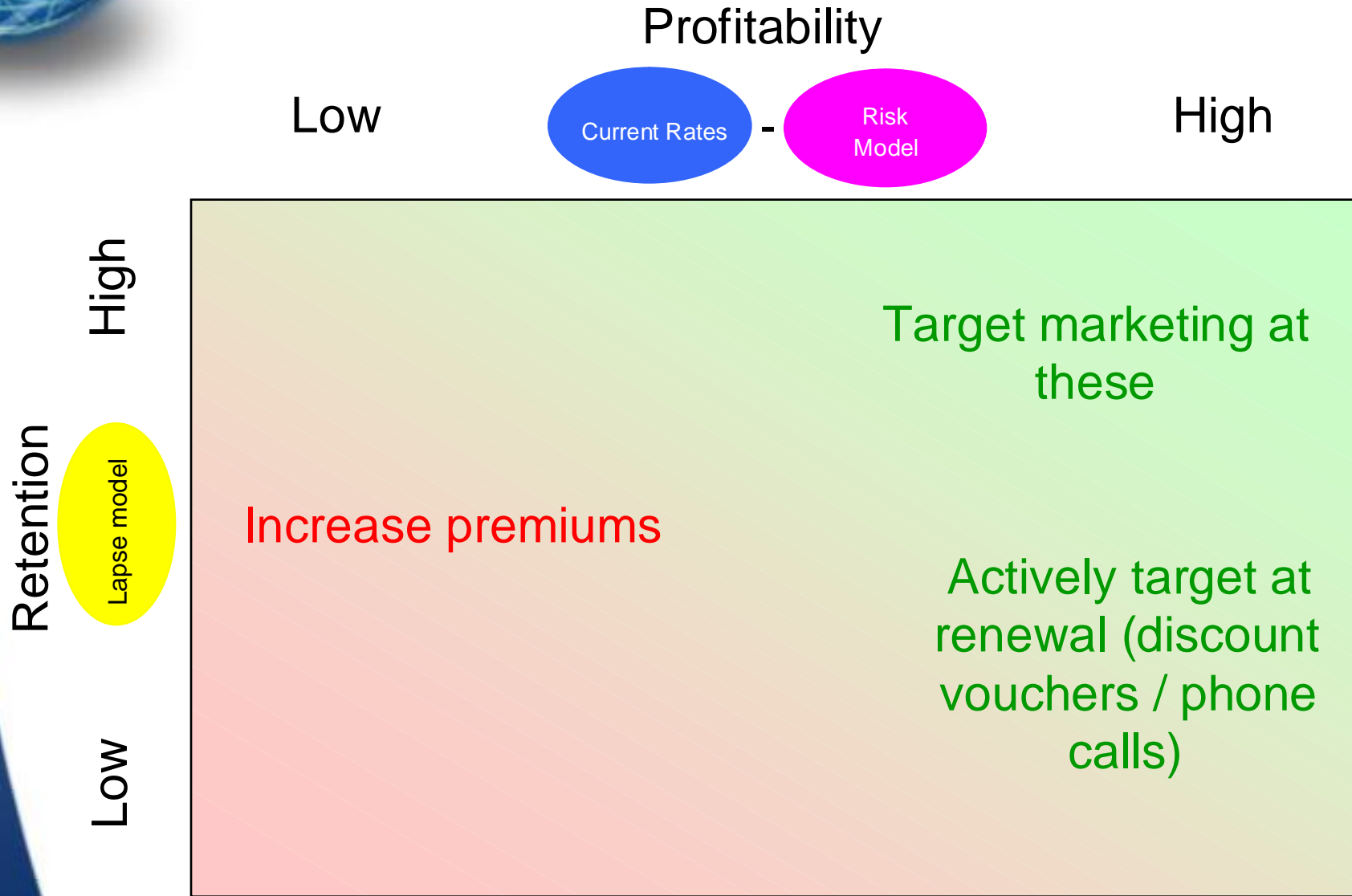- Practical tips

- **Why do it**

Why model lapses / new business?

- Qualitative management decisions
  - marketing strategies
  - renewal campaigns

- Simple expense loadings

- Modeling
  - simple lifetime modeling
  - detailed impact modeling
  - detailed lifetime modeling

Customer value

Profitability

Low   (Current Rates) - (Risk Model)   High

Retention — Lapse model

High

Increase premiums

Target marketing at these

Actively target at renewal (discount vouchers / phone calls)
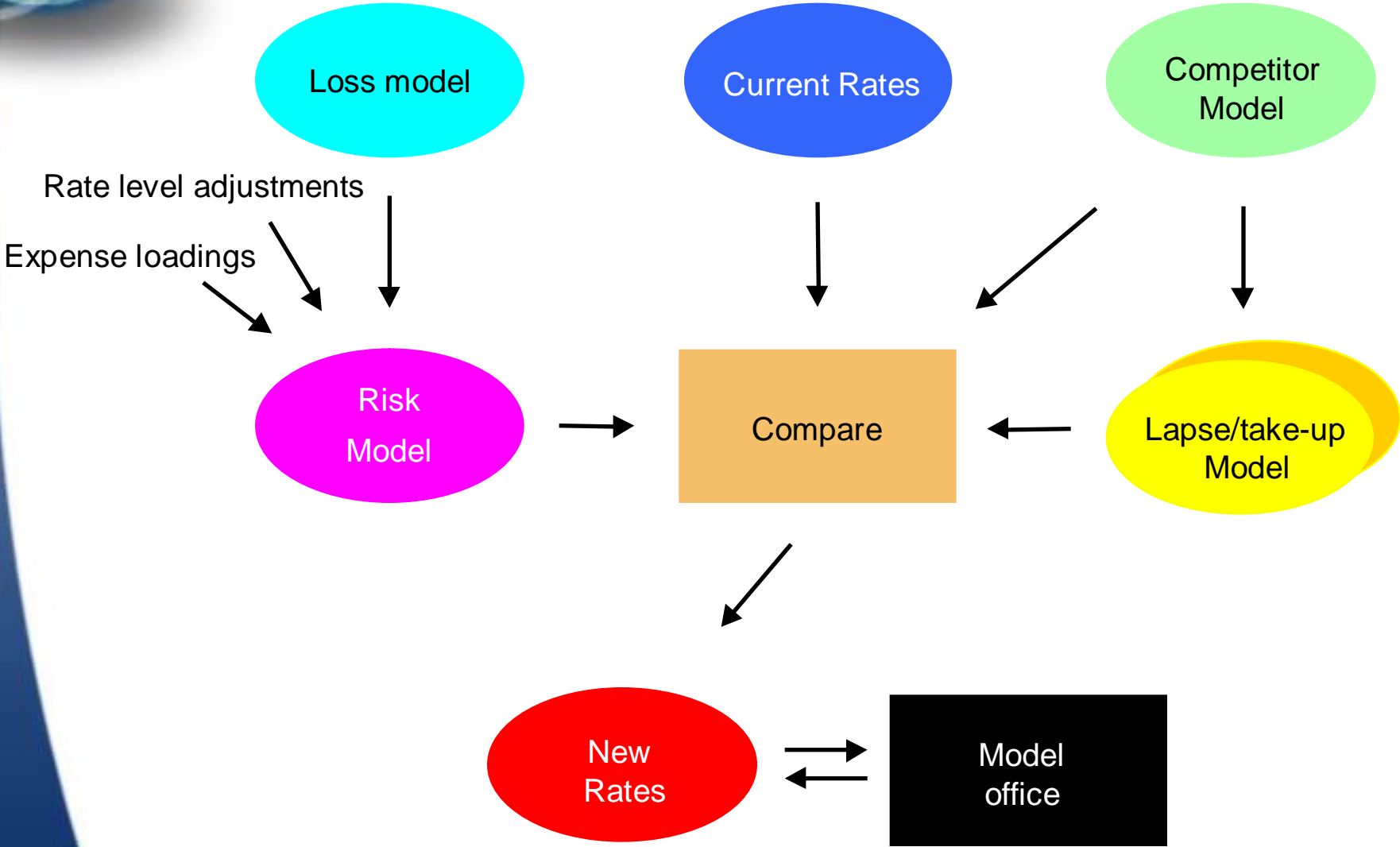
Low

Lifetime expense loads

- 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

Price optimization scenario testing

Loss model

Current Rates

Competitor Model

Rate level adjustments

Expense loadings

Risk Model

Compare

Lapse/take-up Model

New Rates

Model office

Scenario testing techniques

- How do we use information from retention models and claims models to change rates optimally?

- Which is more important - overall rate changes or relativity changes?

- How quickly and for what types of policyholder should we move the rates to the theoretical position?

- What might happen if I do X?

Ingredients

Data

Portfolio now

Current Rates

Assumptions

Competitor Model

Expenses
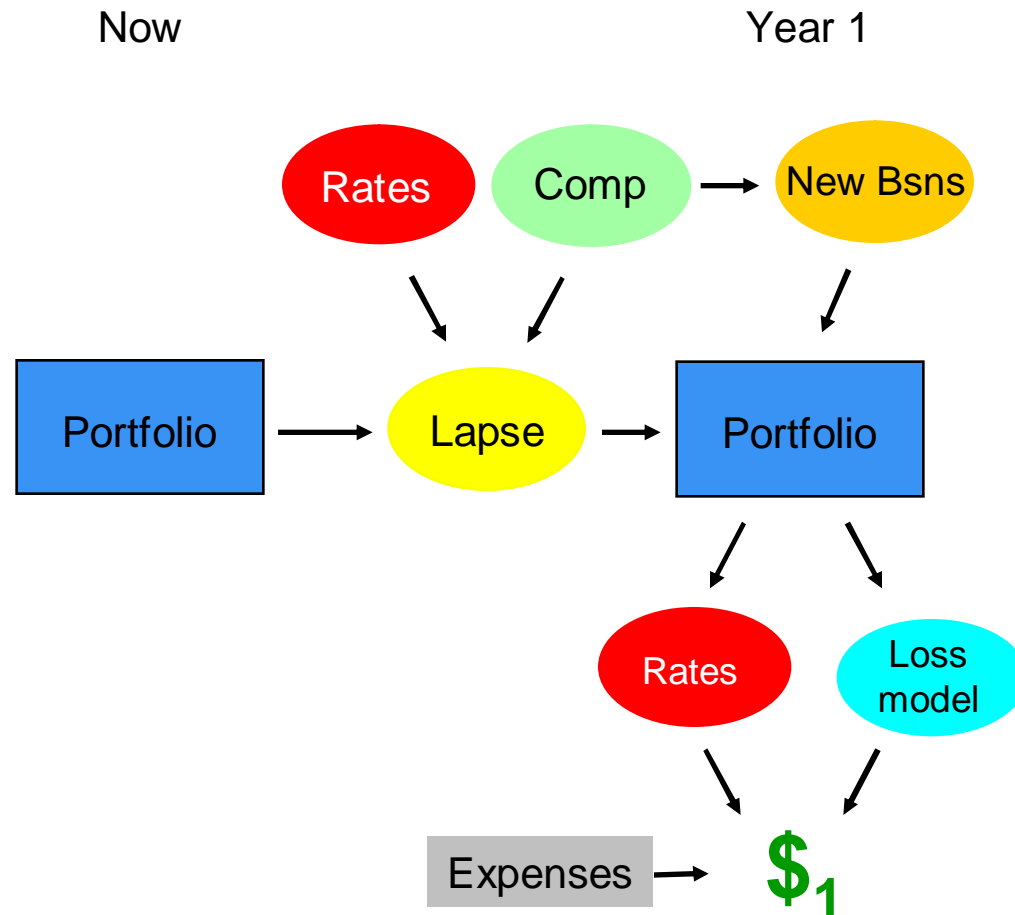
GLMs

Loss model

Lapse model

New business model

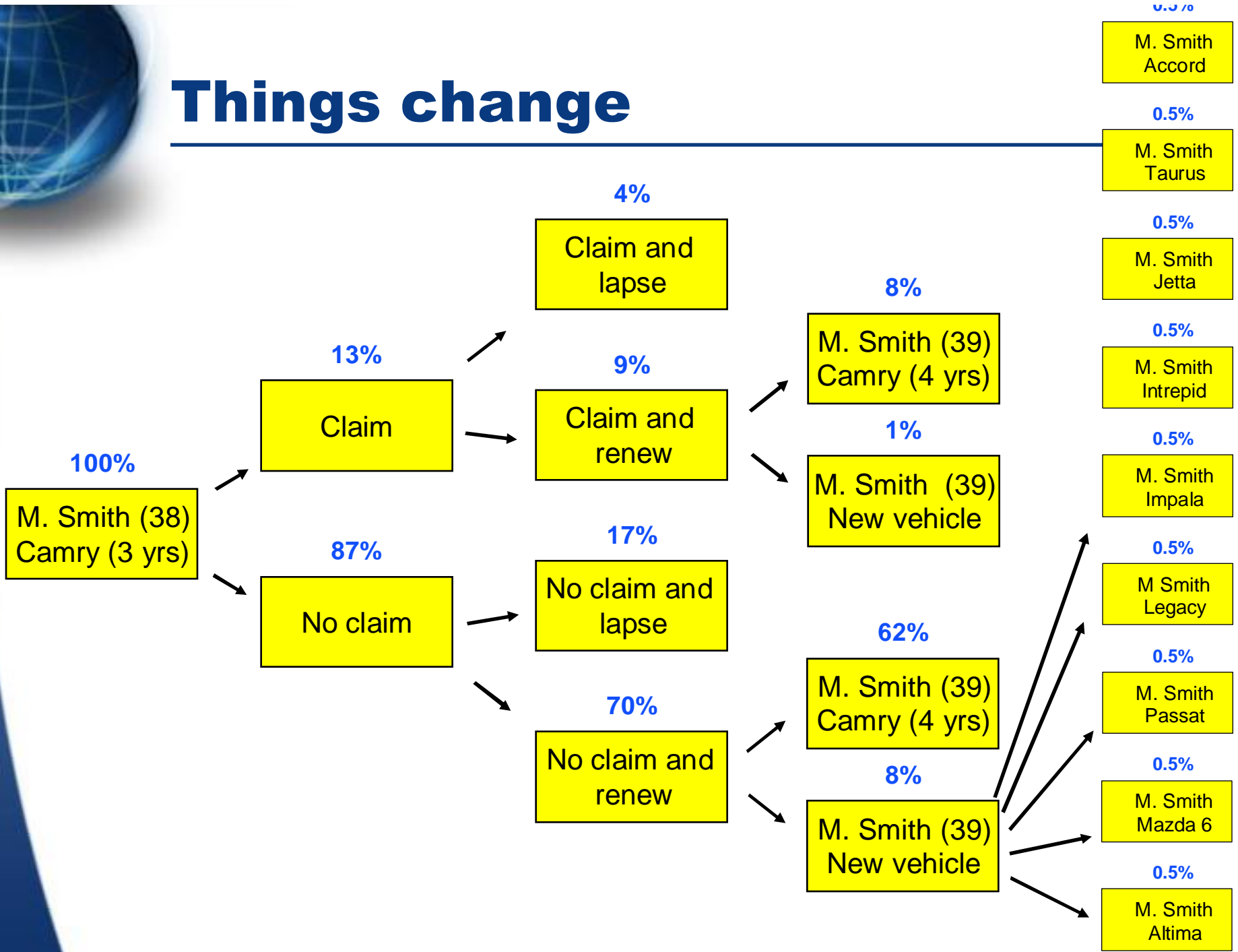**Test**

New Rates

Scenario testing

Problems (1)

- What will the competition do?

- Things change
  - age of insured
  - age of vehicle (home)
  - vehicle (home)
  - address
  - claim surcharges

- What is the measure of success?

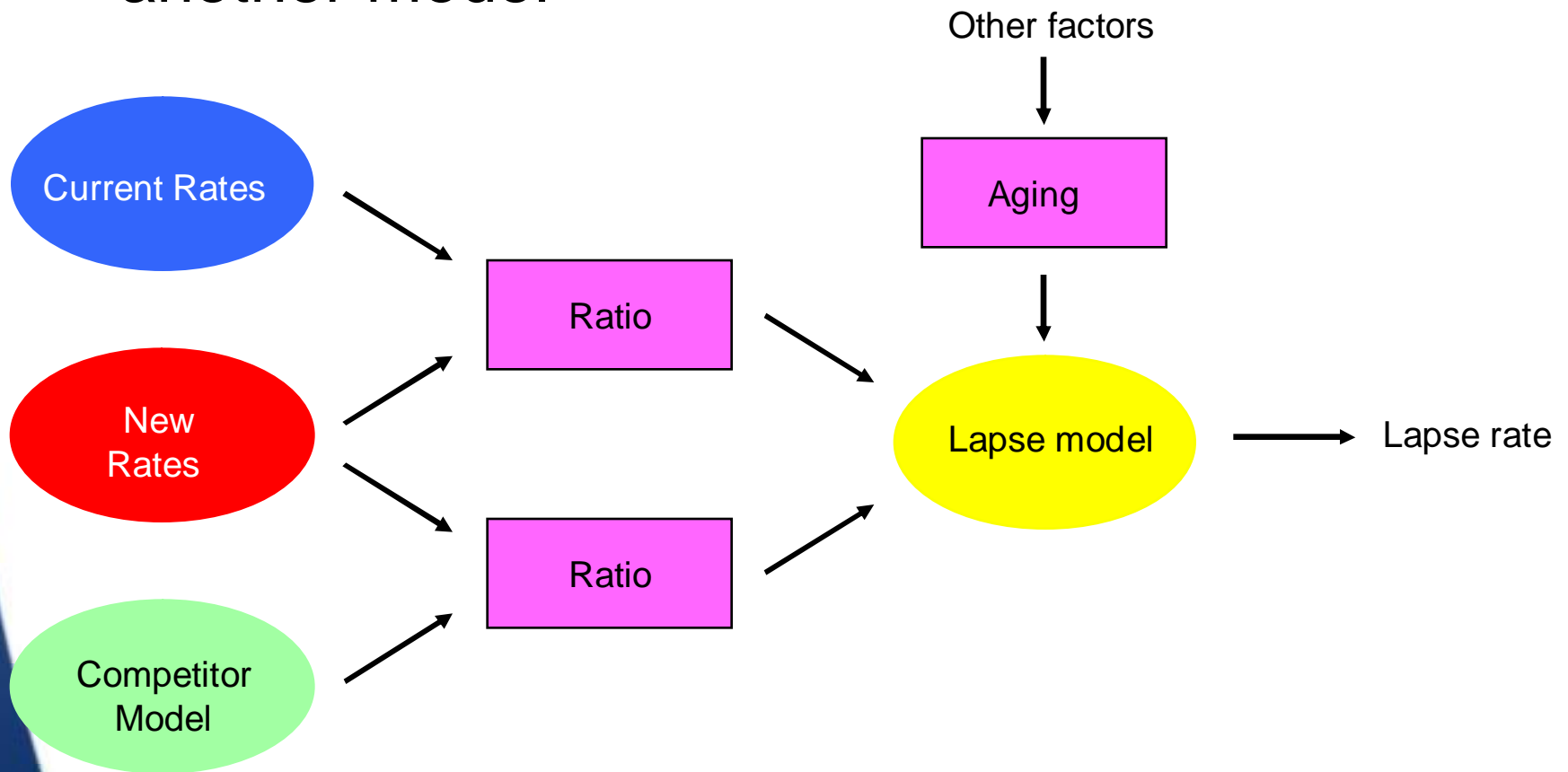- Over what period is the projection done?

Things change

100%
M. Smith (38)
Camry (3 yrs)

13%
Claim

87%
No claim

4%
Claim and lapse

9%
Claim and renew

17%
No claim and lapse

70%
No claim and renew

8%
M. Smith (39)
Camry (4 yrs)

1%
M. Smith (39)
New vehicle

62%
M. Smith (39)
Camry (4 yrs)

8%
M. Smith (39)
New vehicle

0.5%
M. Smith
Accord

0.5%
M. Smith
Taurus

0.5%
M. Smith
Jetta

0.5%
M. Smith
Intrepid

0.5%
M. Smith
Impala

0.5%
M Smith
Legacy

0.5%
M. Smith
Passat

0.5%
M. Smith
Mazda 6
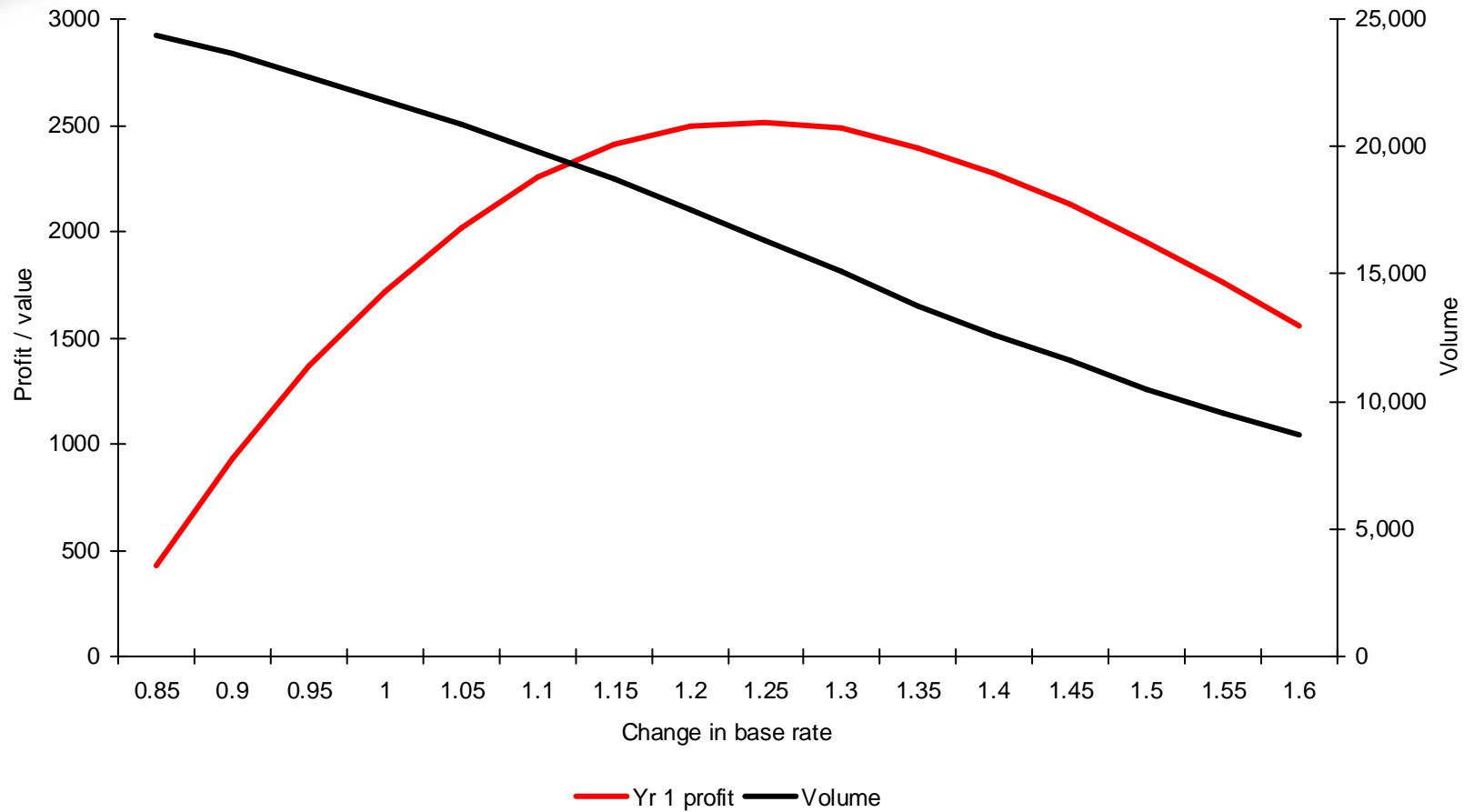
0.5%
M. Smith
Altima

Inputs to some models are outputs from others

- Sometimes model output needs to be processed and/or recategorized before being input to another model

Other factors

Current Rates

New Rates

Competitor Model

Ratio

Ratio

Aging

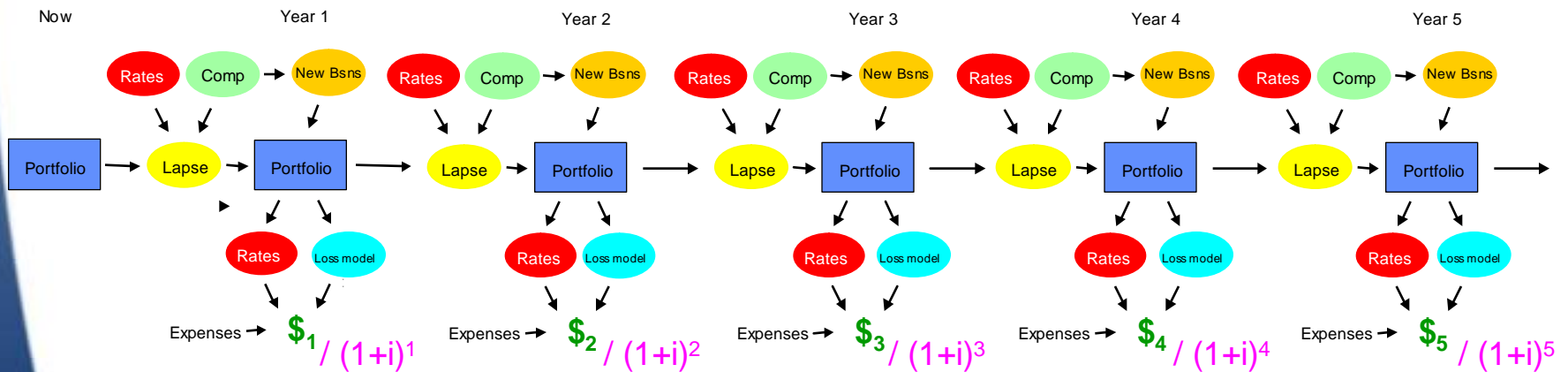Lapse model → Lapse rate

Investigation of base rate change

Problems (2)

- What are we optimizing?
  - Year 1 profit will not consider value business in the future
  - Putting on a life actuary's hat …
- Seek "a_x"
  - two big drivers of retention are age and tenure => people get stickier
  - expected life higher than $1/(1-r)$
  - but multiply by what profit measure?
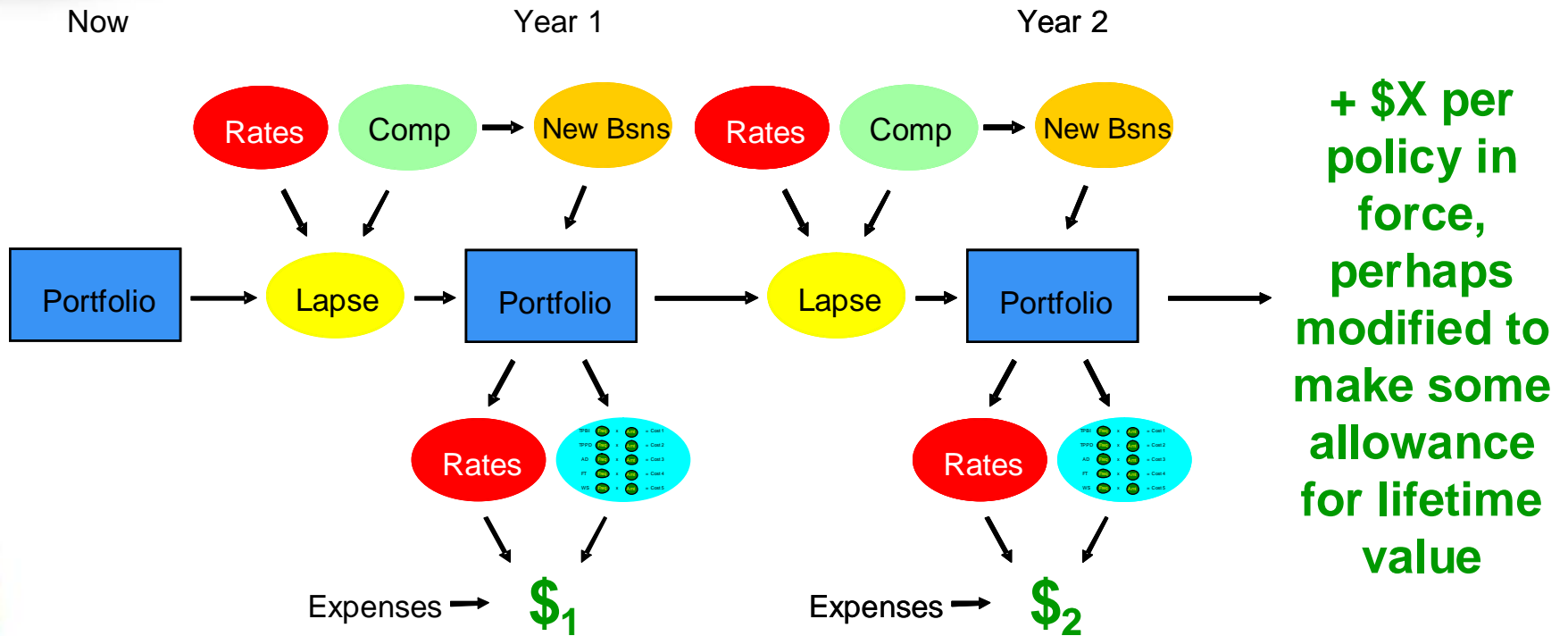 - and account for future rating actions how?

Problems (2)

- What are we optimizing?
  - Year 1 profit will not consider value business in the future
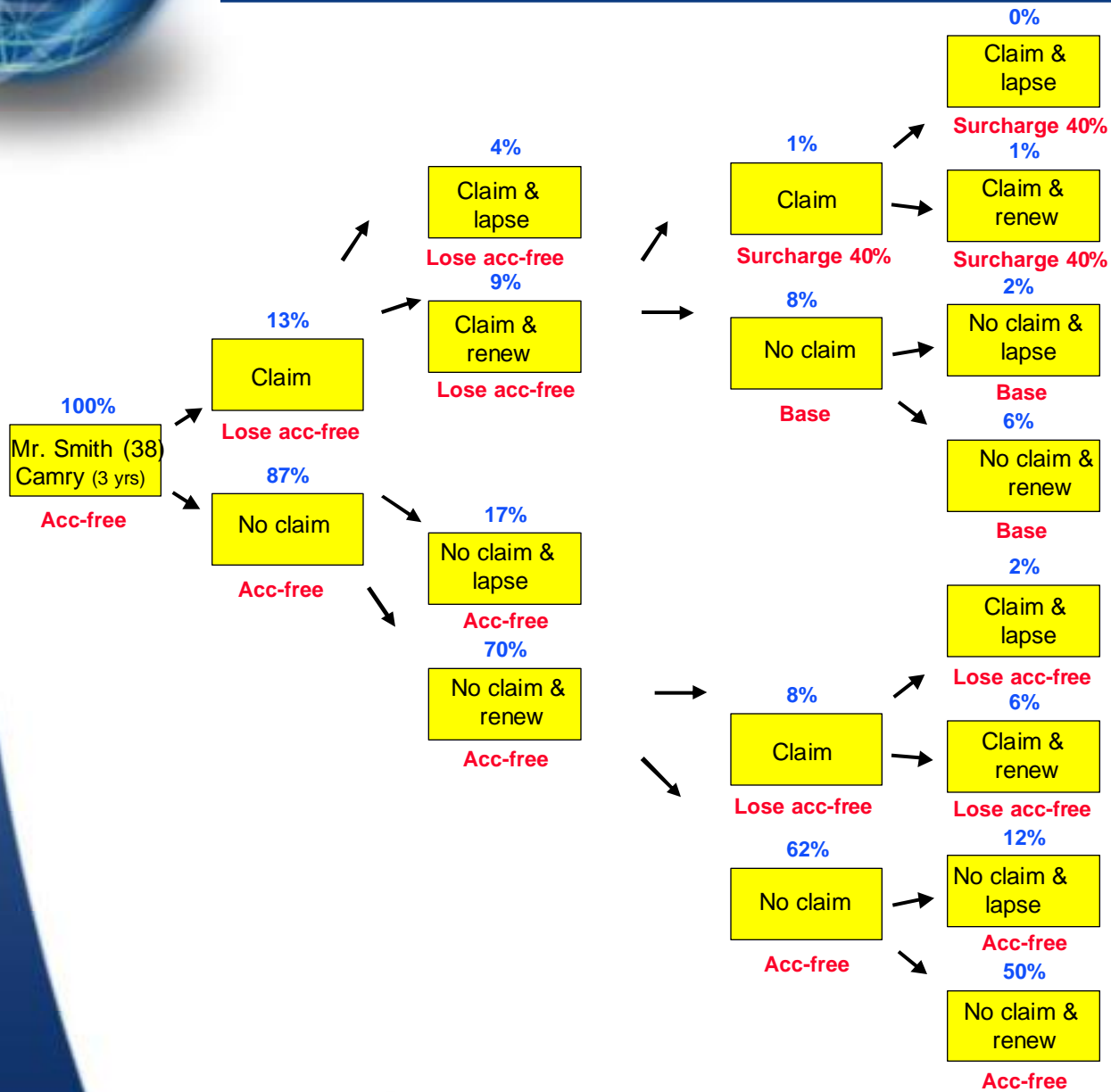 - Putting on a *modern* life actuary's hat…

| Now | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |

Rates — Comp → New Bsns   Rates — Comp → New Bsns   Rates — Comp → New Bsns   Rates — Comp → New Bsns   Rates — Comp → New Bsns   Rates — Comp → New Bsns

Portfolio → Lapse → Portfolio → Lapse → Portfolio → Lapse → Portfolio → Lapse → Portfolio → Lapse → Portfolio → Lapse → Portfolio →

Rates   Loss model   Rates   Loss model   Rates   Loss model   Rates   Loss model   Rates   Loss model

Expenses → $\$_1 / (1+i)^1$ Expenses → $\$_2 / (1+i)^2$ Expenses → $\$_3 / (1+i)^3$ Expenses → $\$_4 / (1+i)^4$ Expenses → $\$_5 / (1+i)^5$

- Too many assumptions - (things change)[5]

A pragmatic compromise?

Multiple year projections

0%
Claim & lapse
Surcharge 40%

4%
Claim & lapse
Lose acc-free

1%
Claim
Surcharge 40%

1%
Claim & renew
Surcharge 40%

13%
Claim
Lose acc-free

9%
Claim & renew
Lose acc-free

8%
No claim
Base

2%
No claim & lapse
Base

100%
Mr. Smith (38) Camry (3 yrs)
Acc-free

6%
No claim & renew
Base

87%
No claim
Acc-free

17%
No claim & lapse
Acc-free

2%
Claim & lapse
Lose acc-free

70%
No claim & renew
Acc-free

8%
Claim
Lose acc-free

6%
Claim & renew
Lose acc-free

12%
No claim & lapse
Acc-free

62%
No claim
Acc-free

50%
No claim & renew
Acc-free

- Achieved using fields for each outcome multiplied by relevant probability

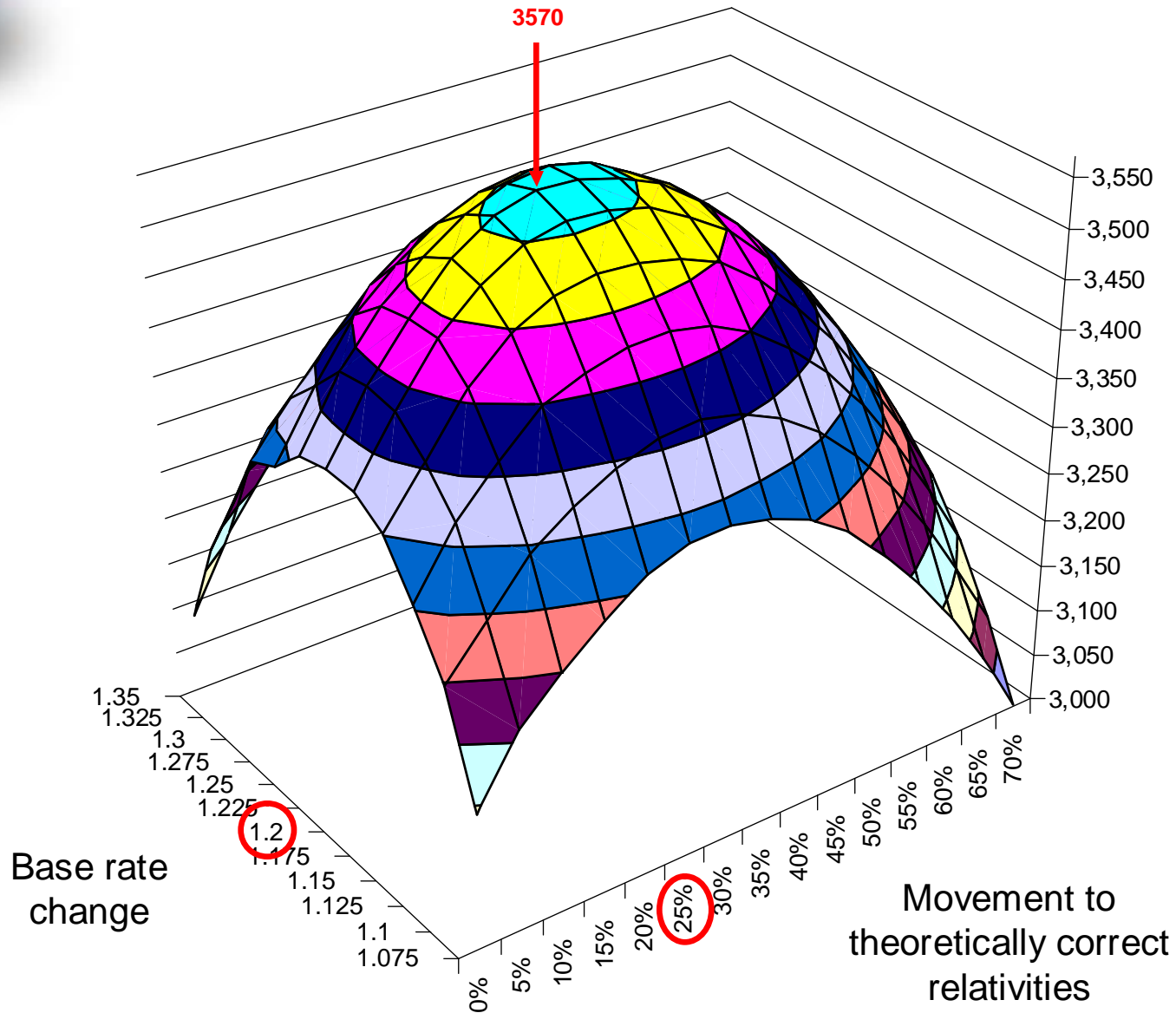# Investigation of base rate change with different success criteria
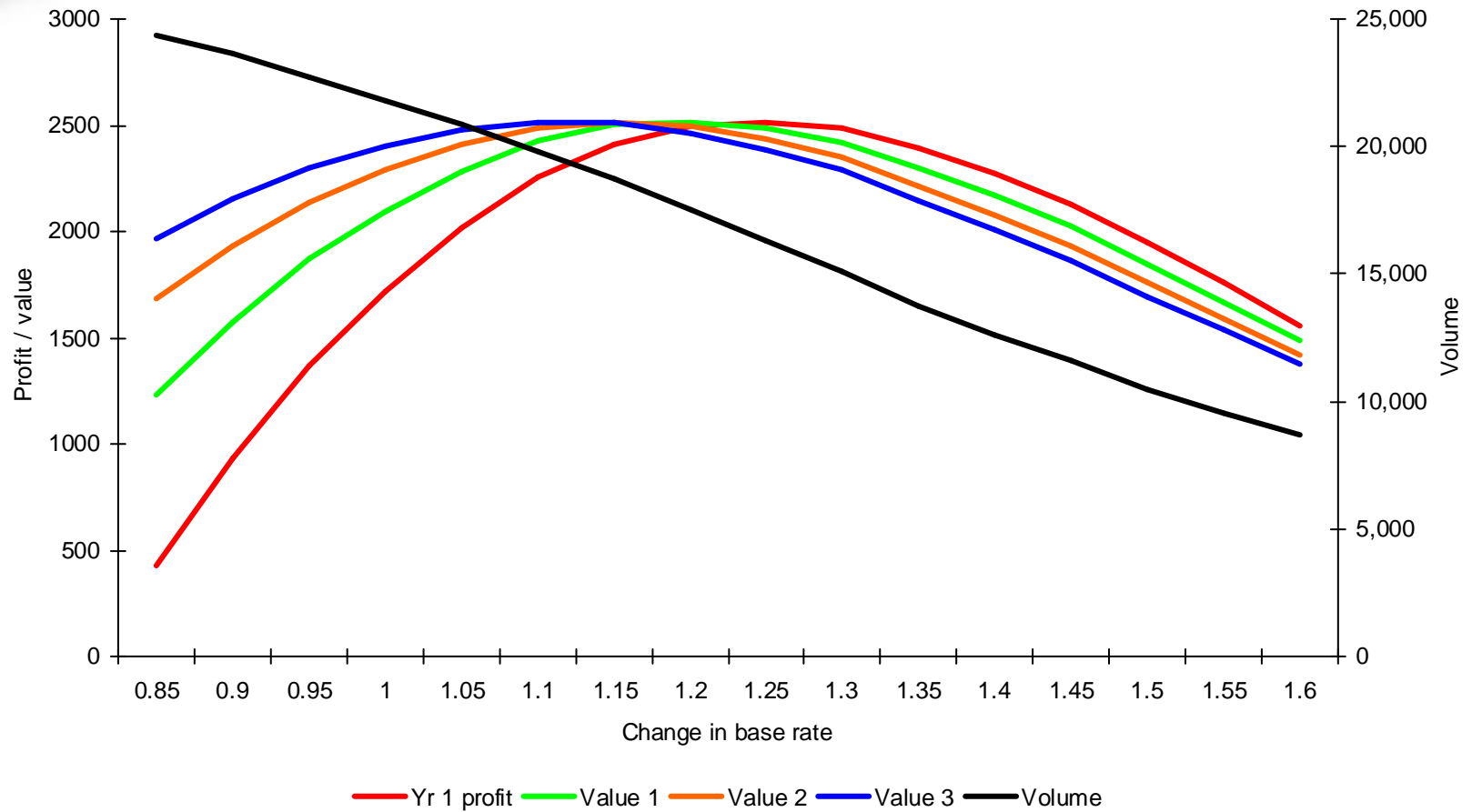
Investigation of base rate change
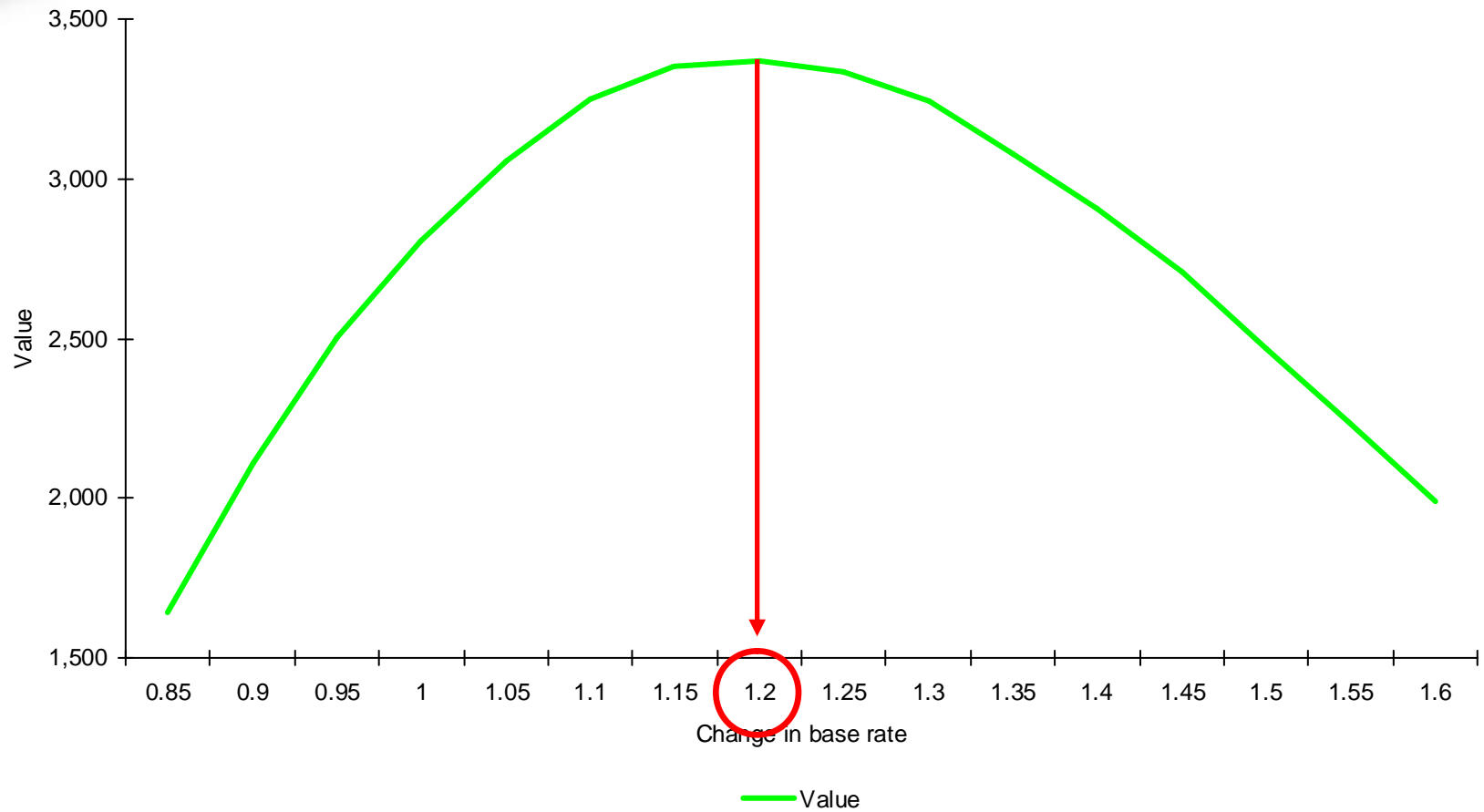
Combined investigation

Types of rating structures
- simple multiplicative

$621.50 x

Age	Factor
17	2.52
18	2.05
19	1.97
20	1.85
21-23	1.75
24-26	1.54
27-30	1.42
31-35	1.20
36-40	1.00
41-45	0.93
46-50	0.84
50-60	0.76
60+	0.78

Group	Factor
1	0.54
2	0.65
3	0.73
4	0.85
5	0.92
6	0.96
7	1.00
8	1.08
9	1.19
10	1.26
11	1.36
12	1.43
13	1.56

Sex	Factor
Male	1.00
Female	1.25

Area	Factor
A	0.95
B	1.00
C	1.09
D	1.15
E	1.18
F	1.27
G	1.36
H	1.44

Types of rating structures - multiplicative with moderator

$621.50 x

Age	Factor
17	2.52
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Sex	Factor
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Subject to max +20% min -10%

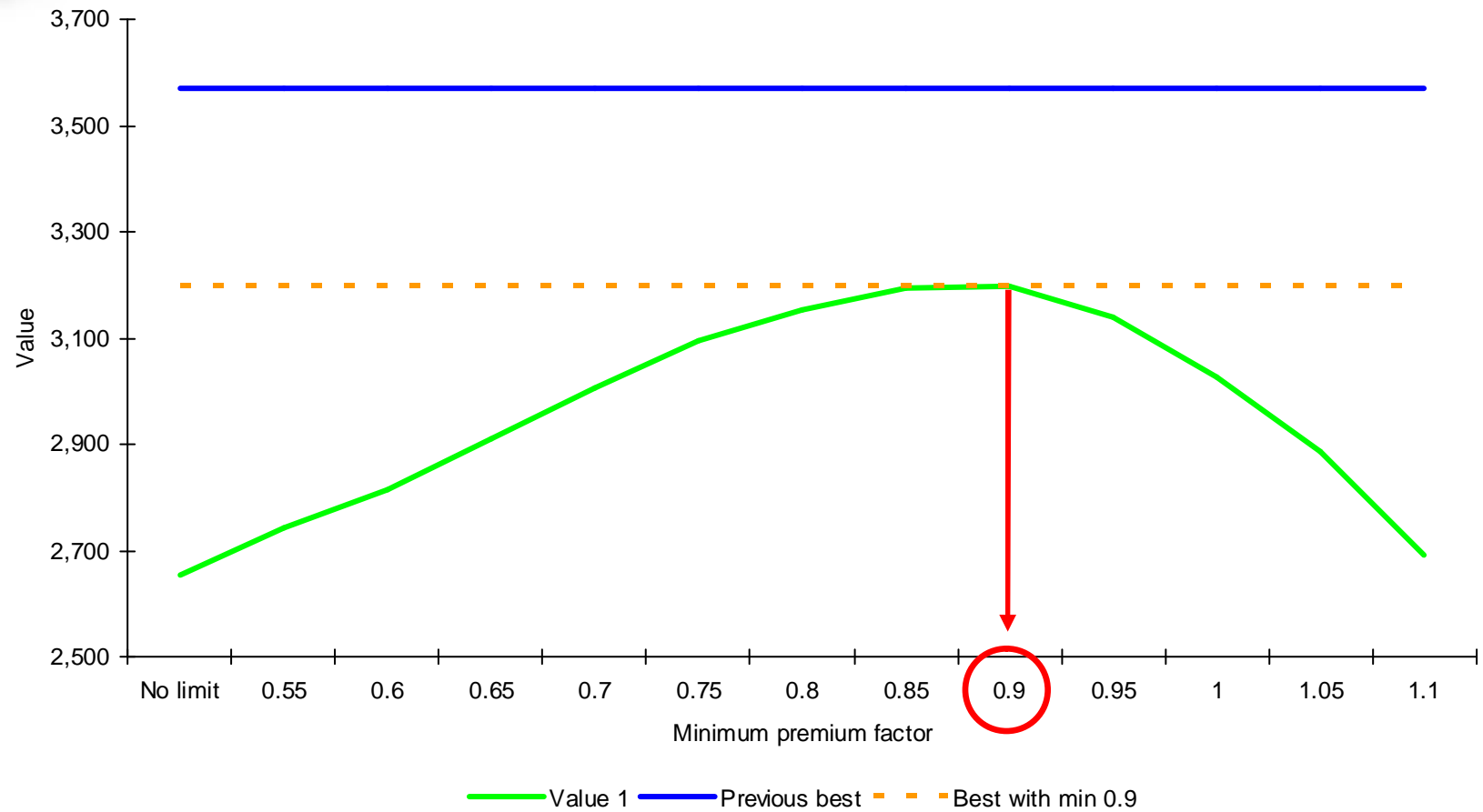# Example of use of moderator

Moderator: pros/cons

- Advantages of moderators include:
  - moves everyone to optimal position (subject to acceptable premium increases) more quickly
  - can take into account elasticity for the type of person in question
  - can be less detailed work required regarding underlying parameterization
  - less work required to parameterize in future

- Disadvantages
  - more onerous system requirements
  - harder to understand rating structure
  - likely to result in different quotes for renewals and new business for an identical risk
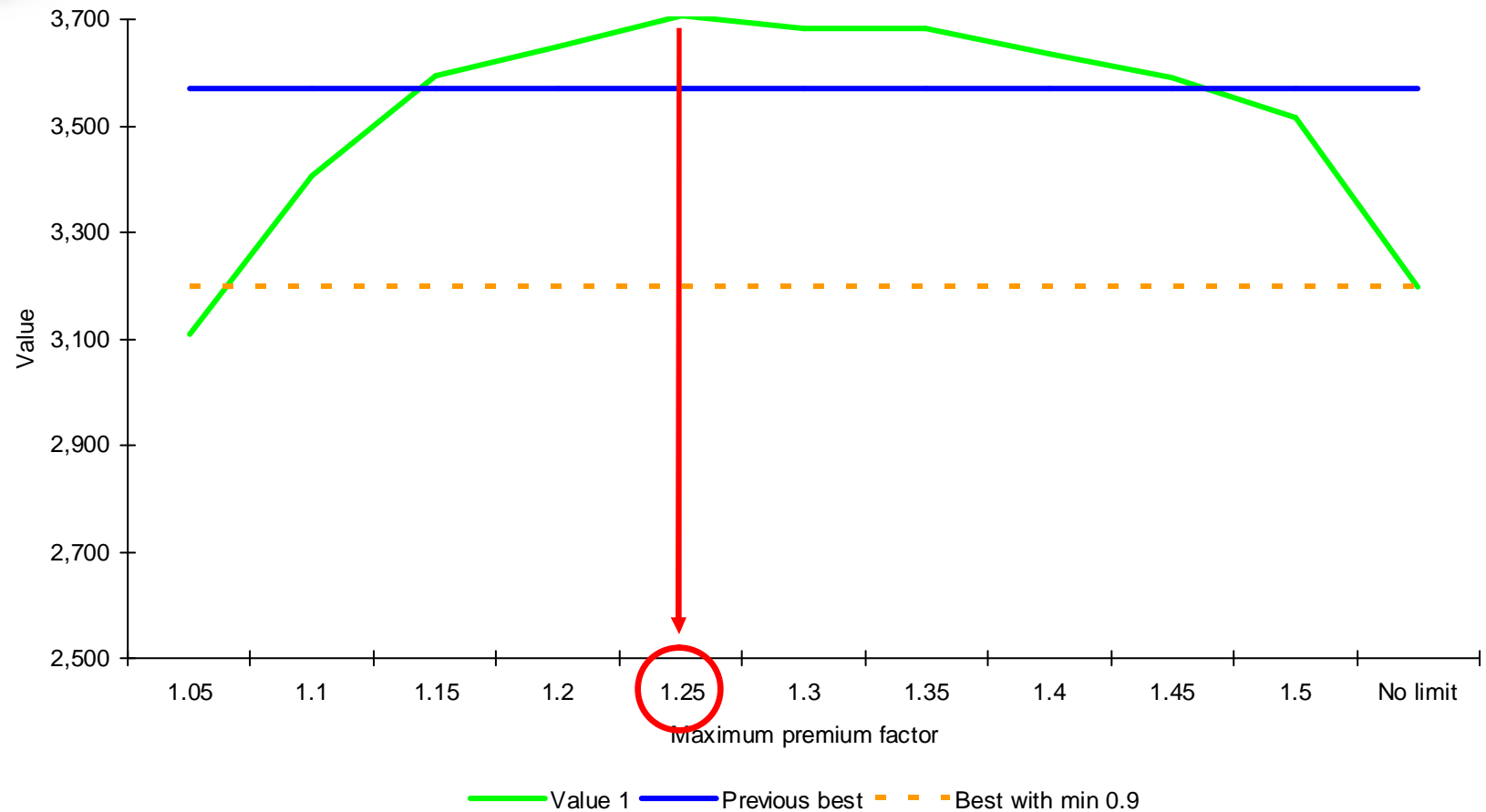 - may not be too popular with some regulators?

Investigation of limiting premium decreases

Investigation of limiting premium increases given 10% limit on decreases