

Modeling Policyholder Retention

2004 CAS Seminar on
Ratemaking

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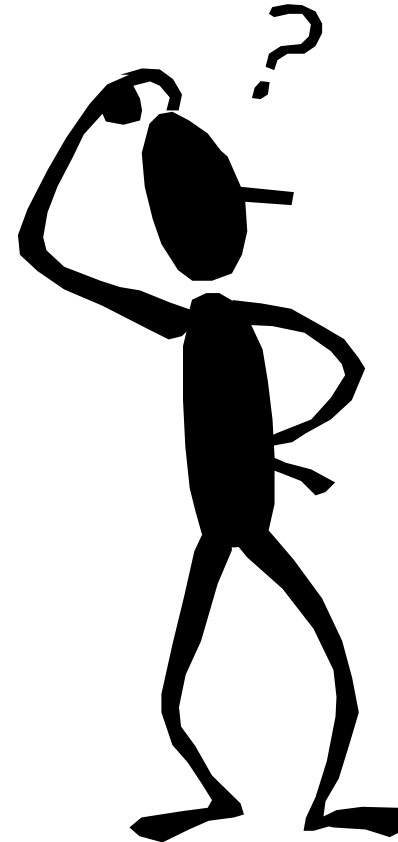
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Retention analysis

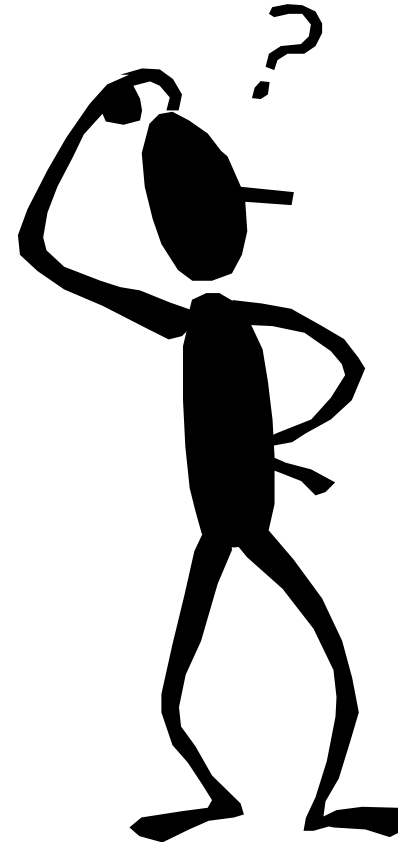
- What to measure
- What to consider
- Practical tips
- Why do it





Retention analysis

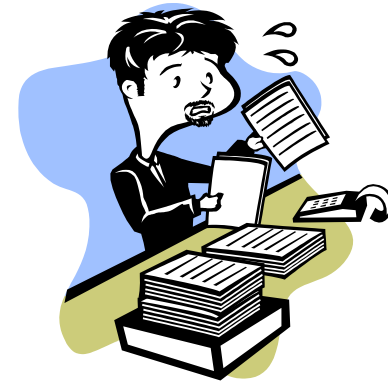
- **What to measure**
- What to consider
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Data required

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





Generalized linear models

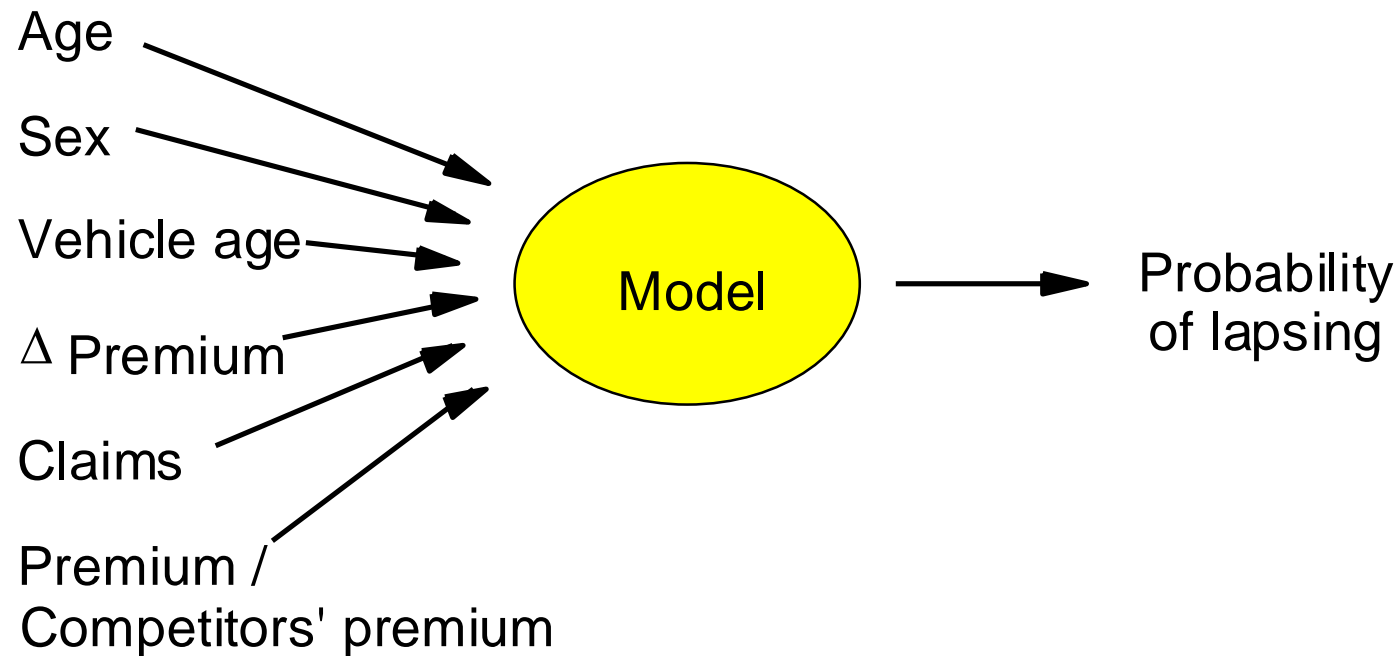
$$E[\underline{Y}] = \underline{\mu} = g^{-1}(\underline{X} \cdot \underline{\beta} + \underline{\xi})$$

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

- Consider all factors simultaneously
- Allow for nature of random process
- Robust and transparent
- EU industry standard

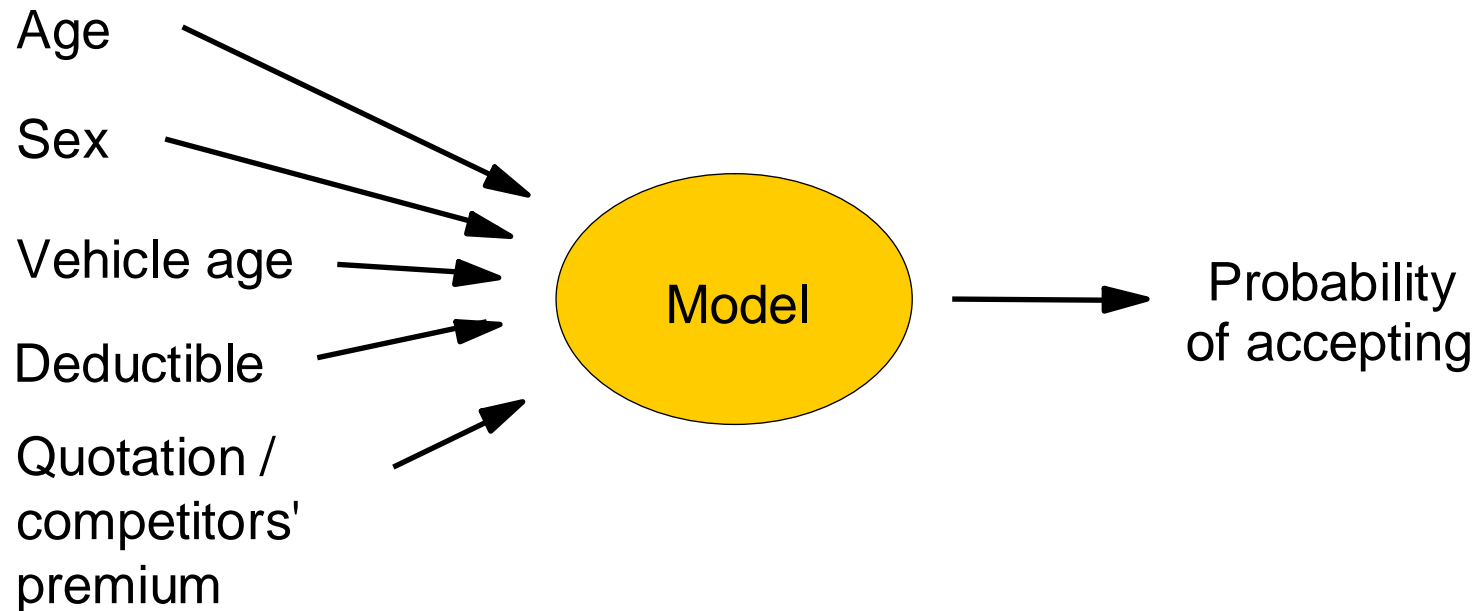
Modeling retention

- Most companies have data on renewal offers



Modeling new business rates

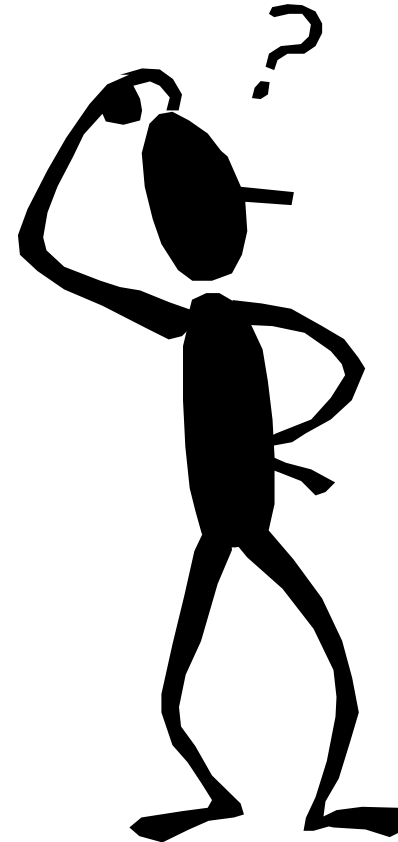
- If details of individual quotes known, can be modeled in similar way
- Otherwise much simpler analysis is all that can be undertaken





Retention analysis

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



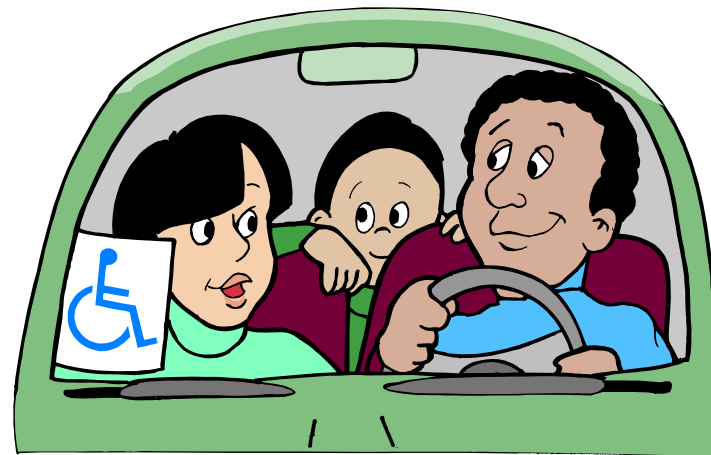


What to consider

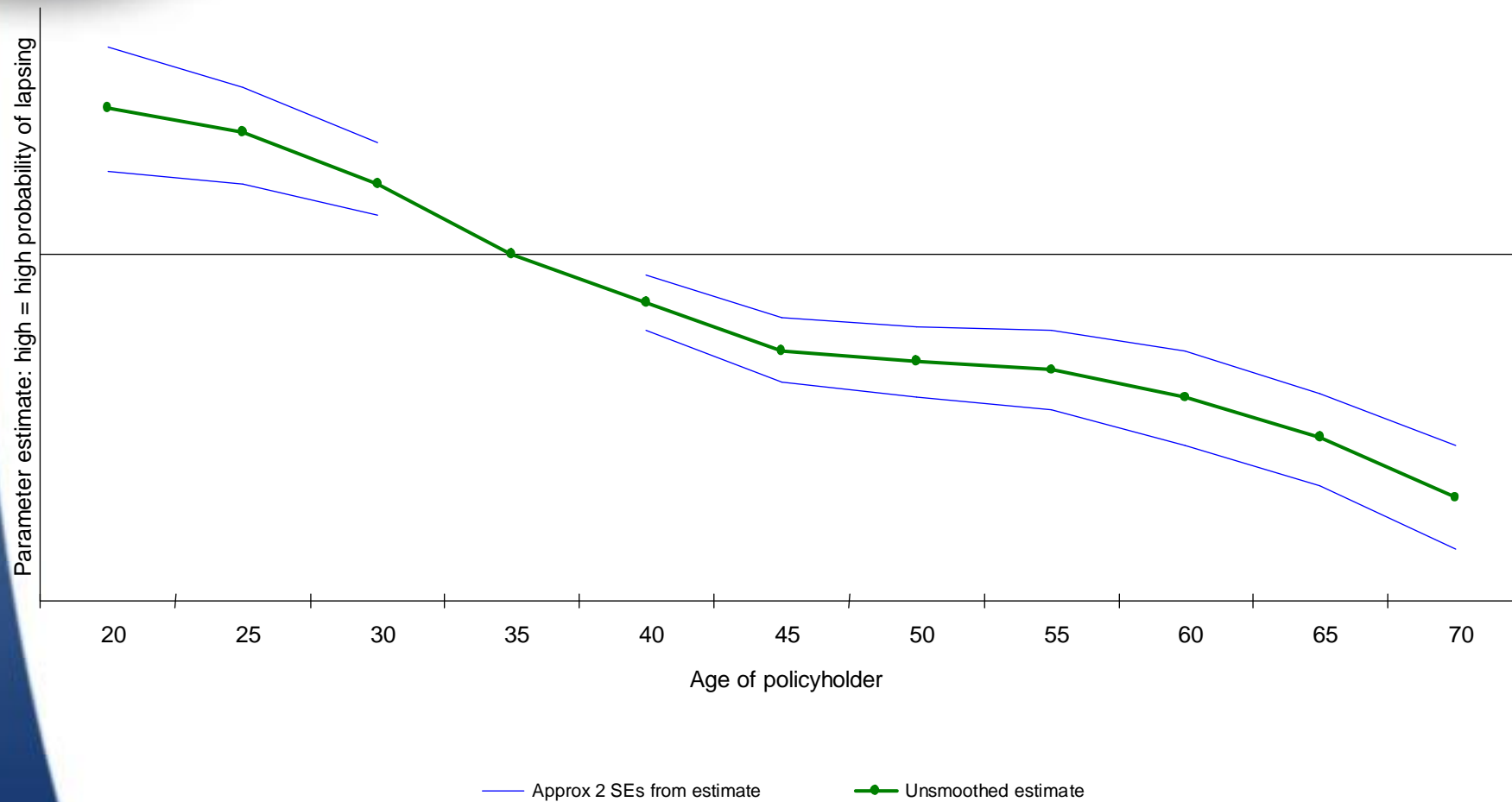
- Who are your customers
- How do you connect
- What have you done to them
- What have others done to them

Who are your customers?

- Age of policyholder
- Age of car
- Claims history
- Other rating factors
- Endorsement activity



Effect of age of policyholder on lapses





How do you connect with them?

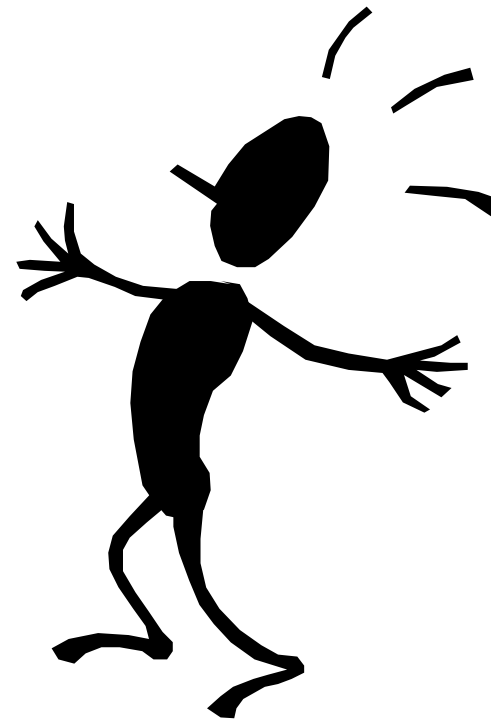
- Distribution channel
- Payment plan
- Other products held
- # years with company



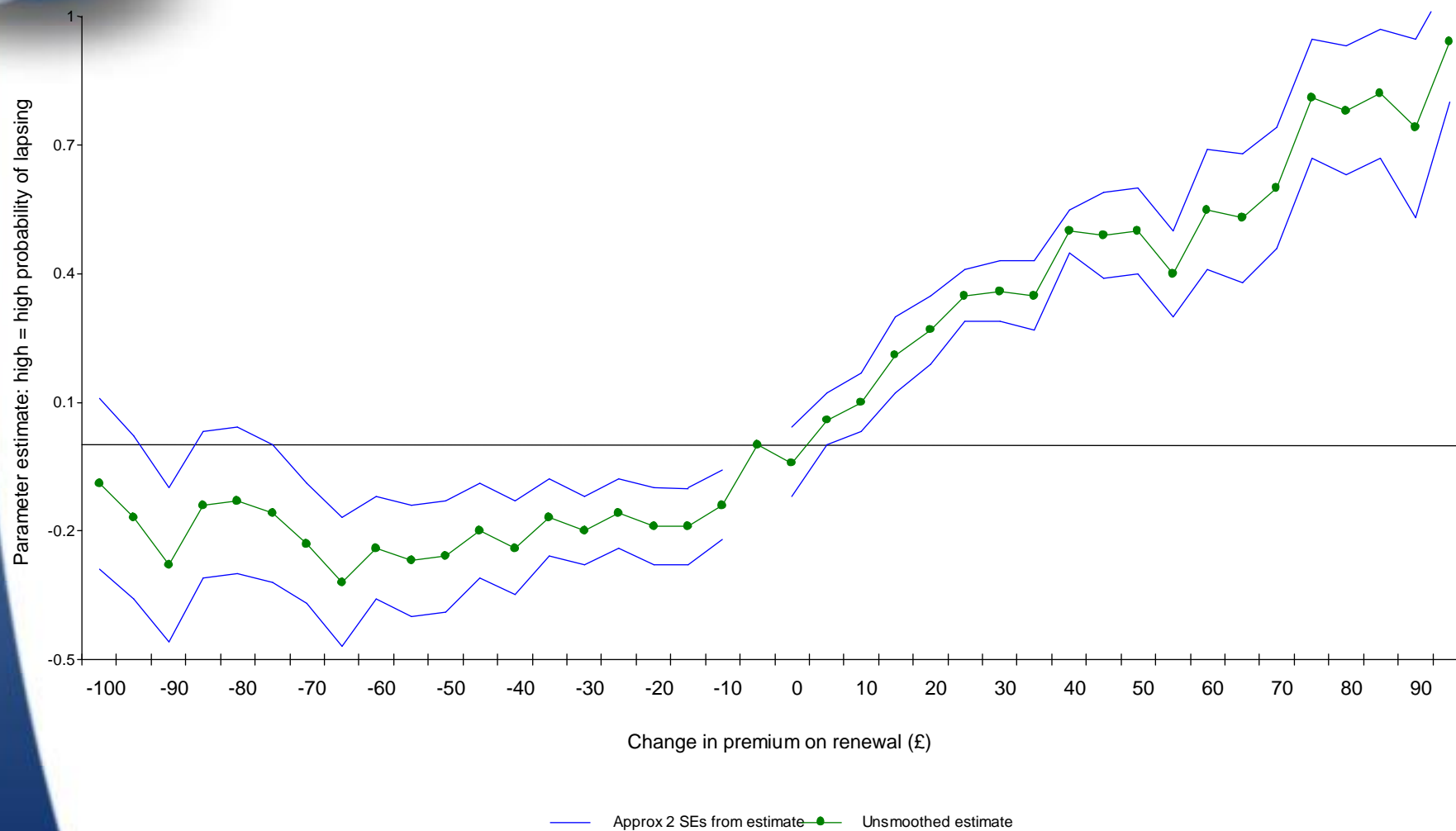


What have you done to them?

- Rate change
- Claims service
- Agent service

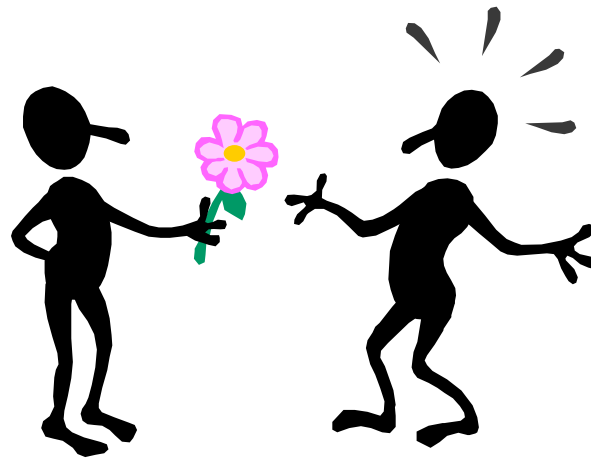


Effect of premium change on lapses



What have others done to them?

- Competitors' premium
- Product differentiation
(probably not applicable to personal lines)

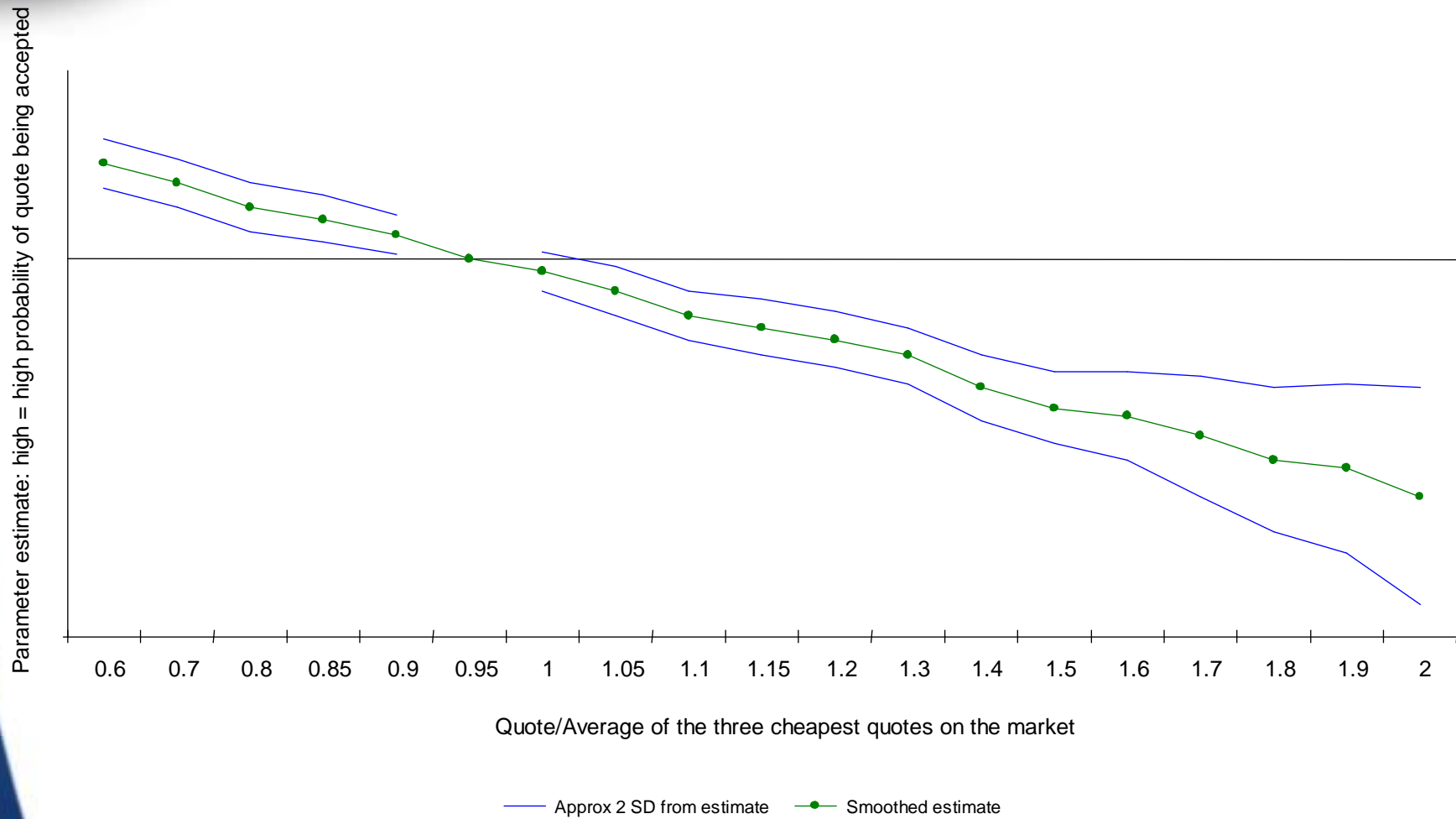




Competitive indices

- For modeling, required at individual policy level
- Many measures can be used, eg
 - quote / average of 3 cheapest from a selection of major competitors
 - quote / 3rd cheapest from a wide range of competitors
 - rank of quote relative to competitors
- Sources of competitor info
 - rate manuals
 - comparative rating software
 - mystery shopping
 - direct questioning of customer

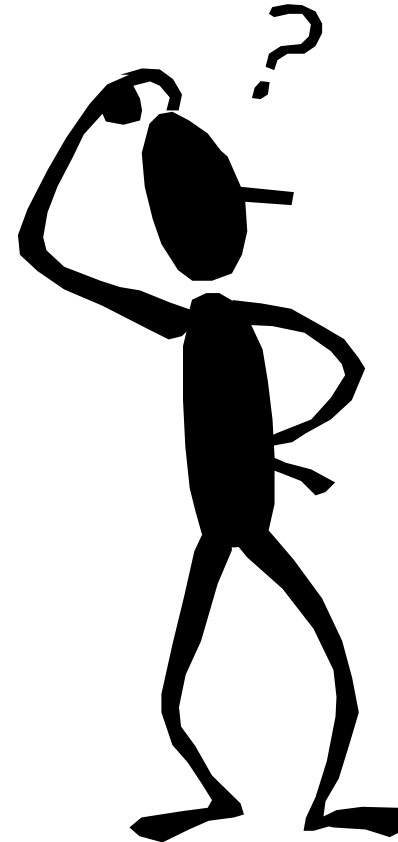
Effect of competitiveness on new business





Retention analysis

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



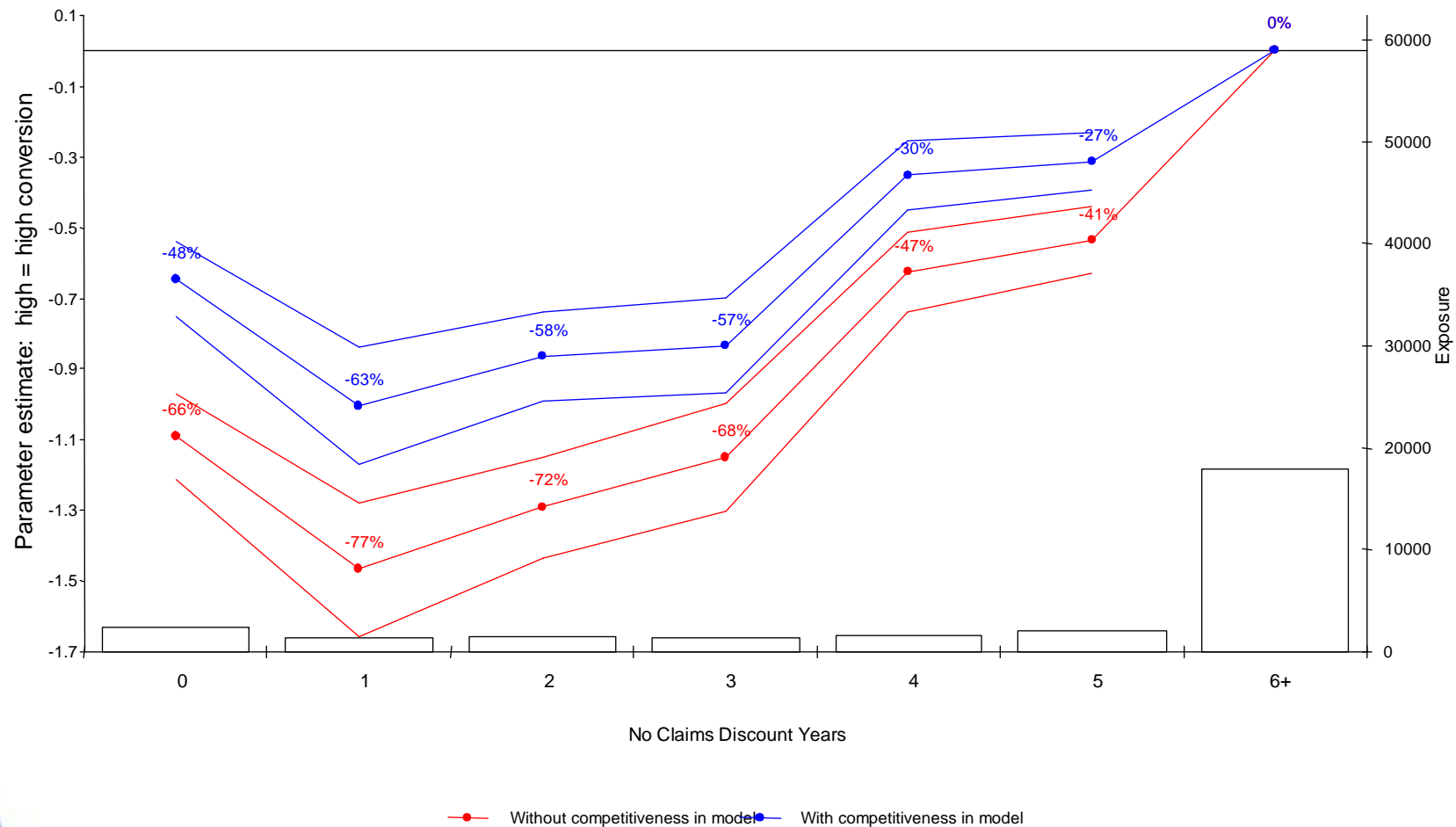


Statistical assumptions

- A logistic model is most appropriate
 - considers $\log(p / [1-p])$ and binomial error
 - maps $[0,1]$ to $[-\infty,\infty]$
 - 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 very 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

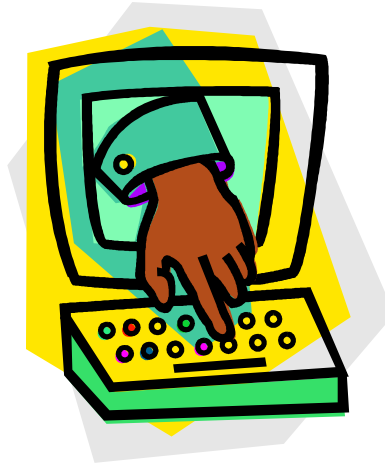


Measuring premium change

- Investigate % change and \$ change
- Suggest fit 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

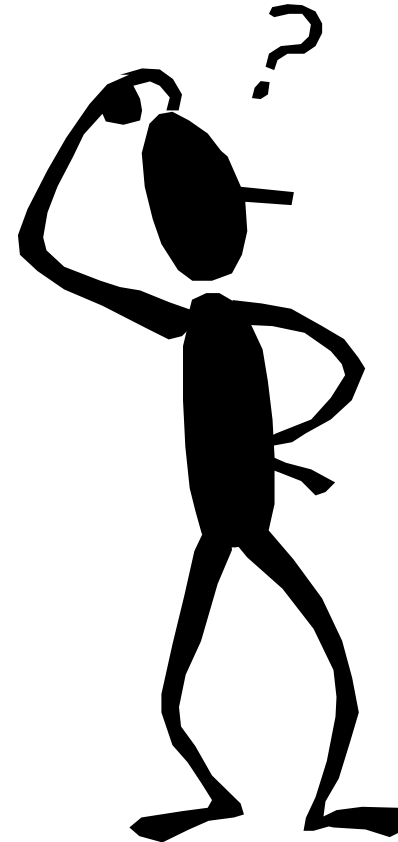
- Customer expectations of premium change
 - try to isolate rate change from risk criteria change which affects premium
 - consider premium change adjusted for change in risk criteria (ie new rates for new risk / old rates for new risk)





Retention analysis

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

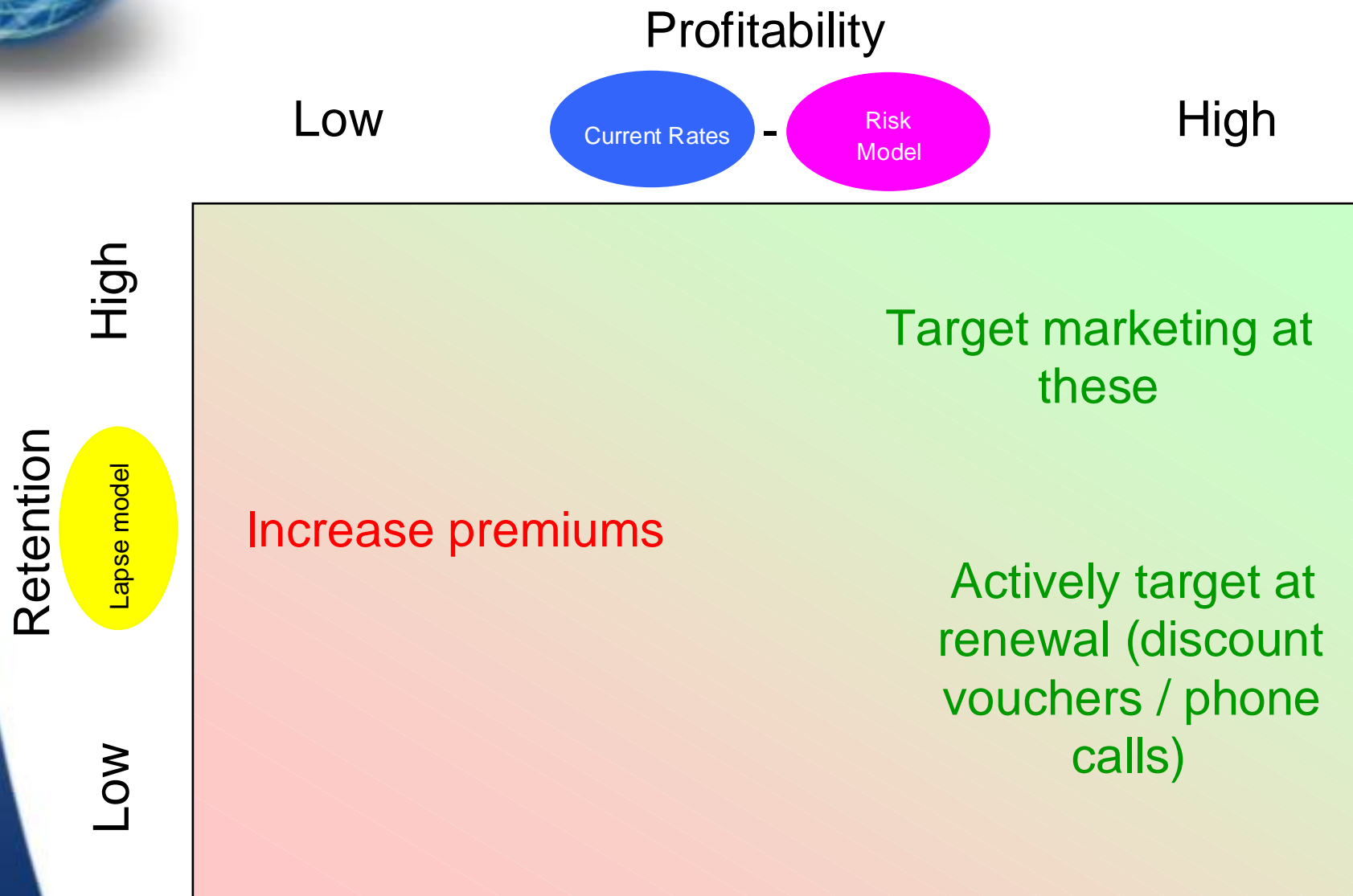




Why model lapses / new business?

- Consideration of expected life of policy and therefore customer value
- Differential expense loadings
- Measures price elasticity
- Scenario tests / detailed model office projections

Customer value

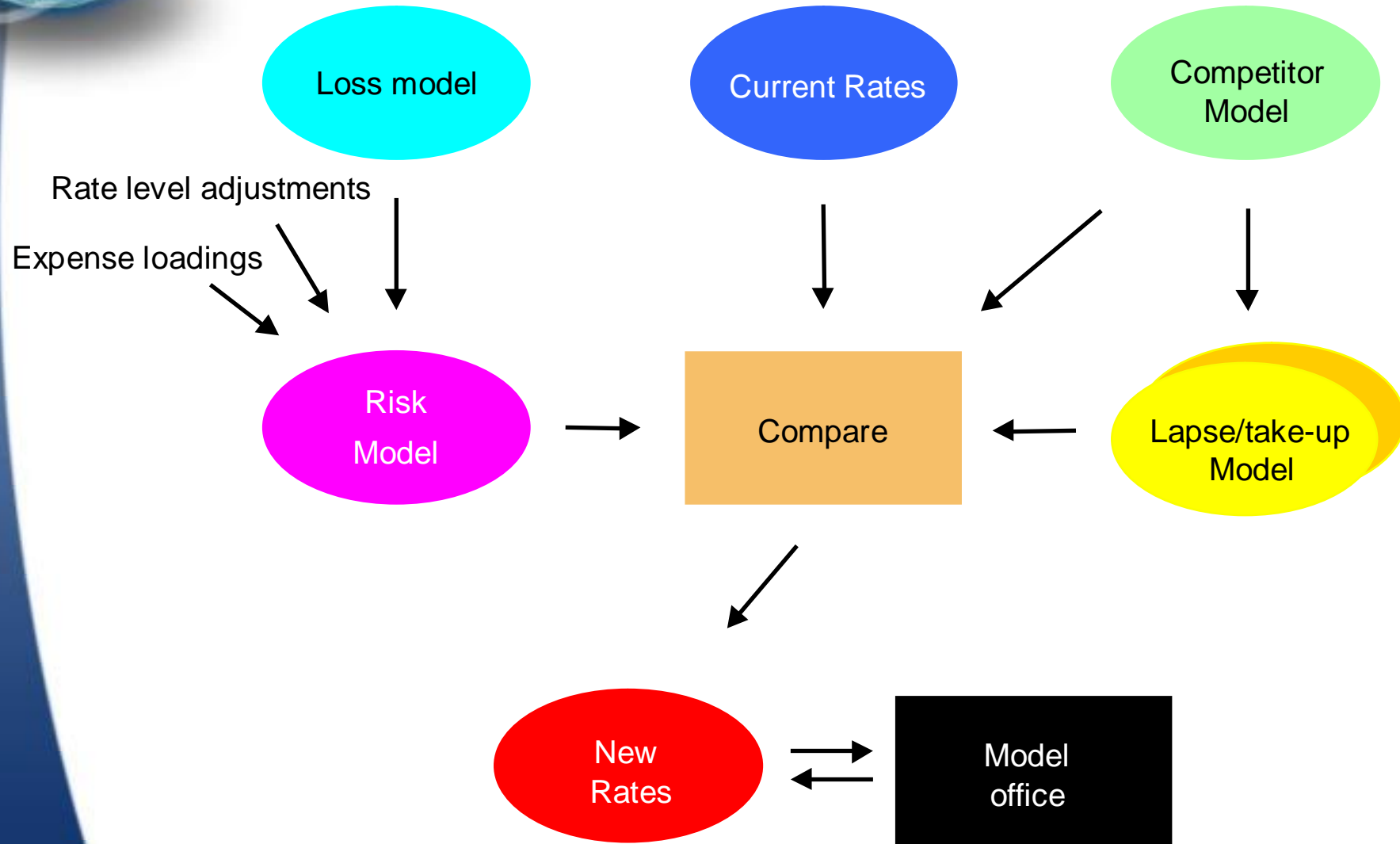




Lifetime expense loads

- 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 $(100 + 4 * 30) / 5 = 44$

Model office





Model office 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

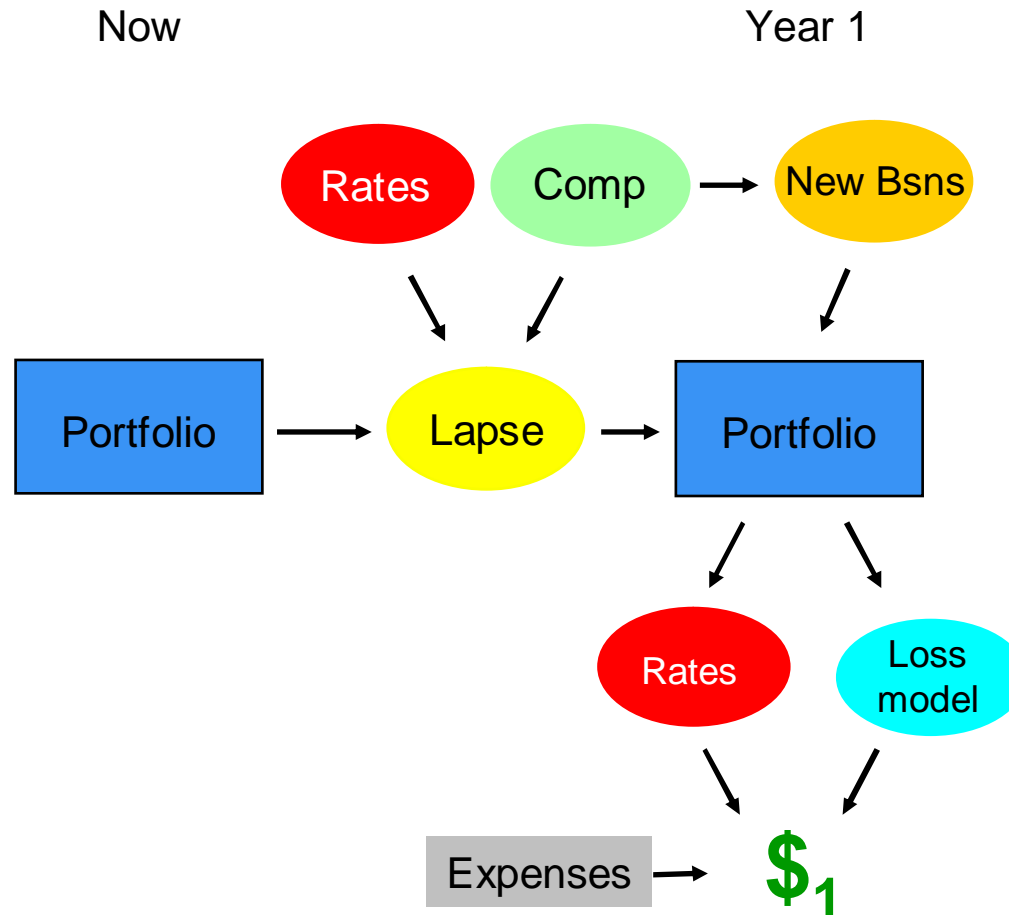
Lapse model

New business model

Test

New Rates

Scenario testing

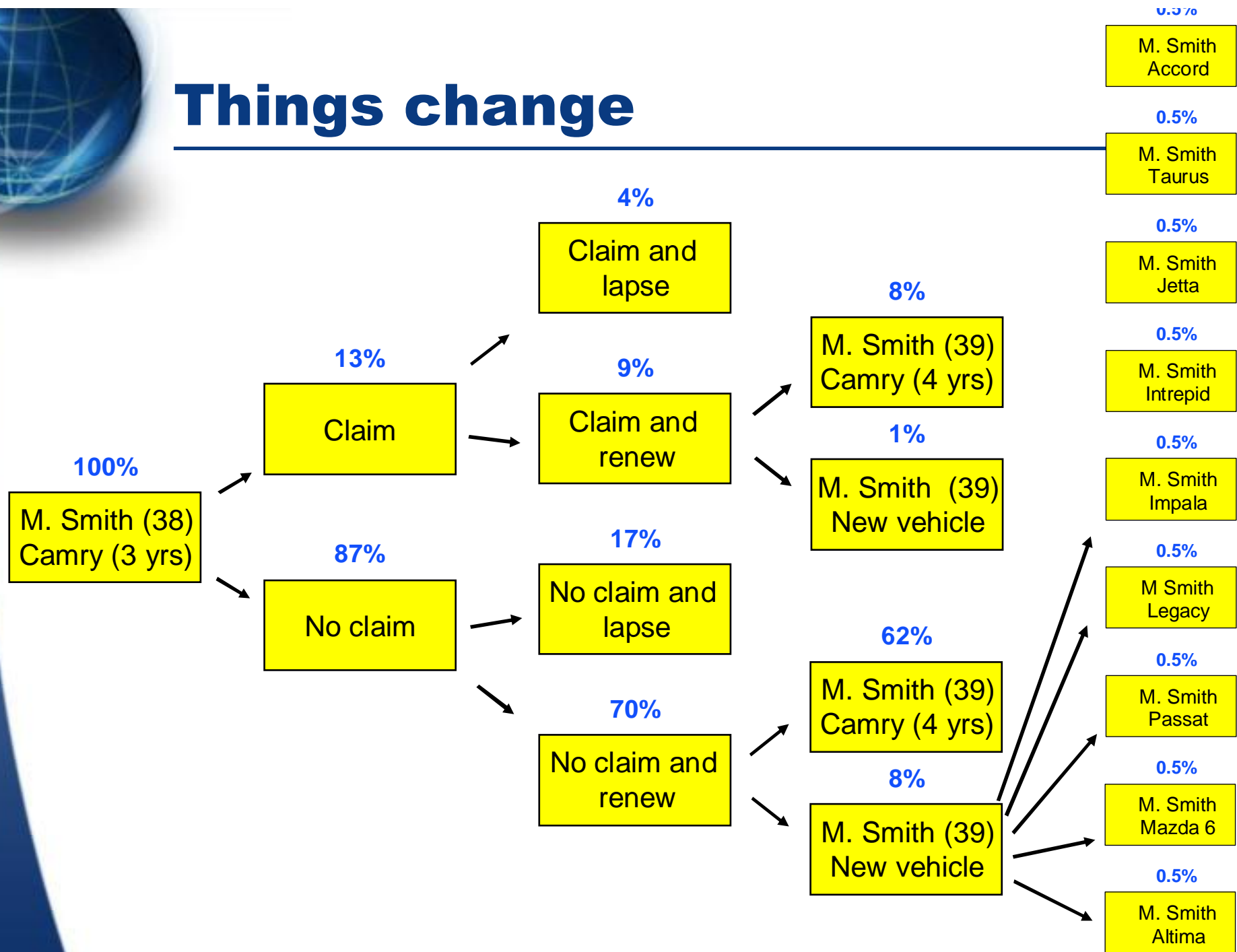




Issues

- 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

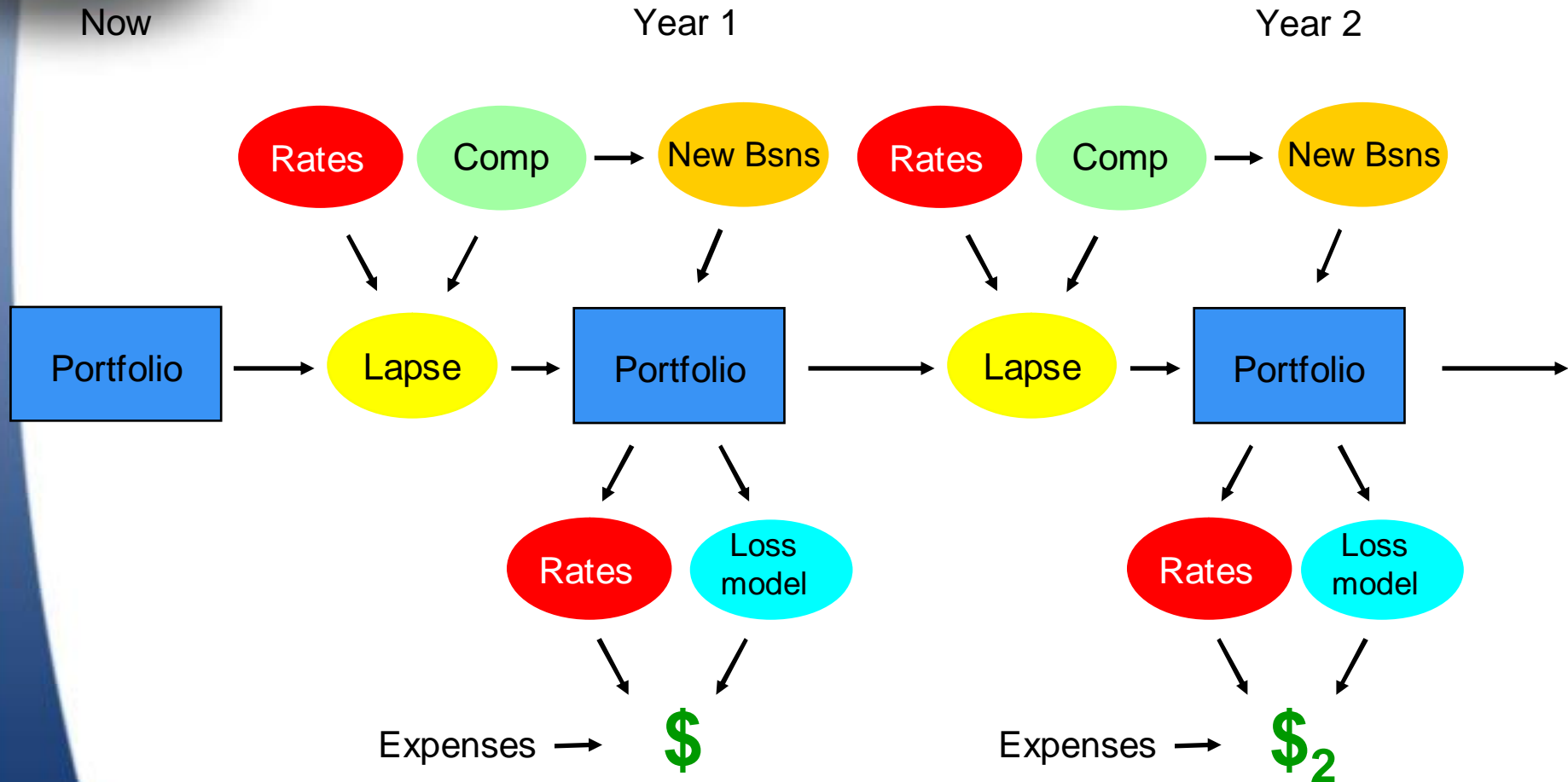




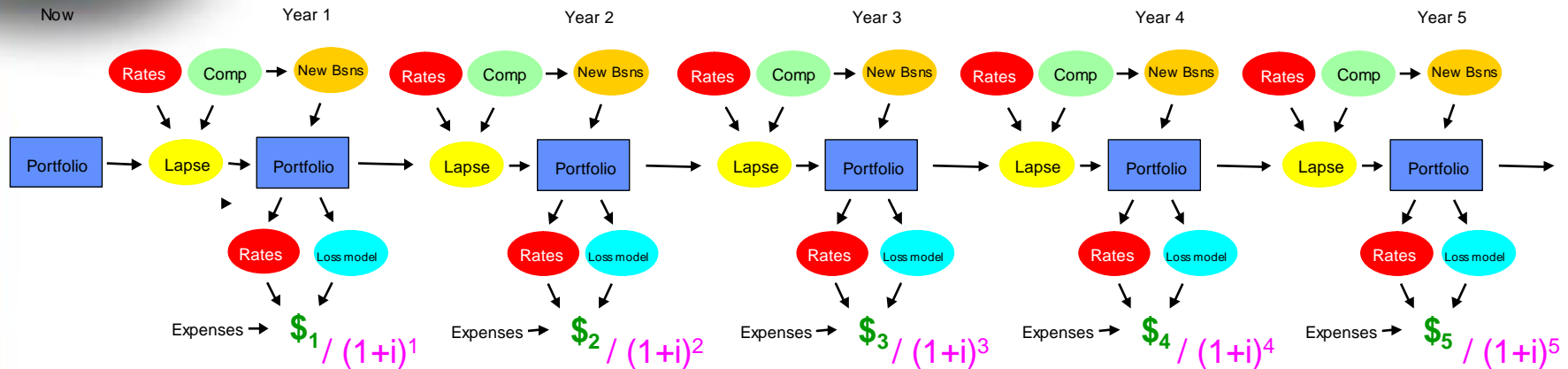
What is the value of having a policy at the end of the year?

- Could value as (year one profit x expected life)
 - two big drivers of retention are age and tenure => people get stickier
 - expected life higher than $1/(1-r)$
 - what is the profit measure?
- In theory best to investigate using multi-year projections

Multiple year projections

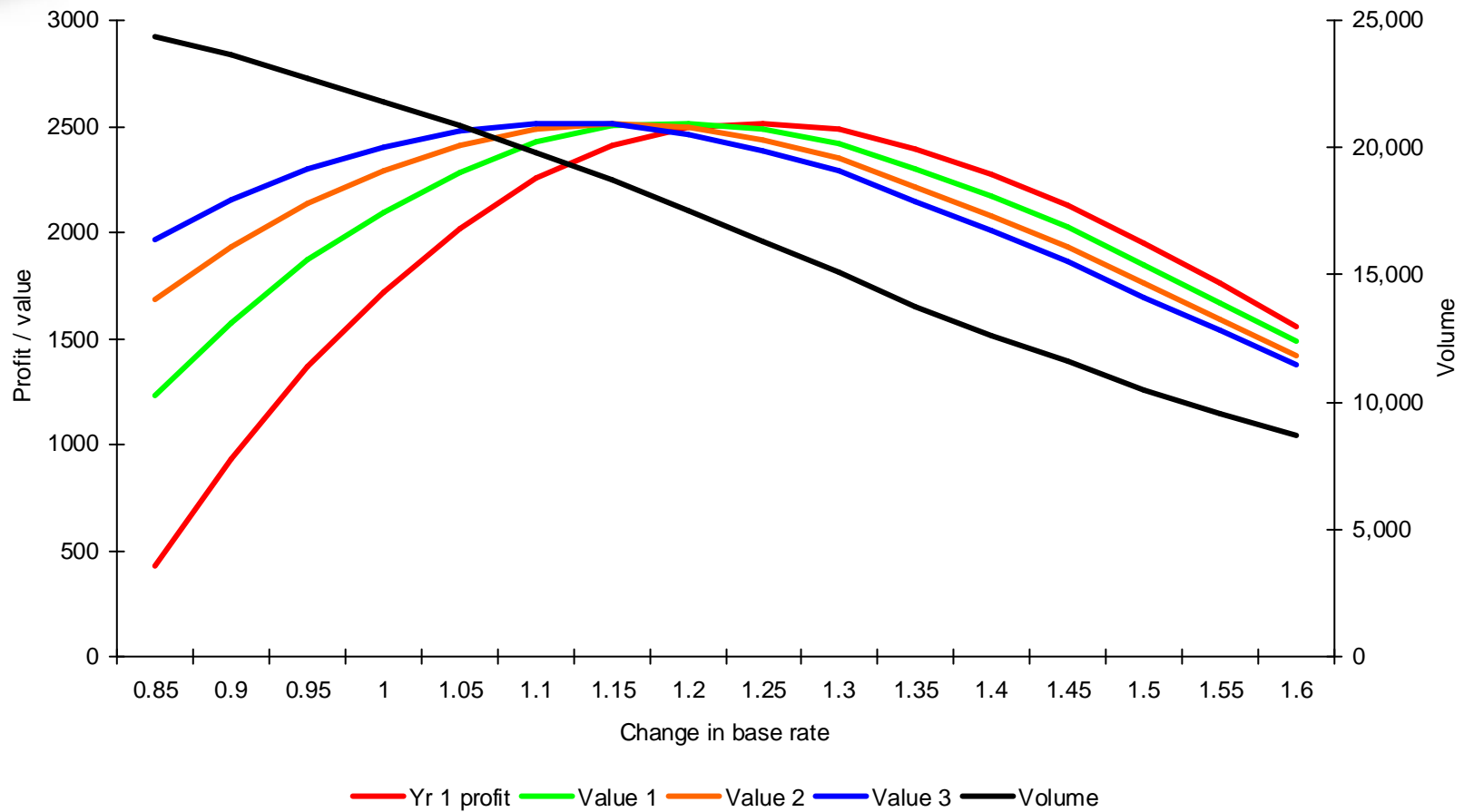


Multiple year projections

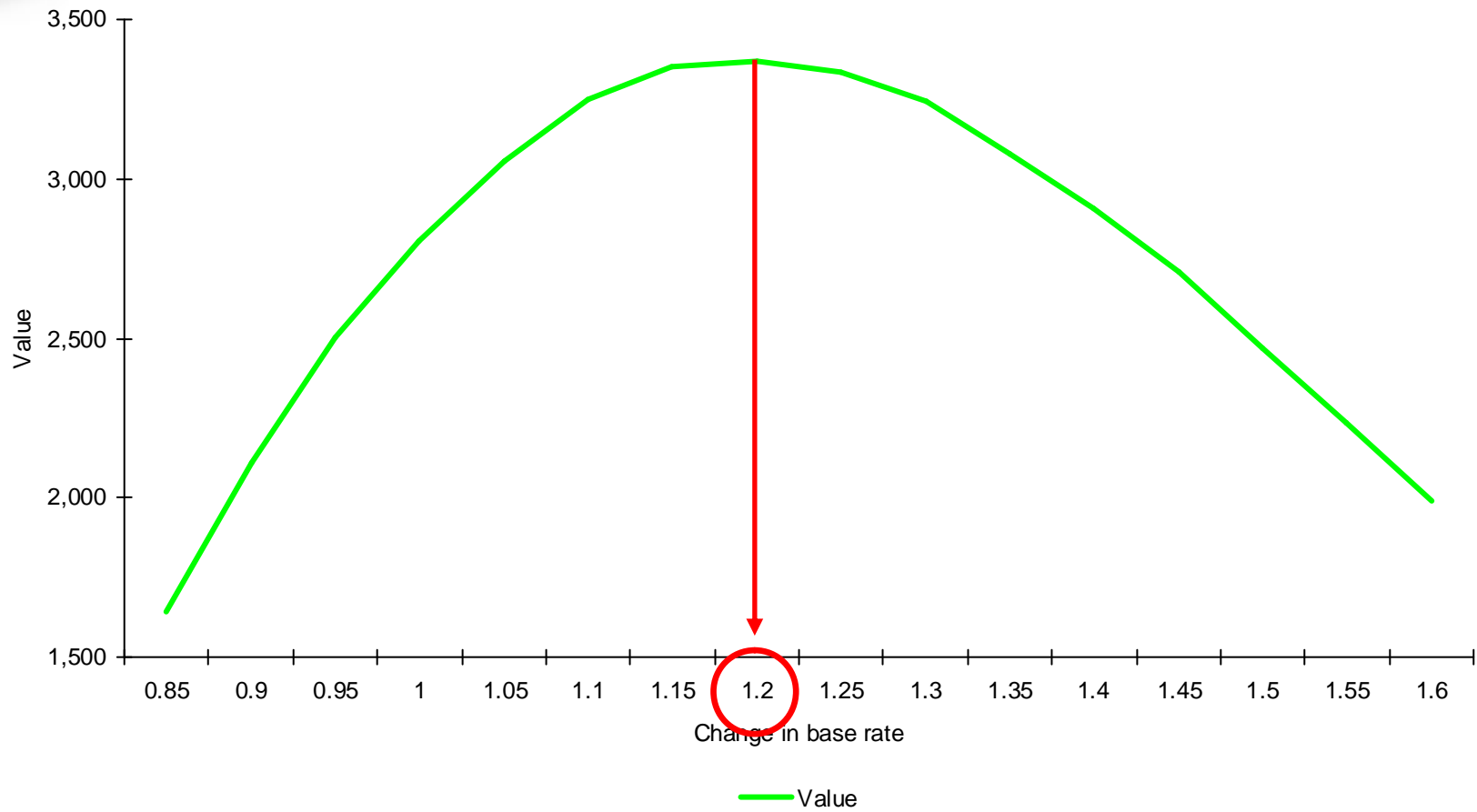


- In theory project many years
- In practice assumptions become too uncertain and model becomes too complex

Investigation of base rate change with different success criteria

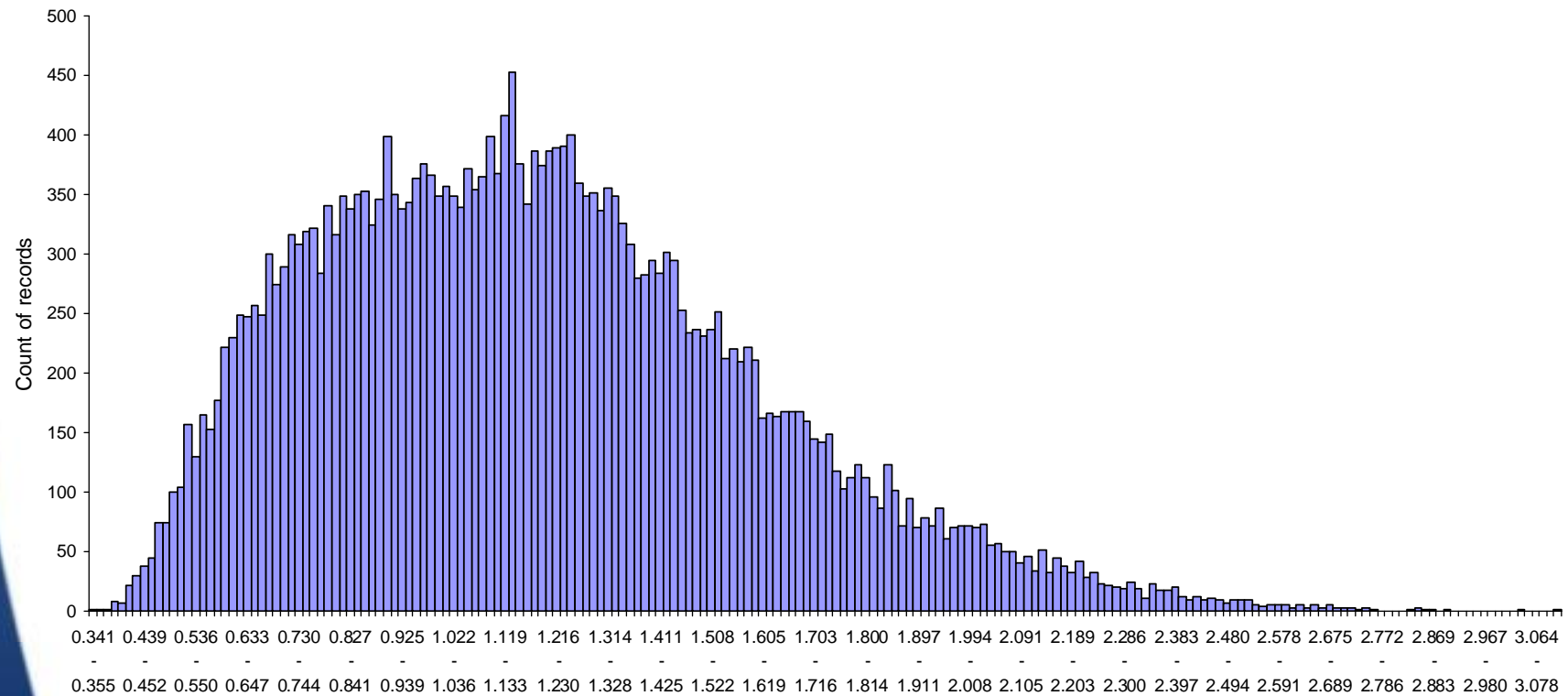


Investigation of base rate change

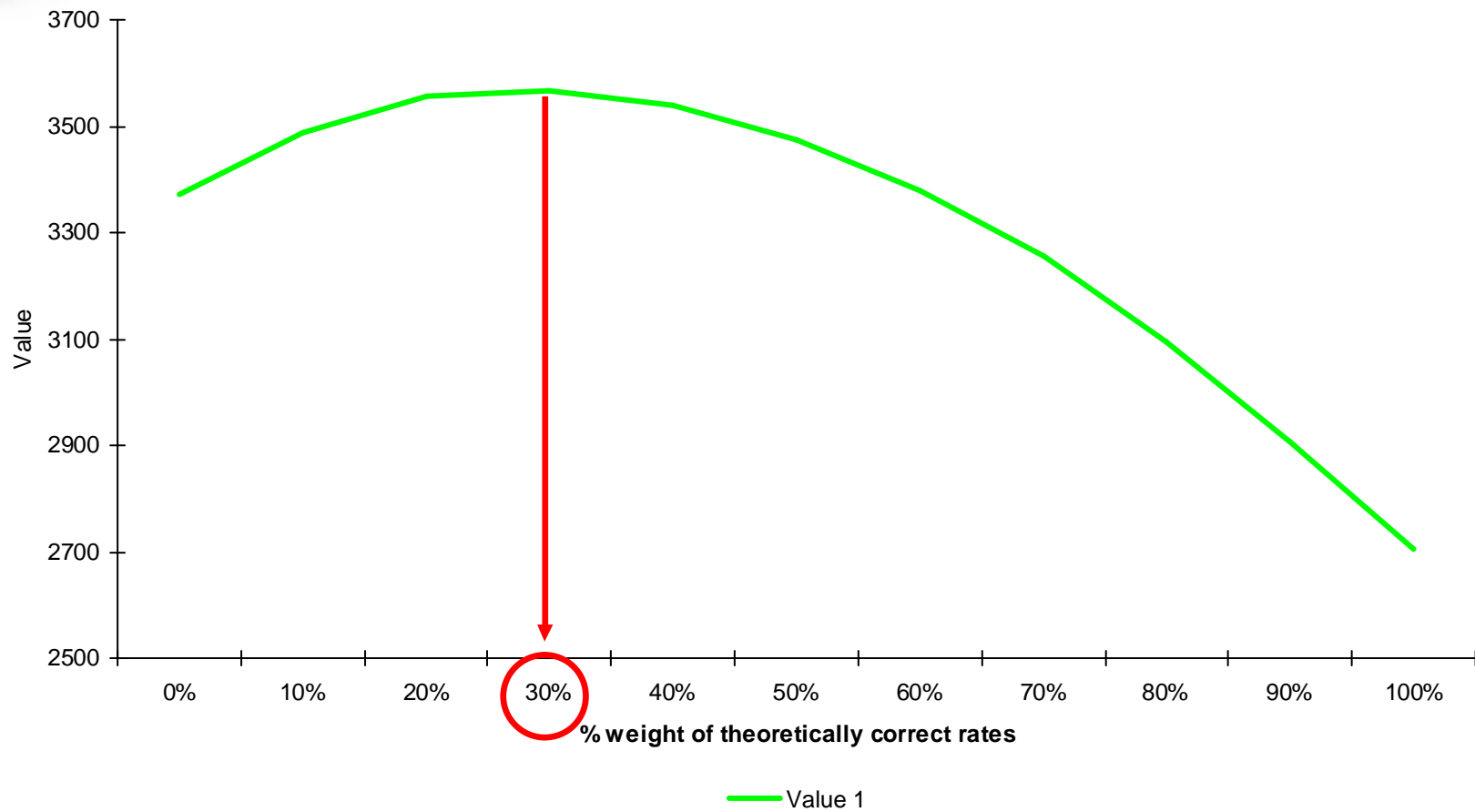


Investigation of relativities

Impact from current relativities to correct relativities

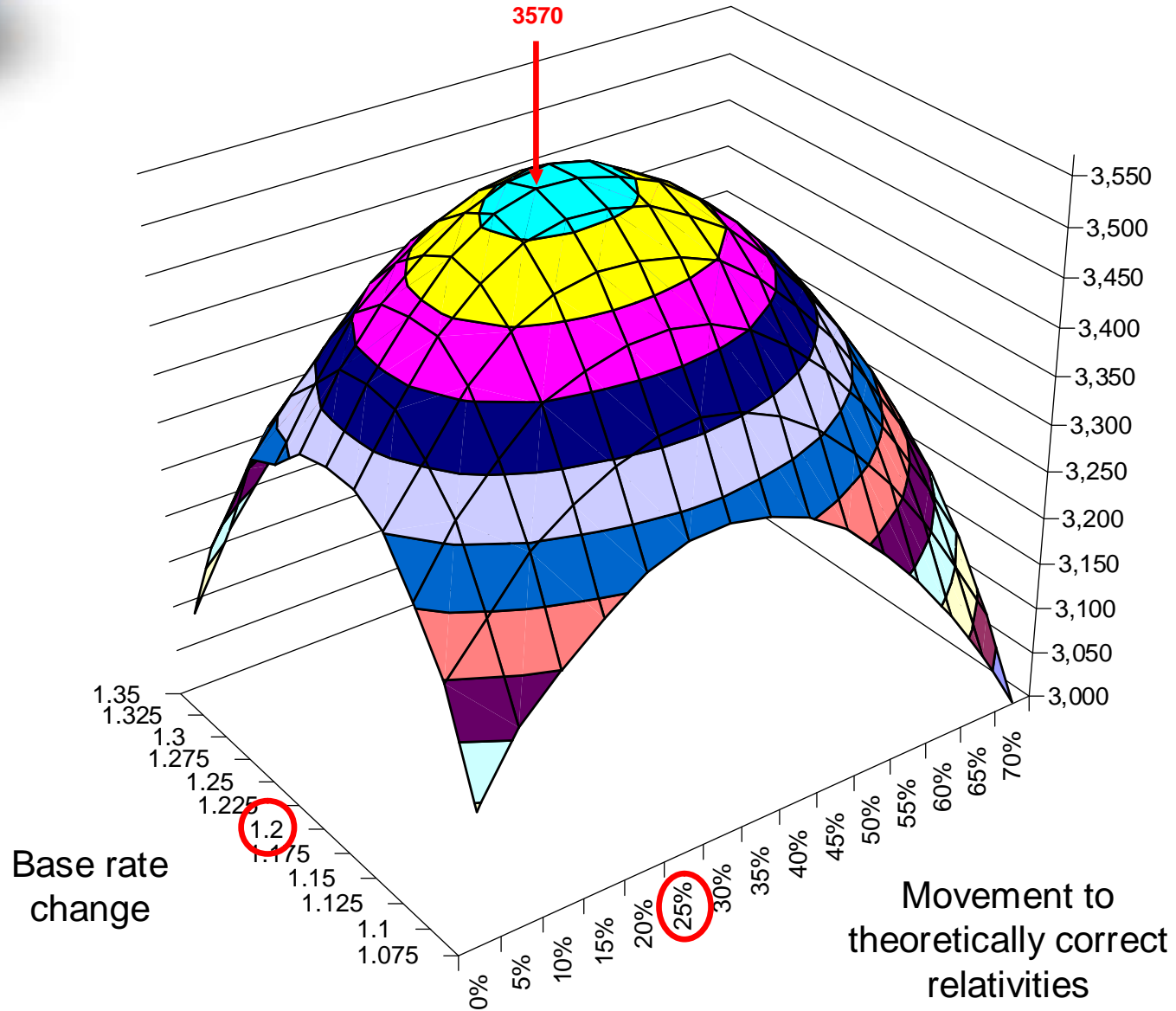


Investigation of changing relativities



Blend of current and theoretically correct relativities

Combined investigation



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