

Modeling Policyholder Retention

2003 CAS Ratemaking Seminar

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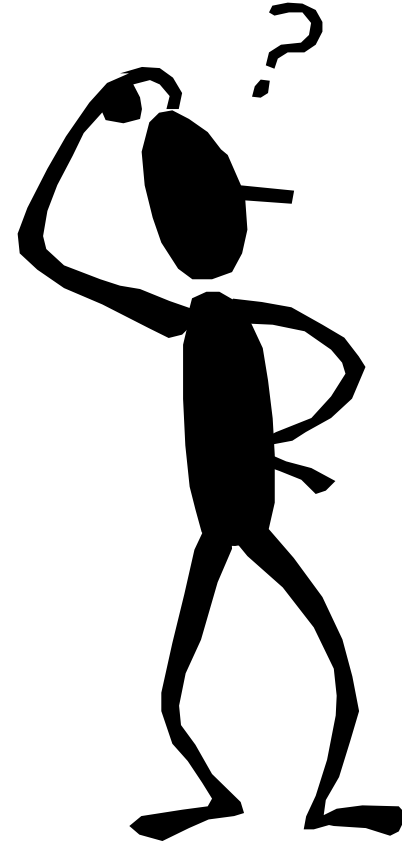
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Retention analysis

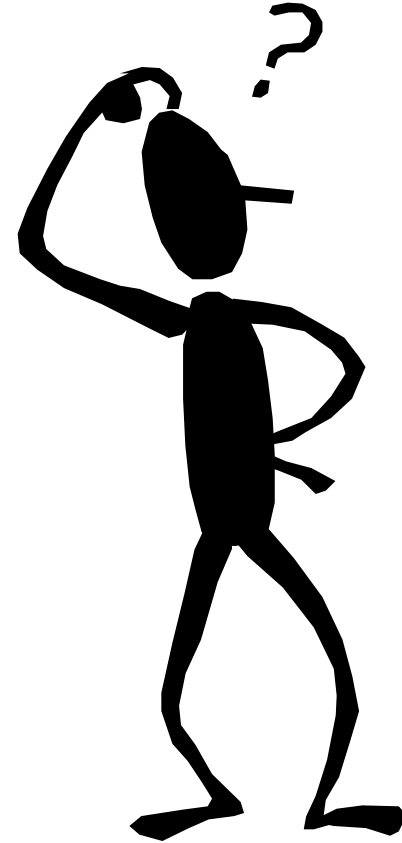
- What to measure
- What to consider
- Practical tips
- Why do it





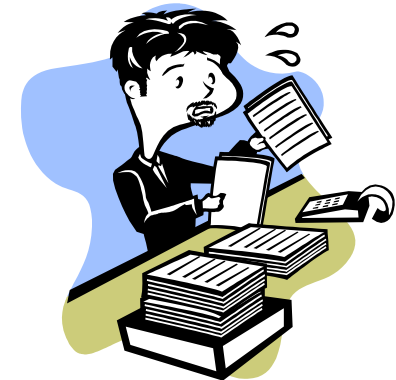
Retention analysis

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



Data required

- Individual policy (or quote) level
- Offer & resulting accept/lapse
- Policy characteristics
- Responsive experience period





Generalized linear models

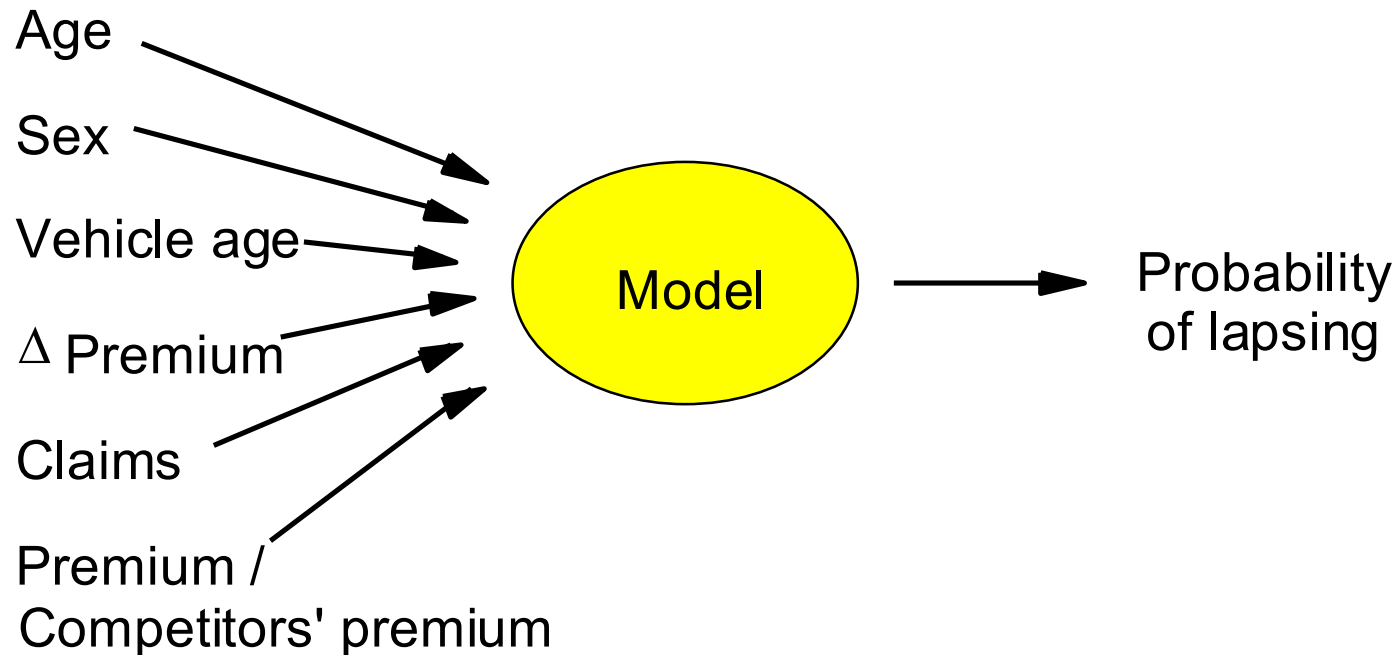
$$E[\underline{Y}] = \underline{\mu} = g^{-1}(\underline{X} \cdot \underline{\beta} + \underline{\xi})$$

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

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

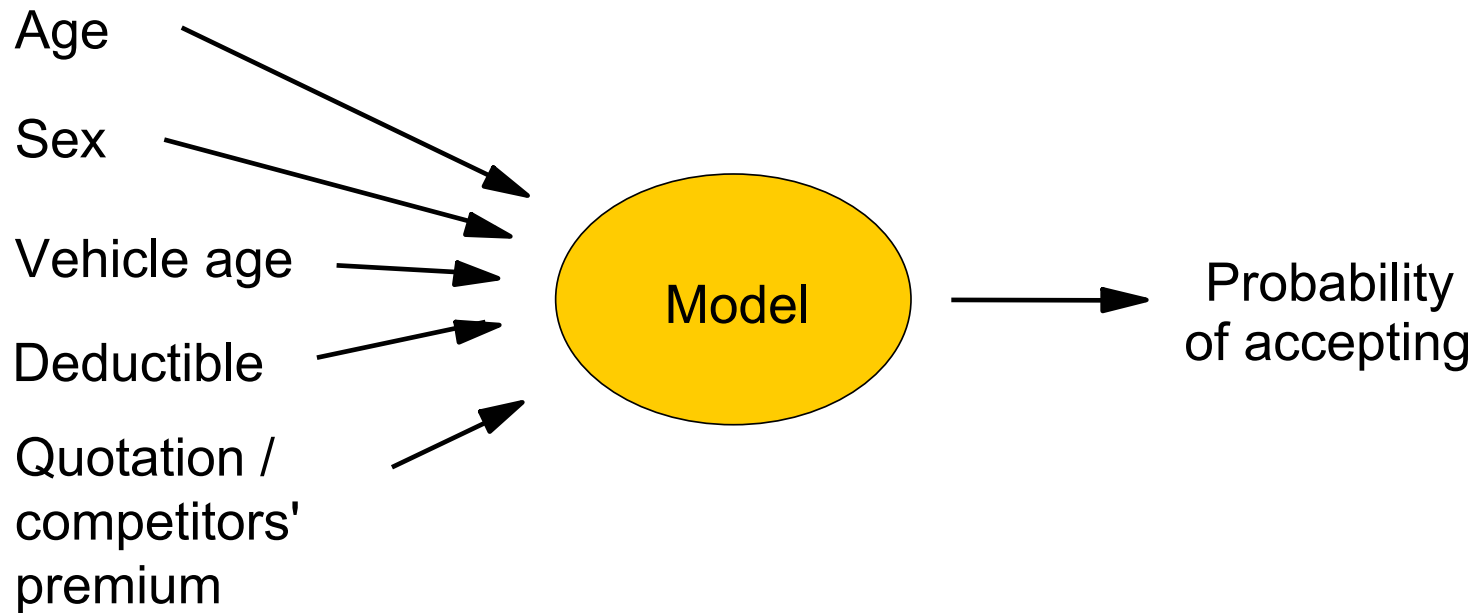
Modeling retention

- Most companies have data on renewal offers



Modeling new business rates

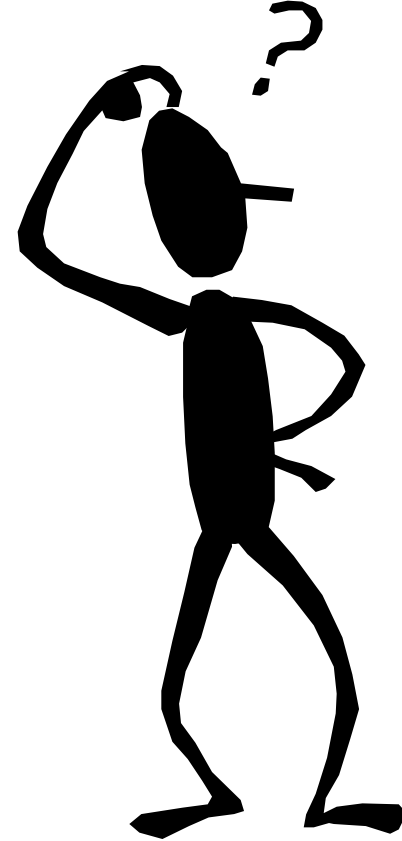
- If details of individual quotes known, can be modeled in similar way
- Otherwise much simpler analysis is all that can be undertaken





Retention analysis

- What to measure
- **What to consider**
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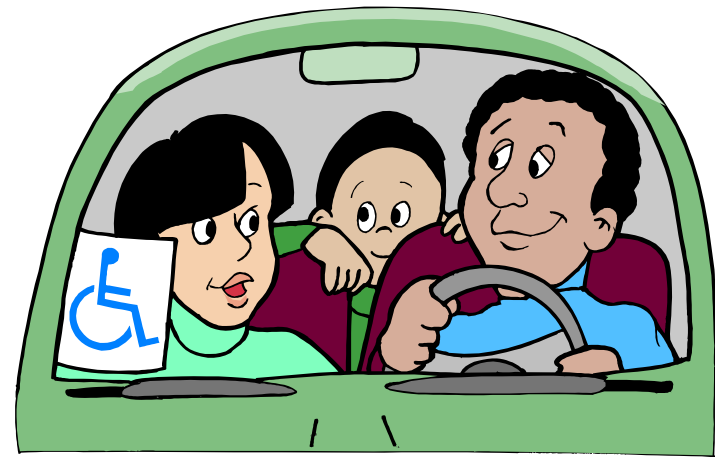


What to consider

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

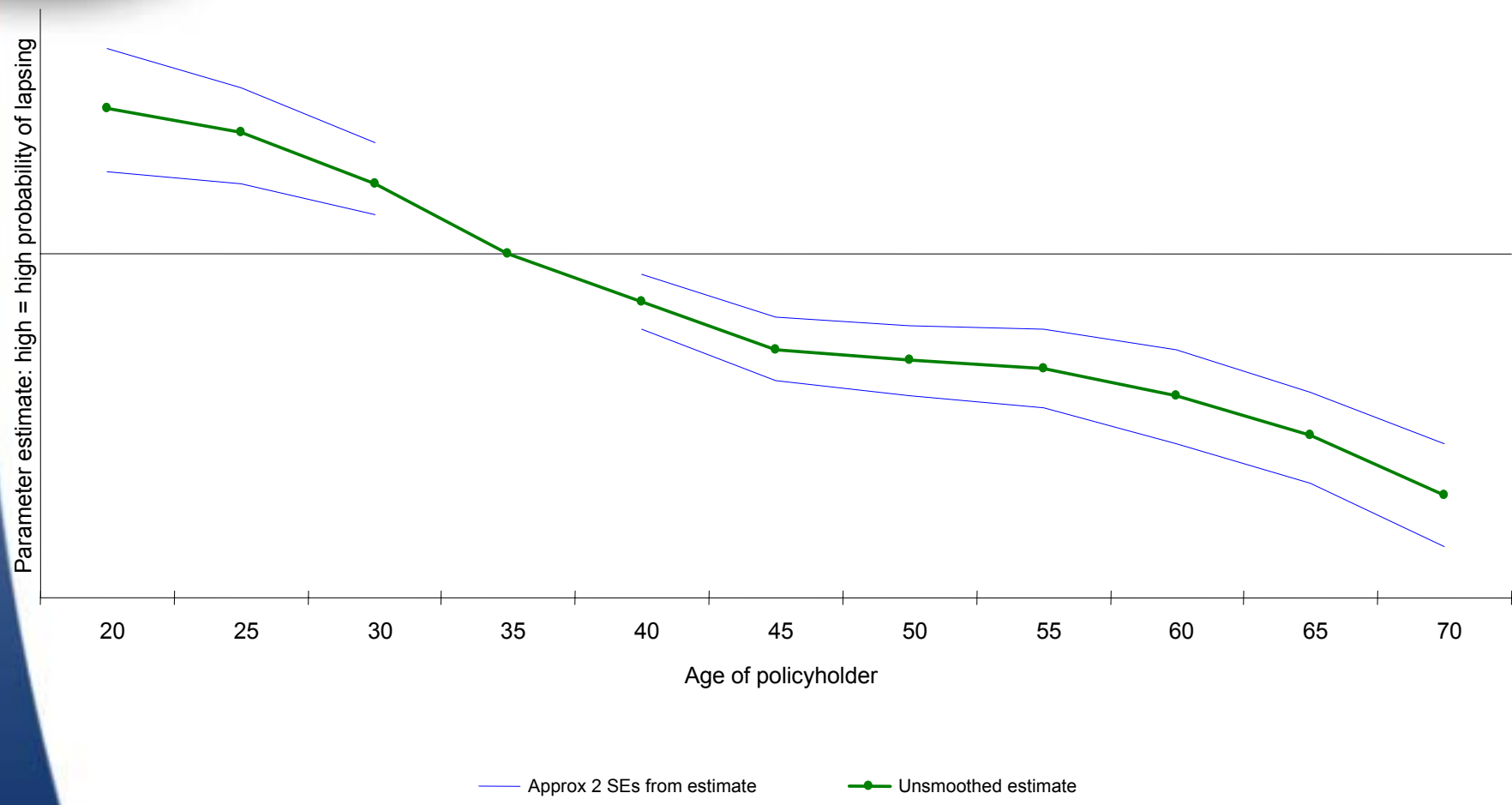
Who are your customers?

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





Effect of age of policyholder on lapses





How do you connect with them?

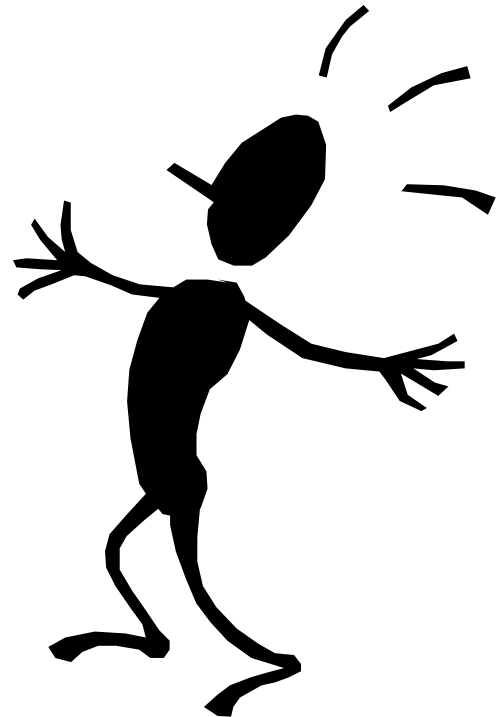
- Source
- Distribution channel
- Payment plan
- Other products held
- # years with company



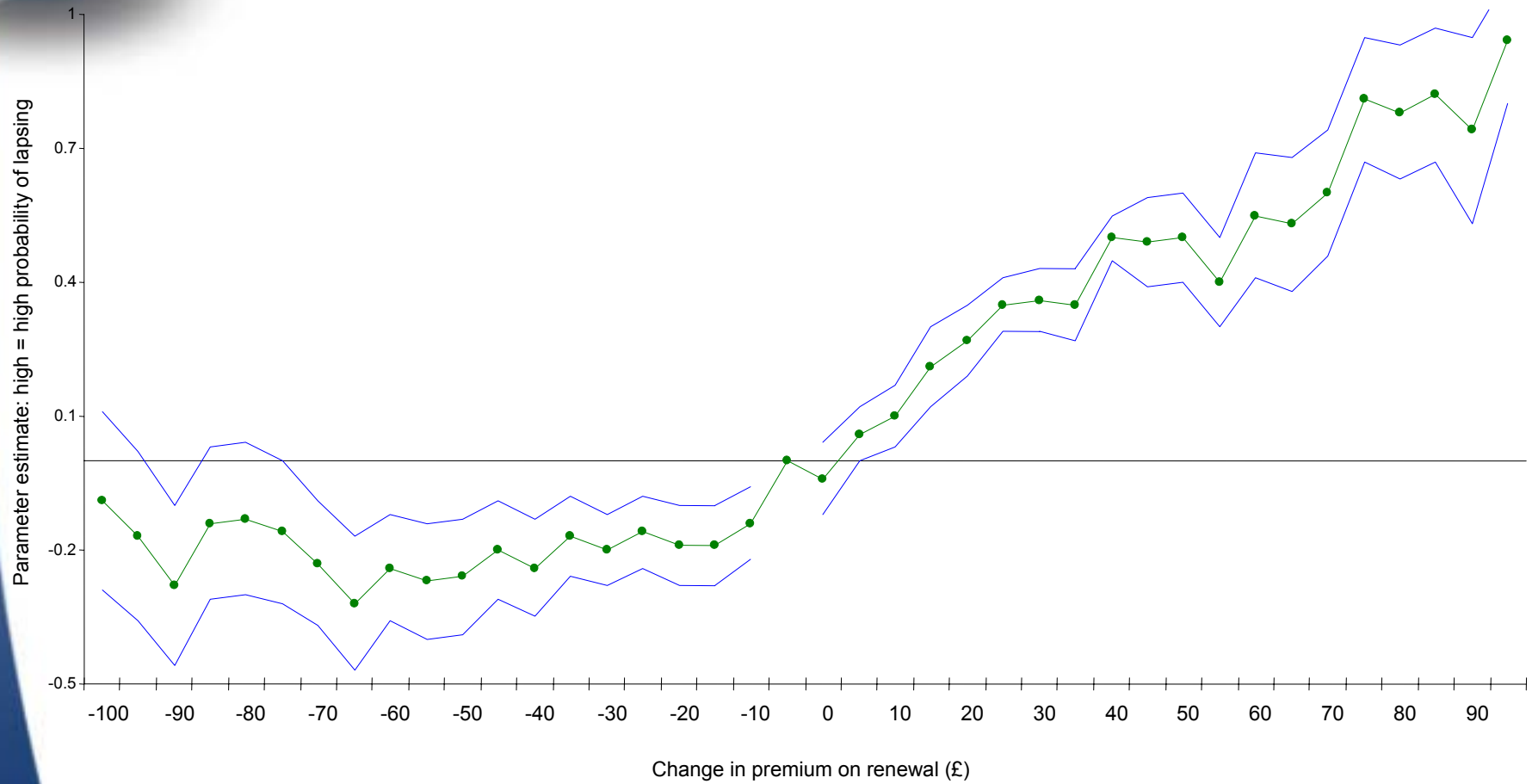


What have you done to them?

- Proposed change in premium
- Claims service
- Agent service



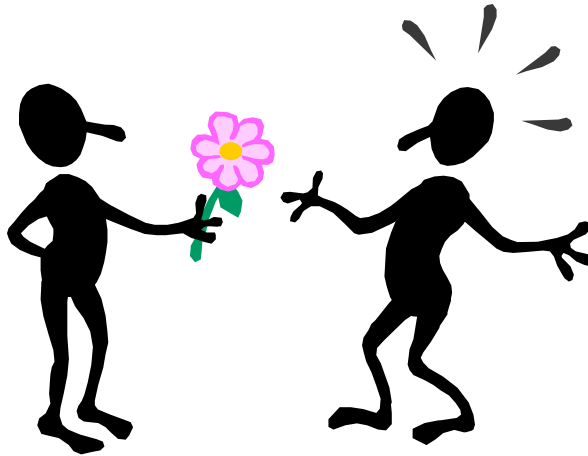
Effect of premium change on lapses



— Approx 2 SEs from estimate —●— Unsmoothed estimate

What have others done to them?

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





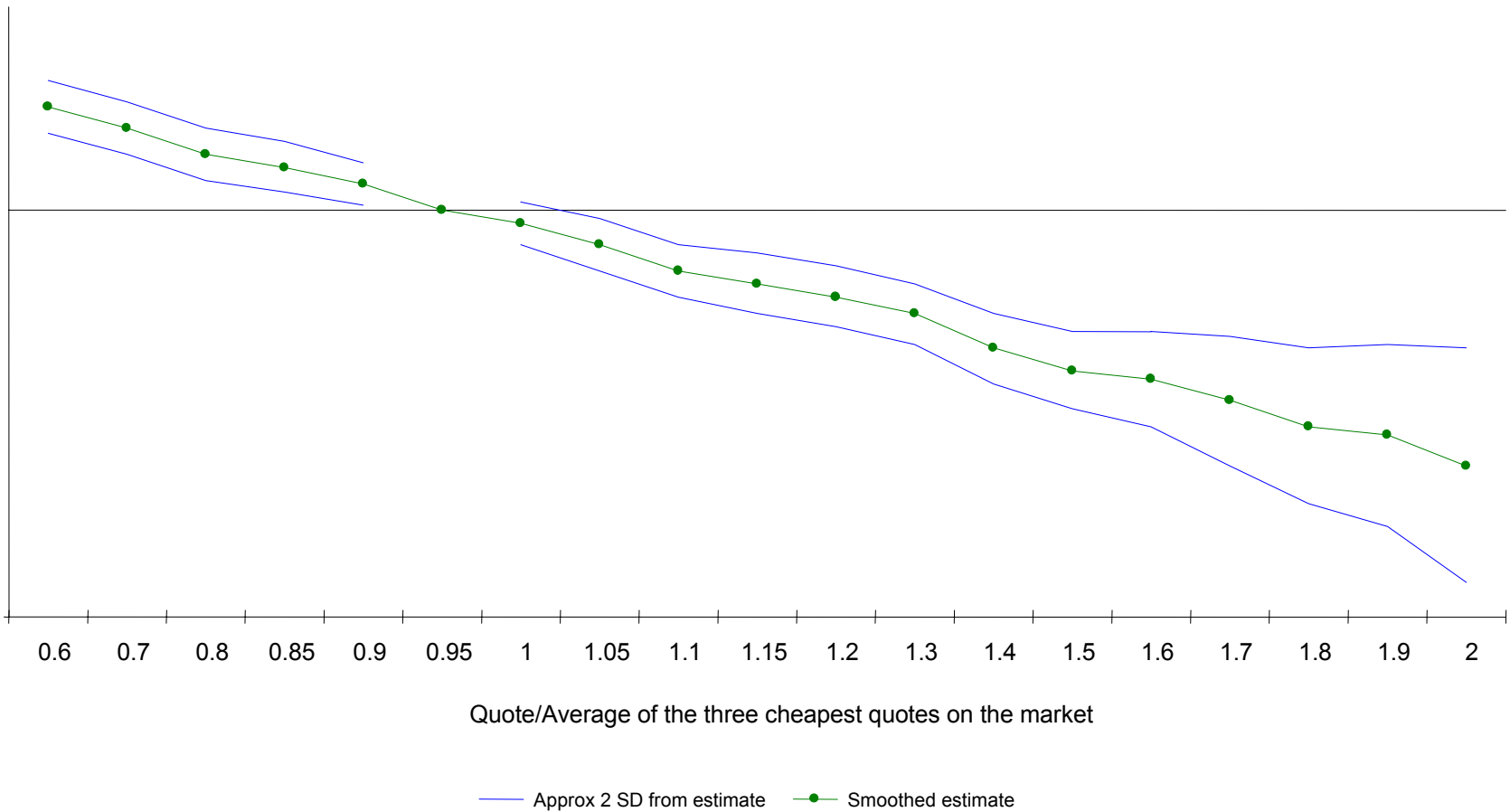
Competitive indices

- 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

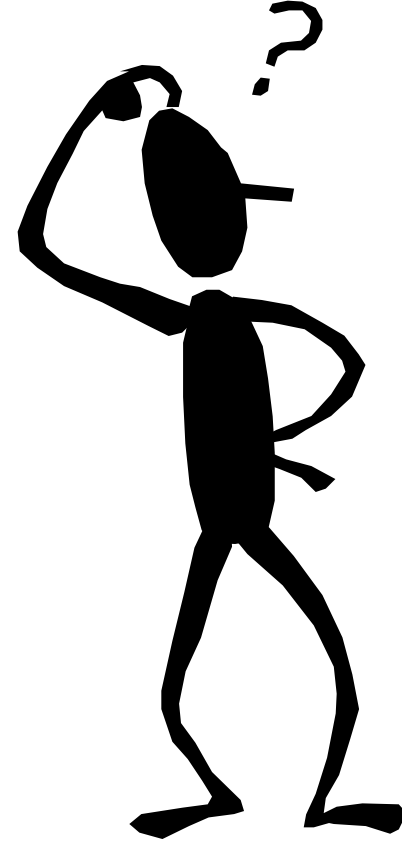
Parameter estimate: high = high probability of quote being accepted





Retention analysis

- What to measure
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- **Practical tips**
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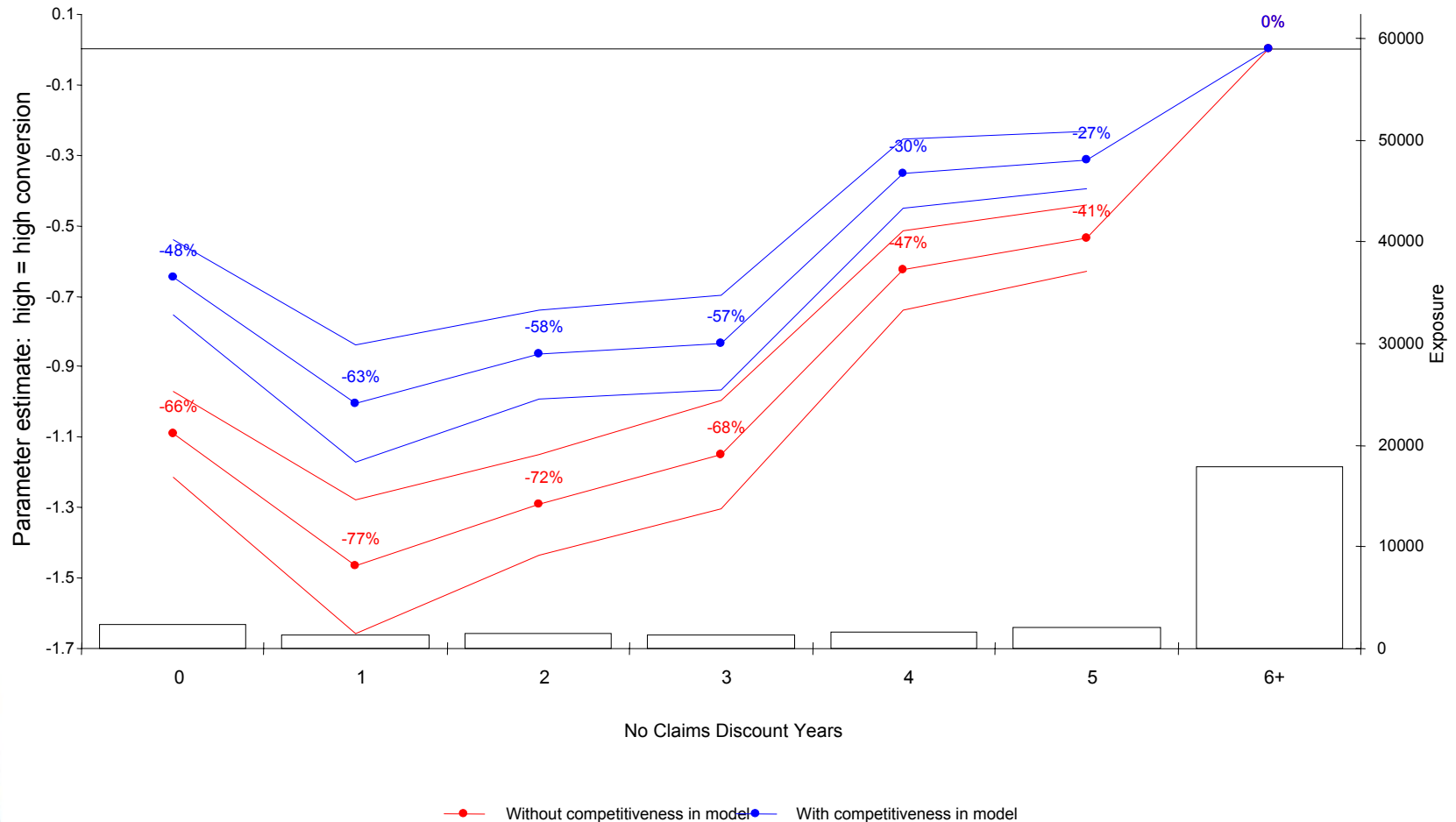


Statistical assumptions

- 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

- % change often seems to be a better measure
 - (and is not polluted with absolute rates)
- 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

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- Practical tips
- **Why do it**

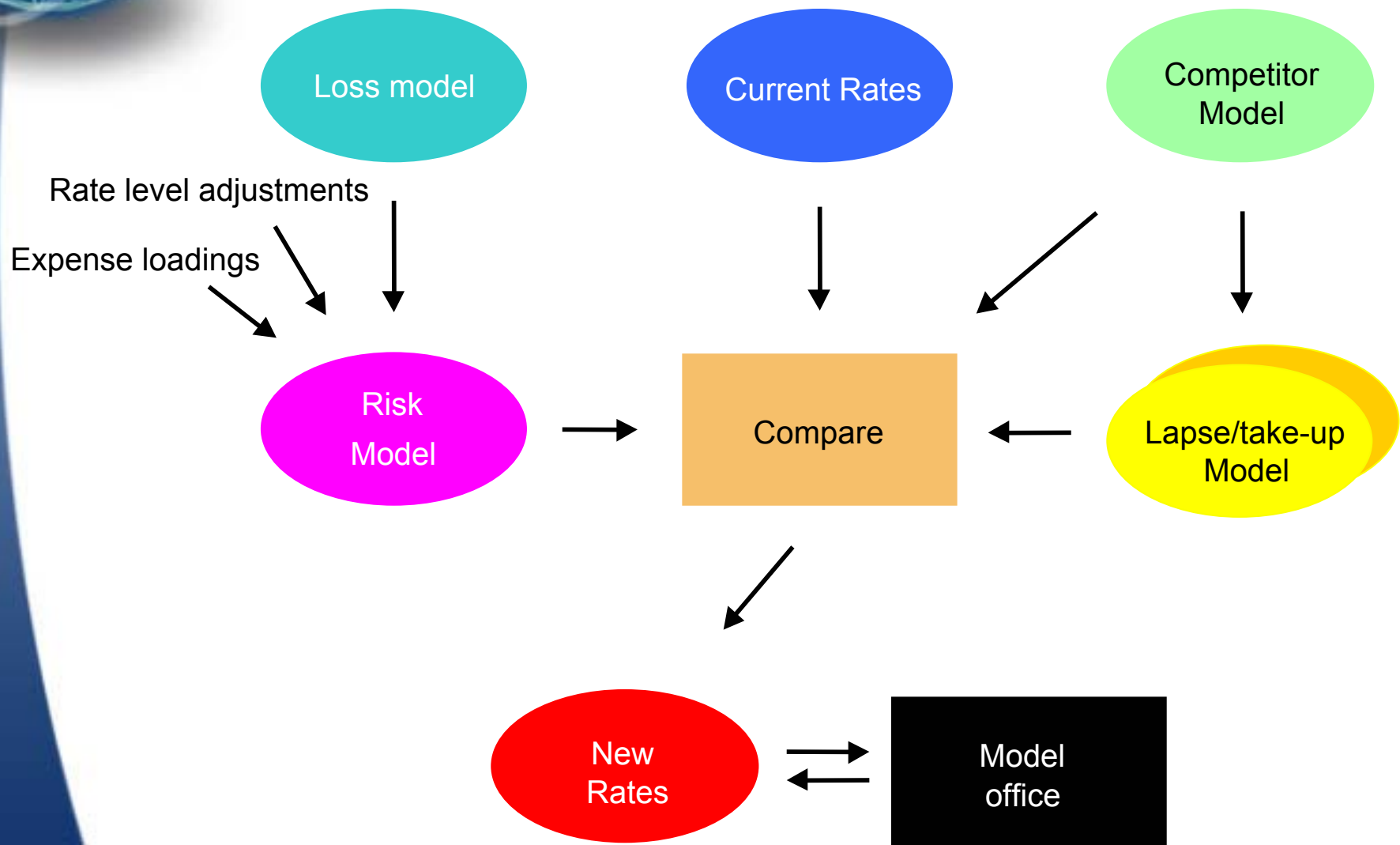




Why model lapses / new business?

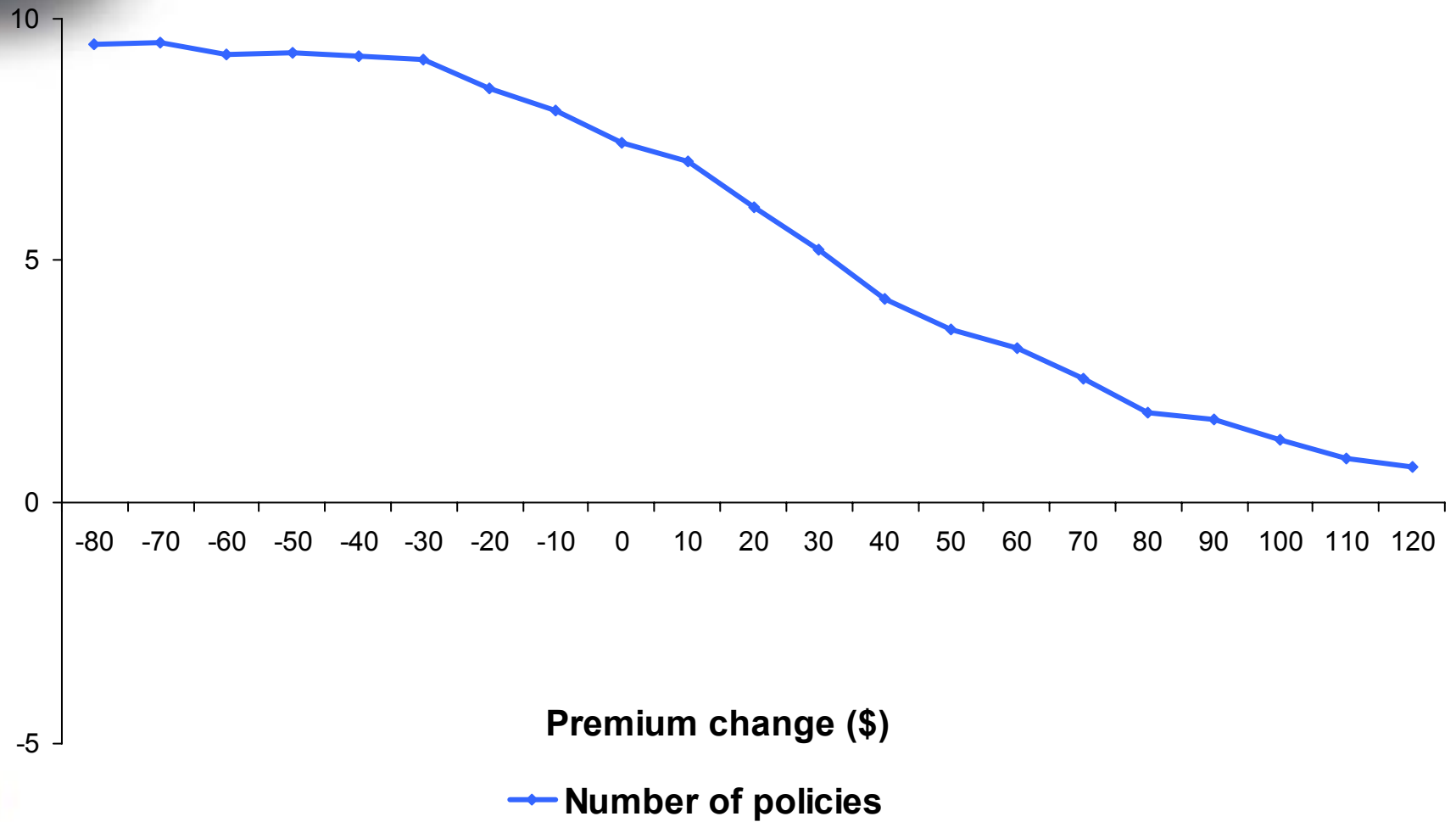
- Ratemaking and the model office
- Qualitative management decisions
- Simple lifetime expense loads
- Lifetime value

Model office

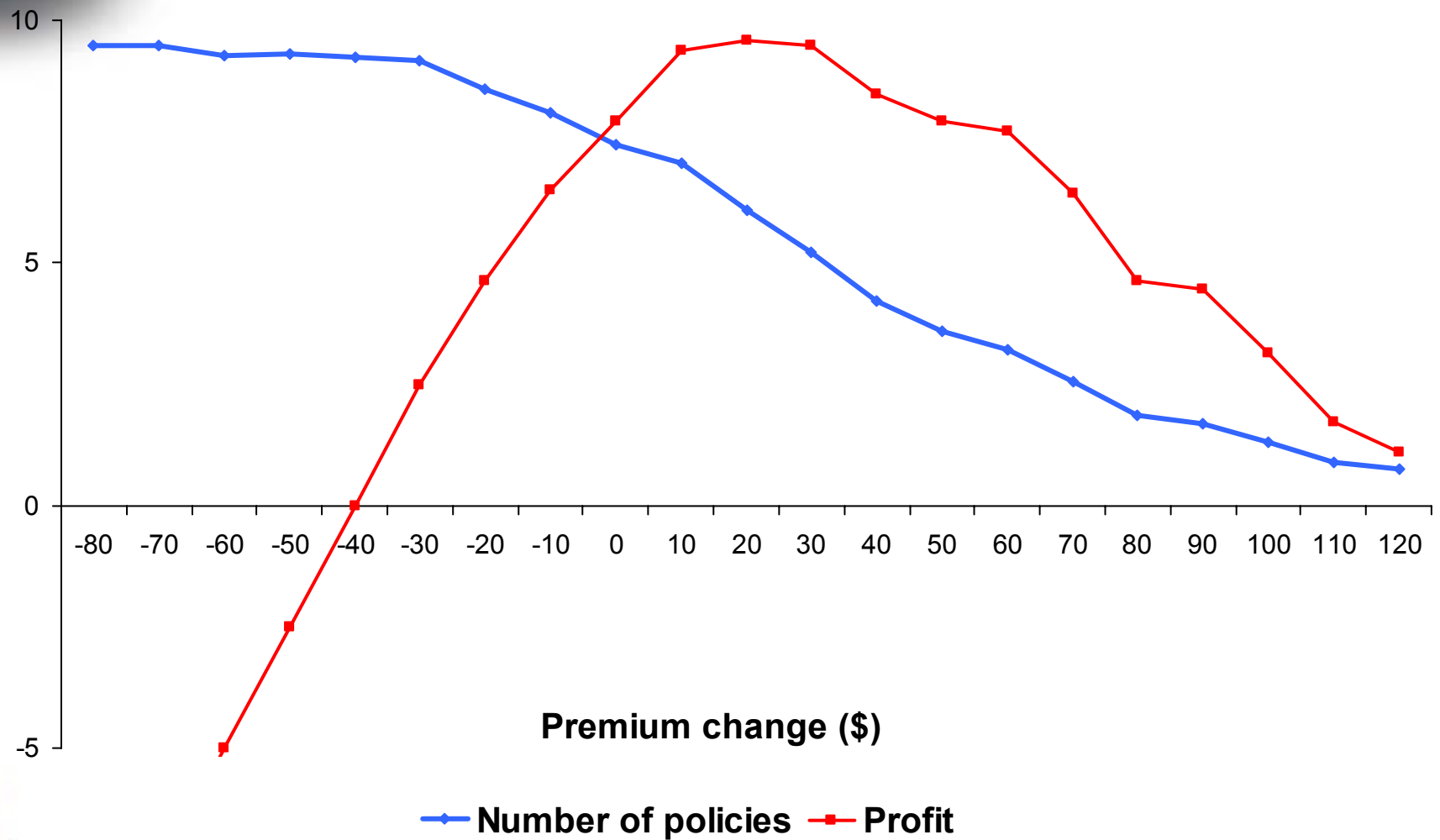




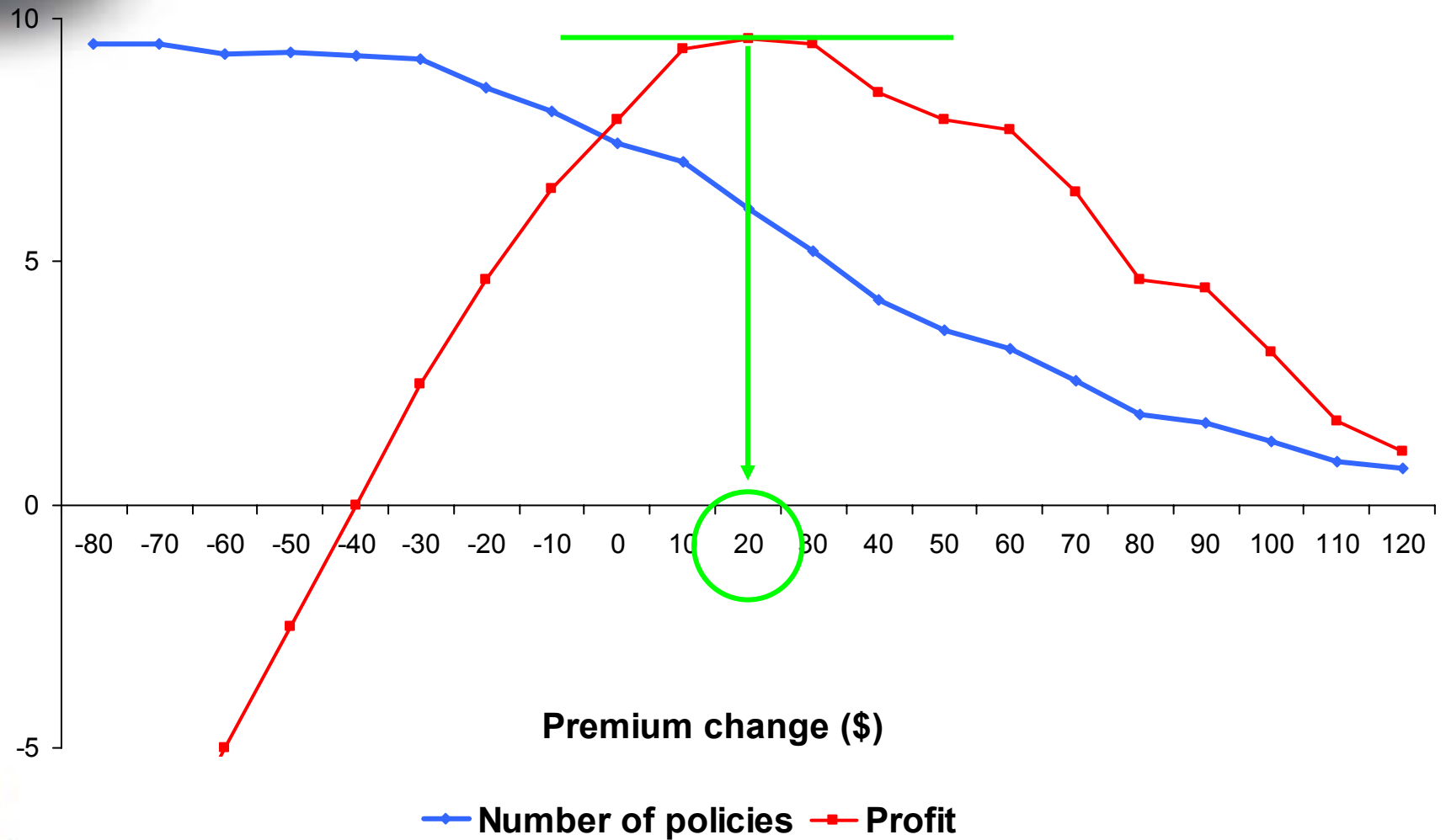
Price elasticity



Price elasticity

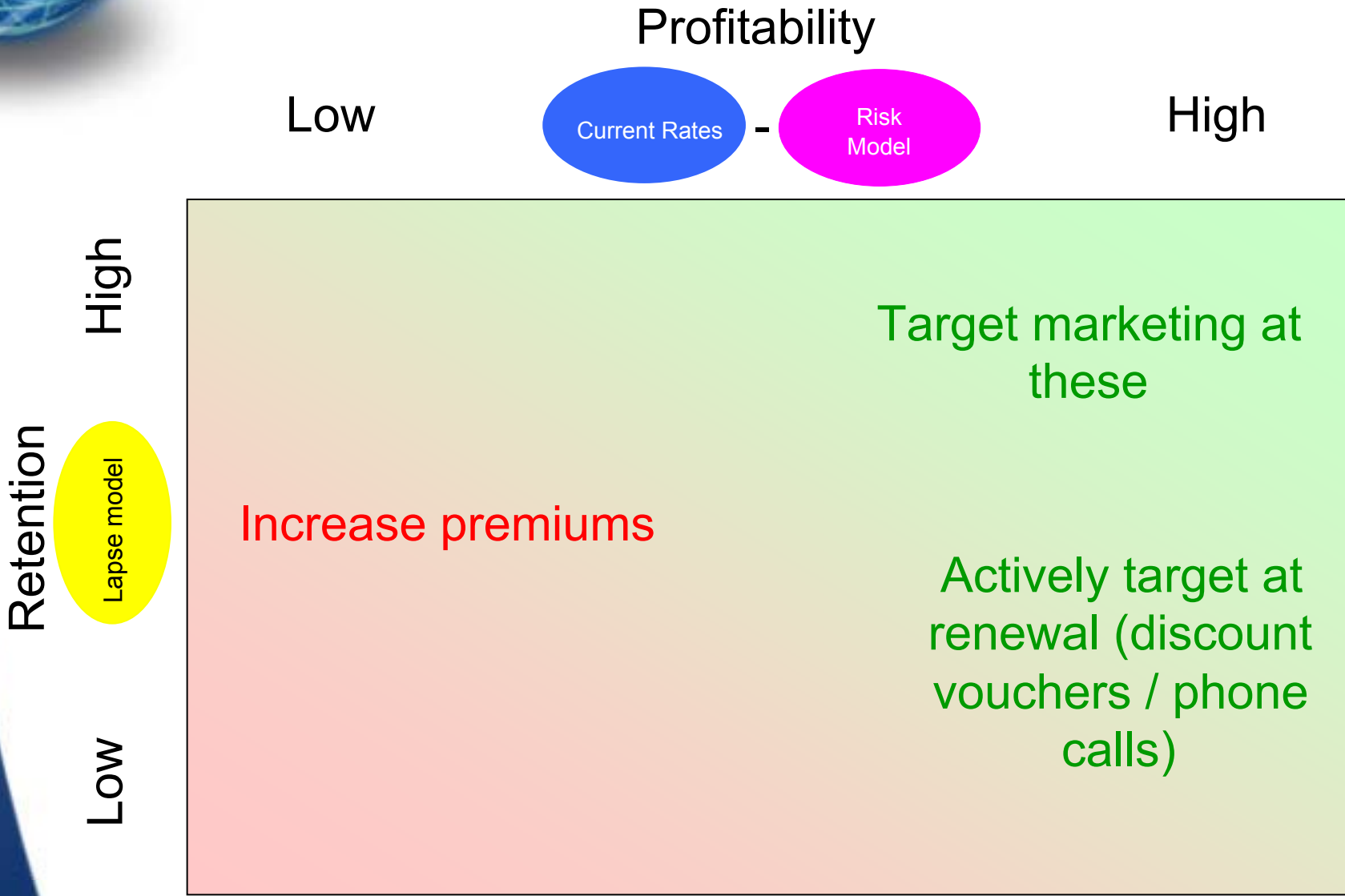


Price elasticity





Customer value



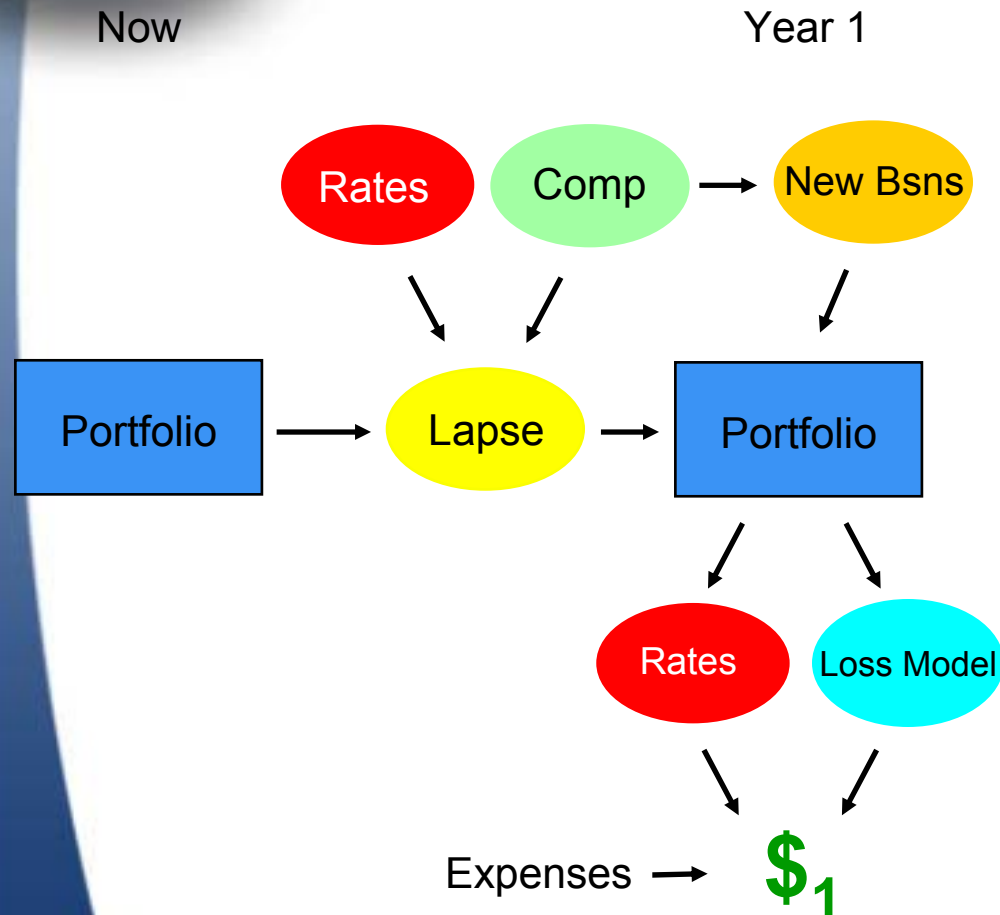


Lifetime expense loads

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

Modeling the future

Short term individual policy projection



- Gives a more accurate estimate of the short term effect of a given rating action
- Fairly simple to program

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