



The Actuarial Profession

making financial sense of the future

GIRO conference and exhibition 2010
Stephen Jones and Michael Korner - EMB



Price Optimisation 2.0

13 October 2010

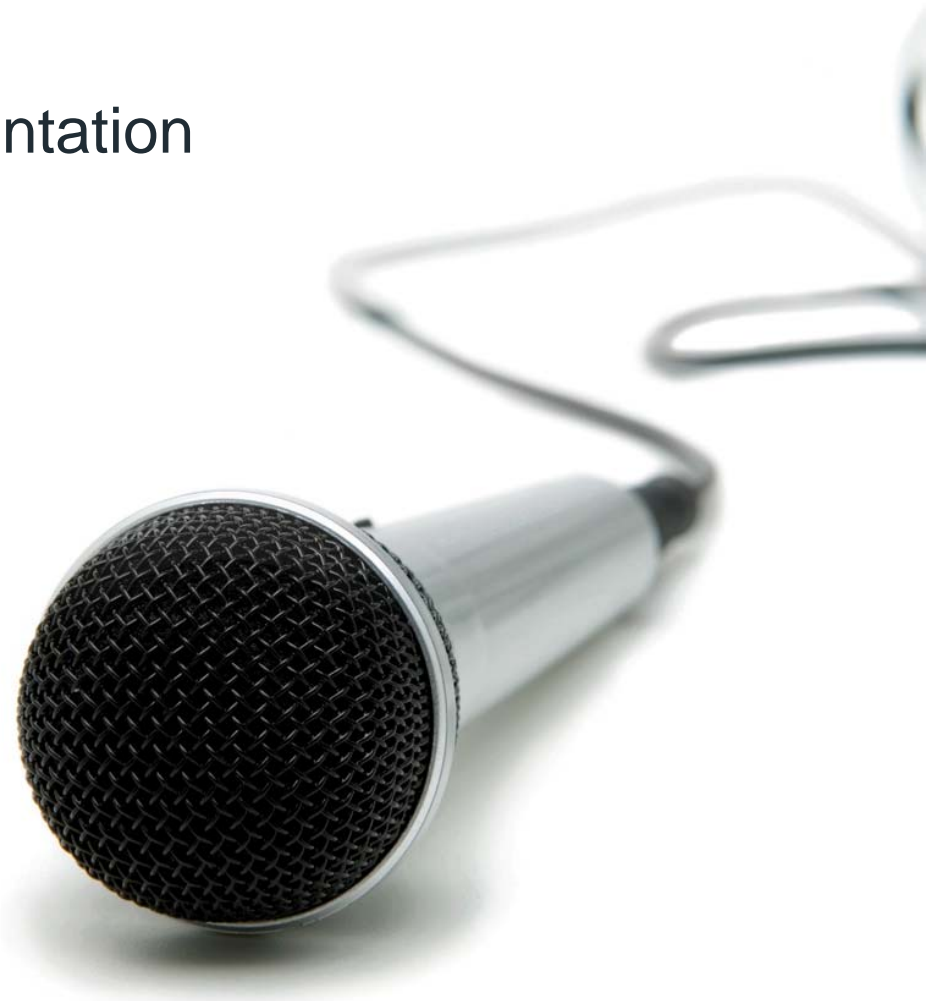
Price optimisation 2.0



- UK price optimisation in Q3 2010
- Elasticity modelling
 - Foundations
 - Does this all still work?
- Offline vs. online
- Optimisation in a hardening market

Notice

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



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A UK price optimisation “audit” in Q3 2010

- Price optimisation techniques are extremely widespread and are embedded in BAU pricing for the vast majority of major directs and panel intermediaries
- Pricing management are generally fully conversant with optimisation concepts and the role of optimisation in KPI targeting
- Any material systems and data issues constraining initial implementations have generally been overcome
- Cultural and TCF inhibitions have typically been overcome and resolved
- Home developments often lag motor in sophistication where both products written, but home specialists are generally sophisticated
- Panel intermediaries are generally operating sophisticated optimisation approaches (and sometimes quite extreme at new business)
- Development focus has shifted from R to NB to enhancement of R
- Current focus in many cases is on automation and on alignment with marketing
- Early-adopters may now be considering “second generation” solutions

In the context of a rapidly hardening motor market

- Premium inflation 37.5% in year to September for comprehensive cover
- Graph of increasing trend in annual increases in private car premiums
- Chart removed, please refer to Confused-EMB Car Insurance Price Index

Source: Confused-EMB Car Insurance Price Index

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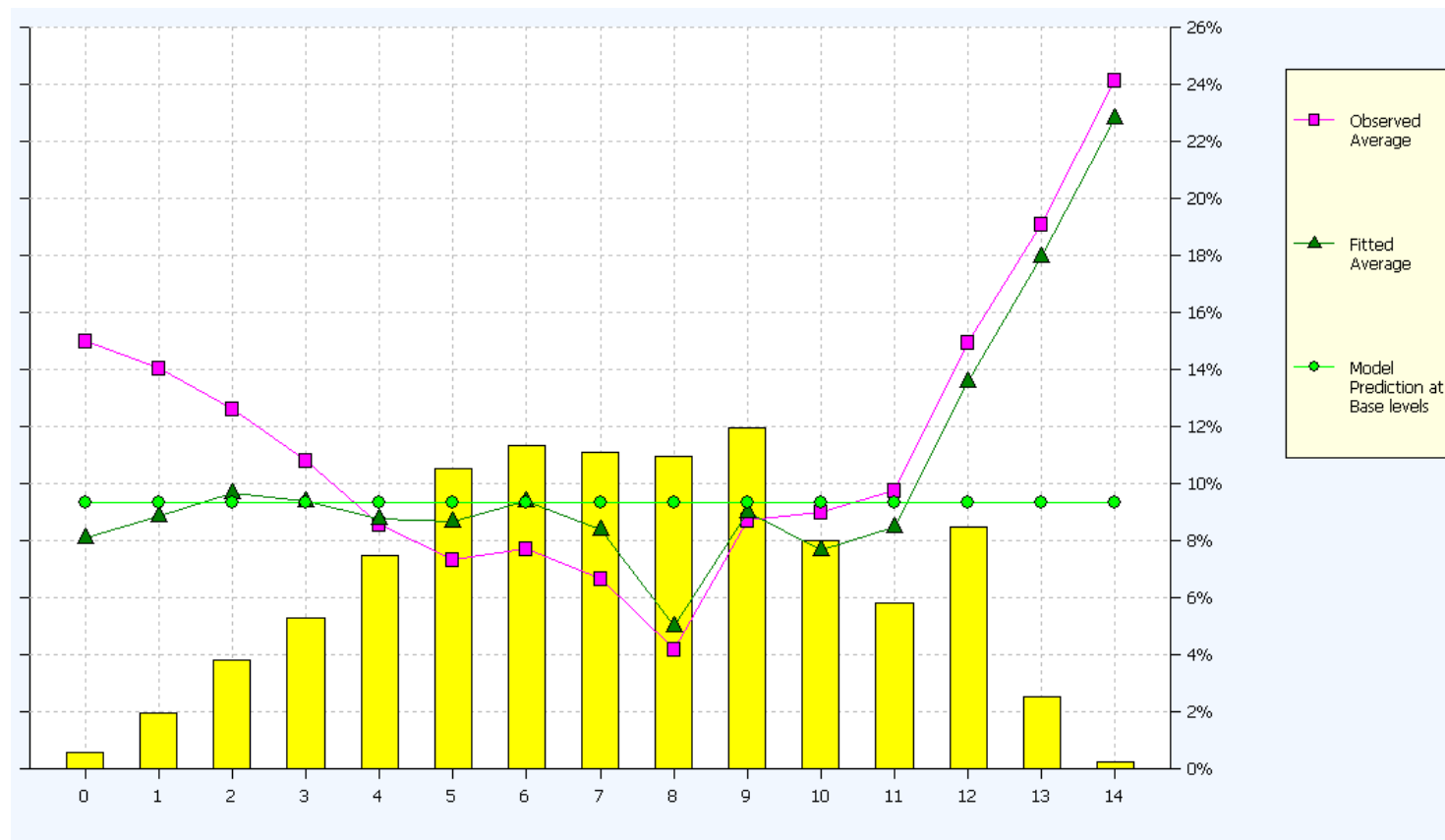
A framework for good technical modelling

Think about new sources of data



Think about the underlying drivers (e.g. of elasticity)

Consider “superfactors” (i.e. composites of related data items)



But don't forget the foundations!

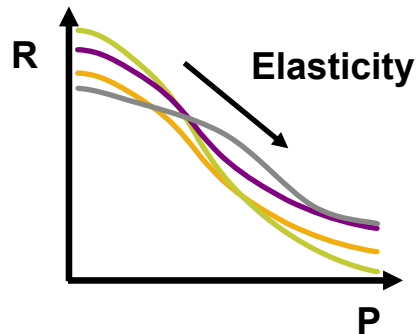
Data

Basic data integrity!

New business quote deduping

Correct premium change definition

Allowing for lapse processing



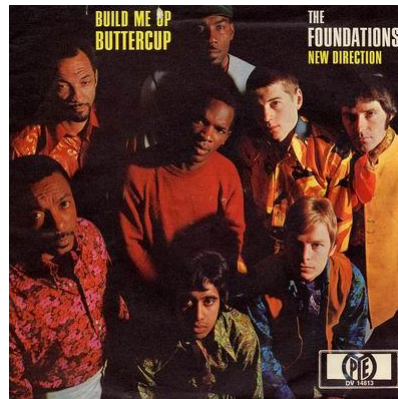
Models

Application of price testing

MTC and add-on propensity models

Segmental models where appropriate

Appropriate use of competitor data



Randomised price tests

- Vary price offered away from standard rates on a random basis
 - Quasi-random selection often needed in practice



Why do we want a randomised price test?

- Correlations between premium change etc. and other factors
 - Particularly when some street pricing has already been conducted
- Tendency for models to underestimate elasticities

Graph removed for issue.
Shows retention rate increasing as premium change increases.

Deploying price tests - principles

- Be careful to remove correlations between price test and other factors:
 - ensure price tests are not truncated by global price constraints such as caps and floors on renewal price changes
 - ensure no other correlations between price test and e.g. time period or segment arising from the testing process
 - define all other price factors as net of any price test

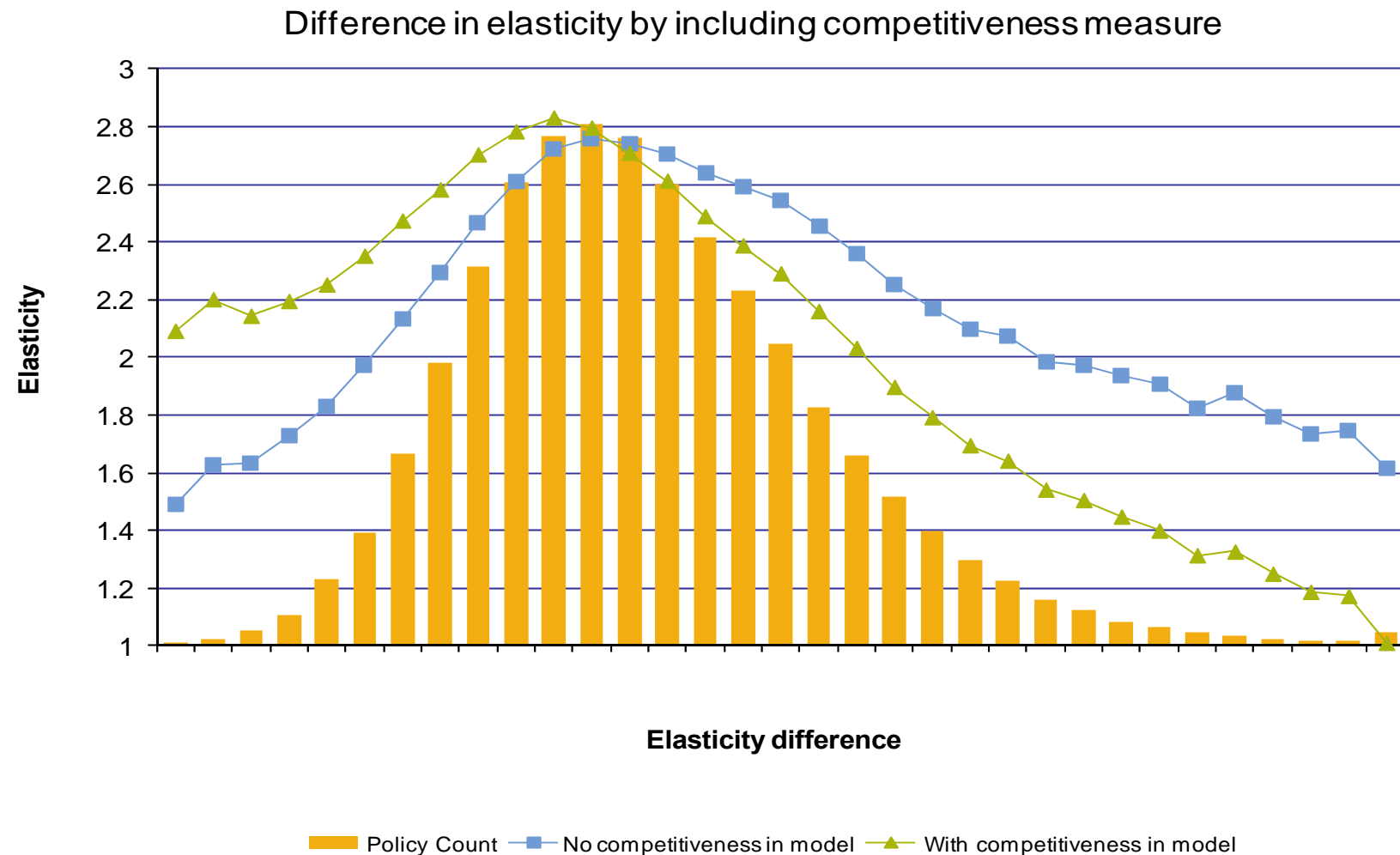


Competitiveness measures

- Use of competitiveness measure alongside price tests enhances elasticity predictions

Graph removed for issue.
Shows how elasticity varies with competitiveness

Even models of competitor prices can significantly enhance elasticity estimation



What do we mean by “price elasticity”?

Most people define elasticity as

- Percentage change in demand/ percentage change in price
 - “Classical elasticity”
 - Definition found in economics textbooks

But sometimes ...

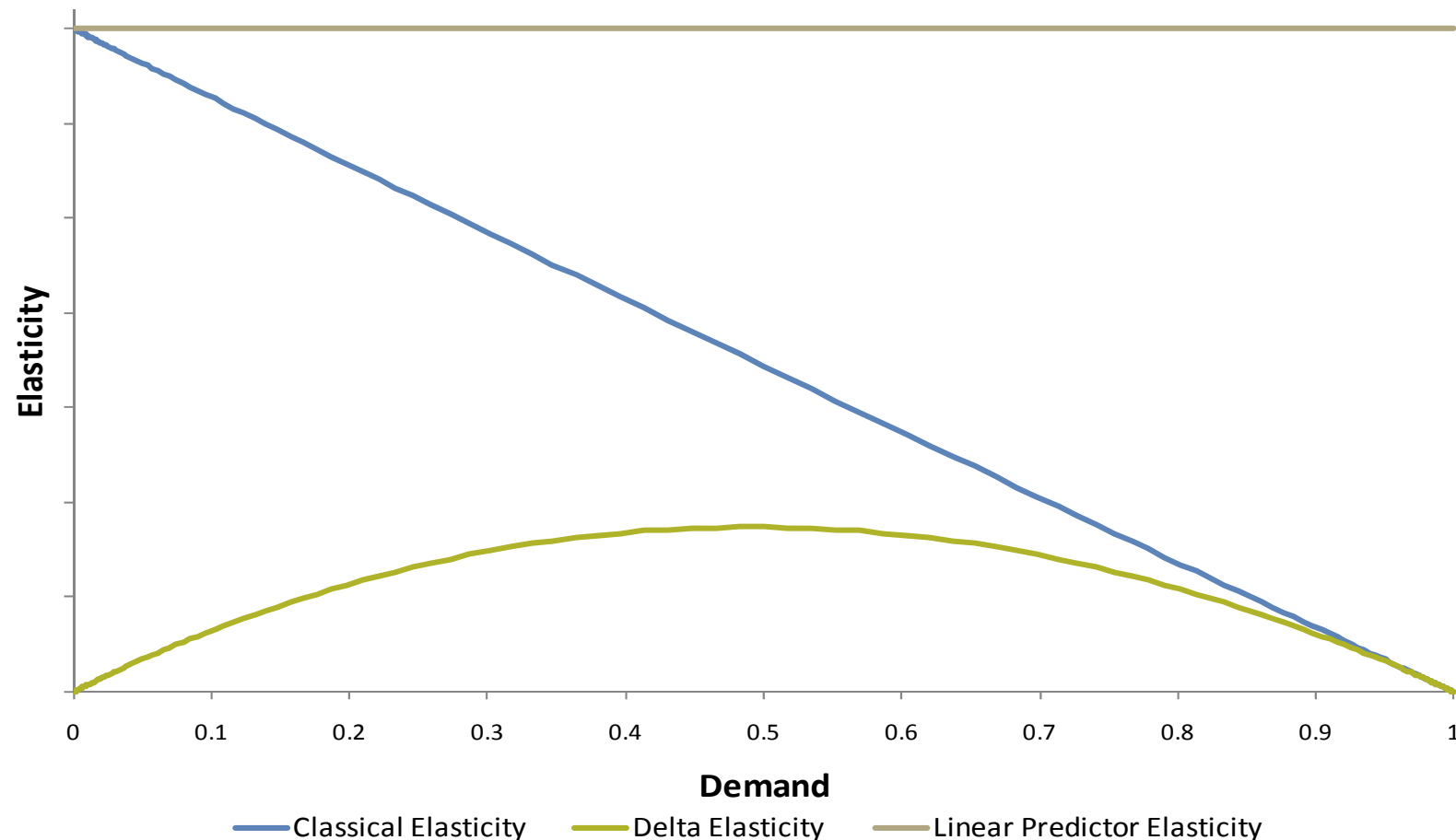
- Percentage point change in demand/ percentage change in price
 - “Delta elasticity”

or ...

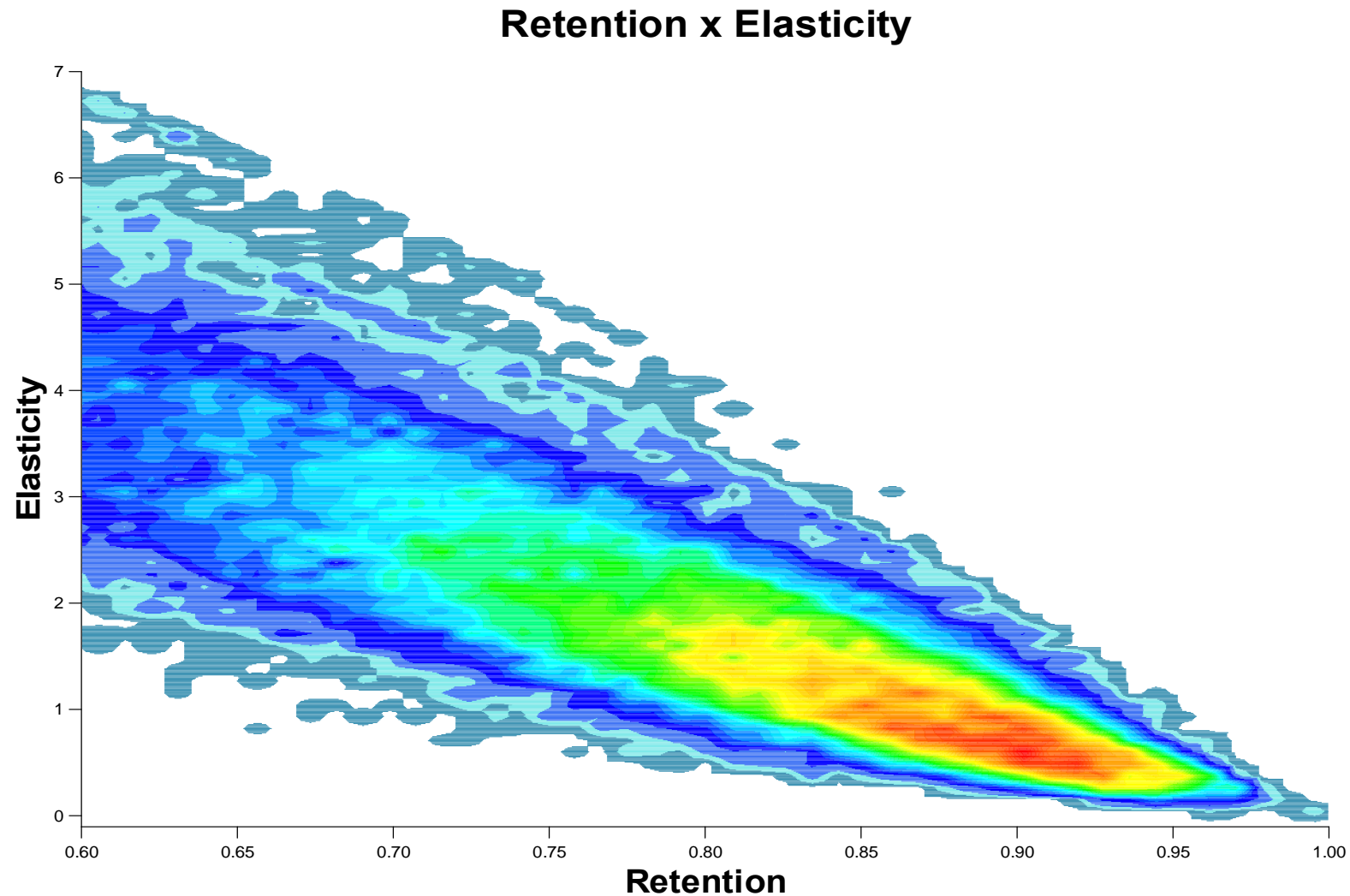
- Absolute change in linear predictor/percentage change in price
 - “Linear predictor elasticity”
 - Doesn't vary with demand

What does logit imply about the relationship between demand and elasticity?

- If there are *no interactions with price change factors*



Classical elasticity and lapse rate – example XY plot



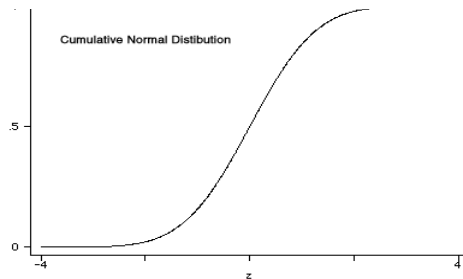
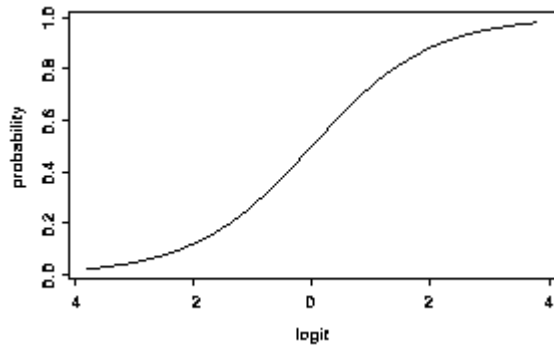
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But is the logit GLM still valid?

Linear Alternatives?



Non-Linear Alternatives?

$$y = \frac{1}{1 + \exp(-X\beta + \Delta P e^{zx})} + error$$

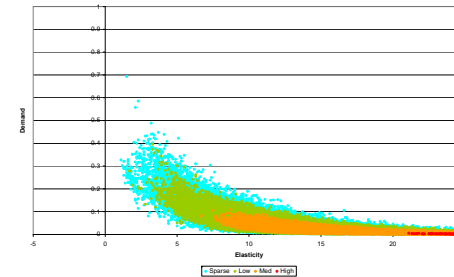
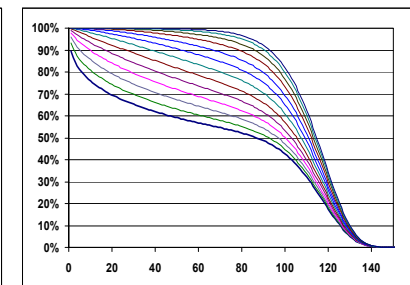
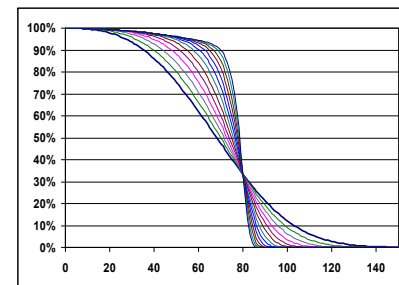
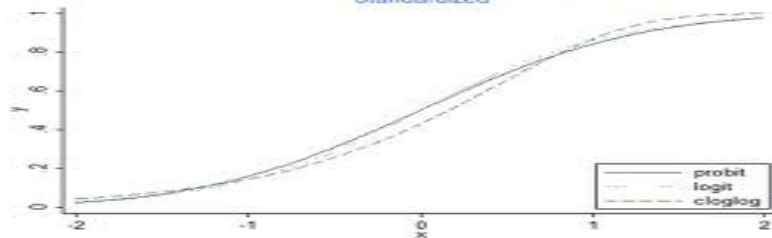
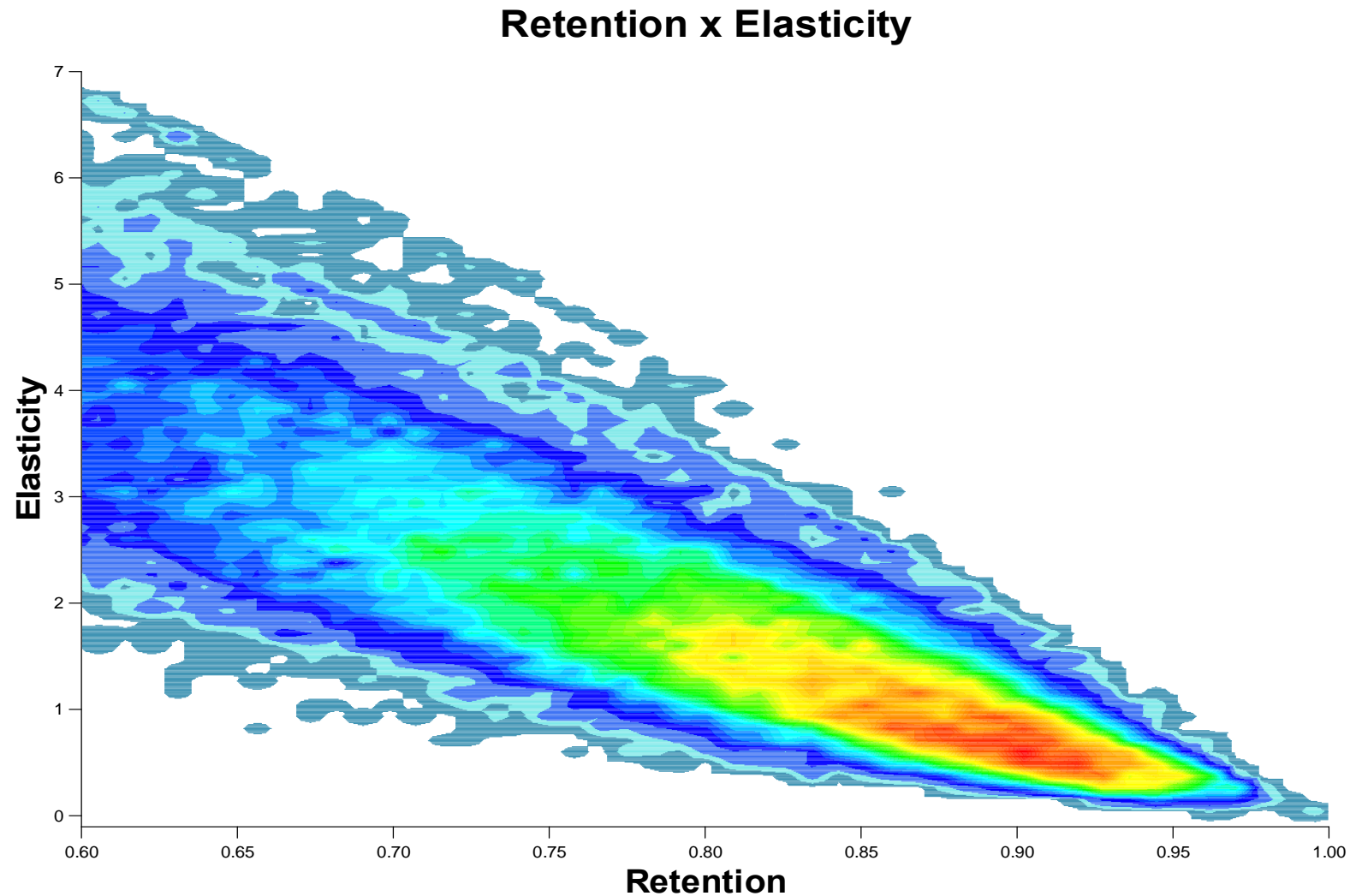


Figure 3.7: Probit, Logit and C-Log-Log Links Standardized

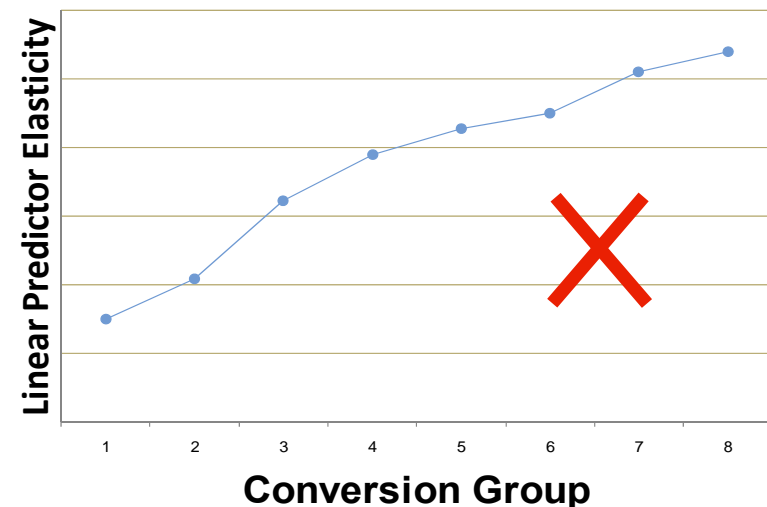
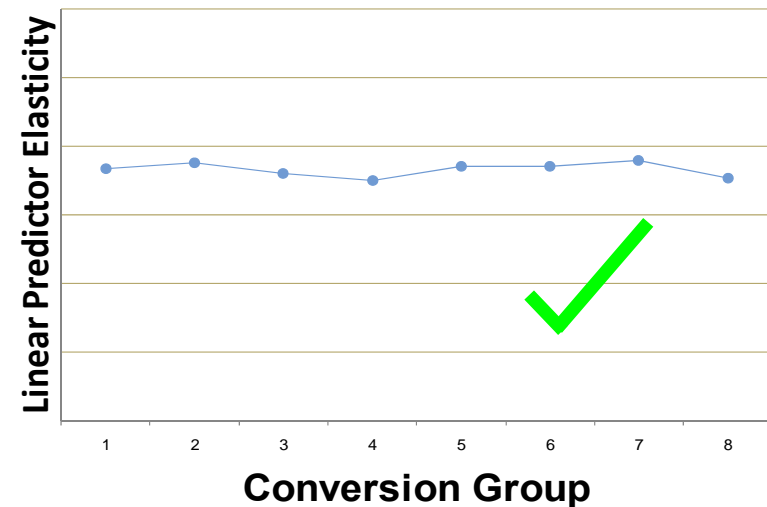


Classical elasticity and lapse rate – example XY plot



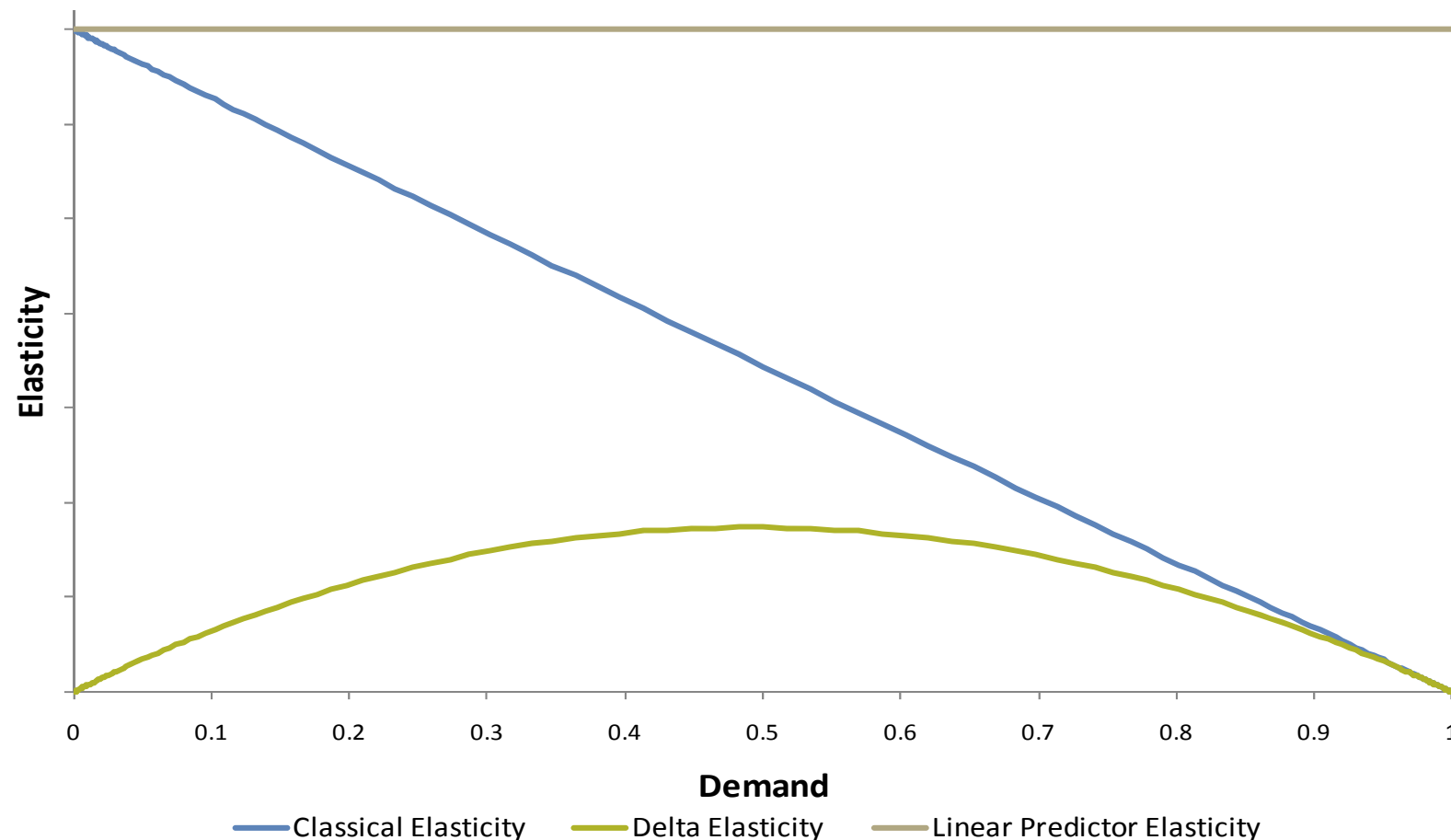
Testing the link function

- Create a conversion (or retention) score based on the model
- Interact this with price test
- This will allow the elasticity to vary with demand independently of the link function
- If the correct link function is chosen, no interaction will be necessary
 - i.e. linear predictor elasticity will not vary with demand



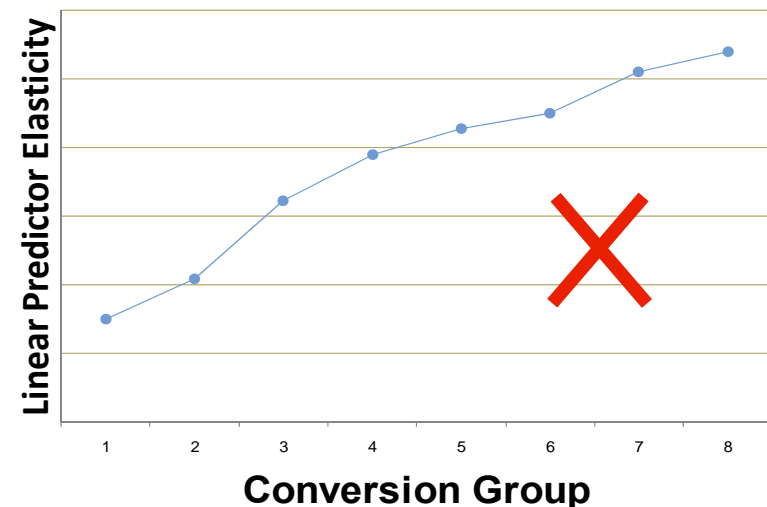
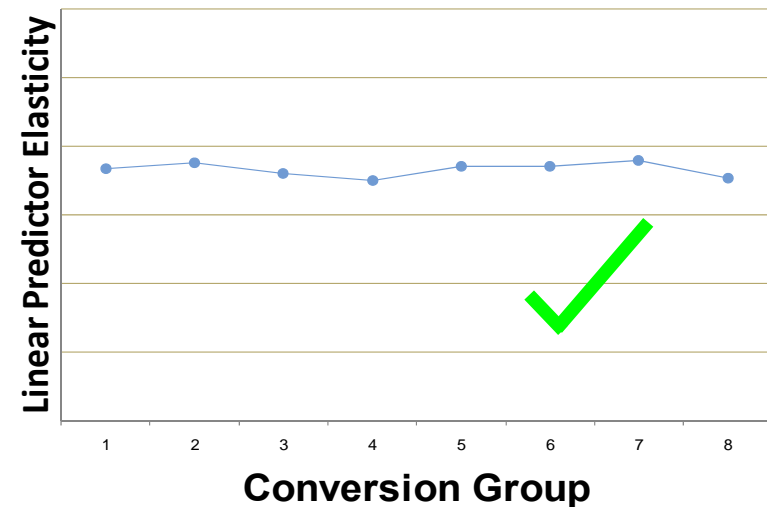
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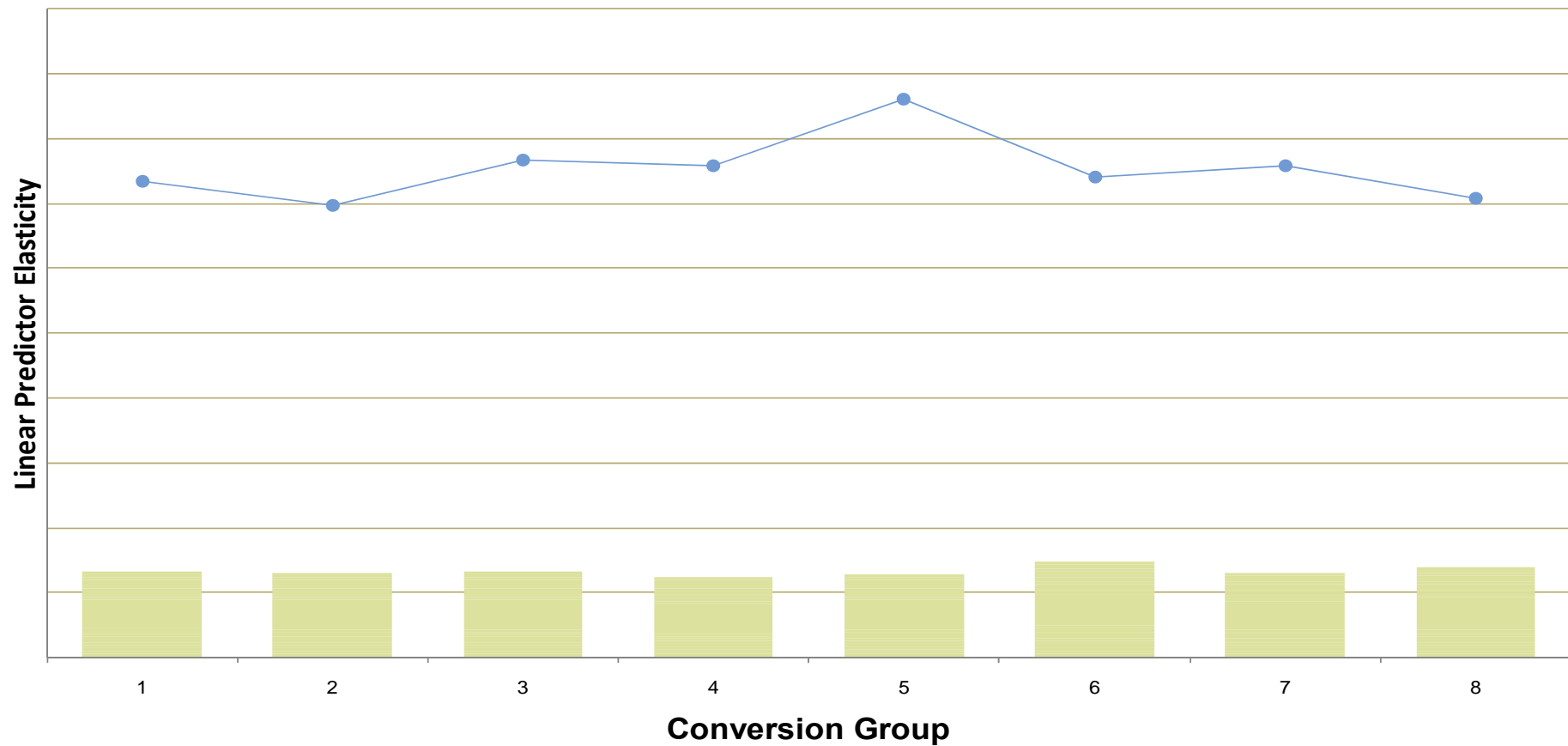
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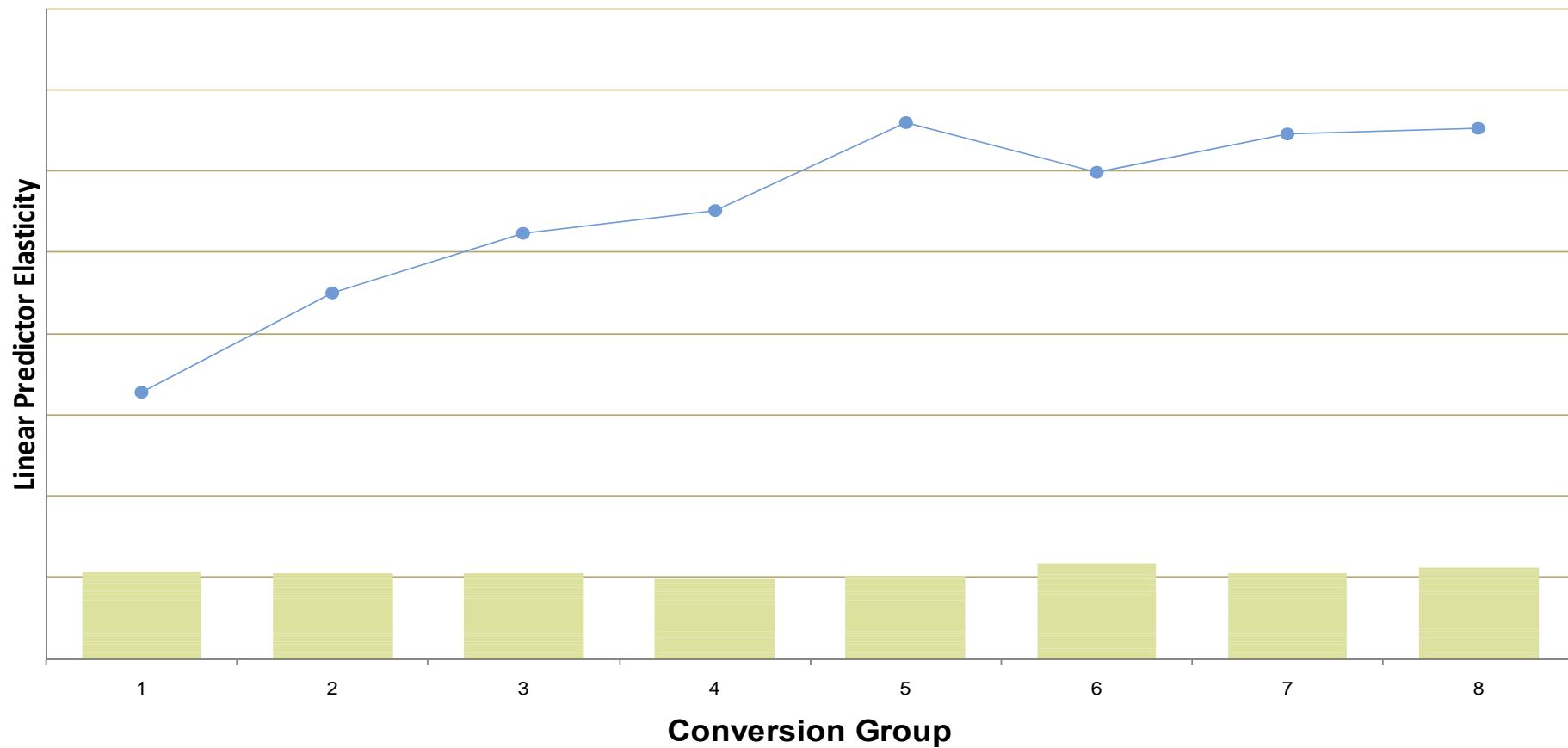
Testing the link function – logit

Comparison site conversion model



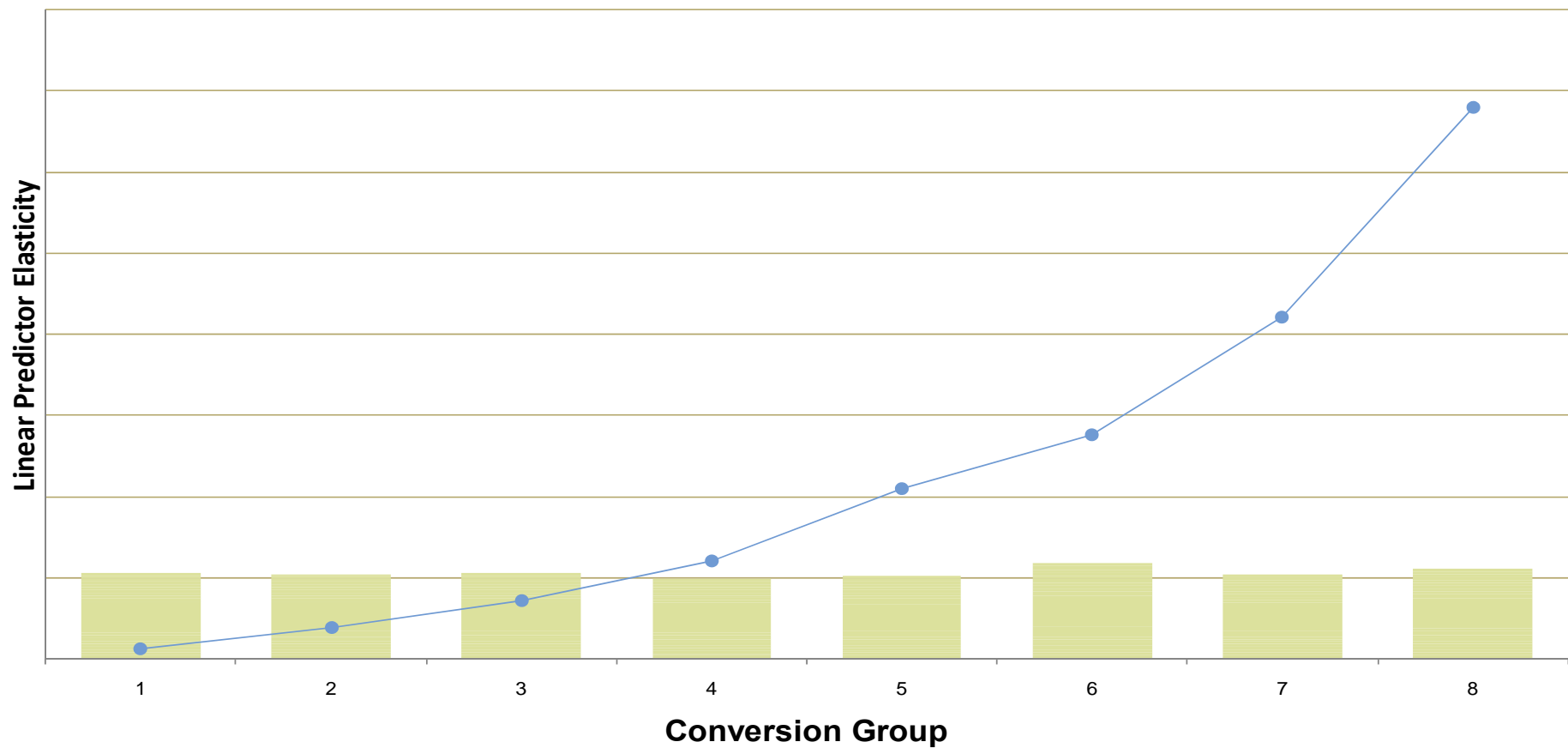
Testing the link function – probit

Comparison site conversion model



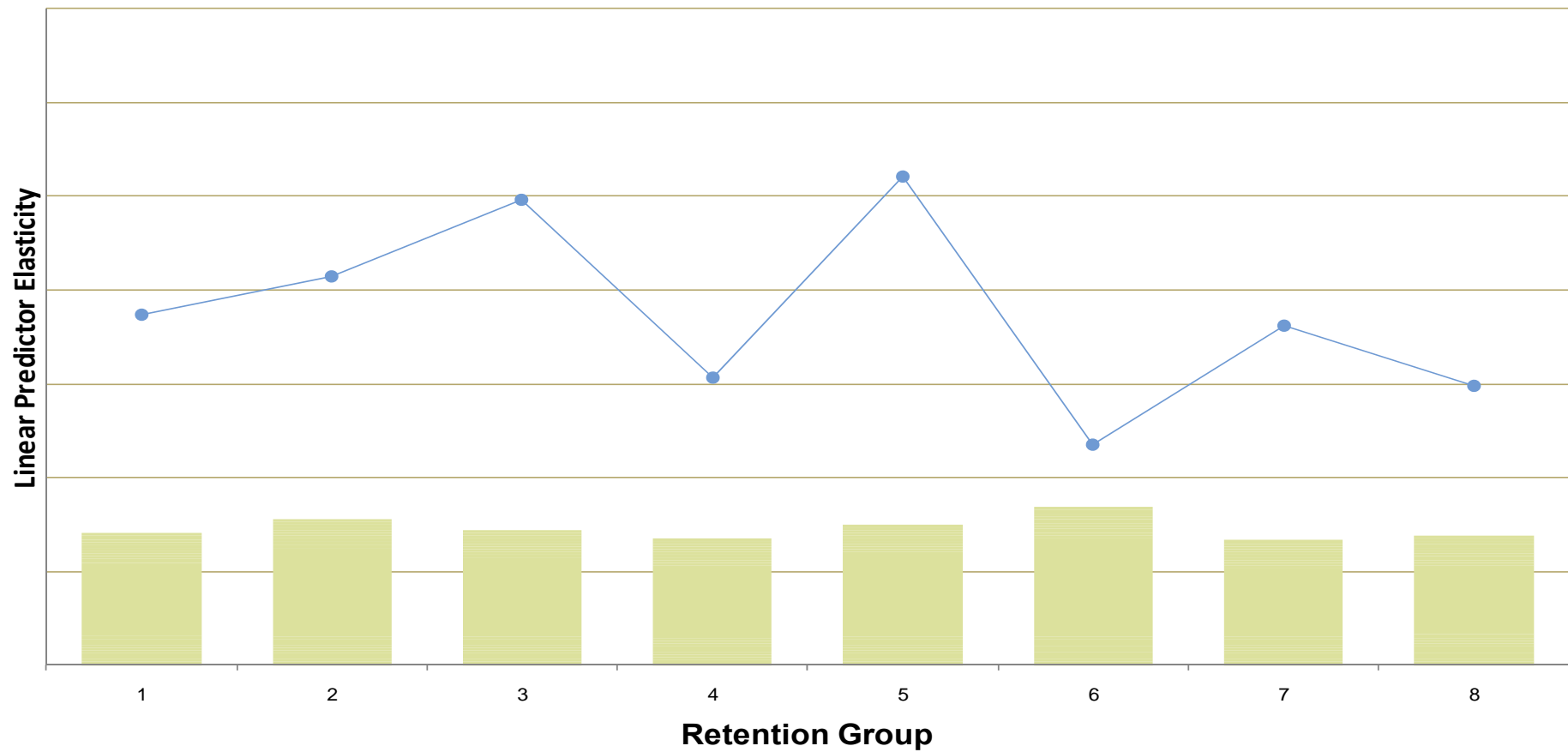
Testing the link function – identity

Comparison site conversion model



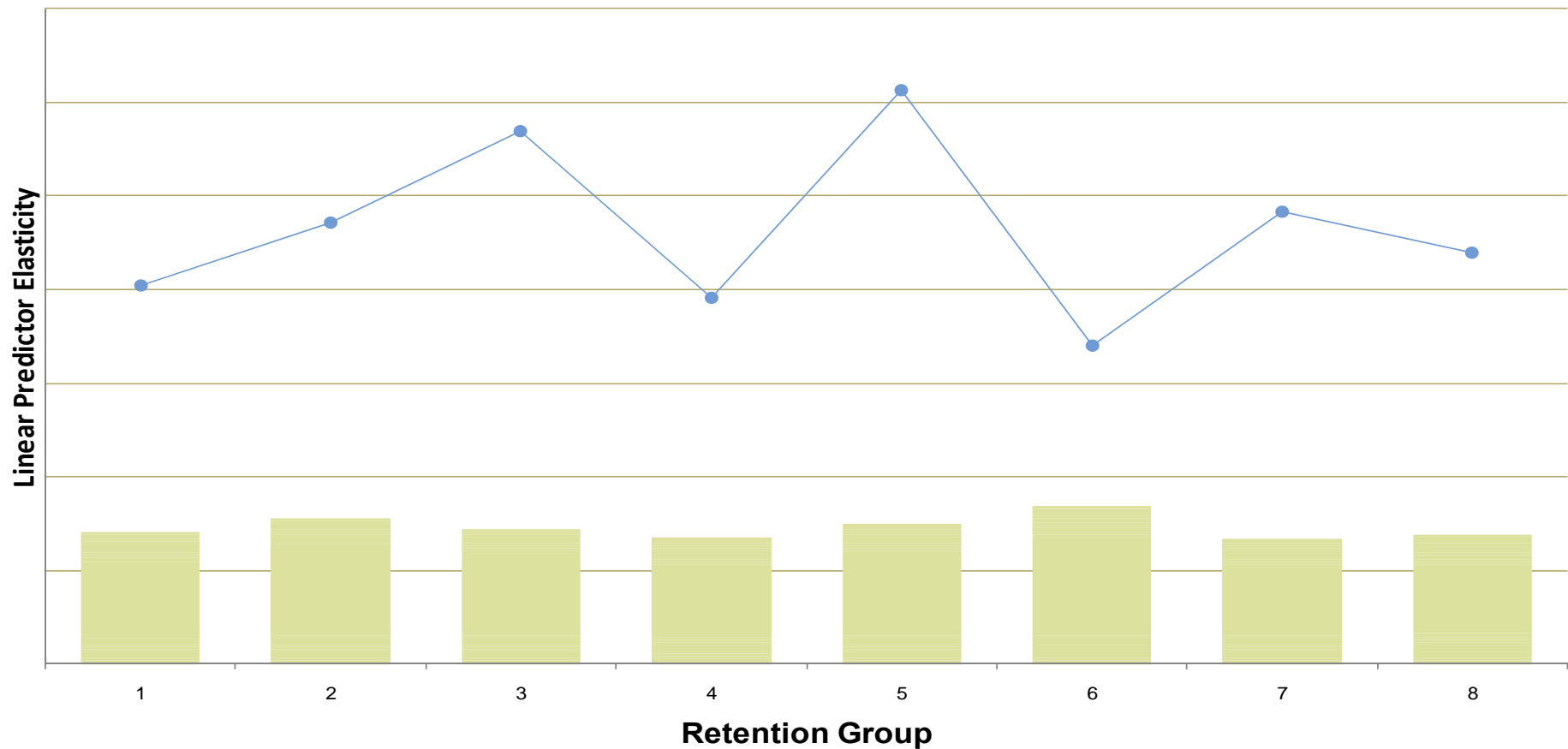
Testing the link function – logit

Retention model

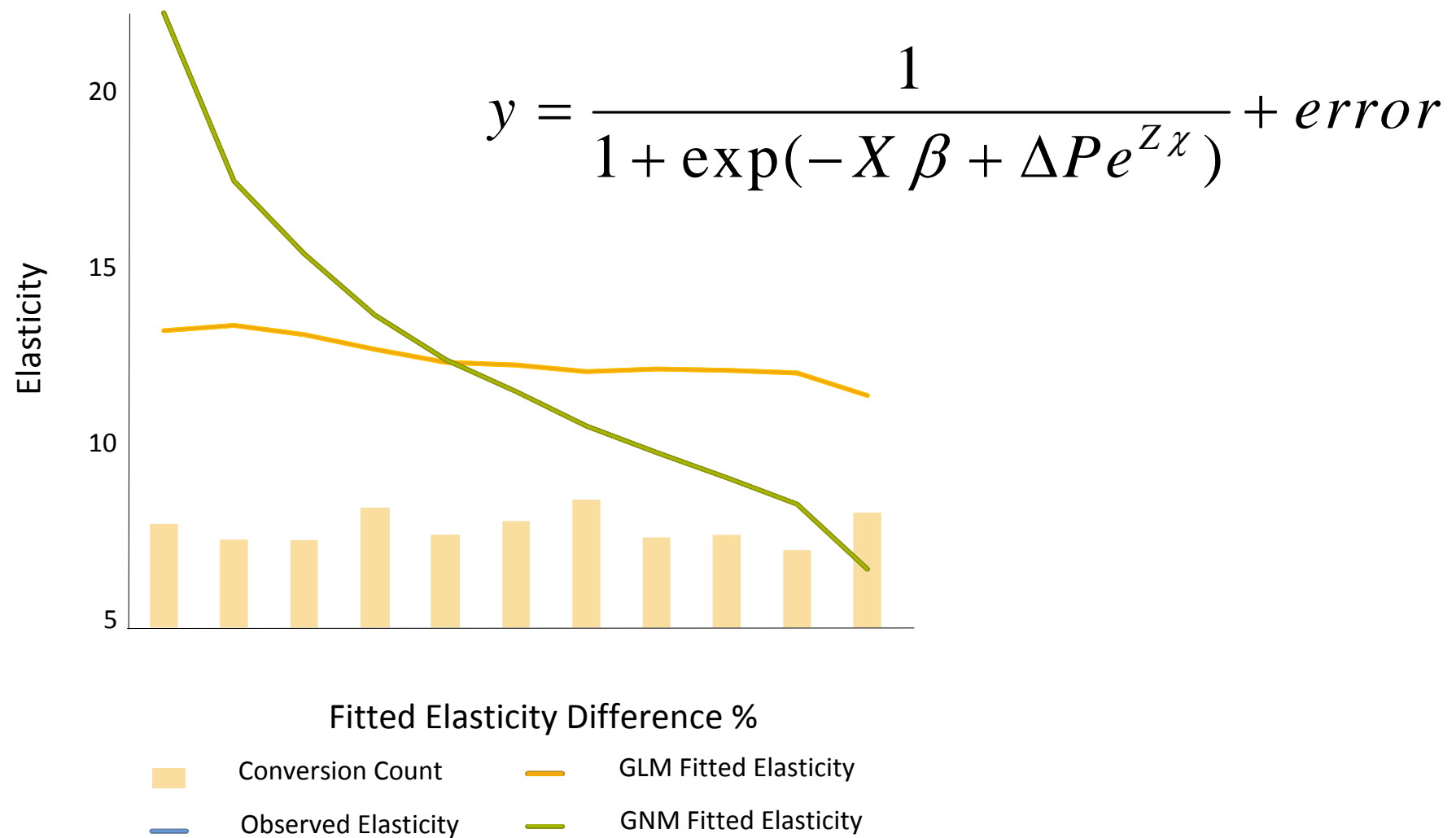


Testing the link function – logit

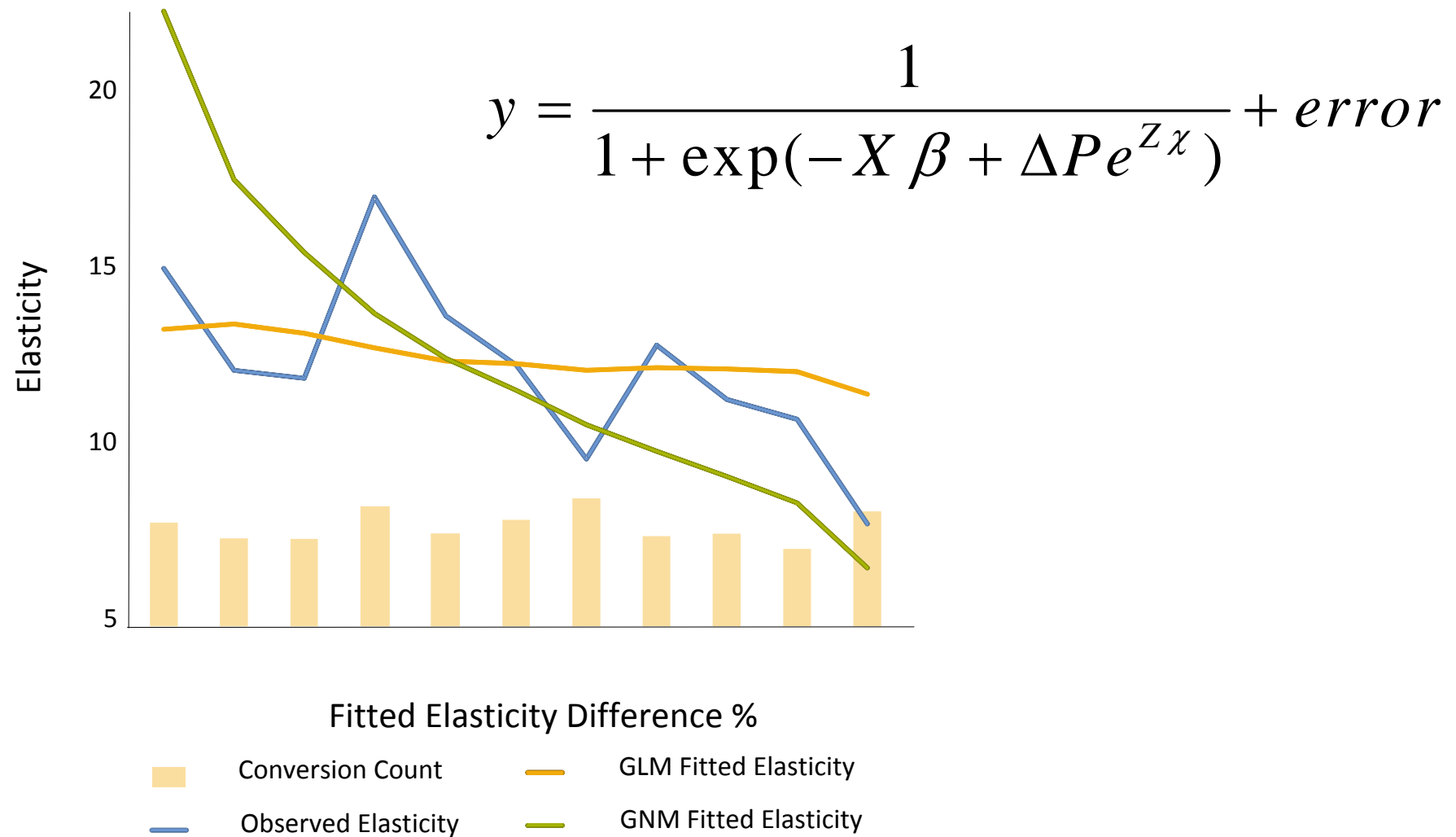
Retention model with two obvious interactions



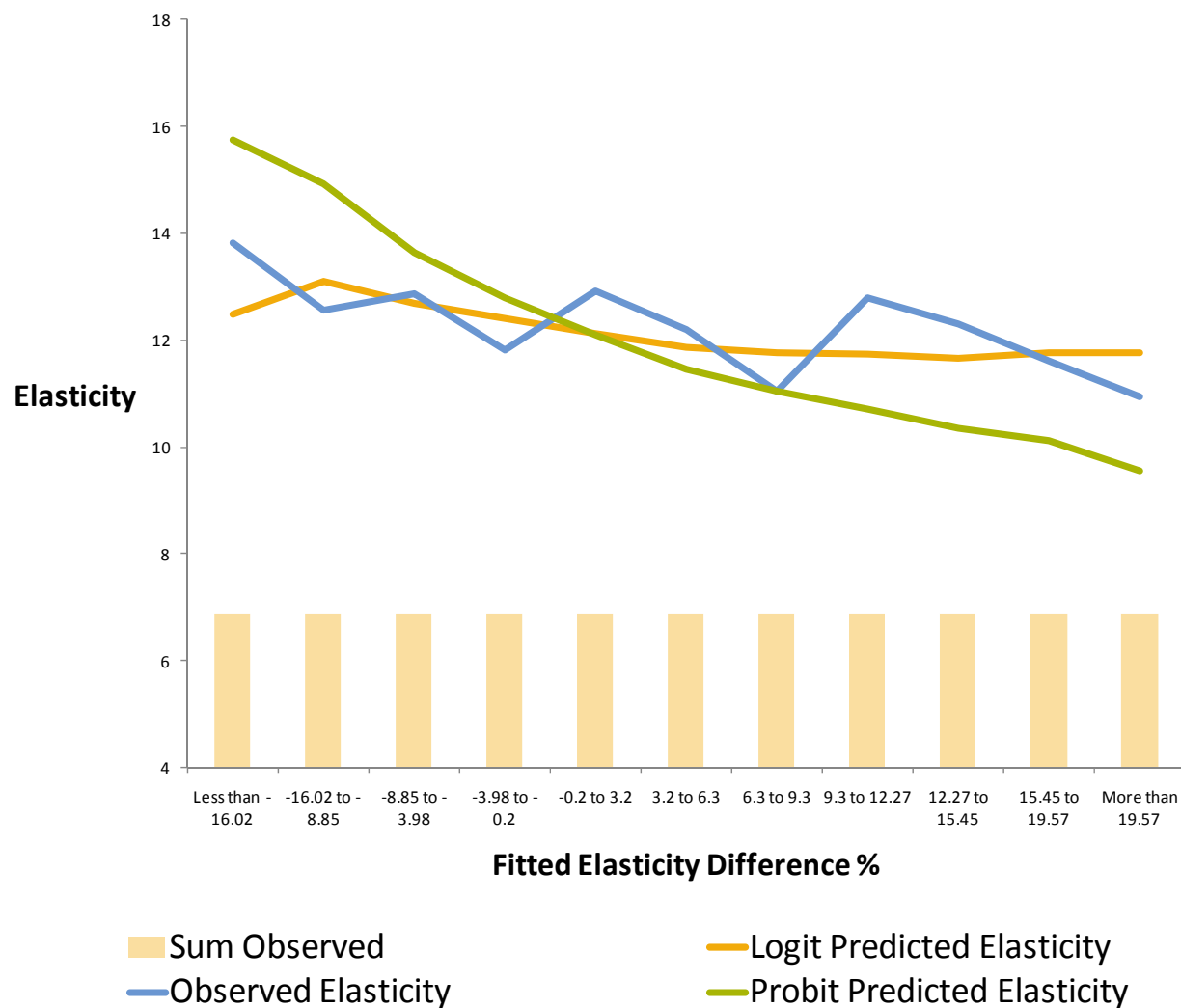
Linear vs. Non-linear



Linear vs. Non-linear



Logit vs. Probit



What on earth was all that about?

- Make sure you build the right models with the right data
- A well designed randomised price test is key to understanding elasticity
- So is a good competitiveness measure
- Remember the relationship between demand and elasticity
- Logistic GLMs still work in the comparison site environment

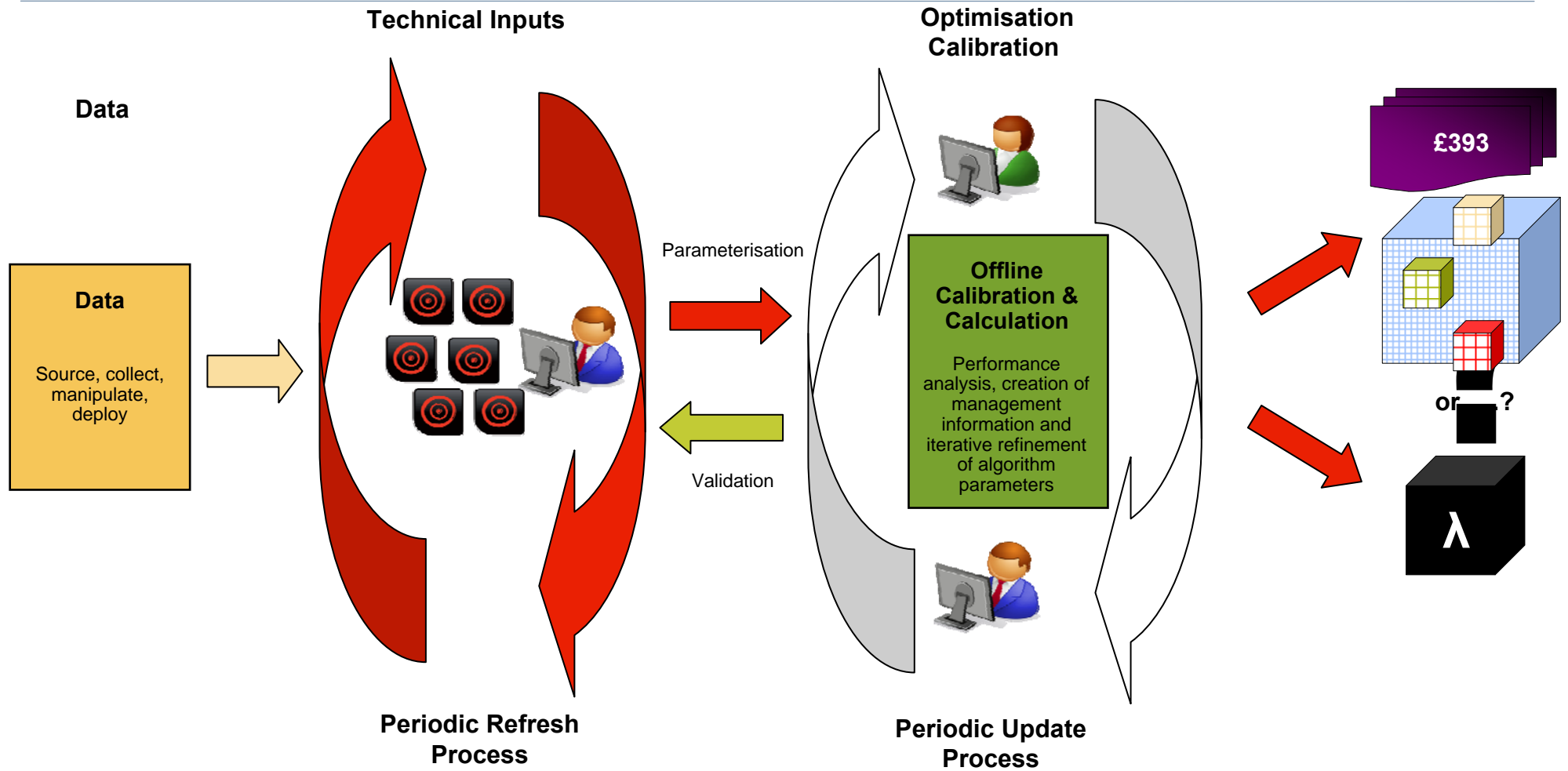


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What's the question?



What are the differences between the approaches?

- Offline
 - Optimisation algorithm is deployed offline in a calibration environment
 - Parameters are developed in advance on a representative risk sample and deployed as factors (R) or tables (NB)
- Online
 - Optimisation algorithm is deployed online within live rating systems
 - Parameterised calculation with business rules undertaken in real time
 - Offline calibration environment used to develop parameters consistent with portfolio-level KPI objectives



What are the similarities between the approaches?



- In both cases, within the offline calibration environment, one might:
 - Identify the range of achievable strategies
 - Analyse predicted pricing outcomes to manage customer impact and avoid any anomalies
 - Investigate the predicted impact of constraints to minimise this
 - Investigate sources of predicted uplift to maximise probability of desired outcome
- ...and in the online implementation environment, one might:
 - Call up-to-the-minute values for specific data items (e.g. compliant market price information for new business)

Why (still) consider offline optimisation?

- People understand and have access to rating tables
 - Typically considerably lower systems impact than online
- People may be nervous of solutions which look like “black boxes”
 - Expert human guidance may minimise risk, but the refresh process can be more resource-intensive
- Can be easier to meet certain types of constraint
- Well-designed tables can achieve a high percentage of the theoretical maximum uplift
 - Offline optimisation algorithms may be more ambitious
- Maintains the distinction between a business solution and an optimisation software tool

Why (now) consider online optimisation?

- Potentially lower (refresh) maintenance:
 - More agile "tweaking"?
 - Lower FTE analyst cost?
- Solution as software:
 - Provides automation of an established process
 - More distributable across channels?
 - Technology now better able to support a real-time solution of appropriate quality and performance?
 - Some may desire a low-maintenance 80/20 solution to "box-tick"?

Price optimisation 2.0



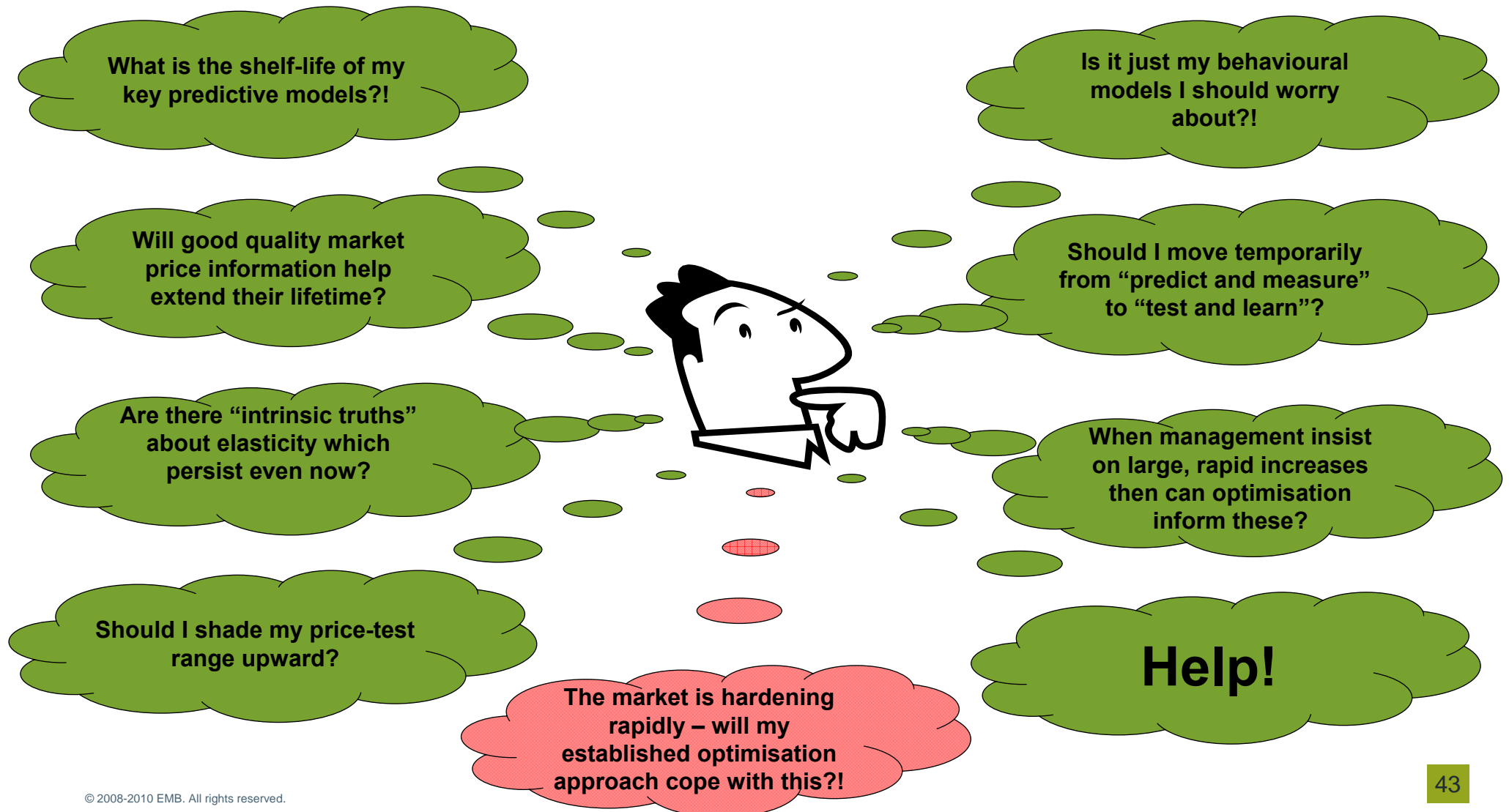
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A hardening market:

- Graph of increasing trend in average annual private car premiums
- Chart removed, please refer to Confused-EMB Car Insurance Price Index

Source: Confused-EMB Car Insurance Price Index

What should I do in a rapidly hardening market?



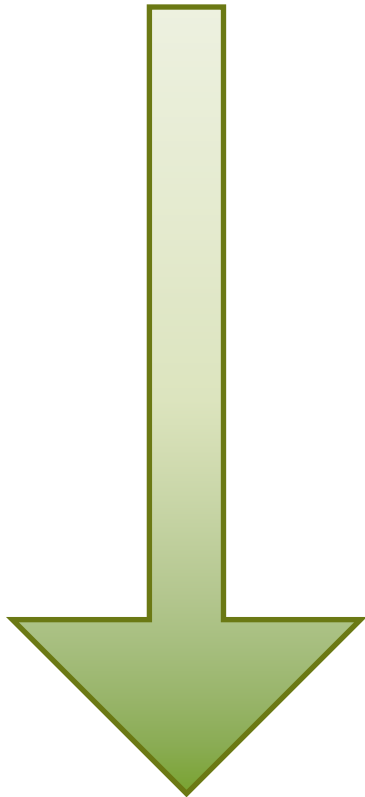
Does it make a difference to my optimisation?

- Yes
 - Targeting needs to change
 - Elasticity models need to account for the new competitive environment
- But...
 - The people who buy more add-ons will still buy more add-ons
 - High premium people will still be more elastic



Adjustments needed are arguably part of BAU in any case – magnitude dependant on degree of hardening

Limited hardening



- Good, up to date competitiveness measure
- Ensure caps and floors are adjusted appropriately
- Project market premium measures forward
- Focus even more on most recent data
- Make judgemental increases to demand base rate

Significant hardening

Discussion

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

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