



Institute
and Faculty
of Actuaries

Meddling with the Modelling – Who knows best?

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Meddling with the Modelling

~~How many sweets in the jar?~~

How many sweets were in the jar?

Meddling with the Modelling



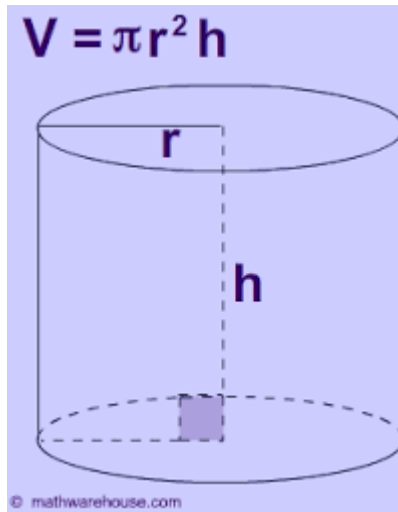
Meddling with the Modelling

Results of our collective expert judgement

Meddling with the Modelling

We guessed 197 and 178

Our basic model used estimates of how many sweets made up the radius and height to give



$$= 3.14 * 4^2 * 6 = 301$$

Did you use a simple model or your gut?

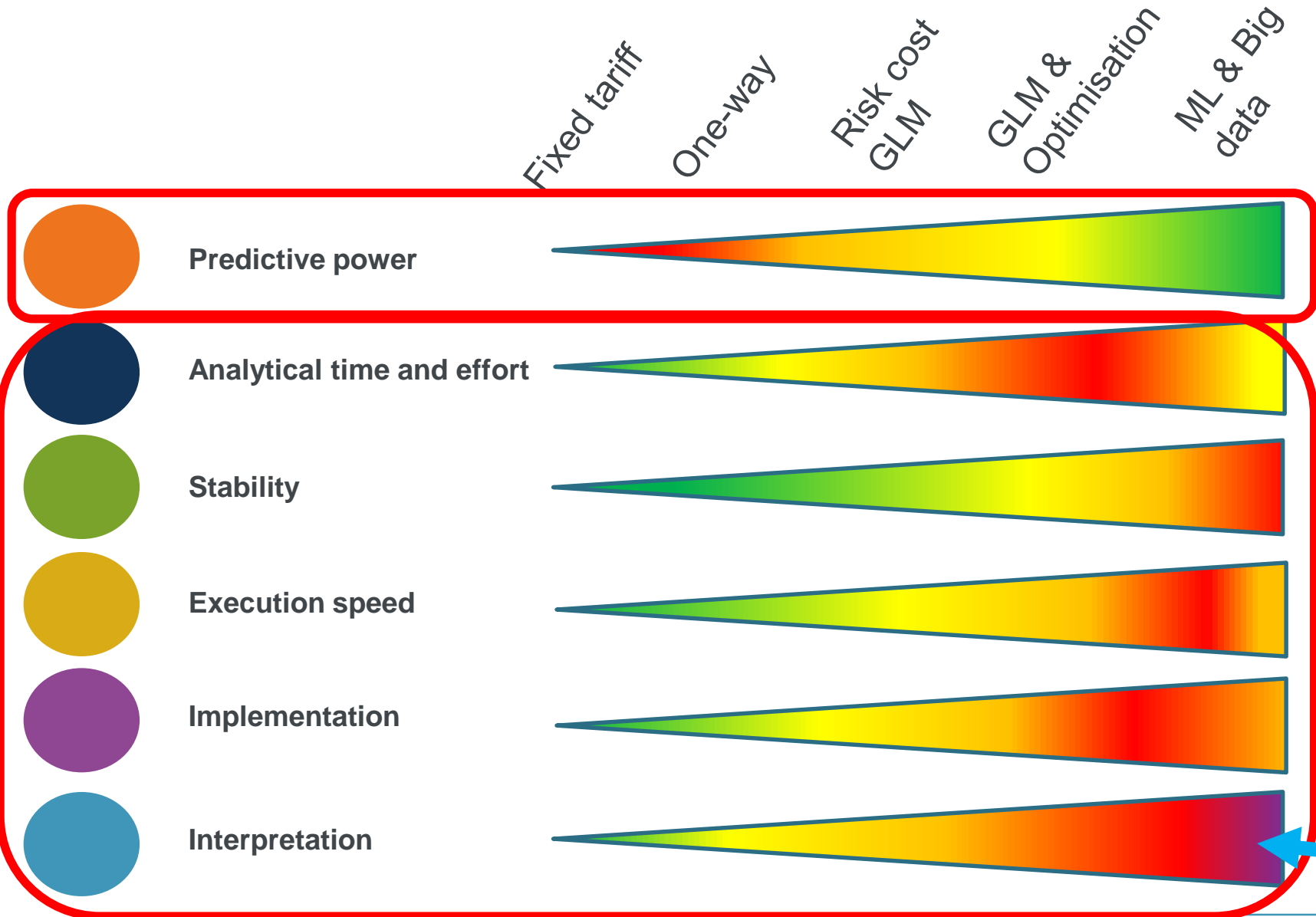
Meddling with the Modelling – Who knows best?



1. Evolving models
2. Experts and models
3. The customer



Evolving models – a Pricing example



- Model progression catalysed by competition and desire to improve predictability
- Typically to the detriment of other factors



Evolving models – why do we do it?



Modellers:

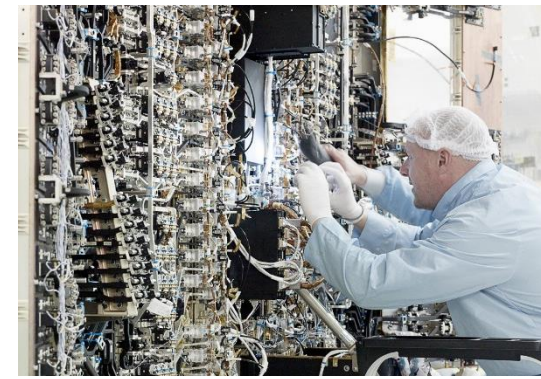
- Are attracted to complexity
- Believe “better” models drive better outcomes



Observation – All things being equal, predictability rises with capability...
...but falls with competition

Meddling with the Modelling – Who knows best?

1. Evolving models
- 2. Experts and models**
3. The customer



Experts and models

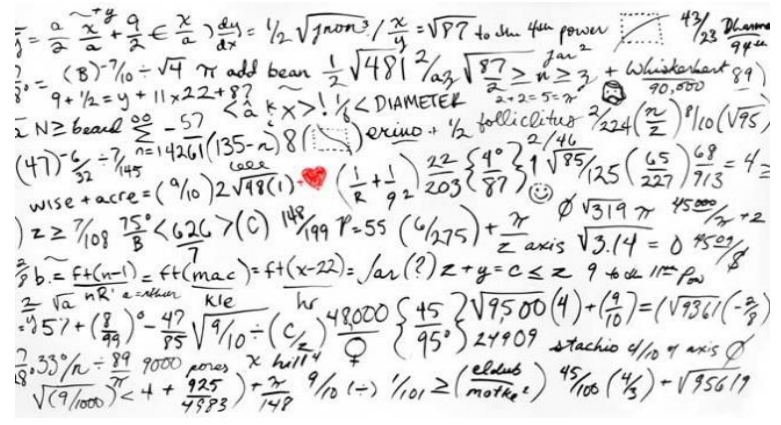


Are models better than experts?

What should expert underwriters do with pricing models?

Are we biased?

Experts vs Models



Vs.



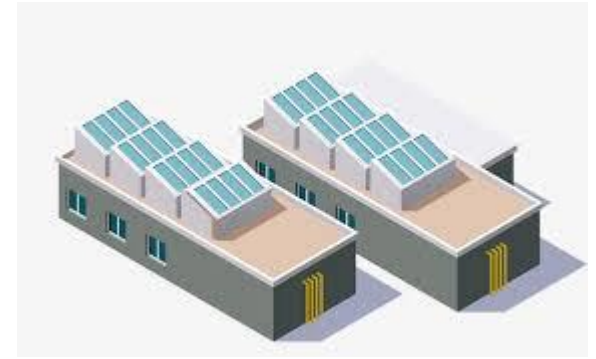
Paul Meehl - 1954

Clinical vs. Statistical Prediction: A Theoretical Analysis & a Review of the Evidence

- Algorithm wins because it's consistent & unbiased
- Humans are biased and seek info to reinforce their views
- Humans make more mistakes

Experts and models – example 1

- A broker is getting quotes for fire cover on a commercial building.
- Your underwriter knows that the only rating factors in the model are
 - Sum insured,
 - Industry type and
 - Postcode.
- The property has a sprinkler system. Your previous underwriter, Bill, gave a 10% discount for sprinklers.



What price adjustment would you make?

-30%, -20%, -10%, 0%, +10%, +20%

Please write down the price adjustment that you would offer.



Results



Experts and models – example 2

Your ex CEO, Mark calls you because his daughter's motor insurance premium is "too expensive" but she is low risk:

- She is 19 but is a sensible and safe driver
- Doesn't drink
- Doesn't normally drive at night
- Only really uses the car to go to and from college



What price adjustment would you make?

-30%, -20%, -10%, 0%, +10%, +20%,

Please write down the price adjustment that you would make.



Results

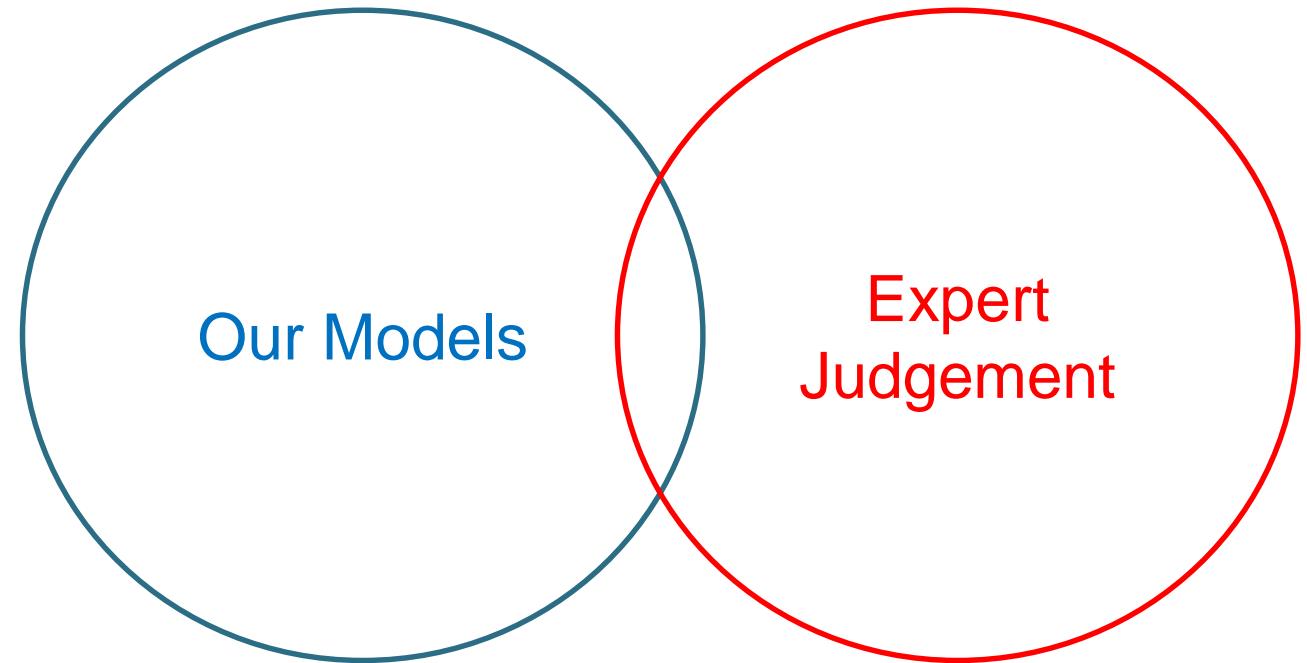
- She is 19 but is a sensible and safe driver
- Doesn't drink
- Doesn't normally drive at night
- Only really uses the car to go to and from college

Experts or Models - Options



When it comes to models, we have three options:

1. Rely exclusively on our models
2. Rely on expert judgement
3. Blend models and experts



Experts vs Models



$f = \frac{a}{2} \frac{x^2}{a} + \frac{b}{2} \frac{x}{a} \in \frac{x}{a}$ $\frac{dy}{dx} = \frac{1}{2} \sqrt{1000} \frac{x}{y} = \sqrt{500}$ to the 4th power $\frac{43}{23}$ $\frac{21}{94}$
 $\sqrt{8} = (8)^{1/2} = \sqrt{4} \sqrt{2}$ add bear $\frac{1}{2} \sqrt{481}$ $\frac{2}{a^2} \sqrt{87} \geq n \geq 3$ + Whiskerhart 89
 $9 + \frac{1}{2} = y + 11 \times 22 + 87$ $\frac{1}{2} < \text{DIAMETER}$ $\frac{1}{2} < \text{DIAMETER}$ $\frac{1}{2} < \text{DIAMETER}$
 $\bar{x} \geq \text{beard}$ $\frac{20}{145}$ $\frac{57}{145}$ $\frac{1}{2} < \text{DIAMETER}$ $\frac{1}{2} < \text{DIAMETER}$ $\frac{1}{2} < \text{DIAMETER}$
 $(47) \frac{6}{52} = \frac{7}{145}$ $\frac{1}{2} < \text{DIAMETER}$ $\frac{1}{2} < \text{DIAMETER}$ $\frac{1}{2} < \text{DIAMETER}$
wise + acre = $(\frac{9}{10}) 2 \sqrt{481}$ $\frac{1}{2} < \text{DIAMETER}$ $\frac{1}{2} < \text{DIAMETER}$
 $z \geq \frac{7}{109}$ $\frac{75}{8} < 6.26 > (C)$ $\frac{148}{199} P = 55$ $(\frac{6}{275}) + \frac{\pi}{2}$ $\frac{1}{2} < \text{DIAMETER}$
 $\frac{2}{3} b = \frac{f(x-1)}{nR} = \frac{f(x-2)}{nR} = \frac{f(x-22)}{nR} = \frac{f(x-22)}{nR}$ $\frac{1}{2} < \text{DIAMETER}$
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Vs.



Paul Meehl - 1954

Clinical vs. Statistical Prediction: A Theoretical Analysis & a Review of the Evidence

- Algorithm wins because it's consistent & unbiased
- Even when clinicians saw the algorithm output, they were still less accurate

Experts with models



Are 45 year olds or 17 year olds better drivers?



Experts on Models – introducing bias

20 COGNITIVE BIASES THAT SCREW UP YOUR DECISIONS

<p>1. Anchoring bias. People are over-reliant on the first piece of information they hear. In a salary negotiation, whoever makes the first offer establishes a range of reasonable possibilities in each person's mind.</p> 	<p>2. Availability heuristic. People overestimate the importance of information that is available to them. A person who is overly concerned about their own health is unhealthy because they know someone who lived to 110 and smoked three packs a day.</p> 	<p>3. Bandwagon effect. The probability of one person adopting a belief increases based on the number of people that have adopted it. This is a powerful form of groupthink and is reason why meetings are often unproductive.</p> 	<p>4. Blind-spot bias. Failing to recognize your own cognitive biases is a bias in itself. People notice cognitive and motivational biases much more in others than in themselves.</p> 
<p>5. Choice-supportive bias. When you choose something, you tend to feel positive about it, even if that choice has flaws. Like how you think your dog is awesome – even if it bites people every once in a while.</p> 	<p>6. Clustering illusion. This is the tendency to see patterns in random events. It is key to various gambling fallacies, like the idea that red is more or less likely to turn up on a roulette table after a string of reds.</p> 	<p>7. Confirmation bias. We tend to listen only to information that confirms our preconceptions – one of the many reasons it's so hard to have an intelligent conversation about climate change.</p> 	<p>8. Conservatism bias. Where people favor previous evidence over new evidence. Information that has emerged. People were slow to accept that the Earth was round because they maintained their earlier understanding that the planet was flat.</p> 
<p>9. Information bias. The tendency to seek information when it does not affect action. More information is not always better. With less information, people can often make more accurate predictions.</p> 	<p>10. Ostrich effect. The decision to ignore dangerous or negative information by "burying" one's head in the sand, like an ostrich. Research suggests that investors check the value of their holdings significantly less often during bad markets.</p> 	<p>11. Outcome bias. Judging a decision based on the outcome – rather than how exactly the decision was made in the moment. Just because you won a lot in Vegas doesn't mean gambling your money was a smart decision.</p> 	<p>12. Overconfidence. Some of us are too confident about our abilities, and this causes us to take greater risks in our daily lives. Experts are more prone to this than laypeople, since they are more convinced that they are right.</p> 
<p>13. Placebo effect. When simply believing that something will have a certain effect on you causes it to have that effect. In medicine, people given fake pills often experience the same physiological effects as people given the real thing.</p> 	<p>14. Pro-innovation bias. When a proponent of an innovation tends to overvalue its usefulness and undervalue its limitations. Sound familiar, Silicon Valley?</p> 	<p>15. Recency. The tendency to weigh the latest information more heavily than older data. Investors often think the market will always look the way it looks today and make unwise decisions.</p> 	<p>16. Salience. Our tendency to focus on the most easily recognizable features of a person or concept. When you think about dying, you might worry about being mangled by a lion, as opposed to what is statistically more likely, like dying in a car accident.</p> 
<p>17. Selective perception. Allowing our expectations to influence how we perceive the world. An experiment involving a football game between students from two universities showed that one team saw the opposing team commit more infractions.</p> 	<p>18. Stereotyping. Expecting a group or person to have certain qualities without having real information about the person. It allows us to quickly identify strangers as friends or enemies, but people tend to overuse and abuse it.</p> 	<p>19. Survivorship bias. An error that comes from focusing only on surviving examples, causing us to misjudge a situation. For instance, we might think that being an entrepreneur is easy because we haven't heard of all those who failed.</p> 	<p>20. Zero-risk bias. Sociologists have found that we love certainty – even if it's counterproductive. Eliminating risk entirely means there is no chance of harm being caused.</p> 

SOURCES: Brain Biases; Ethics Unwrapped; Explorable; Harvard Magazine; HowStuffWorks; LearnVest; Outcome bias in decision evaluation, Journal of Personality and Social Psychology; Psychology Today; The Bias Blind Spot; Perceptions of Bias in Self Versus Others, Personality and Social Psychology Bulletin; The Cognitive Effects of Mass Communication, Theory and Research in Mass Communications; The less-is-more effect: Predictions and tests, Judgment and Decision Making; The New York Times; The Wall Street Journal; Wikipedia; You Are Not So Smart; ZurnalyWiki

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Anchoring bias

Bandwagon effect

Confirmation bias

The crowd – an unbiased expert...



- How big does the crowd need to be?
- How expert on the problem?
- As expertise increases, your useable crowd shrinks.



The crowd – an unbiased expert...



$$\frac{1}{x} = \frac{a}{x} + \frac{9}{x} \in \frac{x}{a} \frac{dy}{dx} = \frac{1}{2} \sqrt{1000^3} / \frac{x}{4} = \sqrt{10^7} \text{ to the 4th power}$$

$$\frac{1}{8} = (8)^{-1/10} \div \sqrt{4} \pi \text{ add bear } \frac{1}{2} \sqrt{48} / \frac{2}{10} \sqrt{\frac{87}{2}} \geq n \geq 3 + \text{Whiskerhart } 89$$

$$\frac{1}{8} = 9 + \frac{1}{2} = y + 11 \times 22 + 8?$$

$$\bar{N} \geq \text{beard } \sum_{n=1}^{\infty} -57 < \frac{1}{2} \frac{1}{x} > ! \frac{1}{8} < \text{DIAMETER} >$$

$$(47) \frac{6}{32} = \frac{7}{145} \frac{1}{4261} (135 - n) 8 \left(\frac{1}{2} \right) \text{eximo} + \frac{1}{2} \text{follicle} \frac{2}{224} \left(\frac{n}{2} \right) \frac{1}{10} (\sqrt{95})$$

$$\text{wise + acre} = \left(\frac{9}{10} \right) 2 \sqrt{48} (1) \left(\frac{1}{2} + \frac{1}{9} \right) \frac{22}{203} \left(\frac{9}{87} \right) \frac{1}{125} \left(\frac{65}{227} \right) \frac{68}{713} = 4 =$$

$$) z \geq \frac{7}{108} \frac{75}{8} < 626 > (C) \frac{148}{199} P = 55 \left(\frac{6}{275} \right) + \frac{\pi}{z} \text{axis } \sqrt{3.14} = 0 \frac{4500}{2} + 2$$

$$\frac{1}{8} b = f + (n-1) = f + (mac) = f + (x-22) = \sqrt{ar} (?) z + y = c \leq z \ 9 \text{ to the 11th power}$$

$$\frac{1}{2} \sqrt{a} \frac{nR^2}{a} = \frac{47}{85} \sqrt{9/10} \div \left(\frac{C}{z} \right) \frac{48000}{95} \left\{ \frac{45}{95} \right\} \sqrt{9500} (4) + \left(\frac{9}{10} \right) = \sqrt{9361} \left(-\frac{2}{8} \right)$$

$$\frac{1}{8} \cdot 33 \frac{1}{n} = \frac{89}{9000} \text{poros } \times \text{hull} \frac{1}{4} \frac{1}{95} \left\{ \frac{45}{95} \right\} 24909 \text{stachio } \frac{4}{10} \text{ axis } \emptyset$$

$$\sqrt{\left(\frac{9}{1000} \right) \frac{\pi}{4} + \frac{925}{4783}} + \frac{\pi}{148} \frac{9}{10} (-) \frac{1}{101} \geq \left(\frac{\text{elub}}{\text{motke}} \right) \frac{45}{100} \left(\frac{4}{3} \right) + \sqrt{95619}$$



...but there are rarely enough experts available to achieve this.

Adjusting models – is it worth it?



Models are better than experts!

Expert underwriters should adjust pricing models with extreme caution

We are all biased

Meddling with the Modelling – Who knows best?



1. Evolving our models
2. Experts vs models
3. **The customer**

Managing customer sentiment



Is model evolution always beneficial to the customer?

Does model evolution create fairer models?

...from who's perspective?

Customer sentiment – evolve with caution



Customers are becoming increasingly confused and annoyed with insurance pricing, in part due to model evolution



“my price has come down – was I overcharged last year”

other er

peo

“stop gaming me”

“why do you penalise me for using

“how can you say my price is correct when it’s gone up 35%”

“well I haven’t flooded in the 5 years I’ve lived here – you must be wrong”

“ I feel betrayed”

Managing customer sentiment



Customer expectation

- You can explain your pricing model to me
- Prices don't fluctuate much over time
- Use my information to give me a lower price...
- ...not a higher price
- Don't penalise me for other people claiming
- Everyone in the market offers similar rates
- Prices reflect loyalty and experience
- Let me haggle...
- ...but give me the best price first time

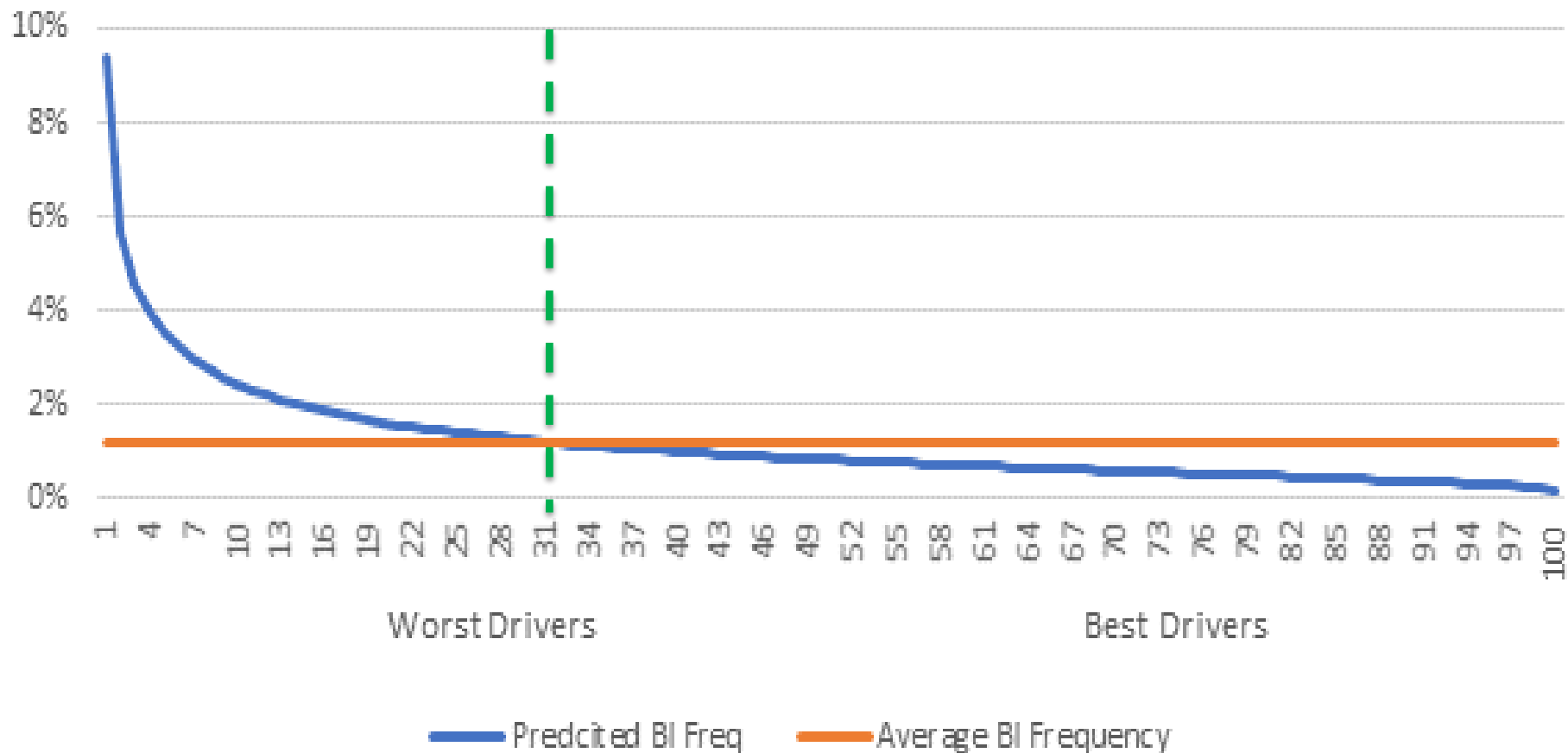
Misalignment between customer expectations and reality continues to grow

How many of you ~~think they are better than~~ think they are better than average? driver?

Aside: So many “better than average” drivers



Predicted BI Frequency by Percentile



It turns out that 70% of drivers are better than average

Customer sentiment – evolve with your eyes open



- **Optimisation can weaponise models**
 - A tool for profits or customer good?
 - Is customer sentiment on your efficient frontier?



- **Vulnerable customers are next to impossible to identify**
 - So what do you do with your models?
 - Very little if you already treat everyone fairly!



- **Customer interpretation**
 - Not always intuitive to us, so what about the customer?
 - Can machine learning help with this?



Managing customer sentiment



Is model evolution always beneficial to the customer?

Does model evolution create fairer models?

Probably not... unless you evolve with this in mind.

Meddling with the Modelling – who does know best?

Answer:

Highly likely it's the algorithm...

...but this is complicated and time consuming to prove...

...and we may not have enough data.

But we do need our expertise to help us understand when and how to build models

Summary

1. Evolving models is essential, but...
2. We rarely know how to overlay expert judgement onto model output
3. We are highly likely to get better outcomes by focusing on the customer

Our judgement and expertise is key to ensuring that models are valid and fit for purpose





Questions



Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

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

(There were 223 sweets in the jar)