Institute and Faculty of Actuaries

Making the best use of expert judgment

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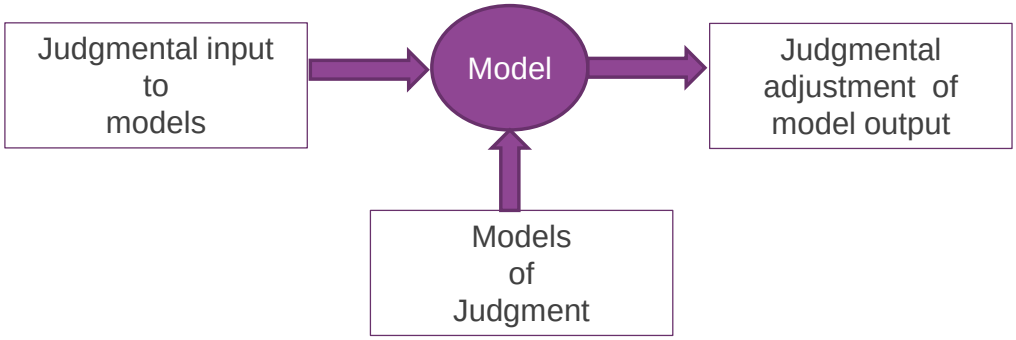
When expert judgment is needed in modelling

- Data selection e.g. should only recent data be used?
- Outlier exclusion
- Choice of modelling approach
- Choice of probability distribution e.g. normal, t, fat-tailed
- To compensate for shortage of data.

Judgmental interaction with models



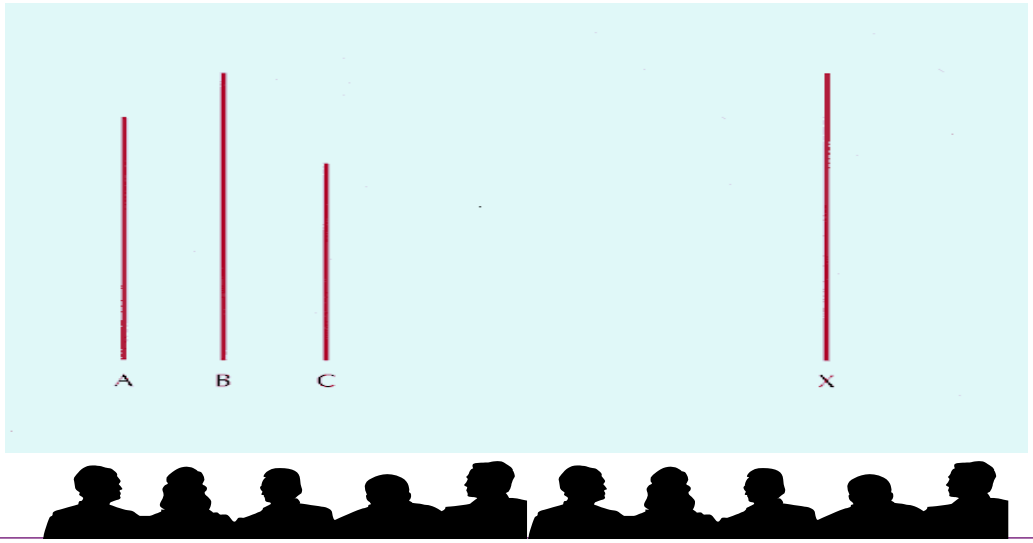
3

Judgmental input to models

1. Group judgments
2. Range estimation
3. Direct probability judgment
4. Credence decomposition.

4

Group biases: Asch's experiments



5

Other problems with group judgments

- Domineering individuals.
- Risky shift -risk underestimated because of shared responsibility.
- Groupthink -risks grossly underestimated
  - no one challenges prevailing view
  - afflicts cohesive, insulated groups which use unstructured processes & have directive leaders.

6

The Delphi method

Designed to avoid biases of face-to-face discussion

-while still allowing interaction between experts.

7

Phases of Delphi

1. Panellists provide estimates individually and privately
   –ideally with anonymous written supporting arguments.

2. Results of polling are tallied and statistics fed back together with anonymous written discussion.

3. Re-polling takes place.

4. Process is repeated until consensus emerges. Median estimate is then used as forecast.

8

Some points on Delphi

- Can be used for large, geographically dispersed groups
- No pressures from dominant individuals
- Anonymity allows change of mind without loss of face.

9

Plausible Range estimation

- One danger is anchoring.

When making a forecast or estimate we usually start with an initial value and adjust from this.

Problem: The initial value act as an anchor and we under adjust from it.

10

How old was Gandhi when he died?

Source: Strack & Mussweiler

One group asked was he older or younger than 9?

Then asked to estimate his age at death *Mean answer: 50*

Another group asked was he older or younger than 140?

Then asked to estimate his age at death *Mean answer 67*

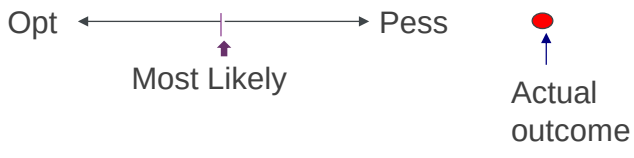
Correct answer: 78

11

When estimating a plausible range the most likely value can become an anchor

As a result the range is too narrow for the stated coverage probability

E.g. 90% prediction interval



This is known as overconfidence.

12

Overcoming overconfidence

- We are better at estimating a coverage probability for a given interval than we are at producing an interval to have a given probability

E.g. What is the probability that the interval 45 to 55 captures Obama's age when he became President?

rather than..

Estimate a 90% interval for Obama's age when he became President.

13

Four–step procedure (Speirs-Bridge et al., 2009)

1. Realistically what do you think the lowest rate of this disease could be over the next year? *12 per 100,000*
2. What do you think the highest rate of this disease could be over the next year? *26 per 100,000*
3. What is your best guess of the rate of this disease over the next year? *19 per 100,000*
4. How confident are you that your interval, 12 to 26 per 100,000 will capture the reported rate of disease (between 0 and 100%)?

14

Direct probability estimation: Availability bias

People assess the likelihood of events by how easily similar events can be recalled or imagined.

But ease of recall or ease of imagination may not be associated with the true likelihood.

Recent events -or those highlighted in the media- are easily recalled and may be over-influential when making judgmental estimates.

15

- A 1993 study found people were willing to pay more for airline travel insurance covering terrorist attacks than for deaths from all possible causes

- Sales of earthquake insurance are highest after an earthquake when the risk is lowest. They then decline as time passes (while the risk gradually increases).

16

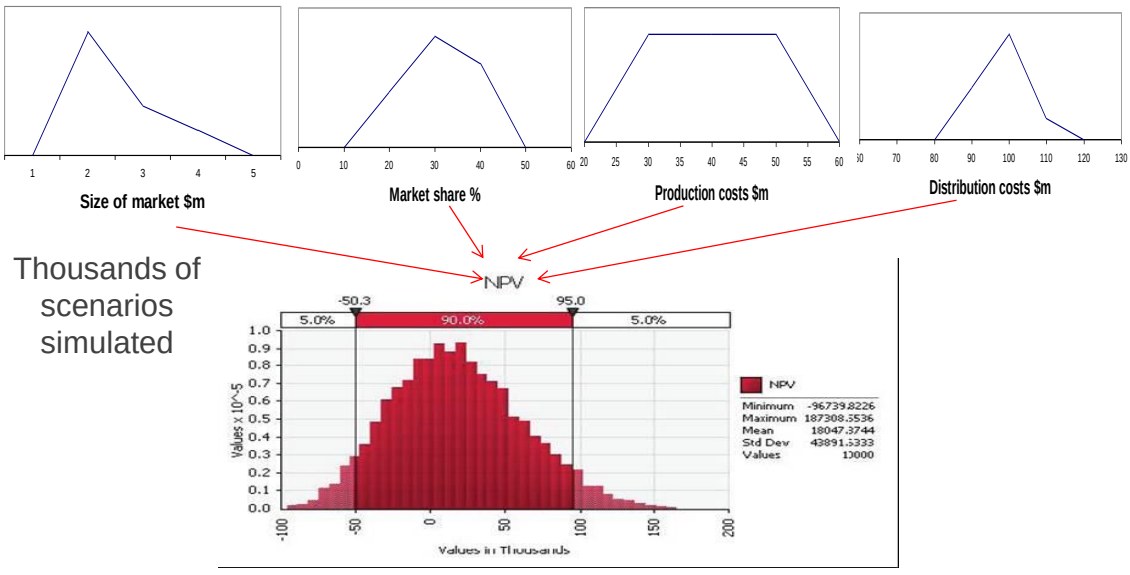
Credence decomposition

Use where uncertainty results from combined effect of a number of factors.

Overcomes processing limitations of human mind by breaking problem down into separate estimates.

Thousands of combinations of outcomes for factors are simulated to obtain a probability distribution for the target variable…

17



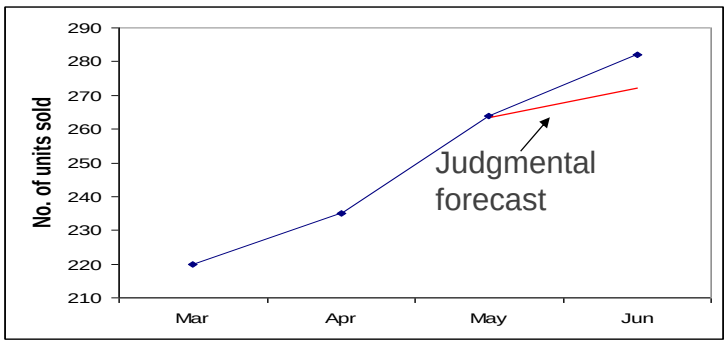
18

Modelling expert judgment

- Correcting for bias
- Overcoming inconsistency

Bias in judgmental extrapolation

- Anchoring can cause people to under estimate upward trends because they stay to close to the most recent value…..

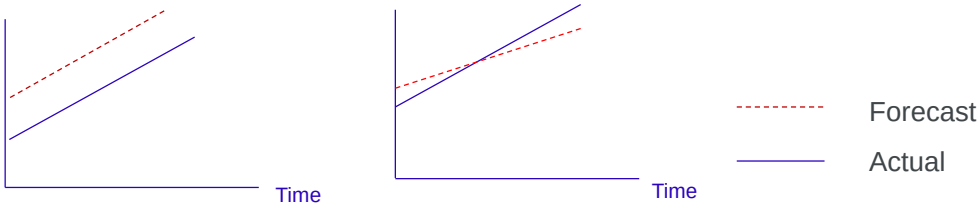


Correcting for bias: Theil's correction

Linear Regression…

Actual = 10 + 1.3 Judgmental Estimate

So: Corrected forecast = 10 + 1.3 Judgmental Estimate



Mean bias

Regression bias

Overcoming Inconsistency

- Judgmental bootstrap model

We fit a regression model to the past judgments made by an expert.

This captures how they use information to make their forecasts.

The model should 'average out' their inconsistencies leading to more accurate forecasts.

We then replace the person with the model and use it for all future estimates.

Example of bootstrap model

Sales (000s) = 12 + 0.3 Adv spend -1.6 Price + 0.4 Competing price

- Useful if expert can detect subtle non-linearities

or

If the regression coefficients partly reflect latent information the expert is using.

23

Judgmentally adjusting model output

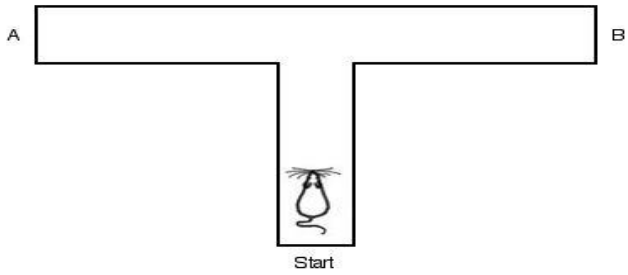
1. Seeing system in randomness
2. Availability bias
3. Base-rate neglect
4. Combination.

24

Rats handled randomness better than Yale students

60% of time

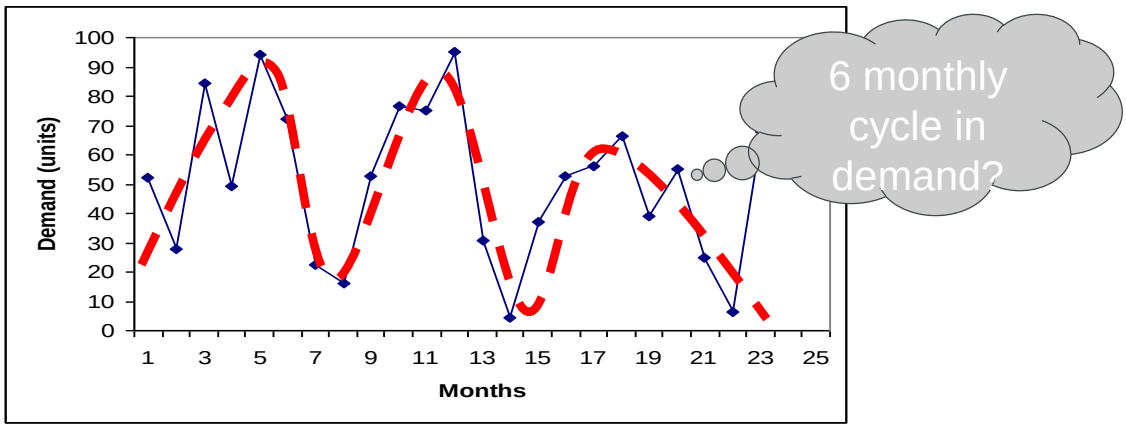
40% of time



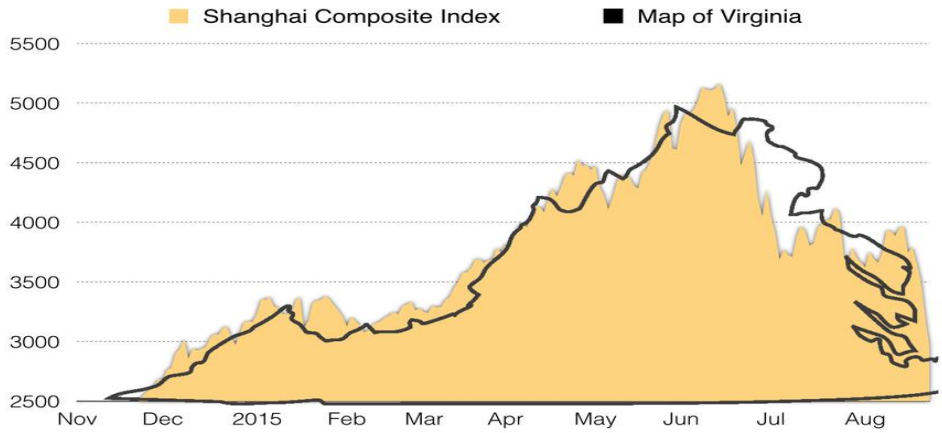
- Rat went to side where food appeared most frequently – correct 60% of time
- Students tried to spot patterns – correct only 52% of time

(see Tetlock, 2005)

Seeing systematic patterns in randomness



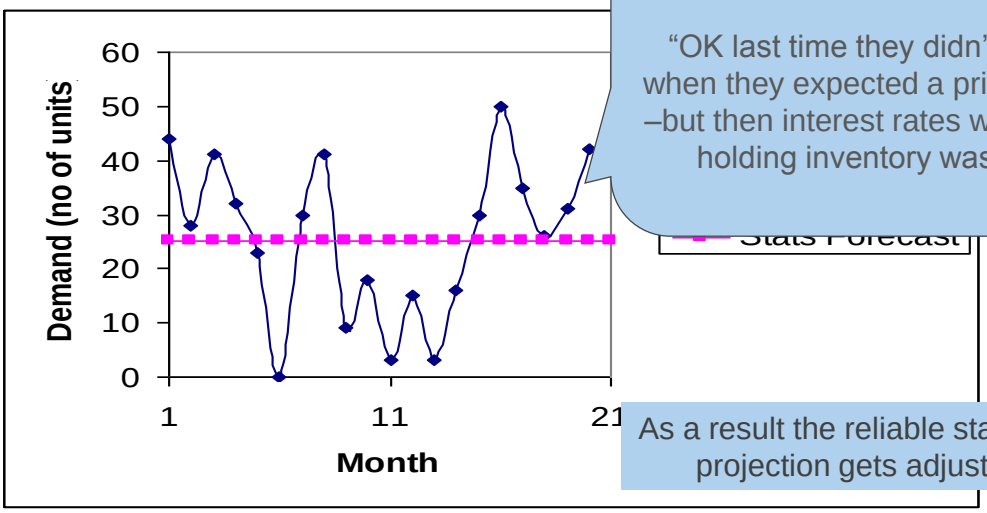
We can't help looking for patterns…



- People are brilliant at inventing explanati

"Our customers have been stocking up in anticipation of a price increase"

"OK last time they didn't stock up when they expected a price increase –but then interest rates were high so holding inventory was costly"

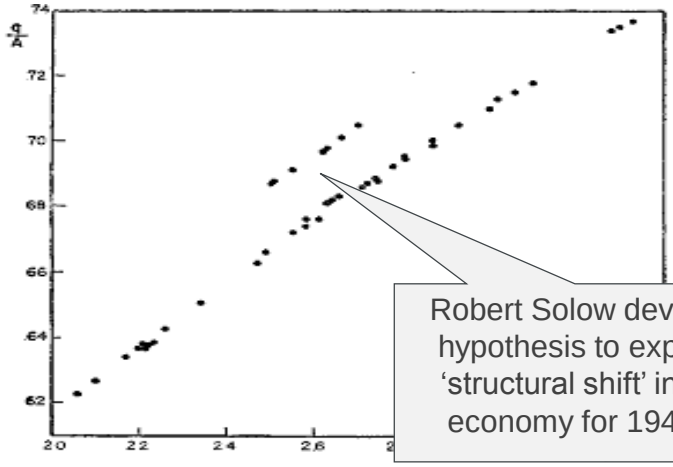


As a result the reliable statistical projection gets adjusted

28

Even Nobel Laureates are not immune…

Output per worker



Capital per worker

It turned out the anomaly was a result of mistakes in arithmetic

Robert Solow developed a hypothesis to explain this 'structural shift' in the US economy for 1943-1949

29

Base-rate neglect

- Focusing on specific case –rather than general rate of occurrence.
- Referred to as 'Inside view' vs 'Outside view'

30

A businessman estimates a 90% chance that his new restaurant will succeed because:

- He is enthusiastic and energetic
- He's hired a good chef
- Many people pass the restaurant each day, etc..

The base rate information indicates that only 15% of restaurants in that town succeed.

31

- People setting up new business ventures were asked to estimate the probability that their business would eventually be operational.
- Their average estimate was 90%.
- Only 47.8% of the prospective ventures actually became going concerns.
- Preparation of projected financial statements led to optimism bias

  -caused entrepreneurs to focus on the specifics of their particular venture.

Cassar G. (2010)

32

Combination of judgment and model

- Simple means of judgmental and model forecasts often improve accuracy

E.g. Model forecast = 50 units
Judgmental forecast = 70 units
Combined forecast = 60 units

When combination worked well

- Forecast of incumbent party's share of vote in US Presidential elections
- Took mean of:
  - -latest percentage in opinion polls
  - -percentage indicated in Iowa exchange market
  - -percentage estimated by a Delphi panel of experts
  - -mean of econometric model forecasts.
- Errors: 2004: 0.3 percentage points
  2008: 0.7 percentage points
  2012: 0.9 percentage points

Source Forprin.com

Conclusions

- Expert judgment is subject to cognitive biases
- Despite these it can bring benefits to the estimation process
- In some case these biases can be mitigated
- Drawing on the complementary benefits of statistical modelling and judgment can often yield the most reliable results