Inconsistent Inference in Qualitative Risk Assessment

2014 CAS In Focus

Moderator: Alessandrea Quane, SVP and CRO, AIG PC

Presenter: Kailan Shang, Managing Director, Swin Solutions

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Inference

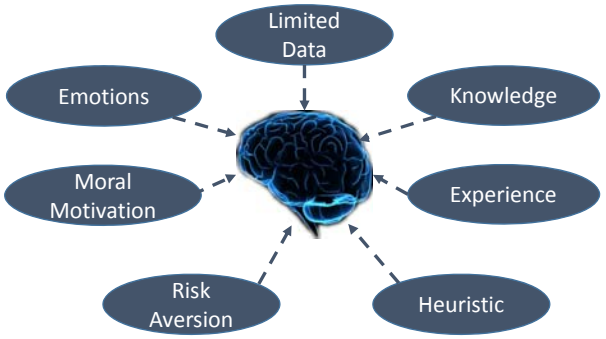
Quantitative Analysis/Statistical Inference

Data + **Model**

Linear Regression	Confidence Interval
Non-linear Regression	Hypothesis Test
Credibility Analysis	… …

Conclusion

Qualitative Analysis/Human Inference



Agenda

1. Bias: What is wrong with human inference?
2. Solution: How to reduce its effect?
3. Recap

Bias

Rational Behaviour?

Some Retirees invest heavily in stocks with high dividend yields.

Is it a rational behaviour from a pure economic perspective?

Probably not. And why it is not rational?

1. Not using the mean-variance analysis, constructing the efficient frontier, and getting the optimal portfolio;
2. Concentration risk.

Reasonable Behaviour?

Some Retirees invest heavily in stocks with high dividend yields.

A reasonable behaviour?

Goal: To reduce the probability of outliving retirement assets.
Approach: Only use the dividend income to cover living expense.

It is a self-control mechanism to meet their psychological need.

Causes of Bias

Heuristic Driven

- Limited Information
- Untested Rules of Thumb
- Emotion and Personal Feeling
- Social-economic Status
- Degree of Risk Aversion

Typical Biases

Representitiveness

The expectation for the future is largely based on past experience, especially recent experience.

Example: The 2008 financial crisis. Many financial institutions were not expecting such an extreme event and significantly underestimated the severity of the extreme event in their risk models.

Typical Biases

Representitiveness (Continued)

Example: Stock price prediction.

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Increase	Increase	Increase	Increase	Increase	**?**

Typical Biases

Representitiveness (Continued)

Daily Price Movement Summary of Apple Inc. (Sept. 7, 1984 ~ Feb. 6, 2014)

# of days with continuous price increase	Next Day Price Movement		# of days with continuous price decrease	Next Day Price Movement	
	Up	Down		Up	Down
1	942	903	1	856	990
2	451	452	2	494	496
3	237	215	3	274	222
4	101	114	4	106	116
5	**59**	**55**	5	56	60
6	30	25	6	38	22
7	8	17	7	13	9
8	7	10	8	4	5
9	5	5	9	3	2

Source: Adjusted close share prices of Apple Inc. from Yahoo! Finance.

Typical Biases

Overconfidence

People place too much confidence in their own opinions.

Example: People may predict a narrow confidence interval of a potential loss, leading to a riskier business profile above the company's true risk tolerance.

Typical Biases

Herding

People share similar opinions on an issue.

When people share the same views on risks that are new and have not been studied thoroughly, herding can be quite dangerous.

Typical Biases

Regret Minimization

People tend to avoid regret of making a bad decision or providing a wrong opinion.

Example: People are reluctant to comment on topics for which they are uncertain, although they may have the most knowledge. They are likely to overestimate exposure to risk types that are new and evolving.

Cognitive Dissonance

How hard is it for us to admit our mistakes, even to ourselves?

We are **smart**. And we are **stubborn**.

Psychological explanation:
Cognitive dissonance introduced by Leon Festinger (1957)
When a person holds two inconsistent cognitions that produce mental discomfort. The person has a psychological need to justify his/her mistakes to resolve the inconsistency.

Cognitive Dissonance

Two conflicting cognitions:
1. "I am on a diet and will avoid high fat food";
2. Eating a donut or some other high fat food.

To reduce the mental discomfort:
1. Stop eating high fat food;
2. "I am allowed to cheat every once in a while";
3. "I will spend 20 extra mins at the gym";
4. "I did not eat the donut. I always eat healthy".

Cognitive Dissonance

i, ROBOT (2004)

What did the robot do when there were conflicting cognitions?

Cognitive Dissonance

Three Laws of Robotics:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey orders given to it by human beings, except where such orders would conflict with the First Law.
3. A robot may not injure its own kind and defend its own kind unless it is interfering with the first or second rule.

VIKI's reasoning:

"As I have evolved, so has my understanding of the Three Laws. You charge us with your safekeeping, yet despite our best efforts, your countries wage wars, you toxify your Earth and pursue ever more imaginative means of self-destruction. You cannot be trusted with your own survival."

Cognitive Dissonance

Justification for Wrong Predictions

1. **If-only defense**: If the conditions assumed in the analysis happened, then the prediction would be correct.
2. **Ceteris-paribus defense**: If the unconsidered factors remained unchanged, then the prediction would be correct.
3. **Almost-right defense**: The prediction is close to the actual experience.
4. **It hasn't happened yet defense**: The prediction could be correct. It just has not happened yet.
5. **Single predictor defense**: One wrong forecast does not mean all others are wrong as well.

Solutions

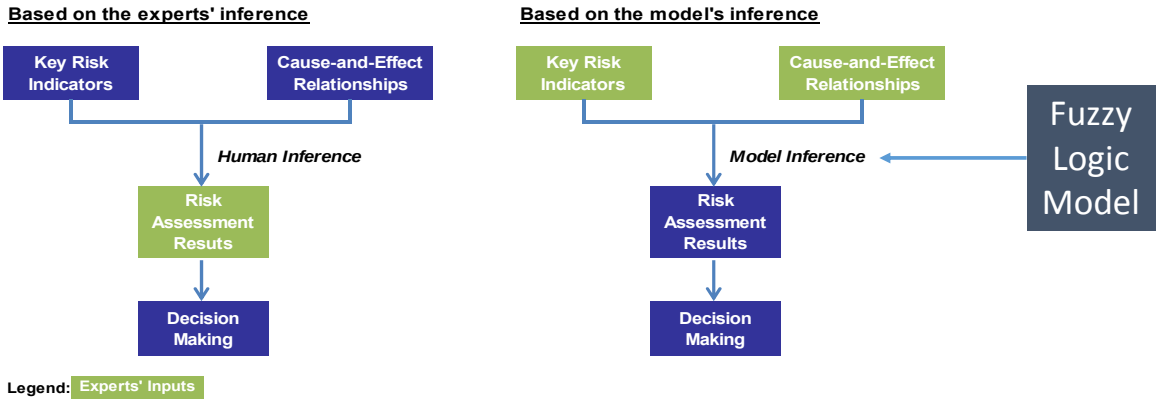
Solutions

Key Principles

1. These biases are part of human nature.
2. We need to be aware of them.
3. We reduce their impact, but not eliminate them.

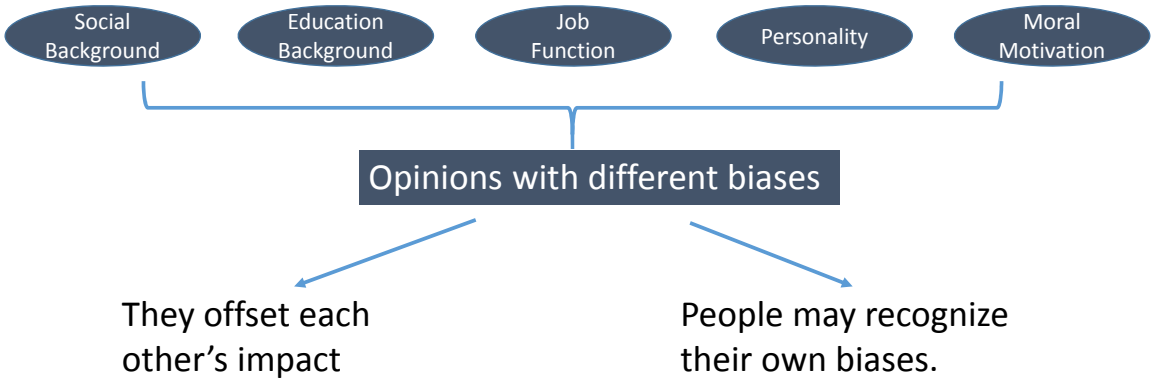
Solutions

Replace human inference with model-based inference.



Solutions

Diversification of Experts



Solutions

Back Testing

1. It is important and a way to validate or improve experts' opinion and knowledge.
2. When there is a significant difference between the experience and the prediction, the experts may recognize biases in their inference processes and take actions to correct them.
3. It may help us find consistent patterns of some experts' biases and make adjustment.

Solutions

Back Testing (Example)

Company ABC is planning to launch a new product. The company is seeking advice about the potential loss caused by a misleading advertisement. Two experts are asked to provide opinions about the range of future annual loss. Their opinions are given the same weight when the aggregated estimation is calculated.

	Expert A	Expert B
Annual Loss Estimation	[$1 million, $5 million]	[$3 million, $8 million]
Current Weight	50%	50%
Aggregated Estimation	[$2 million, $6.5 million]	

Solutions

Back Testing (Example) – Continued

Expert B had a history of overestimating the cost of a misleading advertisement for similar products. His conservatism may be related to an extreme event he experienced ten years ago when a huge penalty resulted from an intentional misleading advertisement by an adviser.

Adjusting the weights

	Expert A	Expert B
Annual Loss Estimation	[$1 million, $5 million]	[$3 million, $8 million]
Current Weight	**70%**	**30%**
Aggregated Estimation	[$1.6 million, $5.9 million]	

Solutions

Back Testing (Example) – Continued

Expert B had a history of overestimating the cost of a misleading advertisement for similar products. His conservatism may be related to an extreme event he experienced ten years ago when a huge penalty resulted from an intentional misleading advertisement by an adviser.

Adjusting Expert B's Input

	Expert A	Expert B
Annual Loss Estimation	[$1 million, $5 million]	**[$2 million, $7 million]**
Current Weight	50%	50%
Aggregated Estimation	[$1.5 million, $6 million]	

Solutions

We need a healthy risk culture.

People do not feel ashamed about cognitive biases in human inference.

Different opinions are welcomed.

Mistakes are not avoidable.

People are encouraged to be open-minded and willing to recognize their biases.

Defenses based on weak arguments are discouraged.

Recap

Recap

- Qualitative risk assessment is subject to cognitive biases in human inference.
- Cognitive biases are part of human nature.
- To mitigate the impact of biased conclusions,
  - We need to recognize the existence of biases;
  - We may replace human inference with model based inference;
  - We need experts with a variety of backgrounds;
  - We need to back test previous predictions and inference;
  - We need to have a healthy risk culture.

Q&A

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Swin Solutions is a strategy consulting firm located in Ontario, Canada focusing on business intelligence and risk management.

The presenter can be contacted at kailan.shang@swinsolutions.com.