

# Modeling Mistakes

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# History

- Advanced Decision Making

- Over 250 students

- Project Based

- Decision Analysis

Job Decisions

Eye Surgery

Marriage

Children

Location

- Financial Modeling

- Over 500 students

- Project Based

- Simulation

Sports

Valuations

Social Security

Distillery

Housing

# Getting Started

- Overwhelming
  - Scope of project
  - Scope of tools
  
- Drive for Perfection
  - Limits 'playing around'
  - Modeling by numbers
  - No Mistakes

Frozen Modeling

# All Models are Wrong!

You can never replicate the real system exactly.

Modeling is not linear

- Start simple
- Add complexity/realism as you cycle through
  - Ignore dependency relations at first
  - If difficult to model, then Don't!
- Purposefully make mistakes/Demented What-If Analysis
- Play, Play, Play

# If Wrong, Why Model?

- Models do not solve the question/problem.
- Models provide insights into the problem.
  - Expected Values
  - Distribution of payoffs/costs
  - Nuanced Risk Analysis
  - What-If Analysis
  - Sensitivity Analysis

# Know Objectives

Thoroughly understand what the model is to be used for and by whom.

## Purpose

- What questions are to answered?
- What measures are to used?
- What inputs will be available?
- Avoid Type III errors

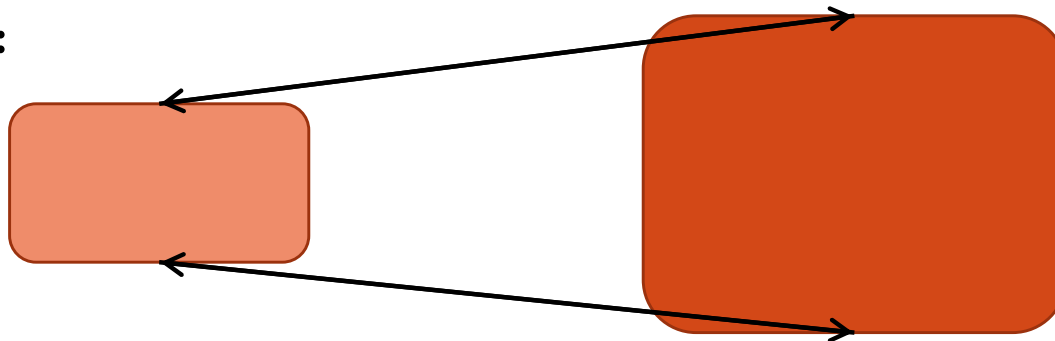
### Stock Option Model:

Keep stock or sell?

(narrow)

Balanced Portfolio

(broad)



### Housing Model:

Keep rental or sell?

(narrow)

Balanced Portfolio

(broad)

# Know your Audience

One of the most difficult concepts for quant heads.

Who will be using model or reading model results?

- What is their sophistication?
- What do they want to know first?
- What measures do they understand?
- Do they hate or embrace uncertainty?
- Do they even understand uncertainty measures?

This impacts not only the final product, but also how the model is constructed, e.g. distribution choice, output templates.

# Communicate Effectively

One of the most important aspects of modeling, if not the most important.

- Gulf between modeler and end user
  - Knowledge of system *vs.* model
  - Expected/desired output *vs.* actual
  
- Use tools, but easy to overwhelm
  - Graphs
  - @RISK Templates
  - Sliders

# People Abhor Uncertainty

- NIMBY
- Uncertainty  $\neq$  Randomness
- Need to develop probabilistic thinking
  - Compare to Worst-Case/Best-Case Analysis
  - More Nuanced, e.g., leverage variability

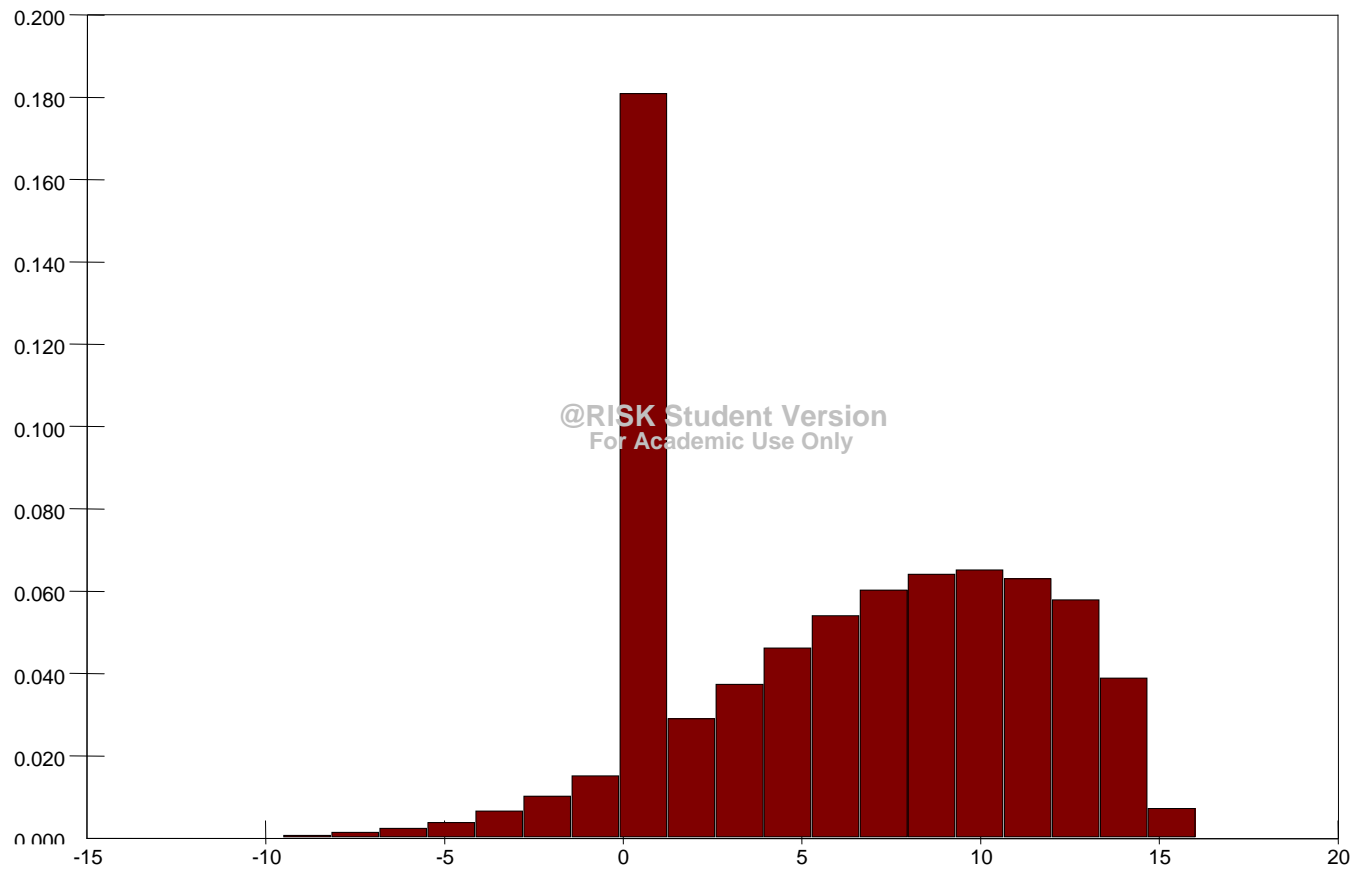
Analysts need not only understand probabilistic thinking, but how to communicate the analysis results to the end user in a meaningful way.

# Distribution Choice

- Step away from the normal
  - Infinite Tails?
  - What happens if output distribution is unusual?
- Taking the choice too seriously
  - Fitting procedures tell us the best fits.
  - Changing the choice easy (SA on distribution choice).

# Bidding Example

## Distribution for Profit



# How We Think

What is the next number in the following sequence?

2, 4, 6, ?

Pot smokers are unmotivated and likely to commit crimes.

	Pot Smoker	No Toker
Upstanding		
Degenerate	√	

# Disconfirming Evidence

When working on a project, we look for confirming evidence and weigh anything that supports our ideas heavily.

We tend to underweight disconfirming evidence, to the point of ignoring it. Contrary information is typically never sought out.

# Presumed Associations

When assessing probabilities, we tend to think back to similar events and the easier it is to recall, the higher the assessed probability. (Availability Heuristic)

- Works well except it can lead us to overestimate the likelihood of vivid or recent events and underestimate the likelihood of more commonly occurring bland events.
- When assessing the likelihood of two events occurring, we tend to recall similar events occurring together. We forget that there are always at least three other combinations to think through. This fact is universally ignored.

# Overconfidence

Others fail, but I won't. Novices are boldly confident.

When assessing a probability distribution, we tend to derive a too narrow range.

With experience comes a more nuanced and complete understanding of what could go wrong and the range of possible results/outcomes.

# Limitations

- Understand your model's limitations.
- Communicate the limitations.
- Remember, all models are wrong!

# Conclusion

- Knowing the decision maker's objectives, what questions the model is to answer and why, the more focused the model and easier it is to communicate the results. Avoid Type III errors.
- Knowing your audience allows you to choose the appropriate output to report and how to interpret the output for the end user.
- Knowing the heuristics people tend to use helps you guide probability assessments around pitfalls and mistakes common to all of us.