

# Use of Decision-Theoretic Models in the Intelligence and Financial Communities

Palisade Risk Conference

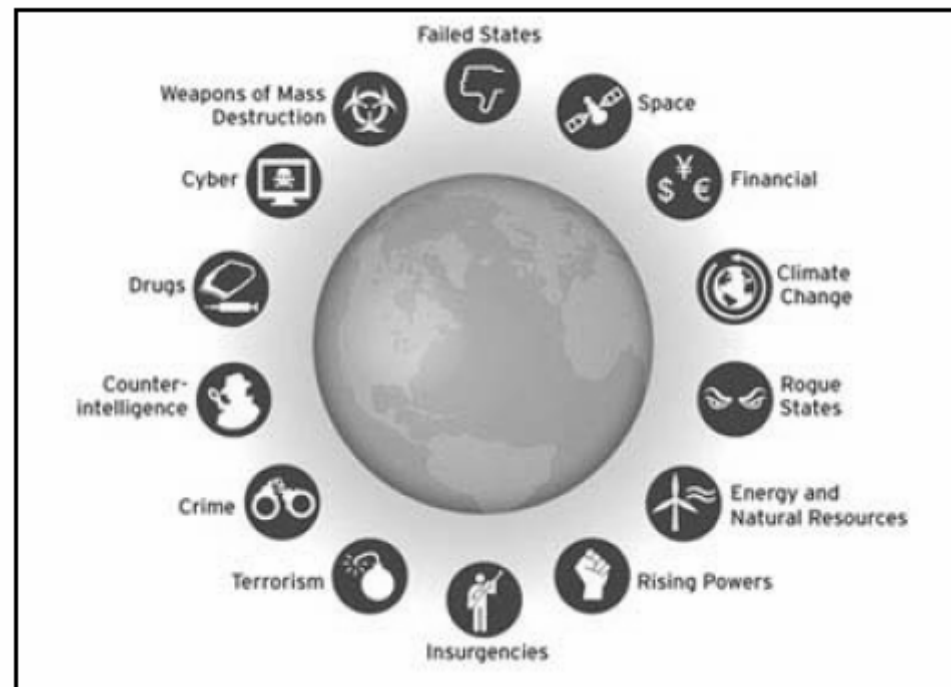
Las Vegas

05-Nov-2010

## *Decision-Theoretic Models: Choice Under Uncertainty*

- Decision theory is concerned with identifying the values, uncertainties, and all other issues relevant to identifying an optimal decision.
- Most of decision theory is prescriptive; i.e., it is concerned with identifying the best decision to take by a decision maker who is fully informed, able to compute with perfect accuracy, and is fully rational.
- However, it also allows for preferences for one outcome over another in the form of marginal utility functions
- Decision-theoretic models require decision support systems and tools

*The intelligence and financial communities are the public/private sectors judged to be most similar in issues and methods. Each has its own approaches to decision making and the analysis required to inform it.*



*Source: Office of the Director of National Intelligence (O/DNI)*

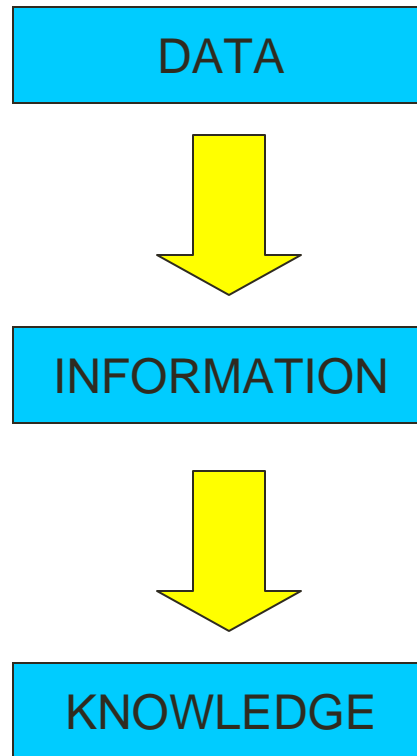
*But in general, the intelligence and financial communities have two very different worldviews about how to manage risk.*

- **The Financial Community: Probability**  
*The future is adequately represented by the past*
- **The Intelligence Community: Plausibility**  
*The future will be unlike the past*

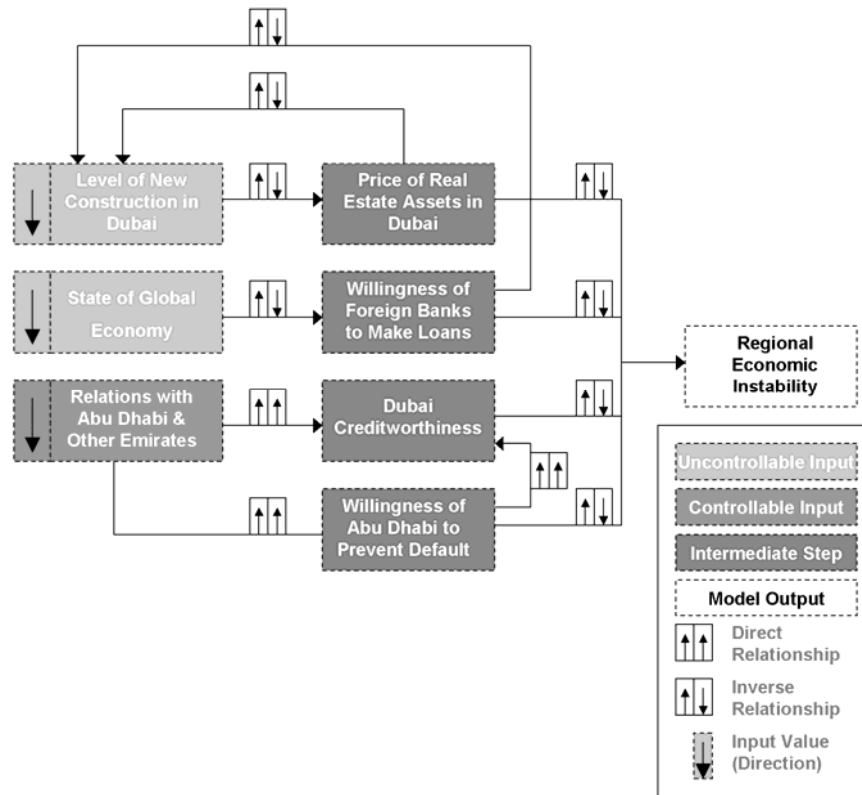
*These differing worldviews cause each to use different types of quantitative and qualitative models to forecast scenarios and estimate likelihood:*

- The Financial Community: **Stochastic Models**
- The Intelligence Community: **Causal Models**

*In the Intelligence Community (IC), sensemaking is emphasized over stochastic representations:*



IC analysts may use *structured analysis methods* that facilitate *critical thinking*, such as use of a *conceptual diagram*.



*When identifying plausible scenarios, structured analysis (facilitated by use of the appropriate tools) is a method for eliminating biases such as the following:*

- Confirmation Bias
- Anchoring Bias
- Random Bias
- Availability Bias
- Framing Bias
- Statistical Bias

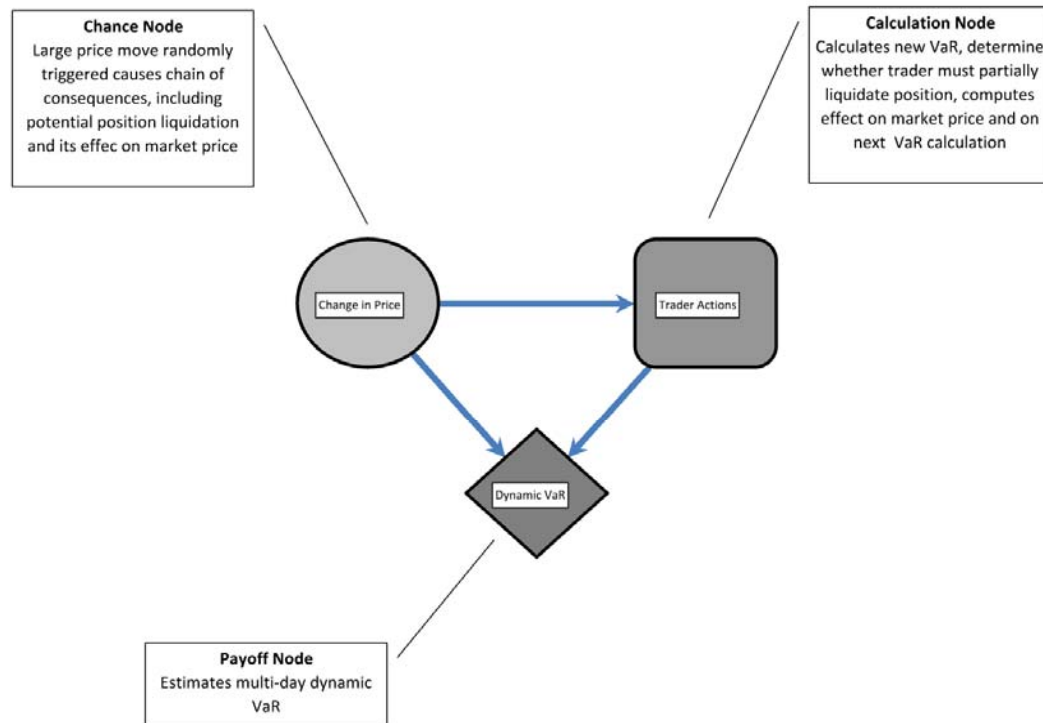
*Such structured analysis may be used to develop models to identify high consequence (extreme) scenarios and most likely scenarios:*

- **Most Likely Scenarios**
  - Wargaming
  - Red Team Exercises
- **High Consequence Events**
  - Agent-Based Models
  - Bayesian Inference Models

*Bayesian or network inference networks are particularly useful in these efforts. Benefits include:*

- Ability to model complex causal chain of events
- Ability to integrate expert knowledge, historical experience, opinions, and even unknown unknowns
- Ability to include feedback mechanisms
- Completeness
- Efficiency

*Such conceptual models can then be used to inform a operational model—especially one that includes decision nodes:*



Created using Palisade's PrecisionTree

*Examples of high-consequence events that might have been identified as plausible (if not probable) include:*

- 9/11 Attacks
- Real Estate Meltdown
- “Flash Crash” of May 2010

*Toward this end, reducing analysts' cognitive biases is an area of intense interest and research in the IC.*

- Information and Knowledge Sharing
  - *e.g., A-Space Collaborative Portal (see Wikipedia)*
- Research on Reducing Cognitive Biases
  - “The Intelligence Advanced Research Projects Activity (IARPA) invests in high-risk/high-payoff research programs that have the potential to provide our nation with an overwhelming intelligence advantage over future adversaries.”
  - Project ACE (Aggregative Contingent Estimation) from IARPA’s Office of Incisive Analysis  
[http://www.iarpa.gov/solicitations\\_ace.html](http://www.iarpa.gov/solicitations_ace.html)



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