

# Three Kinds of Decision Theory

- Normative: Axioms of Rationality
- Prescriptive: How to Apply those  
Axioms
- Descriptive: Actual Human Behavior

# Prescriptive Theory

- Adheres to Normative Axioms
- Looks to Descriptive Theory to determine how to implement those axioms

- RECENT INSIGHT (Bordley & LiCalzi, 2000)

- Utility-maximization is only one way of modeling normatively rational behavior
- Alternate, equally valid, ways exist
- Target-oriented approach is another way

# •Borch Insurance Model

- Firm's goal is being solvent by Friday
- Firm must decide today. Decision's direct consequences will be known Wednesday  
D---Today's Gamble---->Direct Payoff  
D---Today's Gamble---->Direct Payoff----->Friday
- Firm's **Modeled Uncertainty** about those consequences will be resolved tomorrow:
- But there is also **Unmodeled Uncertainty** about what happens between Wednesday and Friday

# Equivalence Result

- The utility of a fixed payoff  $x$  EQUALS the probability that  $x$  will achieve the fixed target, given the unmodelled uncertainties.
- The fixed target coupled with unmodelled uncertainties corresponds to an uncertain target
- Castagnoli & LiCalzi showed that for any utility function, there exists a random target with the utility being the cumulative distribution of the random target

# Target-Oriented Approach

- Individual Maximizes Expected Utility
- Individual Maximizes Probability of Exceeding an Uncertain Threshold
- Think of mode of the threshold as target or reference point
- The uncertainty in the threshold arises from unmodelled uncertainties.

# Prescriptive Decision Theory

- Should we model behavior as maximizing utility?
- Should we model behavior as maximizing probability of exceeding threshold?
- Should we model behavior some other way?

# What would Naturalistic Decisionmaking Suggest?

Choose that prescriptive approach which is most consistent with how skilled people make decisions in natural environments

# Prescriptive Advantages of Target-Formulation

**Bounded Rationality:** Individuals in organizations find thinking in terms of targets easier than thinking in terms of utility functions or willingness to pay functions

**Prospect Theory:** Individual Choice is strongly influenced by reference point (or targets).

Sometimes target or reference point is obvious. Hence assessment reduces to assessing uncertainty about that target

# Pedagogical Differences

Teaching utility-oriented decision theory involves teaching

- probability assessment
- utility assessment

Teaching target-oriented decision theory involves teaching

- probability assessment

with an illustration to trying to meet a target

# New Theoretical Insights

Utility of a consequence,  $c$ , is probability consequence meets a target. There always exists a function  $v$  such that  $u(c) = \Pr(v(c) > T)$ .

Suppose decision  $d$  has random consequences  $X$  where  $v(X)$  is normally distributed

Suppose  $T$  is normally distributed.

- *This is inconsistent with the assumption of global risk-aversion*

# Mathematical Implication

Let  $E_v$  and  $\text{Var}(v)$  denote mean and variance of  $v(X)$ .

Let  $E_T$  and  $\text{Var}(T)$  denote mean and variance of  $T$ .

Then utility of decision  $d$  is a monotonic function of

$$\{ E[v(X)] - E[T] \} / \text{SQRT}[\text{Var}(v) + \text{Var}(T)]$$

which is known as the Sharpe Ratio in Finance  
where  $T$  is the return on a benchmark portfolio

# Four Elements in this Formula

- (1)  $\text{Var}(v)$ : A measure of the risk in the decision
- (2)  $E_v$ : A measure of the average desirability of the decision
- (3)  $ET$ : A measure of the individual's reference point, expectations, or target
- (4)  $\text{Var}(T)$ : A measure of the individual's risk-tolerance: When  $\text{Var}(T)$  is infinite, individual is risk-neutral.

# Desirable Implications for Service Research

Work in service research shows that customer preference for service must be modelled as a function of the GAP between the performance of a service provider and customer expectations for service (GAP ANALYSIS)

This model is consistent with that perspective.

# Empirical Implications

- Suppose the consequences are monetary. Then financial theory generally assumes that  $v$  is logarithmic.
- The Sharpe Ratio describes how individuals are mandated to compare stocks
- Does it describe how individuals compare among monetary lotteries?

# Theoretical Implications

Axioms of Rationality Imply No Correlation  
between Modelled and Unmodelled  
Uncertainties

Assuming Correlation leads to a  
generalization of utility theory

This generalization is equivalent to state-  
dependent utility theory

# Conclusions

Normative Decision Theory has at least two different prescriptive formulations:

- Utility-Oriented Decision Theory
- Goal-Oriented Decision Theory

Naturalistic Decisionmaking provides grounds for preferring goal-oriented decision theory in many cases.

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