ECON 201

CHOICE UNDER UNCERTAINTY – CLASSICAL & CURRENT APPROACHES

Winter 2004
Professor Mark Machina

T, Th 11:00 – 12:20pm
Economics Bldg. 217

Econ 300
Office Hours: Thur. 8-11, 1-2

This course will present and then examine the economist's classical model of choice under uncertainty, namely the expected utility/subjective probability model of risk preferences and beliefs. We will develop the theoretical foundations of this model in a setting of both objective and subjective uncertainty, and examine the concepts and measurement of "risk" and "risk aversion" and how these features influence economic behavior. We will then present methods of estimating and testing different features of the classical model, and give an overview of the empirical/experimental evidence that has accumulated, much of which suggests that preferences and beliefs systematically violate the underlying assumptions of the model. We conclude with an examination of the resulting development of non-expected utility models of risk preferences, and non-probabilistic models of beliefs.

Jan. 6  Introduction & Preliminary Concepts
Jan. 8  Expected Utility Preferences under Objective Uncertainty
Jan. 13 Expected Utility Preferences under Objective Uncertainty (continued)
Jan. 15 Expected Utility Risk Preferences & Probabilistic Beliefs under Subjective Uncertainty
Jan. 20 E.U. Risk Preferences & Probabilistic Beliefs under Subjective Uncertainty (continued)
Jan. 22 Almost-Objective Uncertainty
Jan. 27 Analytics of Risk and Risk Aversion
Jan. 29 Analytics of Risk and Risk Aversion (continued)
Feb. 3  Applications of the Expected Utility Model
Feb. 5  (Thursday) Midterm Exam
Feb. 10 Assessing Preferences and Beliefs
Feb. 12 Evidence on the Shape of the Utility Function
Feb. 17 Evidence on the Underlying Assumptions of the Classical Model
Feb. 24 Generalized Expected Utility Analysis
Feb. 26 Dynamic Consistency and Intertemporal Choice
Mar. 2 Probabilistically Sophisticated Non-Expected Utility Maximizers
Mar. 4 Non-Probabilistic Models of Beliefs
Mar. 9 "Robustifying" the Classical Model of Risk Preferences and Beliefs
Mar. 11 (continued)
Mar. 15 (Monday) FINAL EXAM 11:30am – 2:30pm

READINGS: The readings will consist of handouts, expository articles, and "classic" articles from the literature. All readings will be distributed in advance of the lectures.

EXAMS: The course grade will be determined on the basis of a Midterm and a Final Exam. I will provide practice problems, and there will be review sessions before each exam.

ECONOMICS 201 OUTLINE

I. INTRODUCTION
   a. Preliminary Concepts in Probability Theory
      Probability Distributions, Probability Measures and Cumulative Distribution Functions
      Expected Value, Moments and Stieltjes Integrals
      Concave Functions, Convex Functions and Jensen’s Inequality
      Convolutions, Compound Lotteries and Probability Mixtures
   b. Simple Criteria for Choice Under Uncertainty
      First Order Stochastic Dominance Preference
      Expected Value Criterion and the St. Petersburg Paradox
      Mean-Variance Criterion
      Minimax and Minimax Regret Criteria
      "Safety-First" Criteria

II. EXPECTED UTILITY RISK PREFERENCES UNDER OBJECTIVE UNCERTAINTY
   a. The Structure of Expected Utility Preferences
      Outcome Sets, Lotteries, Choice Sets and Decision Trees
Preferences Functionals and von Neumann-Morgenstern Utility Functions
Properties of Expected Utility Preferences
The Triangle Diagram

b. Characterization of Expected Utility Preferences
Completeness and Transitivity
Mixture Continuity
The Independence Axiom
Expected Utility Representation Theorem

c. Expected Utility Preferences Over Unbounded Distributions
d. The Expected Utility Model - Origins and Historical Misconceptions

III. EXPECTED UTILITY RISK PREFERENCES & PROBABILISTIC BELIEFS UNDER SUBJECTIVE UNCERTAINTY

a. The State-Preference Framework
States, Events, Outcomes and Acts
Splicing Acts
Preference Functions over Subjective Acts

b. Expected Utility Preferences over Subjectively Uncertain Prospects
v-M Utility, Subjective Probability and Expected Utility Formulas
Properties of Expected Utility Preferences over Acts
Statewise/Eventwise Monotonicity
Weak Comparative Probability
Sure-Thing Principle (Separability across Events)
Savage's Theorem
The Hirshleifer-Yaari Diagram
Certainty Line, Fair-Odds Lines and Indifference Curves
Marginal Rates of Substitution and the Separability Property
"Local Risk Neutrality" at Certainty

c. Beliefs and the Hypothesis of Probabilistic Sophistication
"Separation of Preferences and Beliefs"
The Hypothesis of Probabilistic Sophistication
The Comparative Likelihood Relation

d. Savage's Joint Characterization of Subjective Probability and Expected Utility

e. State-Dependent Expected Utility Preferences
Motivation, Examples, and Applications
Violation of Probabilistic Sophistication and Indeterminacy of Beliefs

f. Expected Utility Preferences under Mixed Subjective-Objective Uncertainty

IV. "ALMOST-OBJECTIVE" UNCERTAINTY

a. Properties of "Purely Objective" vs. "Purely Subjective" Events
b. Almost-Objective Events, Acts and Mixtures
   Construction and Revealed Likelihood Properties of Almost-Objective Events
   Preferences over Almost-Objective Acts and Mixtures
   Why Don’t We See Almost-Objective Securities?
   “Objective vs. Subjective Events” rather than “Objective vs. Subjective Processes”

c. Extension to More General Events and State Spaces

V. ANALYTICS OF RISK AND RISK AVERSION
a. Certainty Equivalents, Risk Premiums and Attitudes Toward Risk
b. The Arrow-Pratt Characterization of Comparative Risk Aversion
   Comparative Risk Aversion
   Risk Aversion and Wealth
   Ross Characterization of Comparative Risk Aversion

c. Comparative Risk and the Theory of Stochastic Dominance
   First Order Stochastic Dominance
   Comparative Risk
   Second Order Stochastic Dominance
   Third Order Stochastic Dominance

d. Comparative Statics of Risk and Risk Aversion
   Results for Specific Functional Forms
   General Results
   Theory of Certainty Equivalence

e. Multivariate Risk and Risk Aversion
f. Risk and Risk Aversion under Subjective Uncertainty
   Risk Attitudes in the Hirshleifer-Yaari Diagram
      Risk Aversion, Risk Preference, and Comparative Risk Aversion
      Demand for a Risky Asset
      Risk Aversion and Wealth
   State-Dependent Risk and Risk Aversion

VI. APPLICATIONS OF THE EXPECTED UTILITY MODEL
a. Supply and Demand under Uncertainty
   Price and Non-Price Uncertainty
   Consumption/Savings Decisions
   Do Consumers Benefit from Price Instability?

b. Demand for Insurance
   Coinsurance
   Deductible Insurance
   Background Risk and Uninsurable Risk
   Self-Insurance vs. Self-Protection
c. Risk-Sharing and Markets for Risk
   Pareto Efficient Risk-Sharing
   Optimality of Deductible Insurance
   Markets for Contingent Claims

d. Demand for Information
   Value of Information
   Sequential Search

e. Measurement of Inequality

VII. ASSESSING RISK PREFERENCES AND BELIEFS
   a. Methodological Issues and Basic Techniques
      Verbal versus Choice-Based Elicitation
      Elicitation of Truthful Responses
      Income Effects
   b. Assessing von Neumann-Morgenstern Utility Functions
      Univariate Assessment Methods
      Recovery from Asset Demand Functions
      Multivariate Assessment Methods
   c. Assessing Subjective Probabilities
      Betting Odds and “Coherence”
      Scoring Rules

VIII. EVIDENCE ON THE SHAPE OF THE UTILITY FUNCTION
   a. Laboratory Evidence
      Typical Findings
      “Biases” in Utility Assessment
   b. Field Evidence
      Friedman-Savage Hypothesis
      Skewness Preference, Decreasing Absolute/Increasing Relative Risk
      Aversion
      Estimates of the Magnitude of Risk Aversion
   c. Asymptotic Properties of the Utility Function

IX. EVIDENCE ON THE UNDERLYING ASSUMPTIONS OF THE MODEL
   a. Evidence on the Independence Axiom
      “Allais Paradox” and the Common Consequence Effect
      Common Ratio Effect
      Oversensitivity to Changes in the Probabilities of Low Probability
      Events
      Utility Evaluation Effect
      Evidence on Betweenness
   b. Evidence on Transitivity

Threshold and Cyclic Effects

c. **Evidence on the Stability of Preferences**
   - Invariance of Risk Preferences to Initial Wealth
   - Framing Effects
   - Response Mode Effects and the Preference Reversal Phenomenon

d. **Evidence on the Existence and Use of Subjective Probabilities**
   - Heuristics in the Manipulation of Probabilities
   - The Ellsberg Paradox
   - Newcombe's Paradox

e. **Validity of the Evidence: Objections and Responses**
f. **Theoretically Induced Violations of Expected Utility**
   - Preferences over Delayed-Resolution Risks
   - Group Risk Preferences

X. **EXPECTED UTILITY VS. NON-EXPECTED UTILITY: AN INTRODUCTION**

a. **Preferences Under Objective Uncertainty**
   - Common Framework: Preference Functionals over Distributions
   - Key Difference: Linearity vs. Nonlinearity in the Probabilities

b. **Preferences Under Subjective Uncertainty**
   - Common Framework: Preference Functionals over Acts
   - Key Difference: Separability vs. Nonseparability across Events/States

c. **“Cardinal” vs. “Ordinal” Preferences under Certainty and Uncertainty**

XI. **NON-EXPECTED UTILITY MODELS OF PREFERENCES OVER LOTTERIES**

a. **Separable Functional Forms**
b. **Higher Moments of Utility and General Polynomial Forms**
c. **Weighted Utility**
d. **Rank-Dependent Models**
e. **Expected Regret/Skew-Symmetric Bilinear Preferences**
f. **Non-Expected Utility Preferences over Intertemporal Consumption Streams**

XII. **GENERALIZED EXPECTED UTILITY ANALYSIS**

a. **Smooth Preferences and the “Local Utility Function”**
   - Finite-Outcome Sets
   - Local Utility Function as a Variational Derivative
b. **Theoretical Analysis**
   - Stochastic Dominance Preference, Risk Aversion, and Comparative Risk Aversion
Comparative Statics

c. **Empirical Analysis**
   Skewness Preference and Hypothesis I
   “Fanning Out” and Hypothesis II
   Invariance of Gambling Preferences to Initial Wealth
   Unbounded Probability Distributions and the St. Petersburg Paradox

d. **Applications**
   Temporal Risk
   Cooperative Risk Sharing
   “Non-Utilitarian” Social Welfare Functions

XIII. **DYNAMIC CONSISTENCY AND INTERTEMPORAL CHOICE**

a. **Static, Dynamic and Intertemporal Choice Situations**

b. **Dynamic Arguments Against Non-Expected Utility Preferences**
   Argument that Non-Expected Utility Preferences are “Dynamically Inconsistent”
   Classical “Making Book” Argument against Non-Expected Utility Preferences
   Argument that Non-Expected Utility Maximizers will be “Averse to Information”

c. **Hidden Assumption in these Arguments: Consequentialism**


d. **Consequentialism is Inappropriate when Preferences Are Nonseparable**


e. **Dynamically Consistent Non-Expected Utility Maximizers**

f. **Issues in Modeling Nonseparable Preferences Under Uncertainty**

g. **Choice over Intertemporal Consumption Streams**

XIV. **PROBABILISTICALLY SOPHISTICATED NON-EXPECTED UTILITY MAXIMIZERS**

a. **Description and Properties**
   Natural Examples of Probabilistically Sophisticated Non-Expected Utility Preferences
   Do the Savage Axioms minus the Sure-Thing Principle imply Prob. Sophistication?

b. **Strong Comparative Probability Axiom**
   Comparison with the Sure-Thing Principle

c. **Characterization of Probabilistically Sophisticated Non-Expected Utility Preferences**

d. **Conditional Preferences and Conditional Probability**

e. **“Minimal” Conditions for Probabilistic Sophistication**
   The Horse-Roulette Replacement Axiom

f. **Meaning of “Bayesian Rationality”**

http://econ.ucsd.edu/~mmachina/courses/201/201.html
XVI. “ROBUSTIFYING” THE CLASSICAL MODEL OF RISK PREFERENCES & BELIEFS

a. The Calculus Approach to Robustness

b. Event-Theoretic Representation of the Classical Model

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