ECON 201

CHOICE UNDER UNCERTAINTY – CLASSICAL & CURRENT APPROACHES

Winter 2004	**T,Th 11:00 – 12:20pm**	**Econ 300**
Professor Mark Machina	**Economics Bldg. 217**	**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. 19	Expected Utility vs. Non-Expected Utility: An Introduction
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	"Robustifying" the Classical Model of Risk Preferences and Beliefs (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 UTILI 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"**

XVI. "ROBUSTIFYING" THE CLASSICAL MODEL OF RISK PREFERENCES & BELIEFS

a. The Calculus Approach to Robustness
b. Event-Theoretic Representation of the Classical Model