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.

DATE TOPIC
Mar. 31 Introduction & Preliminary Concepts
Mar. 31 Expected Utility Preferences under Objective Uncertainty
Apr. 7 Expected Utility Preferences under Objective Uncertainty (continued)
Apr. 7 Expected Utility Risk Preferences & Probabilistic Beliefs under Subjective Uncertainty
Apr. 14 E.U. Risk Preferences & Probabilistic Beliefs under Subjective Uncertainty (continued)
Apr. 14 Almost-Objective Uncertainty
Apr. 21 Analytics of Risk and Risk Aversion
Apr. 21 Analytics of Risk and Risk Aversion (continued)
Apr. 28 Applications of the Expected Utility Model
Apr. 28 (Thursday) Midterm Exam
May 5 Assessing Preferences and Beliefs
May 5 Evidence on the Shape of the Utility Function
May 12 Evidence on the Underlying Assumptions of the Classical Model
May 12 Expected Utility vs. Non-Expected Utility: An Introduction
May 19 Generalized Expected Utility Analysis
May 19 Dynamic Consistency and Intertemporal Choice
May 26 Probabilistically Sophisticated Non-Expected Utility Maximizers
May 26 Non-Probabilistic Models of Beliefs
June 2 “Robustifying” the Classical Model of Risk Preferences and Beliefs
June 2 “Robustifying” the Classical Model of Risk Preferences and Beliefs (continued)

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. A list of further readings appears at the end of this syllabus.

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.
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 overActs
   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 Maximators 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 Maximators
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”

XV. NON-PROBABILISTIC MODELS OF BELIEFS

a. Criteria for Choice Under Complete Ignorance
b. Slanted Probability Models
c. Multiple-Measure Models
d. Non-Additive Measures
e. Second Order Probabilities

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

a. The Calculus Approach to Robustness
b. Event-Theoretic Representation of the Classical Model
c. Phi-Derivatives and Local Robustness
   Local Event-Additivity and Phi-Derivatives
   Local Betting Preferences
   Local Probabilistic Sophistication
d. Global Robustness Results
   Path Integrals over Subjective Acts
   Non-Existence of Linear Paths
   Almost-Linear Paths and the Line Integral Approximation Theorem
e. Almost-Objective and Subjective Likelihood without Probabilistic Sophistication
f. Attitudes Toward Risk without Probabilistic Sophistication
READINGS (starred readings are required)

The following text chapters can serve as an excellent introduction to the field:


The following are some general texts, surveys and books of readings on choice under uncertainty:


I. INTRODUCTION (The following are some standard general texts on probability)


**II. EXPECTED UTILITY RISK PREFERENCES UNDER OBJECTIVE UNCERTAINTY**


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


IV. “ALMOST-OBJECTIVE UNCERTAINTY”

V. ANALYTICS OF RISK AND RISK AVERSION

VIa. APPLICATIONS OF EXP. UTILITY: SUPPLY & DEMAND UNDER UNCERTAINTY


**VIIb. APPLICATIONS OF EXPECTED UTILITY: DEMAND FOR INSURANCE**


**VIIc. APPLICATIONS OF EXP. UTILITY: RISK SHARING AND MARKETS FOR RISK**


**Applications of Expected Utility: Demand for Information**


**Applications of Expected Utility: Measurement of Inequality**


**Assessing Preferences and Beliefs**


**VIII. EVIDENCE ON THE SHAPE OF THE UTILITY FUNCTION**


**IX. EVIDENCE ON THE UNDERLYING ASSUMPTIONS OF THE EU MODEL**


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

The following readings are general surveys of non-expected utility theory:


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


**XII. GENERALIZED EXPECTED UTILITY ANALYSIS**


The following debate brought out some particularly evocative language by Professor Allais:


XIII. DYNAMIC CONSISTENCY AND INTERTEMPORAL CHOICE


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


**XV. NON-PROBABILISTIC MODELS OF BELIEFS**


ECONOMICS 201 REQUIRED READINGS PACKAGE:


