# ECONOMICS 171: DECISIONS UNDER UNCERTAINTY

**Winter 2009**

**Lectures:** Tu, Th 8:00-9:20am  
**York 2622**

**Prof:** Mark Machina  
**Office:** Economics Bldg 217  
**Office Hours:** Tu, Th 12-2pm

**TA:** Benjamin Horne  
**Economics Bldg 122**  
**Wed 1-3pm**

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You are responsible for all the material in the assigned chapters. I will also distribute additional required reading (Handouts 1–10) in class.

**EXAMS:** The course grade is determined on the basis of two Midterms and a Final Exam.

**COURSE WEB PAGE:** The course web page is at:  

This web page contains useful information and materials about the course, including Old Exam Questions and information about the exams.
This course will examine how economic agents make decisions under conditions of uncertainty. It will examine the various ways in which economists represent the phenomenon of uncertainty, the fundamental principles of choice under uncertainty, the concepts and measurement of “risk” and “risk aversion,” and the analysis of how these features influence economic behavior.

In the process of presenting this material, we will examine laboratory methods for eliciting and testing hypotheses about attitudes toward risk, the representation and elicitation of uncertain beliefs, intertemporal choice under uncertainty, psychological evidence and other “paradoxes” that attack the economic approach, and current research in light of this evidence.

Prerequisites: Econ 120A and Math 20F (Econ 100A or 170A also highly recommended).

I. INTRODUCTION: ASPECTS OF DECISION MAKING UNDER UNCERTAINTY
   a. Positive Decision Theory versus Normative Decision Theory
   b. The Representation of Uncertainty
      Objective Uncertainty: Outcomes, Probabilities, Lotteries, and Decision Trees
      Subjective Uncertainty: States, Events, Acts, and Payoff Tables
      Mixed Subjective-Objective Uncertainty: “Horse/Roulette Lotteries”
   c. Criteria for Choice under Uncertainty
      First Order Stochastic Dominance Preference
      The Expected Value Criterion
      The Mean-Variance Criterion
      Minimax and “Safety First” Criteria
      The Expected Utility Criterion

II. PRELIMINARY CONCEPTS IN PROBABILITY THEORY
   a. Probability Distributions and Cumulative Distribution Functions
   b. Expected Value, Variance and Skewness
   c. Concave Functions, Convex Functions and Jensen’s Inequality
   d. Conditional Probability and Bayes’ Law
   e. Compound Lotteries and Probability Mixtures

III. EXPECTED UTILITY RISK PREFERENCES UNDER OBJECTIVE UNCERTAINTY
   a. Expected Utility Preferences over Objective Lotteries
      von Neumann-Morgenstern Utility Functions and the Expected Utility Formula
      Properties of von Neumann-Morgenstern Utility Functions
      Properties of Expected Utility Preferences
      The Triangle Diagram
   b. The Axioms of Expected Utility Theory
      Completeness and Transitivity
      Mixture Continuity
      The Independence Axiom
   c. The Expected Utility Representation Theorem
   d. Expected Utility Preferences over Unbounded Probability Distributions
IV. EXPECTED UTILITY PREFERENCES UNDER SUBJECTIVE UNCERTAINTY
   a. The State-Preference Framework
      States, Events, Outcomes and Acts
   b. Expected Utility Preferences over Subjective Acts
      v-M Utility, Subjective Probability and Expected Utility Formulas
   c. The Hypothesis of Probabilistic Sophistication
   d. Properties of Expected Utility Preferences Over Subjectively Uncertain Acts
      Statewise/Eventwise Monotonicity
      The Comparative Likelihood Relation over Events
      Separability across Mutually Exclusive Events: The Sure-Thing Principle
   e. Savage’s Joint Characterization of Subjective Probability and Expected Utility
   f. State-Dependent Expected Utility Preferences
   g. Expected Utility Preferences under Mixed Subjective-Objective Uncertainty

V. 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
   c. Comparative Risk and the Theory of Stochastic Dominance:
      First Order Stochastic Dominance
      Comparative Risk
      Second Order Stochastic Dominance
      Skewness Preference and Third Order Stochastic Dominance
   d. Comparative Statics of Risk and Risk Aversion:
      Results for Specific Functional Forms
      General Results
   e. The Theory of Certainty Equivalence
   f. The Ross Characterization of Comparative Risk Aversion
   g. Multivariate Risk and Risk Aversion
   h. Risk and Risk Aversion in the State-Preference Framework

VI. TECHNIQUES FOR 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
VII. EVIDENCE ON THE SHAPE OF THE UTILITY FUNCTION

a. Laboratory Evidence:
   Typical Findings
   “Biases” in Utility Assessment

b. Field Evidence:
   The 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

VIII. EVIDENCE ON THE UNDERLYING ASSUMPTIONS OF THE MODEL

a. Evidence on the Independence Axiom:
   The “Allais Paradox” and the Common Consequence Effect
   The Common Ratio Effect
   Oversensitivity to Changes in the Probabilities of Low Probability Events
   The Utility Evaluation Effect
   Evidence on Betweenness

b. Evidence on Transitivity:
   Threshold and Cyclic Effects
   The Preference Reversal Phenomenon

c. Evidence on the Stability of Preferences:
   Invariance of Risk Preferences to Initial Wealth
   Framing Effects
   Response Mode Effects

d. Evidence on the Existence and Use of Subjective Probabilities:
   Heuristics in the Manipulation of Probabilities
   The “Ellsberg Paradox” and its Implications

e. The Validity of the Evidence: Objections and Responses

IX. NON-EXPECTED UTILITY MODELS OF PREFERENCES

a. Non-Expected Utility Preference Functions: An Introduction
b. Separable Functional Forms
c. Higher Moments of Utility
d. Weighted Utility
e. “Expected Utility with Rank-Dependent Probabilities”
f. Expected Regret
g. Generalized Expected Utility Analysis
   Local Utility Functions
   Generalizations of Expected Utility Theorems
   “Fanning Out” and Violations of the Independence Axiom

X. INTERTEMPORAL CHOICE AND DYNAMIC CONSISTENCY

a. Static, Dynamic and Intertemporal Choice Situations
b. Dynamic Arguments Against Non-Expected Utility Preferences
c. The Hidden Assumption in these Arguments: Consequentialism
d. Dynamically Consistent Non-Expected Utility Maximizers