ECON 281: SPECIAL TOPICS IN ECONOMICS ALTERNATIVE THEORIES OF CHOICE UNDER UNCERTAINTY

Winter 2014	T,Th 9:00-10:20am	Sequoyah 244
Prof. Mark Machina	Office: Econ 217	Office Hours: Wed 9:00-1:00

This course examines alternatives to the classic expected utility and subjective expected utility models of risk preferences and beliefs. It begins with an review of the classical models, presents the various systematic violations of them, and then presents and analyzes those alternatives which have been offered.

DATE	TOPIC
Jan. 7	Introduction & Preliminary Concepts
Jan. 9	Expected Utility Risk Preferences under Objective and Subjective Uncertainty
Jan. 14	Evidence on the Underlying Assumptions of the Classical Models
Jan. 16	Evidence on the Underlying Assumptions of the Classical Models (continued)
Jan. 21	Non-Expected Utility Models of Risk Preferences
Jan. 23	Non-Expected Utility Models of Risk Preferences (continued)
Jan. 28	Generalized Expected Utility Analysis
Jan. 30	Generalized Expected Utility Analysis (continued)
Feb. 4	Dynamic Consistency: Arguments and Counterarguments
Feb. 6	Dynamic Consistency: Arguments and Counterarguments (continued)
Feb. 11	(Tuesday) Midterm Exam
Feb. 13	Probabilistic Sophistication
Feb. 18	Probabilistic Sophistication (continued)
Feb. 20	Models of Ambiguity and Ambiguity Aversion
Feb. 25	Models of Ambiguity and Ambiguity Aversion (continued)
Feb. 27	Models of Ambiguity and Ambiguity Aversion (continued)
Mar. 4	Almost-Objective Uncertainty
Mar. 6	Almost-Objective Uncertainty (continued)
Mar.11	Subjective Expected Utility Analysis without the Sure-Thing Principle or Probabilistic Beliefs
Mar.13	Subjective Expected Utility Analysis w/o Sure-Thing Principle or Probabilistic Beliefs (cont.)
Mar.18	(Tuesday) FINAL EXAM 11:30am-2:30pm
	(Review Sessions will be scheduled prior to each exam.)

READINGS: The readings will consist of handouts, expository articles, classic articles from the literature and current research articles. I will make the required readings available via the web or printed handouts.

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 281 OUTLINE

Winter 2014

Mark Machina

I. INTRODUCTION & PRELIMINARY CONCEPTS

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. The Representation of Uncertainty

Objective Uncertainty: Outcomes, Probabilities and Lotteries Subjective Uncertainty: States, Events, Acts and Payoff Tables Mixed Subjective-Objective Uncertainty: "Horse/Roulette Lotteries" Two-Stage Uncertainty

c. Simple Criteria for Choice Under Uncertainty

First Order Stochastic Dominance Preference Expected Value Criterion and the St. Petersburg Paradox Mean-Variance Criterion Minimax and "Safety-First" Criteria

II. EXPECTED UTILITY PREFERENCES UNDER OBJECTIVE UNCERTAINTY

a. Expected Utility Preferences under Objective Uncertainty

Preferences Functions and von Neumann-Morgenstern Utility Functions Cardinal and Ordinal Aspects of Utility Functions Properties of Expected Utility Preferences The Triangle Diagram

b. Axiomatic Characterization of Expected Utility Preferences

Completeness and Transitivity Mixture Continuity The Independence Axiom Expected Utility Representation Theorem

III. 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. Evidence on the Shape of the Utility Function

Friedman-Savage Hypothesis Skewness Preference, Decreasing Absolute/Increasing Relative Risk Aversion

IV. EXPECTED UTILITY RISK PREFERENCES AND PROBABILISTIC BELIEFS UNDER SUBJECTIVE UNCERTAINTY

a. The State-Preference Framework

States, Events, Outcomes and Acts Preference Functions over Subjective Acts Objective:Subjective Uncertainty: Anscombe-Aumann Acts

b. Expected Utility Preferences over Subjectively Uncertain Prospects

Subjective Probability and Subjective Expected Utility 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 "Local Risk Neutrality" about Certainty

c. 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

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

Savage's Egg Example and Motivation of the Sure-Thing Principle

Savage's Axioms

Ordering and Nondegeneracy

Eventwise Monotonicity

Small Event Continuity

Weak Comparative Likelihood

Sure Thing Principle

Savage's Proof

e. Expected Utility Preferences under Mixed Subjective-Objective Uncertainty Anscombe-Aumann Acts

f. State-Dependent Expected Utility Preferences

Motivation, Examples, and Applications Violation Comparative Likelihood and Indeterminacy of Beliefs

V. 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

VI. EVIDENCE ON THE UNDERLYING ASSUMPTIONS OF THE CLASSICAL MODELS

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 Evidence on Betweenness

b. Evidence on Transitivity

Threshold and Cyclic Effects The Preference Reversal Phenomenon

c. Evidence on the Stability of Preferences

Stochastic Choice Invariance of Risk Preferences to Initial Wealth Framing Effects Response Mode Effects and the Preference Reversal Phenomenon

d. Evidence on the Magnitude of Risk Aversion

- e. Evidence on the Hypothesis of Probabilistic Sophistication: Ambiguity Aversion Ellsberg Urns and the Ellsberg Paradoxes
- **f. The Evidence from Psychologists** Framing and Reference Point Effects

g. Validity of the Evidence: Objections and Responses

h. Theoretically Induced Violations of Expected Utility Preferences over Delayed-Resolution Risks Group Risk Preferences

VII.NON-EXPECTED UTILITY MODELS OF OBJECTIVE RISK PREFERENCES

a. Preferences Under Objective Uncertainty

Common Framework: Preference Functionals over Distributions Key Difference From Expected Utility: Nonlinearity in the Probabilities

- **b. Separable Functional Form (original version of Prospect Theory)** Criticism of the Separable Form
- c. Higher Moments of Utility and General Polynomial Forms
- d. Weighted Utility and Karmarker's Model
- e. The Rank-Dependent Model
- f. The Dual Model
- g. Expected Regret/Skew-Symmetric Bilinear Preferences
- h. Experimental Tests of Non-Expected Utility Models

VIII. GENERALIZED EXPECTED UTILITY ANALYSIS

a. Smooth Preferences and the Local Utility Function

Finite-Outcome Sets: Local Utility Function as a Probability Derivative Continuum Outcome Sets: Local Utility Function as a Variational Derivative Local Utility Functions of Some Non-Expected Utility Functional Forms

b. Theoretical Analysis

Robustness of the Classical Analytics Outcome-Monotonicity and Outcome Derivatives Characterization of Risk Aversion Asset Demand and Insurance Characterization of 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 and Induced Preferences Cooperative Risk Sharing "Non-Utilitarian" Social Welfare Functions

IX. DYNAMIC CONSISTENCY: ARGUMENTS AND COUNTERARGUMENTS

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

X. PROBABILISTICALLY SOPHISTICATED NON-EXPECTED UTILITY MAXIMIZERS

a. Definition of Probabilistic Sophistication

Do the Savage Axioms minus the Sure-Thing Principle imply Prob. Sophistication?

b. Strong Comparative Probability Axiom

Comparison with the Sure-Thing Principle and Weak Comparative Probability Axiom Ellsberg Urns and the Strong Comparative Probability Axiom

c. Characterization of Probabilistically Sophisticated Non-Expected Utility Preferences

d. Conditional Preferences and Conditional Probability

- e. "Minimal" Conditions for Probabilistic Sophistication under Mixed Uncertainty The Horse-Roulette Replacement Axiom
- f. Meaning of "Bayesian Rationality"

XI. MODELS OF AMBIGUITY AND AMBIGUITY AVERSION

- a. Maxmin Expected Utility
- **b. Ordinal Certainty Equivalent Preferences**
- c. Vector Expected Utility
- d. Choquet Expected Utility
- e. The "Smooth Preferences" Model

- f. Variational Preferences
- g. Source Preference
- h. Critique of the Major Models: The Case of Three or More Outcomes
- i. Experimental Tests of Ambiguity Aversion Models

XII. ALMOST-OBJECTIVE UNCERTAINTY

- a. The Six Properties of Purely Objective Events
- b. Almost-Ethically-Neutral Events

c. Almost-Objective Events, Acts and Mixtures Definition of an Almost-Objective Event

Measure Properties of Almost-Objective Events Almost-Objective Acts and Mixtures

d. Preferences over Almost-Objective Acts

Revealed Beliefs over Almost-Objective Events Betting Preferences over Almost-Objective Acts and Mixtures Objective Risk Preferences Implied by Attitudes Toward Subjective Uncertainty

XIII. SUBJECTIVE EXPECTED UTILITY ANALYSIS WITHOUT THE SURE-THING PRINCIPLE OR PROBABILISTIC SOPHISTICATION

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 highly recommended)

In case you're not already familiar with them, the following text chapters can serve as an excellent inroduction to the field:

Kreps, D., A Course in Microeconomic Theory. Princeton Univ. Press, 1990, Ch. 3

Mas-Colell, A., M. Whinston & J. Green, Microeconomic Theory. Oxford Univ. Press, 1995, Ch. 6

Varian, H., Microeconomic Analysis, 3rd ed. W.W. Norton & Co., 1992, Ch. 11

The following are some texts and surveys of the material covered in this course

- Abdellaoui, M. and J. Hey (eds.) (2008). *Advances in Decision Making under Risk and Uncertainty*. Dordrecht: Springer.
- Camerer, C. and M. Weber (1992). "Recent Developments in Modeling Preferences: Uncertainty and Ambiguity," *Journal of Risk and Uncertainty* 5, 325-370.
- Edwards, W. (1992). *Utility Theories: Measurements and Applications*. Boston: Kluwer Academic Publishers.
- Eeckhoudt, L. and C. Gollier (1995). *Risk: Evaluation, Management and Sharing*. New York: Harvester Wheatsheaf. (English translation of 1992 French edition.)
- Epstein, L. (1992). "Behavior Under Risk: Recent Developments in Theory and Applications," in Laffont, J.-J. (ed.). Advances in Economic Theory, Vol. II. Cambridge University Press.
- Fishburn, P. (1988). Nonlinear Preference and Utility Theory. Baltimore: Johns Hopkins Univ. Press.
- Geweke, J. (ed.). (1992). Decision Making under Risk and Uncertainty: New Models and Empirical *Findings*. Dordrecht: Kluwer Academic Publishers.
- Hamouda, O. and J.C.R. Rowley (eds.) (1997b). *Paradoxes, Ambiguity and Rationality* (Vol. 2 of *Foundations of Probability, Econometrics and Economic Games*). Cheltenham, U.K.: Edward Elgar Publishing Ltd.
- Hey, J. and P. Lambert (eds.) (1987). Surveys in the Economics of Uncertainty. Oxford: Basil Blackwell Ltd.
- Karni, E. and D. Schmeidler (1991). "Utility Theory with Uncertainty," in Hildenbrand, W. and H. Sonnenschein (eds.). *Handbook of Mathematical Economics, Vol. IV.* Elsevier.
- Kelsey, D. and J. Quiggin (1992). "Theories of Choice Under Ignorance and Uncertainty," *Journal* of Economic Surveys 6, 133-153.
- Kischka, P. and C. Puppe (1992). "Decisions under Risk and Uncertainty: A Survey of Recent Developments," *Mathematical Methods of Operations Research* 36, 125-147.
- Kreps, D. (1988). Notes on the Theory of Choice. Boulder, Col.: Westview Press.
- Machina, M. (1987). "Choice Under Uncertainty: Problems Solved and Unsolved," *Journal of Economic Perspectives*, Summer 1987.
- Machina, M. "Non-Expected Utility Theory," in *The New Palgrave Dictionary of Economics, 2nd Edition*, Steven N. Durlauf and Lawrence E. Blume (eds.), Palgrave Macmillan.
- McKenna, C. (1986). The Economics of Uncertainty. New York: Oxford University Press.

- Munier, B. (1989). "New Models of Decision under Uncertainty: An Interpretive Essay," *European Journal of Operations Research* 38, 307-317.
- Pratt, J., H. Raiffa and R. Schlaifer (1995). *Introduction to Statistical Decision Theory*. Cambridge, Mass.: MIT Press.
- Siniscalchi, M. (2008). "Ambiguity and Ambiguity Aversion," in the *New Palgrave Dictionary of Economics*, 2nd Edition, Ed. Steven N. Durlauf and Lawrence E. Blume, Palgrave Macmillan.
- Starmer, C. (2000). "Developments in Non-Expected Utility Theory: The Hunt for a Descriptive Theory of Choice Under Risk," *Journal of Economic Literature* 38, 332-382.
- Sugden, R. (1986). "New Developments in the Theory of Choice Under Uncertainty," *Bulletin of Economic Research* 38, 1-24.
- Wakker, P. (2008). "Uncertainty," in in the *New Palgrave Dictionary of Economics*, 2nd Edition, Ed. Steven N. Durlauf and Lawrence E. Blume, Palgrave Macmillan.
- Wakker, P. (2010). *Prospect Theory: For Risk and Ambiguity*. Cambridge: Cambridge University Press.
- Weber, M. and C. Camerer (1987). "Recent Developments in Modeling Preferences under Risk," *OR Spektrum* 9, 129-151.
- **I. INTRODUCTION** The following are some standard on probability. (You presumably know all the probability theory that will be used in this course)
 - Billingsley, P. (1986). Probability and Measure, 2nd Ed. New York: John Wiley and Sons.
 - Feller, W. (1968). An Introduction to Probability Theory and Its Applications, Volume I, 3rd Ed. New York: John Wiley & Sons.
 - Feller, W. (1971). An Introduction to Probability Theory and Its Applications, Volume II, 2nd Ed. New York: John Wiley & Sons.
- Parzen, E. (1960). Modern Probability Theory and Its Applications. New York: John Wiley & Sons.

II. EXPECTED UTILITY PREFERENCES UNDER OBJECTIVE UNCERTAINTY

- Arrow, K. (1951). "Alternative Approaches to the Theory of Choice in Risk-Taking Situations," *Econometrica* 19, 404-437.
- Bernoulli, D. (1738). "Specimen Theoriae Novae de Mensura Sortis," Commentarii Academiae Scientiarum Imperialis Petropolitanae [Papers of the Imperial Academy of Sciences in Petersburg] V, 175-192. English translation: "Exposition of a New Theory on the Measurement of Risk," Econometrica 22 (1954), 23-36.
- Fishburn, P. and P. Wakker (1995). "The Invention of the Independence Condition for Preferences," *Management Science* 41, 1130-1144.
- * Friedman, M. and L. Savage (1948). "The Utility Analysis of Choices Involving Risk," *Journal of Political Economy* 56, 279-304.
 - Hammond, P. (1998). "Objective Expected Utility," in Barberá, S., P. Hammond and C. Seidl (1998). *Handbook of Utility Theory. Volume 1: Principles.* Dordrecht: Kluwer Academic Publishers.

- * Herstein, I. and J. Milnor (1953). "An Axiomatic Approach to Measurable Utility," *Econometrica* 21, 291-297.
- * Machina, M. (1988). "Expected Utility Hypothesis," in John Eatwell, Murray Milgate and Peter Newman, Macmillan (eds.) *The New Palgrave: A Dictionary of Economics*.
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 - Pratt, J., H. Raiffa and R. Schlaifer (1964). "The Foundations of Decision Under Uncertainty: An Elementary Exposition," *Journal of the American Statistical Association* 59, 353-375.
 - Samuelson, P. (1950). "Probability and the Attempts to Measure Utility," *Economic Review* 1, 167-173.
- * Samuelson, P. (1952). "Probability, Utility, and the Independence Axiom," *Econometrica* 20, 670-678.
 - Samuelson, P. (1952). "Utility, Preference, and Probability," (Abstract of a paper given at the conference on "Les Fondements et Applications de la Théorie du Risque en Econométrie," Paris).
 - Neumann, J. and O. Morgenstern (1944). *Theory of Games and Economic Behavior*. Princeton: Princeton University Press. (2nd Ed. 1947; 3rd Ed. 1953).

III. ANALYTICS OF RISK AND RISK AVERSION

- Arrow, K. (1974). "The Theory of Risk Aversion," in *Essays in the Theory of Risk-Bearing*. Amsterdam: North-Holland Publishing Company.
- Bardsley, P. (1991). "Global Measures of Risk Aversion," Journal of Economic Theory 55, 145-160.
- Diamond, P. and J. Stiglitz (1974). "Increases in Risk and in Risk Aversion," *Journal of Economic Theory* 8, 337-360.
- Karni, E. (1983). "Risk Aversion for State Dependent Utility Functions: Measurement and Applications," *International Economic Review* 24, 637-647.
- Karni, E. (1985). Risk Aversion with State-Dependent Preferences: Some Economic Applications," Chapter 3 of Karni (1985).
- Kimball, M. (1990). "Precautionary Saving in the Small and in the Large," Econometrica 58, 53-73.
- Levy, H. (1992). "Stochastic Dominance and Expected Utility: Survey and Analysis," *Management Science* 38, 555-593.
- Machina, M. and J. Pratt, (1997). "Increasing Risk: Some Direct Constructions," *Journal of Risk* and Uncertainty 14, 103-127.
- Machina, M. and M. Rothschild (1988). "Risk," in John Eatwell, Murray Milgate and Peter Newman, Macmillan (eds.) *The New Palgrave: A Dictionary of Economics*.
- Pratt, J. (1964). "Risk Aversion in the Small and in the Large," *Econometrica* 32, 122-136.
 Pratt, J. and R. Zeckhauser (1987). "Proper Risk Aversion," *Econometrica* 55, 143-154.
- * Rothschild, M. and J. Stiglitz (1970). "Increasing Risk: I. A Definition," *Journal of Economic Theory* 2, 225-243. [Alternatively, read Machina & Rothschild (1988)]

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- Yaari, M. (1969). "Some Remarks on Measures of Risk Aversion and On Their Uses," *Journal of Economic Theory* 1, 315-329.

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IV. EXPECTED UTILITY RISK PREFERENCES AND PROBABILISTIC BELIEFS UNDER SUBJECTIVE UNCERTAINTY

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 - Fishburn, P. (1969). "A General Theory of Subjective Probabilities and Expected Utilities," *Annals of Mathematical Statistics* 40, 1419-1429.
- * Hammond, P. (1998). "Subjective Expected Utility," in Barberá, S., P. Hammond and C. Seidl (1998). *Handbook of Utility Theory. Volume 1: Principles*. Dordrecht: Kluwer Academic Publishers.
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 - Kyburg, H. and H. Smokler (eds.) (1980). *Studies in Subjective Probability, 2nd Ed.* Huntington, New York: Robert E. Krieger Publishing Co.
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 - Myerson, R. (1979). "An Axiomatic Derivation of Subjective Probability, Utility, and Evaluation Functions," *Theory and Decision* 11, 339-352.
- * Savage, L. (1954). *The Foundations of Statistics*. New York: John Wiley and Sons. Revised and Enlarged Edition, New York: Dover Publications, 1972. [Chapter 2]

Suppes, P. (1956). "The Role of Subjective Probability and Utility in Decision Making" Proceedings of the Third Berkeley Symposium on Mathematical Statistics and Probability, 1954-1955, 5, 61-73.

V. ASSESSING RISK PREFERENCES AND BELIEFS

- * Becker, G., M. DeGroot and J. Marschak (1964). "Measuring Utility by a Single-Response Sequential Method," *Behavioral Science* 9, 226-232.
 - DeGroot, M. (1970). Optimal Statistical Decisions. New York: McGraw-Hill. Chapter 6.
 - Farquhar, P. (1984). "Utility Assessment Methods," Management Science 30, 1283-1300.
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 - Hogarth, R. (1975). "Cognitive Processes and the Assessment of Subjective Probability Distributions," *Journal of the American Statistical Association* 70, 271-289.
 - Hull, J., P. Moore and H. Thomas (1973). "Utility and its Measurement," *Journal of the Royal Statistical Society, Series A* 136, 226-247.
 - Savage, L. (1971). "The Elicitation of Personal Probabilities and Expectations," *Journal of the American Statistical Association* 66, 783-801.

VI. EVIDENCE ON THE UNDERLYING ASSUMPTIONS OF THE CLASSICAL MODELS

- Allais, M. (1953a). "Fondements d'une Théorie Positive des Choix Comportant un Risque et Critique des Postulats et Axiomes de l'Ecole Américaine," *Econométrie*, Colloques Internationaux du Centre National de la Recherche Scientifique, Paris 40, 257-332.
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- * Birnbaum, M. (2008). "New Paradoxes of Risky Decision Making," *Psychological Review* 115, 463-501.
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- * Birnbaum, M. and W. McIntosh (1996). "Violations of Branch Independence in Choices Between Gambles," *Organizational Behavior and Human Performance* 67, 91-110.
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Halevy, Y. (2007). "Ellsberg Revisited: An Experimental Study," Econometrica 75, 503-536.

- Heath, C. and A. Tversky (1991). "Preferences and Belief: Ambiguity and Competence in Choice Under Uncertainty," *Journal of Risk and Uncertainty* 4, 5-28.
- * Hey, J. and D. di Cagno (1990). "Circles and Triangles: An Experimental Estimation of Indifference Lines in the Marschak-Machina Triangle," *Journal of Behavioral Decision Making* 3, 279-306.
- * Kahneman, D. and A. Tversky (1979). "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica* 47, 263-291.
- * Keller, R. (1985). "The Effects of Problem Representation on the Sure-Thing and Substitution Principles," *Management Science* 31, 738-751.
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