

## **AGRICULTURAL ECONOMICS 613**

### **INTRODUCTION TO ECONOMICS OF RISK**

#### Syllabus

3 credits, 3 hrs. of lecture:

Prerequisites: STAT 511 (basic statistics), ECON 511 (intermediate micro theory), AGECE 552 (math programming), or equivalent.

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#### Description and Objectives

The course is an introduction to the economics of risk. It emphasizes the expected utility hypothesis and individual decision making. It will be oriented toward providing a background in expected utility theory and application from which students can move on to applications and more advanced work in their fields of specialty. The course is presented at a level that can be handled by agricultural economics master's students who have had intermediate microeconomic theory.

#### Grading

Homework and class participation 50%

Final exam 50%

#### Term Paper or Presentation

Students are required to do an acceptable paper or presentation. The project or presentation is not intended to be a huge deal. I want you to do something outside of what is covered in class. Some examples: review several articles on a topic, do something empirical, or give a 20 minute presentation to the class on something you are doing or have done in the area of risk. Many students in the past have presented their MS thesis work if it has something to do with risk, or you may present something you are working out for your dissertation if it has something to do with risk. I will be flexible and most students choose the presentation option, but a paper is equally acceptable. Presentations are usually the last couple of weeks of class, but you may do it earlier.

#### Office Hours

Stop by my office or e-mail for an appointment. The other class I teach (AGECE 424) meets MWF 1:30 to 2:20 and has three two-hour labs, which begin on Thursdays at 7:30, 1:30 and 3:30, so I won't be in my office at those times. I check email often so that is the first choice to contact me.

## COURSE OUTLINE

**Class 1&2: Introduction:** Expected Utility Hypothesis, Axioms, Proof of EUH, uniqueness of utility, EUH history

Readings: 1 (pp. 77-85)

**Classes 3 through 7: Technical Aspects of Risk:** indirect utility; risk aversion; certainty equivalent; risk premium; insurance premium; maximum bid; absolute and relative risk aversion; increasing, constant, and decreasing absolute and relative risk aversion; units of risk aversion; bounded utility; uncertain vs. certain initial wealth; investor behavior and risk aversion; utility of wealth vs. income; log utility and geometric mean; utility functional forms; getting  $U(W)$  from  $r(W)$ .

Readings: 1, 3-6, 11

**Class 8:** Utility function elicitation, Joint estimation of technology and risk preferences

Reading: 12, 13

**Class 9 and 10:** Review of probability, Expected utility and moments, example extension application AgRisk, price and yield uncertainty

Reading: 15

**Class 11 & 12:** Stochastic Dominance

Readings: 23, 24, 27

**Class 13 & 14:** Mean-Variance Model

Readings: 31-32

**Class 15:** Riskless Assets: MV Separation Theorem, Stochastic Dominance with a riskless asset

Readings: 36, 39, 40

**Class 16 & 17:** Covariance Risk, Diversification, Single Index Model

Readings: 48-50

**Class 18:** MOTAD, Target MOTAD

Readings: 44-46

**Class 19:** CAPM

Readings: 51-52

**Class 20:** Increasing Risk I

Readings: 54

**Class 21:** Lexicographic Utility and Safety First

Readings: 56

**Class 22:** GAMS problems

**Class 23 & 24:** Production under Risk

Readings: 60

**Class 25:** Increasing Risk II

Reading: 55

**Class 26:** Time, Risk, and Related Issues

Reading: 64

**Class 27 & 28:** Discrete Stochastic Programming

Readings: 66

**Class 29:** Failures of Expected Utility Theory (Anomalies and Prospect Theory)

Readings: 73, 77

**Class 29:** State Preference Theory

Readings: 79

**Class 30:** Review of EUH (2018 – We didn't get to this topic the last time the course was taught, so I may bring a couple of quotes from the readings to class the first week.)

Readings: 73

## **AGEC 613 Readings**

Most of the journal articles are available on-line, so I assume you can find them, but let me know if you can't find a journal article. The bold readings are the most important in each section. We will discuss how to acquire the book chapters in class.

### **Introduction**

1. **Copeland and Weston, Financial Theory and Corporate Policy, Chapter 4, pp. 77-108.**
2. Luce and Raiffa, Games and Decisions, Chapter 2, pp. 12-38.

### **Technical Aspects of Risk**

3. **Levy and Sarnat, Portfolio and Investment Selection: Theory and Practice, Chapters 4 and 5.**
4. **Robison and Barry, The Competitive Firm's Response to Risk, Chapters 1, 2, and 3.**
5. **Pratt, "Risk Aversion in the Small and in the Large", Econometrica, Vol. 32, No. 12 (January-April 1964), pp. 122-136.**
6. **Arrow, "The Theory of Risk Aversion," Ch. 3 in Essays in the Theory of Risk Bearing.**
7. Raskin and Cochran, " Interpretations and Transformations of Scale for the Pratt-Arrow Absolute Risk Aversion Coefficient: Implications for Generalized Stochastic Dominance," **Western Journal of Agricultural Economics**, 11(2): 204-210
8. Mossin, Jan, "Optimal Multiperiod Portfolio Policies" J. of Business, April 1968, pp. 215-229.
9. Keeney & Raiffa. Decisions with Multiple Objectives: Preference and Value Trade Offs, Chapter 4.
10. Ingersoll **Theory of Financial Decision Making**, Rowman and Littlefield, 1987
11. Saha, Atanu. "Expo-Power Utility: A 'Flexible' Form for Absolute and Relative Risk Aversion," **Am. J. Agr. Econ.** November 1993, pp. 905-913

### **Measuring Risk Attitudes**

12. **Anderson, Dillon, and Hardaker, Ag Decision Analysis, Chapter 4.**
13. **Saha, Atanu, C. Richard Shumway and Hovav Talpaz, "Joint Estimation of Risk Structure and Technology Using Expo-Power Utility: Am. J. Agr. Econ., 76(May 1994):173-84.**
14. Cochran, M. J., P. Zimmer, S. C. Goh, N. D. Stone, T. Toman, and G. L. Helms. "An Expert System to Elicit Risk Preferences: The Futility of Utility Revisited?" **Computers and Electronics in Agriculture**. 4(1990):361-375.

Numerous other references on measuring risk aversion and utility will be distributed in a pdf file.

### **Review of Probability**

15. **Anderson, Dillon, and Hardaker, Ag Decision Analysis, Chapter 1 and 2.**
16. Taylor, C.R., "Two Practical Procedures of Estimating Multivariate NonNormal Errors," **Am. J. Agr. Econ.** 72(Feb 1990): 210-17.
17. Moss and Shonkwiler, "Estimating Yield Distributions with a Stochastic Trend and Nonnormal Errors," **Am. J. Agr. Econ.** 75(Nov. 1993)1056-62.
18. Ramirez, Moss, and Boggess, "Estimation and Use of the Inverse Hyperbolic Sine Transformation to model Non-Normal Correlated Random Variates," **J. Appl. Stat.** 21(Dec 1994): 289-304.
19. Ramirez "Estimation and Use of a Multivariate Parametric Model for Simulating Heteroskedastic, Correlated, Nonnormal Random Variables: The Case of Corn Belt Corn, Soybeans, and Wheat Yields," **Am. J. Agr. Econ.** 79(Feb 1997):191-205.
20. Paul W. Gallagher, U. S. Corn Yield Capacity and Probability: Estimation and Forecasting with Non-symmetric Disturbances *North Central Journal of Agricultural Economics* , Vol. 8, 1, pp. 27, January, 1986 (paper on negatively skewed corn yields)
21. Paul W. Gallagher, U.S. Soybean Yields: Estimation and Forecasting with Non-symmetric Disturbances *American Journal of Agricultural Economics* , Vol. 69, 4, pp. 796-803, November, 1987 (paper on negatively skewed soybean yields)
22. Just, Richard E. and Quinn Weniger. "Are Crop Yields Normally Distributed?" **Am. J. Agr. Econ.** 81(May 1999):287-304.

### **Stochastic Dominance**

Basic Stochastic Dominance

23. **Hanoch and Levy, "The Efficiency Analysis of Choices Involving Risk", Rev. of Econ. Studies, 1969, pp. 335-346.**
24. **Levy and Sarnat, Portfolio and Investment Selection, Chapter 6, "The Efficiency Analysis of Investment Under Uncertainty: Stochastic Dominance Rules".**

Nth Order Stochastic dominance

25. Ingersoll, Theory of Financial Decision Making, Appendix to Chapter 5, pp. 137-39 "Stochastic Dominance".

Stochastic Dominance with Respect to a Function

a. Theory

26. Meyer, J. "Choice Among Distributions", Journal of Economic Theory 14(1977):326-336.

27. **Meyer, J. "Second Degree Stochastic Dominance With Respect to a Function", International Economic Review, 18(1977):477-487.**

b. Application

28. King and Robison, "An Interval Approach to Measuring Decision Maker Preferences", Am. J. Agr. Econ., 63(1981):510-20.

29. King & Robison, "Implementation of the Interval Approach to the Measurement of Decision Maker Preferences," Mich. State U., Ag. Exp. Sta. Research Report #418, E. Lansing, MI, November 1981.

c. A computer program

30. Goh, Shih, Cochran, Raskin, "A Generalized Stochastic Dominance Program for the IBM PC", Southern Journal of Agricultural Economics, December 1989, pp. 175-182. (These authors also have a U of Arkansas bulletin on the program.)

### **Mean-Variance**

31. **Turvey, Baker, Weersink, "Farm Operating Risk and Cash Rent Determination", Journal of Agricultural and Resource Economics, 1992.**

32. **Levy and Sarnat, Portfolio and Investment Selection: Theory and Practice, Chapters 7, 8, 9.**

33. Levy and Sarnat, Capital Investment and Financial Decision, Chapter 11, "Decreasing Risk by Diversification: The Portfolio Approach".

34. Meyer, Jack, 1989. "Two-Moment Decision Models and Expected Utility Maximization: Reply," American Economic Review, vol. 79(3), pages 603, June.

35. Haim Levy Two-Moment Decision Models and Expected Utility Maximization: Comment The American Economic Review, Vol. 79, No. 3. (Jun., 1989), pp. 597-600.

### **MV with a Riskless Asset (Separation Theorem)**

36. **Johnson, S.R. "A Re-examination of the Farm Diversification Problem", J. of Farm Economics, 49(1967) :610-621.**

37. Tobin, J. "Liquidity Preference as Behavior Towards Risk", Rev. of Econ. Studies, (Feb. 1958), pp. 65-86.

38. McCarl and Spreen have a MV example program in their Chapter 14 – Risk Modeling <http://agecon2.tamu.edu/people/faculty/mccarl-bruce/mccspr/new14.pdf>

### **SD with a Riskless Asset**

39. **Levy and Kroll, "Ordering Uncertain Options with Borrowing and lending", The Journal of Finance, Vol. 33, No. 2. (May, 1978), pp. 553-574.**

40. Levy and Kroll, "Efficiency Analysis with Borrowing and Lending: Criteria and their Effectiveness", Review of Econ. and Statistics, Feb. 1979, pp. 179-205.
41. Levy and Kroll, "Stochastic Dominance With a Riskless Asset: An Imperfect Market", J. of Financial and Quantitative Analysis, June 1979, pp. 179-205.
42. Gloy, Brent A. and Baker, Timothy G., "The Importance of Financial Leverage and Risk Aversion in Risk-Management Strategy Selection." American Journal of Agricultural Economics, Vol. 84, pp. 1130-1143, 2002
43. Haim Levy, "Stochastic Dominance: Investment Decision Making under Uncertainty " Springer; 2nd ed. edition (February 23, 2006) | ISBN:0387293027

### MOTAD

44. Hazell, P.R.B. "A Linear Alternative to Quadratic and Semivariance Programming for Farm Planning Under Uncertainty", Am. J. Agr. Econ., Feb. 1971, pp. 53-61.
45. P. Barry, editor, Risk Management in Agriculture, Chapters 9 and 10.
46. Tauer, L.W. "Targt MOTAD", Am. J. Agr. Econ. 15(1983):606-610.
47. McCarl and Spreen have a MOTAD examples in their Chapter 14 – Risk Modeling <http://agecon2.tamu.edu/people/faculty/mccarl-bruce/mccspr/new14.pdf>

### Single Index Model

48. Sharpe, William F. "A Simplified Model for Portfolio Analysis" Management Science Jan. 1963, pp. 277-293.
49. Collins and Barry, "Risk Analysis With Single-Index Portfolio Models: An Application to Farm Planning", Am. J. Agr. Econ., Feb. 1986, pp. 152-161.
50. Turvey, C.G., H.C. Driver, and T.G. Baker, "Systematic and Nonsystematic Risk in Farm Portfolio Selection", Am. J. Agr. Econ., Nov. 1988, pp. 831-836.

### CAPM

51. Copeland and Weston, Financial Theory and Corporate Policy, Chapter 7, "Market Equilibrium: CAPM and APT".
52. Levy and Sarnat, Portfolio and Investment Selection: Theory and Practice, Chapter 11, "The Capital Asset Pricing Model (CAPM): Price Determination in the Stock Market".
53. Barry, P. J. "Capital Asset Pricing and Farm Real Estate" AJAE. 62(1980): 549-553

### Increasing Risk

54. Rothschild and Stiglitz, "Increasing Risk: I. A Definition", Journal of Economic Theory, 1970, pp. 225-243.

55. Rothschild and Stiglitz “Increasing Risk II: Its Economic Consequences, **J. Econ. Theory**, (1971), pp. 6684.

### **Lexicographic Utility and Safety First**

56. **Barry, P.J., editor, Risk Management in Agriculture, Chapter 2 (pp. 19-21), and Chapter 5.**
57. Robison and Barry, **The Competitive Firm’s Response to Risk:** Chapter 14.
58. Kataoka, S. “A Stochastic Programming Model: **Econometrica** 31(1968):181-196.
59. Roy, A. D. “Safety-First and the Holding of Assets” **Econometrica** 20(1952):431-449.
60. Telser, L. “Safety-First and Hedging” **Review of Economic Studies** 23(1955-1956):1-16.
61. Charnes, A. and W.W. Cooper, “Chance Constrained Programming”, **Management Science** 6(1959):73-79.

### **Production Under Risk**

62. **Anderson, Dillon and Hardaker, Ag Decision Analysis, Chapter 6, “Production Under Risk”.**

### **Time, Risk and Related Issues**

63. Hertzler, Greg. (1997). A new theory for explaining the paradoxes in decision making under risk and for measuring time and risk preferences. In **Risk management strategies in agriculture; State of the art and future perspectives** edited by R. Huirne, J. Hardaker and A. Dijkhuizen 1997, Mansholt Studies 7, Backhuys Publishers, Leiden, 319 pp.
64. **Ingersol, Theory of Financial Decision Making, pp 43-44, Chapter 10 “Intertemporal Models in Finance,” and Appendix A to chapter 11.**
65. Schnitkey and Novak. “Alternative Formulations of risk Preferences in Dynamic Investment Models,” S-232 Proceedings 1994, Iowa State University.

### **Discrete Stochastic Programming (Stochastic Programming with Recourse)**

66. **Featherstone, Preckel, and Baker, “Modeling Farm Financial Decisions in a Dynamic and Stochastic Environment”, Agr. Finance Rev. 50(1990):80-99.**
67. Cocks, “Discrete Stochastic Programming”, **Management Science** 15(1968):72-79.
68. Rae, A.N. “An Empirical Application and Evaluation of Discrete Stochastic Programming in Farm Management”, **Amer. J. Agr. Econ.** 53(1971):625-638.
69. Rae, “Stochastic Programming, Utility, and Sequential Decision Problems in Farm Management”, **Am. J. Agr. Econ.** 53(1971):448-60.



70. Krause, Deuson, Baker, Preckel, Lowenberg-DeBoer, Reddy, and Maliki, "Risk sharing Versus Low-Cost Credit Systems for International Development", **Am. J. Agr. Econ.** Nov. 1990, pp. 911-922.
71. Turvey and Baker, "A Farm-Level Financial Analysis of Farmers' Use of Futures and Options Under Alternative Farm Programs", **Am. J. Agr. Econ.**, Nov. 1990, pp. 946-957.
72. Chapter XIV Risk Modeling of McCarl and Spreen  
Download page: <http://agecon2.tamu.edu/people/faculty/mccarl-bruce/books.htm>  
Specific chapter:  
<http://agecon2.tamu.edu/people/faculty/mccarl-bruce/mccspr/new14.pdf>

### **Failures of the EUH**

#### **a. Shoemaker**

73. Schoemaker, Paul, "The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations", **J. Econ. Lit.** June 1982, pp. 529-63

#### **b. Machina**

74. Machina, Mark, J., "Choice Under Uncertainty: Problems Solved and Unsolved," **Economic Perspectives**, volume 1, number 1, summer, 1987, pp. 121-154

#### **c. Allais Paradox**

75. Allais, M. (1953). "Le comportement de l'homme rationnel devant le risque: critique des postulats et axiomes de l'école Américaine". *Econometrica* 21 (4): 503–546.  
[JSTOR 1907921](https://www.jstor.org/stable/1907921)

Don't tell anyone but I recommend the Wikipedia entry on this topic:  
[http://en.wikipedia.org/wiki/Allais\\_paradox](http://en.wikipedia.org/wiki/Allais_paradox)

#### **d. Kahneman and Tversky: Prospect theory**

76. Collins, W. Musser, and R. Mason, "Prospect Theory and Risk Preferences of Oregon Seed Producers", **Am. J. Agr. Econ.**, May 1991, pp. 429-35.
77. Kahneman, and Tversky, "Prospect Theory: An Analysis of Decision Under Risk", **Econometrica** 47(1979)263-91.

### **State Preference Theory**

78. Copeland and Weston, **Financial Theory and Corporate Policy**, Ch. 5, "State-Preference Theory", pp. 109-139.
79. Arrow, "The Role of Securities in the Optimal Allocation of Risk-Bearing", **Review of Economic Studies**, pp. 91-96

### **Review of EUH**

80. Anderson, Dillon, Hardaker, "Farmers and Risk", Invited paper at the XIX International Conference of Agricultural Economists, Aug. 26-Sept. 4, 1985, Malaga, Spain, pp. 1-10.