Syllabus for
Applied Simulation for Economic Analysis
Agricultural Economics 643
Tues & Thurs 12:45 - 2:00 p.m.
Room 111B&C AGLS
Fall 2017

Academic Integrity Statement

"An Aggie does not lie, cheat, or steal or tolerate those who do." For more information regarding the Honor Council Rules and Procedures refer to the website at http://www.tamu.edu/aggiehonor

Purpose

The purpose of the course is to teach graduate students how to design, construct, use, and evaluate simulation models of economic systems. The course is designed to use a combination of class lectures and home works where the students develop Monte Carlo simulation models of economic systems. Emphasis will be on students learning how to apply their training in economic theory, econometrics, statistics, and knowledge of real world problems to the analysis of risk for improving economic decisions.

Simulation models will be developed using Excel so the need to learn a programming language is largely eliminated. The mathematical functions in Excel and special stochastic simulation functions in Simetar will be used to develop, simulate, and evaluate complex applied problems. Emphasis will be on learning how the pre-programmed functions in Simetar work and how to apply them to perform complex stochastic simulation analyses if you do not have Simetar.

Parameter estimation for Univariate and Multivariate distributions will be covered for both Normal and Non-Normal distributions. Special problems associated with stochastic simulation of econometric models will be covered as well as using optimal control theory techniques to optimize non-linear simulation models.

Prerequisite(s)

AGEC 661
ECMT 676 or Stat

Grades

Four or five homework problems will be assigned during the semester. These assignments are to be completed on your own unless otherwise arranged. Collaboration with other students will be dealt with according to University policies for cheating. There will be two exams with one coming in October and the other during Finals week. The term paper will consist of an original research problem that is written in AJAE format and style. You shall identify the problem, review the literature, state the objective, describe the methodology, develop the model, estimate the parameters, present the estimated model, the simulation results, and validation statistics. Each student must work independently on their own paper. Students are encouraged to collaborate with the instructor, their academic advisor and other students, but the end product must be their own work.

Grades will be computed using the following formula:

30%	Exam 1
30%	Exam 2
15%	Home works
20%	Term Paper (See last page for more information)
5%	Term paper progress report due November 13, see the next to the last page for more information

Textbook

Richardson, J.W. "Simulation for Applied Risk Management," January 2010. This is the required text for the class. The book is provided free on the class website: www.afpc.tamu.edu/courses/643 under the tab for Simetar manuals.

Instructors:	James Richardson, Henry Bryant, and Alek Maisashvili
Office:	Suite 351 AGLS
Phone No.:	845-5913
e-mail:	jwrichardson@tamu.edu, hbryant@afpc.tamu.edu, and amaisashvili@ag.tamu.edu

Office hours: Tuesday and Thursday 8 - 11 am

Topics and Readings: The italicized readings listed below are required. The others are for your education. Each lecture will be recorded and made available on the class website at: http://www.afpc.tamu.edu/courses/643/. A password is required to access the videos. The password will be given out in class. Publications in italics are required readings.

* indicates **required** reading

Week 1	**Introduction, Risk, Models and Simetar**
* *Textbook Chapters 1, 2, 4, 14, and 16* *Richardson, J.W. "The Farm Level Modeler's Tool Kit: Simetar."* * *Reutlinger, S. "Techniques for Project Appraisal Under Uncertainty." 1970, pages 1-13.* * Hardaker, J.B., et al. "Coping With Risk In Agriculture." 3rd Edition Cambridge, MA: CABI Publishing, 2004, pages 1-15. Jones. "Simulation and Business Decisions." (Easy to read book that gives a good overview of what simulation can be used for)	
Week 1	**Generating Random Numbers**
* Kautt, Glenn and Fred Wieland. "Modeling the Future: The Full Monte, the Latin Hypercube and Other Curiosities." Journal of Financial Planning, 2001. McKay, Beckman, and Conover. "A Comparison of Three Methods for Selecting Values of Input Variables in the Analysis of Output from a Computer Code." Technometrics, 1979, Vol. 21, No. 2. * *Stein, Michael. "Large Sample Properties of Simulations Using Latin Hypercube Sampling." Technometrics, 1987, Vol. 29, No. 2.* Matsumoto, Makoto and Takuji Nishimura. "Mersenne Twister: A 623-Dimensionally Equidistributed Uniform Pseudo-Random Number Generator." ACM Transactions on Modeling and Computer Simulation, 1998, Vol. 8, No. 1. * Law, A.M. and W.D. Kelton. "Simulation Modeling and Analysis." New York: McGraw-Hill Book Company, Third Edition, 2001, Chapter 7, pages 240-278.	
Week 2	**Examples of Stochastic Simulation Models and Reviews**
* *Richardson, J.W. and H.P. Mapp, Jr. "Use of Probabilistic Cash Flows in Analyzing Investments Under Conditions of Risk and Uncertainty." Southern Journal of Agricultural Economics, 8(December 1976): 19-24.* * *Pouliquen, L.Y. "Risk Analysis in Project Appraisal." 1970, World Bank Staff Occasional Papers Number Eleven, pages 1-35.* Vose, D. "Risk Analysis: A Quantitative Guide." John Wiley & Sons, Ltd., Second Edition, 2000, pages 57-65.	
Bernstein, P.L. "Against the Gods: The Remarkable Story of Risk." John Wiley & Sons, Inc., pages 1-22. Judge, Day, Johnson, Rausser, and Martin. "Quantitative Methods in Agricultural Economics, 1940s to 1970s." Published by the University of Minnesota Press, Minneapolis, for the American Agricultural Economics Association, pages 157-310.	

Week 2	Univariate Probability Distribution Parameter Estimation and Simulation

* *Textbook chapters 5, 6 and 16 (pages 3-20 and 27-29).*

* *Hardaker, J.B., et al. "Coping With Risk In Agriculture." 3rd Edition Cambridge, MA: CABI Publishing, 2004, pages 30-51.*

* Vose, D. "Risk Analysis: A Quantitative Guide." John Wiley & Sons, Ltd., Second Edition, 2000, pages 99-143.

Law, A.M. and W.D. Kelton. "Simulation Modeling and Analysis." 1982, Chapter 4, pages 137-152.

Law, A.M. and W.D. Kelton. "Simulation Modeling and Analysis." 1982, Chapter 5, pages 155-218.

* *McCarl, B. "Forming Probability Distributions." AGEC 622 Notes, Summer 1996.*

* Mjelde, Anderson, Coble, Mouflih, Outlaw, Richardson, Stokes, and Sundarapather. "Tutorial on Density Function Estimation and Use." 1993, Texas A&M University, FP 94-2.

* *Goodwin, B.K. and Alan P. Ker. "Modeling Price and Yield Risk." In A Comprehensive Assessment of the Role of Risk in U.S. Agriculture, R.E. Just and R.D. Pope editors, Norwell, Mass: Kluwer Academic Publisher, 2000.*

Weeks 3 & 4	Multivariate Distributions: The Normal and Non-Normal Case Multivariate Parameter Estimation

* *Textbook Chapters 7 and 16 (pages 20-26).*

* *Richardson, J.W., S.L. Klose, and A.W. Gray. "An Applied Procedure for Estimating and Simulating Multivariate Empirical (MVE) Probability Distributions in Farm-Level Risk Assessment and Policy Analysis."*

* *Richardson, J.W. and K.D. Schumann. "Modeling Correlation of Non-Normally Distributed Random Variables in Stochastic Simulation Models." 2004.*

* *Clements, A.M., Jr., H.P. Mapp, Jr., and V.R. Eidman. "A Procedure for Correlating Events in Farm Firm Simulation Models." Technical Bulletin T-131, Oklahoma Agricultural Experiment Station, August 1971.*

* Richardson, J.W. and G.D. Condra. "A General Procedure for Correlating Events in Simulation Models."

Embrechts, Paul, Alexander McNeil, and Daniel Straumann. "Correlation and Dependence in Risk Management: Properties and Pitfalls."

Weeks 4 & 5	Copulas and Kernal Density Functions

* *Hardaker, J.B., et al. "Coping With Risk In Agriculture." 3rd Edition Cambridge, MA: CABI Publishing, 2004, pages 64-80.*

* *Richardson, J.W., G. Lien and J.B. Hardaker. "Simulating Multivariate Distributions with Sparse Data: A Kernel Density Smoothing Procedure." 2006, IAAEA Paper.*

Richardson, J.W., J.L. Outlaw, and K. Schumann. "Kernal Density Functions to Estimate Parameters to Simulate Stochastic Variables with Sparse Data: What is the Best Distribution?" Risk Analysis VII. 2010.

* Nelsen, Roger B. "Properties and Applications of Copulas: A Brief Summary."

* Juarez, Miriam T. "Copula Based Stochastic Weather Generator as an Application for Crop Growth Models and Crop Insurance." Ph.D. Dissertation, Department of Agricultural Economics, Texas A&M University, 2012, pages 23-35.

Woodard, J.D., N.D. Paulson, D. Vedenov, and G.J. Power. "Estimation Efficiency in the Modeling of Dependence Structures: An Application of Alternative Copulas to Insurance Rating."

Week 5	Modeling Price and Yield Risk and Model Validation

* *Textbook Chapters 3 and 16 (pages 29-33).*

Law, A.M. and W.D. Kelton. "Simulation Modeling And Analysis." 1982, Chapter 10 (pages 333-348).

* Goodwin, Barry K. And Alan P. Kerr. "Modeling Price and Yield Risk." Chapter 14 in *The Role of Risk in Agriculture*.

Week 6	Bootstrap Simulation

** Textbook Chapter 11*

Vose, D. "Risk Analysis: A Quantitative Guide." John Wiley & Sons, Ltd., Second Edition, 2000, Chapter 7, pages 181-200.

* Krinsky and A. Leslie Robb. "On Approximating the Statistical Properties of Elasticities." *The Review of Economics and Statistics.* 1986.

Weeks 5-7	Expected Utility

** Textbook Chapter 10*

** Hardaker on Utility Function Selection email to James Richardson. July 2007.*

** Hardaker, J.B., et al. "Coping With Risk In Agriculture." 3rd Edition Cambridge, MA: CABI Publishing, 2004, pages 81-106.*

** Meyer, J. "Expected Utility as a Paradigm for Decision Making in Agriculture." In A Comprehensive Assessment of the Role of Risk in U.S. Agriculture, R.E. Just and R.D. Pope editors, Norwell, Mass: Kluwer Academic Publisher, 2000.*

** Meyer, D. J. and J. Meyer. "Relative Risk Aversion: What Do We Know?" The Journal of Risk and Uncertainty. 31:3(2005):243-262).*

Meyer, D. J. and J. Meyer. Risk Preferences in multi-period consumption models, the equity premium puzzle and habit formation utility." Journal of Monetary Economics. 52(2005):1497-1515.

Meyer, D. J. and J. Meyer. "*Measuring Risk Aversion." NOW: The Essence of Knowledge. Boston - Delft. 2006.*

Week 7 & 8	Stochastic Dominance and Stochastic Efficiency

Gloy, B.A. and T.G. Baker. "A Comparison of Criteria for Evaluating Risk Management Strategies." Agricultural Finance Review, 2001.

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

** Hardaker, J.B., J.W. Richardson, G. Lien, and K.D. Schumann. "Stochastic Efficiency Analysis with Risk Aversion Bounds: A Simplified Approach." The Australian Journal of Agricultural and Resource Economics, 48:2, 2004, pages 253-270.*

Richardson, J.W. and J.L. Outlaw. "Ranking Risky Alternatives: Innovations in Subjective Utility Analysis." Risk Analysis VI, 2008.

* McCarl, B. "Generalized Stochastic Dominance: An Empirical Examination." Southern Journal of Agricultural Economics, 1990, pages 49-55.

Ribera, L.A., F.M. Hons, and J.W. Richardson. "Tillage and Cropping Systems: An Economic Comparison Between Conventional and No-Tillage Farming Systems in Burleson County, Texas." Agronomy Journal. Vol. 96, March-April 2004, pgs 415-424.

Lien, G., O. Flaten, A. Korsaeth, K.D. Schumann, J.W. Richardson, R. Eltun, J.B. Hardaker. "Comparison of Risk in Organic, Integrated and Conventional Cropping Systems in Eastern Norway." *Journal of Farm Management: Journal of the Institute of Agricultural Management*, 12, 7(2005): 385-401.

Lien, G., J.B. Hardaker, O. Flaten. "Risk and Economic Sustainability of Crop Farming Systems." 2005.

Lien, G., S. Stordal, J.B. Hardaker, and L.J. Asheim. "Risk Aversion and Optimal Forest Replanting: A Stochastic Efficiency Study." European Journal of Operational Research, 2006.

Upadhyay, B.M., E.G. Smith, G.W. Clayton, K.N. Harker, J.T. O'Donovan, and R.E. Blackshaw. "Economic Evaluation of Seeding Decisions in Hybrid and Open-Pollinated Herbicide-Resistant Canola (Brassica Napus)." Canadian Journal of Plant Science, 2005.

** Hardaker, J.B., et al. "Coping With Risk In Agriculture." 3rd Edition Cambridge, MA: CABI Publishing, 2004, pages 126-139.*

Hardaker, J.B. and G. Lien. "Stochastic Efficiency Analysis with Risk Aversion Bounds: A Comment." Australian Journal of Agricultural and Resource Economics, 2010, Vol. 54, pages 379-383.

Meyer, J., J.W. Richardson, and K.D. Schumann. "Stochastic Efficiency Analysis with Risk Aversion Bounds: A Correction." Australian Journal of Agricultural and Resource Economics, 53, 521-525, 2009.

Week 8	CV Stationarity and Heteroscedasticity and Sparse Data
* *Textbook Chapter 9*	
Week 9	**Optimal Control Theory**
* *Textbook Chapter 12* * Richardson, J.W. and D.E. Ray. "Commodity Programs and Control Theory." AJAE, 64 (1982): 28-38. Richardson, J.W., D.E. Ray, and J.N. Trapp. "Illustrative Applications of Optimal Control Theory Techniques to Problems in Agricultural Economics." Okla. Agric. Exper. Station, Bulletin B-739, 1979.	
Week 10	**Simulating Black Swans**
* Tabeb, Nassim N. "The Black Swan: The Impact of the Highly Improbable." New York: Random House. Prologue and Chapter 15.	
Week 10	**Insurance, Portfolio Analysis, and 3rd Generation Models**
* *Textbook Chapter 14 (pages 3-6).* * *Coble, K.H. and T.O. Knight. "Crop Insurance As a Tool for Price and Risk Management." In A Comprehensive Assessment of the Role of Risk in U.S. Agriculture, R.E. Just and R.D. Pope editors, Norwell, Mass: Kluwer Academic Publisher, 2000.* Hauser, R.J., B.J. Sherrick, and G.D. Schnitkey. "Relationships Among Government Payments, Crop Insurance Payments and Crop Revenue." European Review of Agricultural Economics, Vol. 31, No. 3, 2004, pages 353-368. Lewellen W.G. and M.S. Long. "Functional and Behavioral Application." Decision Sciences, 1972, Vol. 3, pages 19-33. Gray, A.W., J.W. Richardson, and J. McClaskey. "Farm-Level Impacts of Revenue Assurance." *Review of Agricultural Economics*, 17(1995): 171-183.	
Week 11	**Financial Options**
* *Hull, J. (2000): Options, Futures, and Other Derivatives, Prentice Hall: Upper Saddle River, New Jersey. Chapters 9-10.*	
Week 12	**Real Options and Covariance Shrinkage**
**J. Schafer & K. Strimmer, "A shrinkage approach to large-scale covariance matrix estimation and implications for functional genomics", Statistical Applications in Genetics and Molecular Biology, vol. 4, issue 1, article 32* **Dixit, A and Pindyck, R. (1994): Investment Under Uncertainty, Princeton University Press: Princeton, New Jersey. Chapters 1-2.* * *Du, Xiaodong and D.A. Hennessy. "The Planting Real Option in Cash Rent Valuation." Working Paper 08-WP 463, February 2008.* O. Ledoit & M. Wolf, "Honey, I shrunk the sample covariance matrix", Journal of Portfolio Management, Summer 2004, pp. 110-119 Longstaff, F.A. and E.S. Schwartz (2001): "Valuing American Options by Simulation: A Simple Least-Squares Approach," Review of Financial Studies, 14:113-147. Tower, L.W. "When to Get In and Out of Dairy Farming: A Real Option Analysis." Cornell University Working Paper, October 2004.	
Week 13 & 14	**Correlation Induction and Simulation for Inference**
* Iman, R. and W.J. Conover (1982): "A Distribution-Free Approach to Inducing Rank Correlation Among Input Variables." Communications in Statistics – Simulation and Computation, 11(3): 311-334. Paulson, N.D. and B.A. Babcock (2008): "Get a GRIP: Should Area Revenue Coverage be Offered Through the Farm Bill or as a Crop Insurance Program?" *Journal of Agricultural and Resource Economics*, 33(2): 137-153. * Dickey, D. and W.A. Fuller (1979): "Distribution of the estimates for autoregressive time series with a unit root," Journal of the American Statistical Association, 74:427-431.	
Week 15	**Agent Based Simulation**
Tesfatsion, L. (2003): "Agent-Based Computational Economics," ISU Economics Working Paper No. 1, Iowa State University. * Zhang, T. and Brorsen, B.W. (2010): "The long-run and short-run impact of captive supplies in the spot market price: an agent-based artificial market," American Journal of Agricultural Economics, 92(4):1181-1194.v	

AGEC 643 Class Schedule
Tues & Thurs 12:45 - 2:00 p.m.
Room 111B&C AGLS
Fall 2017

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	Aug 27	28 **First Day of Fall Classes**	29 Simetar and Simulation Example Models	30	31 Simulation With Simetar	**Sept 1**	2
2	3	4	5 Univariate Distributions	6	7 Parameter Estimation	8	9
3	10	11	12 Univariate Distribution and KDE's	13	14 MV Norm (Alek)	15	16
4	17	18	19 MV Empirical	20	21 Copulas	22 **HOMEWORK 1 DUE**	23
5	24	25	26 Copulas MV KDE's	27	28 Model Validation	29	30
6	**Oct 1**	2	3 Bootstrap Simulation	4	5 Expected Utility	6	7
7	8	9	10 Expected Utility	11	12 Stochastic Dominance	13 **HOMEWORK 2 DUE**	14
8	15	16	17 Stochastic Efficiency	18	19 CV Stationarity Heteroskedastic Errors	20	21
9	22	23	24 Optimal Control Theory	25	26 **Mid-Term Exam**	27	28
10	29	30	31 Insurance & Portfolio Analysis	**Nov 1**	2 Simulate Uncertainity And Black Swans	3 **HOMEWORK 3 DUE**	4
11	5	6	7 Simulation for Finance (Bryant)	8	9 Simulation for Finance (Bryant)	10 **Term Paper Progress Report**	11
12	12	13	14 Real Options (Bryant)	15	16 Real Options (Bryant)	17 **HOMEWORK 4 DUE**	18
13	19	20	21 Simulation for Inference (Bryant)	22	23 **HOLIDAY**	24 **HOLIDAY**	25
14	26	27	28 Correlation Induction (Bryant)	29	30 High Performance Simulation (Bryant)	**Dec 1**	2
15	3	4	5 Agent Based Simulation (Bryant)	6 **HOMEWORK 5 DUE**	7 **No Class - Reading Day**	8	9
16	10	11 **Term Paper DUE**	12	13 **Final Exam 8 – 10 am**	14	15	16

Progress Report on Term Paper
Due November 10, 2017
Worth 5 Points on Final Grade

Refined statement of the problem with 5+ references to support your statement of the problem. Explain why the problem is important and who has worked on the problem in the past.

Objective. Clearly state what the objective of the paper will be, based on your review of the literature and after identifying holes in the literature.

Review of literature. Briefly describe the studies you will be using to support the methodology selected for the paper.

Detailed description of the methodology you plan to use for the paper.

Describe the data you will be using for the paper and give the source(s) for the data.

Format for Term Paper
Due December 11, 2017

Quoted from the course Syllabus:
The term paper will consist of an original research problem that is presented in AJAE format and style. You shall identify the problem, review the literature, state the objective, describe the methodology, develop the model, estimate the parameters, present the estimated model, the simulation results, and validation statistics. Each student must work independently on their own paper. Students are encouraged to collaborate with the instructor, their academic advisor and other students, but the end product must be their own work.

20 pts **Introduction**
Introduction should consist of a 1 page description of the economic problem to be addressed. Literature must be cited to prove there is an economic problem.

10 pts **Objective**
Clear should be a concise statement of the objective for the paper. This may include a hypothesis to be tested. One paragraph should be sufficient.

20 pts **Methodology**
Methodology should be a 1 to 2 page description of the methodology used for the paper. The methodology must be based on the literature in the field and must be well documented with adequate references to the literature. The methodology must be based on or use concepts presented in AGEC 643. Describe the methodology using statistical procedures, mathematics, and economic theory. Indicate how the methodology will enable you to achieve the objective and test the hypothesis.

5 pts **Data**
Describe the data used for the analysis, including the source, and how it will be used with the methodology.

25 pts **Model and Results**
Describe your model, your parameter estimates and present the results. The results should address the problem in the introduction and achieve the objective stated for the paper.

10 pts **Summary and Conclusions**
Prepare a ½ page summary of the research and draw conclusions from the results.

10 pts **References**
Include only the publications you cited in the paper. Use AJAE format.

Example of a Term Paper
See Richardson and Mapp – the SJAE (1976) Ice Plant model on your reading list.