

RISK ANALYSIS AND RISK MANAGEMENT IN AGRICULTURE: THEORY AND APPLICATIONS

Instructors

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 - Prof. Dr. Oliver Mußhoff, Georg-August-University Goettingen, Faculty of Agricultural Sciences, Department for Agricultural Economics and Rural Development, Farm Management
 - Dr. Gunnar Breustedt, Department of Agricultural Economics, University Kiel
- In addition, several guest lectures will contribute to specific topics of the course.

Course Description

Many decisions in agriculture and related industries have to be made under uncertainty. Risk, however, adds a considerable degree of complexity to the decision making process. This course presents the theoretical concepts of rational choice under uncertainty and develops the building blocks for risk management in agribusiness. Once the necessary statistical tools are reviewed, various indicators of the firm's risk exposition are discussed, including Value at Risk (VaR) and Expected Tail Loss (ETL). Moreover, the foundations of stochastic optimization are presented. The theoretical part enables the participants to understand the most important risk management tools, as insurance, futures, financial options, real options or weather derivatives. Much emphasis is put on the numerical aspects of risk management. For example, participants will be practically advised to use stochastic simulation and genetic algorithms.

Course Outline

I. Introduction

- Classification of risk sources
- Components of a risk management system

II. Statistical Tools

- Distributions: expected value, variance, tests
- Stochastic processes: diffusion processes, jump processes GARCH, characteristics, tests
- Stochastic simulation: implementation, variance reduction procedures

III. Risk Measurement

- Value at Risk (VaR), Expected Tail Loss (ETL), Extreme Value Theory (EVT)

IV. Decision Theory

- Expected utility theory, expected value variance analysis, stochastic dominance

V. Risk Programming

- Diversification
- MOTAD

VI. Analysis and Management of Production and Price Risk

- Optimal input use under risk
- Empirical modeling of production risk

VII. Hedging and Insurance

- Hedging with futures
- Theoretical and empirical analysis of crop insurance

VIII. Stochastic Dynamic Optimization

- Ito's Lemma
- Stochastic dynamic programming (Hamilton-Jacobi-Bellman-equation)
- Binominal Trees, Genetic algorithms

IX. Real Options

- Classification, valuation, applications
- Empirical validation of real options models

X. Contingent Claim Analysis

- Risk neutral valuation, no-arbitrage-pricing
- Black-Scholes-model
- Pricing in incomplete markets

XI. Weather Derivatives

- Modelling weather related risks
- Pricing of weather derivatives

Teaching methods

Lectures (40%), seminars (20%), PC-demonstrations (20%), hands-on-exercises (20%)

Grading

Presentation (40%), assignments (40 %), participation (20 %)

Credit points

6

Requirements

Statistics, microeconomics (master level), good MS-EXCEL skills

References

- CHAVAS, J. P. (2004): Risk Analysis in Theory and Practice. Elsevier.
- DIXIT, A., PINDYCK, R.S. (1994): Investment under Uncertainty. Princeton University Press, Princeton.
- DOWD, K. (2002): Measuring Market Risk. John Wiley & Sons, LTD.
- HARDAKER, J. B., HUIRNE, R. B. M., ANDERSON, J.R., LIEN, G. (2004): Coping with Risk in Agriculture. Second Edition. CAB International. Wallingford.
- HULL, J.C. (2000): Options, Futures, & other Derivatives. Prentice-Hall, Ic.
- MUBHOFF, O., HIRSCHAUER, N. (2003): Bewertung komplexer Optionen - Umsetzung numerischer Verfahren mittels MS-EXCEL und Anwendungsmöglichkeiten der Optionspreistheorie auf Sachinvestitionen -. PD-Verlag, Heidenau.
- NEFTCI, N.S. (1996): An Introduction to the Mathematics of Financial Derivatives. Academic Press, San Diego.
- ROBINSON, L.J., BARRY, P.J. (1987): The Competitive Firm's Response to Risk. Macmillan, London.

Software

MS-EXCEL and STATGRAPHICS

Language

English or German (depending on participants)

Organization and time

The course is split up into two one-week-modules. They are held at Humboldt University in Berlin and Georg-August-University Goettingen. For further information contact Martin Odening (m.odening@agrار.hu-berlin.de, 03020936487).