

Lectures and Seminars in Insurance Mathematics and related fields
at ETH Zurich

Spring Semester 2017

Quantitative Risk Management, by Prof. Dr. Patrick Cheridito, #401-3629-00L

This course introduces methods from probability theory and statistics that can be used to model financial risks. Topics addressed include loss distributions, multivariate models, copulas and dependence structures, extreme value theory, risk measures, aggregation of risk, and risk allocation.

Individual chapters covered are:

1. Risk in Perspective
2. Basic Concepts
3. Multivariate Models
4. Copulas and Dependence
5. Aggregate Risk
6. Extreme Value Theory
7. Operational Risk and Insurance Analytics

Literature:

McNeil, A.J., Frey, R. and Embrechts, P. Quantitative Risk Management: Concepts, Techniques and Tools, Princeton University Press, Princeton, 2015 (Revised Edition)

Place: Main Building of ETH Zurich, Auditorium **HG G3**

Time: Thursday, 10.15 to 12.00 h

Start Date: Thursday, 23. February, 2017

Language: English

Economic Theory of Financial Markets, by Prof. Dr. Mario V. Wüthrich #401-3956-00L

This lecture provides an introduction to economic theory of financial markets. It presents the basic financial and economic concepts to insurance mathematicians and actuaries.

We treat the following topics:

- Fundamental concepts in economics
- Portfolio theory
- Mean variance analysis, capital asset pricing model
- Arbitrage pricing theory
- Cashflow theory
- Valuation principles
- Stochastic discounting, deflator techniques
- Interest rate modeling
- Utility Theory

Place: Main Building of ETH Zurich, Auditorium **HG D1.1**

Time: Mondays, 16.15 to 18.00 h

Start Date: Monday, 20. February, 2017

Language: English

Selected Topics in Life Insurance Mathematics, by Prof. Dr. Michael Koller, #401-3923-00L

Stochastic Models Life Insurance

1. Markov chains
2. Stochastic processes for demography and interest rates
3. Cash flow streams and reserves
4. Mathematical reserves and Thiele's differential equation
5. Theorem of Hattendorff
6. Unit linked policies

Place: Main Building of ETH Zurich, Auditorium **HG D3.2**

Time: Friday, 16.15 to 18.00 h

Start Date: Friday, 24. February, 2017

Language: English

Stochastic Loss Reserving Methods, by Dr. René Dahms, #401-3917-00L

Loss Reserving is one of the central topics in non-life insurance. Mathematicians and actuaries need to estimate adequate reserves for liabilities caused by claims. These claims reserves have an influence on all financial statements, future premiums and solvency margins. We present the stochastics behind various methods that are used in practice to calculate those loss reserves.

We will present the following stochastic claims reserving methods/models:

- Stochastic Chain-Ladder Method
- Bayesian Methods, Bornhuetter-Ferguson Method, Credibility Methods
- Distributional Models
- Linear Stochastic Reserving Models, with and without inflation
- Bootstrap Methods
- Claims Development Result (solvency view)
- Coupling of portfolios

Literature:

Wüthrich, M.V., Merz, M. Stochastic Claims Reserving Methods in Insurance, Wiley 2008.

Place: ETH Zurich, Auditorium **ML E12**

Time: Wednesday, 16.15 to 18.00 h

Start Date: Wednesday, 22. February, 2017

Language: English

Risk and Insurance Economics, by Prof. Dr. Wanda Mimra, #363-1017-00L

The course covers economics of risk and insurance. Topics covered are fundamentals of insurance, risk measures and risk management, demand and supply of insurance and asymmetric information in insurance markets.

The following topics are treated:

- fundamentals of insurance
- what is the rationale for corporate risk management?
- measures of risk and methods of risk management
- demand for insurance
- supply of insurance
- information problems in insurance markets: moral hazard, adverse selection, fraud

Literature:

[1] Peter Zweifel and Roland Eisen (2012), Insurance Economics, Springer.

[2] S. Hun Seog (2010), The Economics of Risk and Insurance, Wiley-Blackwell.

- [3] Ray Rees and Achim Wambach (2008), The Microeconomics of Insurance, Foundations and Trends in Microeconomics: Vol. 4: No 1-2.
- [4] Eeckhoudt/Gollier/Schlesinger (2007), Economic and Financial Decisions under Risk, Princeton University Press.
- [5] introductory background reading: Harrington/Niehaus (2003), Risk Management and Insurance, McGraw Hill.

Place: ETH Zurich, Auditorium **LFW B1**
Time: Wednesday, 17.15 to 19.00 h
Start Date: Wednesday, 22. February, 2017
Language: English

Computational Statistics, by Dr. Martin Mächler and Prof. Dr. Peter L. Bühlmann, #401-3632-00L

"Computational Statistics" deals with modern methods of data analysis (aka "data science") for prediction and inference. An overview of existing methodology is provided and also by the exercises, the student is taught to choose among possible models and about their algorithms and to validate them using graphical methods and simulation based approaches.

Course Synopsis:

multiple regression, nonparametric methods for regression and classification (kernel estimates, smoothing splines, regression and classification trees, additive models, projection pursuit, neural nets, ridge and the lasso, boosting). Problems of interpretation, reliable prediction and the curse of dimensionality are dealt with using resampling, bootstrap and cross validation. Details are available via <https://stat.ethz.ch/lectures/>

Exercises will be based on the open-source statistics software R (<http://www.R-project.org/>). Emphasis will be put on applied problems. Active participation in the exercises is strongly recommended. More details are available via the webpage <https://stat.ethz.ch/lectures/> (-> "Computational Statistics").

Lecture are available on <http://stat.ethz.ch/education/> (-> "Computational Statistics").

Place: Main Building of ETH Zurich
Time: Thursday, 13.15 to 15.00 h, Lecture at Auditorium **HG G3**
 Friday, 09.15 to 10.00 h, Lecture at Auditorium **HG E1.2**
 Friday, 10:15 to 12:00 h, Exercise session at Auditorium **HG E1.2**
Start Date: Thursday, 23. February, 2017
Language: English

An Introduction to the Modelling of Extremes, by Prof. Dr. Paul Embrechts, #401-3919-60L

In this course, students learn to distinguish between so-called normal models, i.e. models based on the normal or Gaussian distribution, and so-called heavy-tailed or power-tail models. They learn to do some standard modelling and data analysis for one-dimensional data. The probabilistic key theorems are the Fisher-Tippett Theorem and the Balkema-de Haan-Pickands Theorem. These lead to the statistical techniques for the analysis of extremes or rare events known as the Block Method, and Peaks Over Threshold Method, respectively.

- Introduction to rare or extreme events
- Regular variation
- The Convergence to types theorem

- The Fisher-Tippett theorem
- The Method of block maxima
- The Maximal domain of attraction
- The Fréchet, Gumbel and Weibull distributions
- The POT Method
- The Point Process Method: a first introduction
- The Pickands-Balkema-de Haan theorem and its applications
- Some extensions and outlook

Literature:

There will be no script available, students are required to take notes from the blackboard lectures. The course follows closely Extreme Value Theory as developed in:

[1] Embrechts, P., Klueppelberg, C. and Mikosch, T. Modelling Extremal Events for Insurance and Finance. Springer 1997.

Further relevant literature is:

[2] Resnick, S.I. Heavy-Tail Phenomena. Probabilistic and Statistical Modeling. Springer 2007.

[3] Resnick, S.I. Extreme Values, Regular Variation, and Point Processes. Springer 1987.

Place: Main Building of ETH Zurich, Auditorium **HG D5.2**

Time: Wednesdays, 13.15 to 15.00 h

Start Date: Wednesday, 22. February, 2017

Language: English

Talks in Financial and Insurance Mathematics, Proff. P. Cheridito, P. Embrechts, M. Schweizer, M. Soner, J. Teichmann, M.V. Wüthrich, #401-5910-00L

Research Seminar in Financial and Insurance Mathematics

For the program see <https://www.math.ethz.ch/imsf/courses/talks-in-imsf.html>

Place: Main Building of ETH Zurich, Auditorium **HG G43**

Time: Thursday, 17.15 to 18.00 h

Start Date: Thursday, 23. February, 2017

Language: English

Additional Lectures at the University of Zurich:

Social Health Insurance - Competition versus Solidarity, by Prof. Dr. Konstantin Beck, #3717-BEOCo225

The aim is to present a concise overview over the Swiss Social Health Insurance market and its specific problems of implementation and regulation. The lecture addresses as well the economic basics of this market as well as the current political debate and proposed changes. It provides detailed insight into actuaries' responsibility and daily business within health insurance.

Individual chapters treated are:

1. Institutional setting
2. The risk of health care expenditures
3. Econometric problems
4. Premium and copayment
5. Defining the level of reserves
6. Switching risks and adverse selection

7. Risk selection and social goals
8. Risk equalization
9. The physician market / Managed Care
10. Associations in the health insurance market.

An interactive simulation of the insurance market may help to understand the theoretical part of the lecture.

Literature:

Konstantin Beck (Ed.): Risiko Krankenversicherung, Haupt, Bern, 3rd. Edition. 2013.
Lecture notes will refresh some chapters of this book.

Place: Main Building of University of Zurich, Auditorium **F 104** (to be confirmed)

Time: Wednesday, 14.00 to 15.45 h

Start Date: Wednesday, 22. February, 2017

Test: Wednesday, 14. June 2017

Language: German

Topics of Applied Risk Management, by Dr. Gerold Studer, #3876-MFOEC150

This course provides insights into financial risk management tools and techniques broadly used in the world of banking, providing theoretical foundations and discussing typical applications in practice. The lectures are complemented by case studies, allowing students to apply the techniques in real world set-ups.

The following topics are treated:

- Introduction: Banking activities & their characteristics; Is risk management a value creating activity?
- Managing interest rate risk: Value vs. income effect, Duration & convexity; Replication - portfolios; Interest rate swaps - valuation and risk sensitivities
- Market risk: Options and their sensitivities; Dynamic hedging and replication; VaR - methodologies / Backtesting / Stresstesting
- Credit risk: Default probabilities; Rating agencies; Internal rating models; Recovery rates; Exposure modelling; Credit portfolio models; Credit derivatives / CDOs / CLNs
- Operational risk: Nature of operational risk; Managing operational risk; Quantification of operational risk
- Capital: Role of capital for financial institutions; Capital regulations for banks (Basel III)

Place: University of Zurich (tbd)

Time: Friday, 16.00 to 18.00 h

Start Date: Friday, 3. March, 2017

Language: English

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