

**Lectures and Seminars in Insurance Mathematics and Related Fields
at ETH Zurich**

Spring Semester 2018

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, risk measures, extreme value theory, multivariate models, copulas and dependence structures as well as operational risk.

Individual chapters covered are:

1. Introduction
2. Basic Concepts in Risk Management
3. Empirical Properties of Financial Data
4. Financial Time Series
5. Extreme Value Theory
6. Multivariate Models
7. Copulas and Dependence
8. Operational Risk

Literature:

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

Place: ETH Zurich, Auditorium **ML H44**

Time: Thursday, 10.15 to 12.00 h

Start Date: 22. February, 2018

Language: English

Market-Consistent Actuarial Valuation, by Prof. Dr. Mario Wüthrich and Dr. Hansjörg Furrer, #401-4920-00L

In this lecture we give a full balance sheet approach to the task of actuarial valuation of an insurance company. Therefore we introduce a multidimensional valuation portfolio (VaPo) on the liability side of the balance sheet. The basis of this multidimensional VaPo is a set of financial instruments. This approach makes the liability side of the balance sheet directly comparable to its asset side.

The lecture is based on four sections:

1. Stochastic discounting
2. Construction of a multidimensional Valuation Portfolio for life insurance products (with guarantees)
3. Construction of a multidimensional Valuation Portfolio for a run-off portfolio of a non-life insurance company
4. Measuring financial risks in a full balance sheet approach (ALM risks)

Literature:

Wüthrich, M.V.: Market-Consistent Actuarial Valuation, 3rd edition (2016). EAA Series Textbook, Springer, Berlin. ISBN 978-3-319-46635-4

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

Time: Monday, 16.15 to 18.00 h

Start Date: 19. February, 2018

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: 21. February, 2018

Language: English

Data Analytics for Non-Life Insurance Pricing, by Dr. Christoph Buser and Prof. Dr. Mario Wüthrich, #401-3936-00L

We study statistical methods in supervised learning for non-life insurance pricing such as generalized linear models, generalized additive models, Bayesian models, neural networks, classification and regression trees, random forests, gradient boosting machines and support vector machines. Moreover, we present unsupervised learning methods applied to telematics car driving data.

We present the following chapters:

- generalized linear models (GLMs)
- generalized additive models (GAMs)
- credibility theory
- classification and regression trees (CARTs)
- bagging, random forests and boosting
- support vector machines (SVMs)
- unsupervised learning methods
- telematics car driving data

Literature:

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2870308

Place: Main Building of ETH Zurich, Auditorium **HG F5**
Time: Tuesday, 16.15 to 18.00 h
Start Date: 20. February, 2018 (at Auditorium **ML D28!**)
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: 23. February, 2018
Language: English

Computational Statistics, by Prof. Dr. Marloes Maathuis, #401-3632-00L

"Computational Statistics" deals with modern methods of data analysis (aka "data science") for prediction and inference. The course is hands-on, and methods are applied using the statistical programming language R.

Place: Main Building of ETH Zurich
Time: Thursday, 13.15 to 15.00 h, Lecture at Auditorium **HG F3**
Friday, 09.15 to 10.00 h, Lecture at Auditorium **HG G3**
Friday, 10:15 to 12:00 h, Exercise session at Auditorium **HG D3.2 and E 1.2**
Start Date: 22. February, 2018
Language: English

Statistical Learning Theory, by Prof. Dr. Joachim Buhmann, #252-0526-00L

The course surveys recent methods of statistical learning. The fundamentals of machine learning as presented in the course "Introduction to Machine Learning" are expanded and in particular, the theory of statistical learning is discussed.

The course covers advanced methods of statistical learning :

- Theory of estimators: How can we measure the quality of a statistical estimator? We already discussed bias and variance of estimators very briefly, but the interesting part is yet to come.
- Variational methods and optimization: We consider optimization approaches for problems where the optimizer is a probability distribution. Concepts we will discuss in this context include: Maximum Entropy, Information Bottleneck, Deterministic Annealing
- Clustering: The problem of sorting data into groups without using training samples. This requires a definition of „similarity" between data points and adequate optimization procedures.
- Model selection: We have already discussed how to fit a model to a data set in ML I, which usually involved adjusting model parameters for a given type of model. Model selection refers to the question of how complex the chosen model should be. As we already know, simple and complex models both have advantages and drawbacks alike.

- Statistical physics models: approaches for large systems approximate optimization, which originate in the statistical physics (free energy minimization applied to spin glasses and other models); sampling methods based on these models.

Literature:

- [1] T. Hastie, R. Tibshirani, and J. Friedman. The Elements of Statistical Learning. Springer, 2001.
- [2] L. Devroye, L. Györfi, and G. Lugosi: A probabilistic theory of pattern recognition. Springer, New York, 1996.

Place: ETH Zurich
Time: Monday, 14:15 to 16.00 h, Lecture at Auditorium **ML H44**
Monday, 16:15 to 18.00 h, Practice at Auditorium **ML H44**
Start Date: 19. February 2018

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

The course covers economics of risk and insurance.

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: Tuesday, 10.15 to 12.00 h
Start Date: 20. February, 2018
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: 22. February, 2018
Language: English

Additional Lecture at the University of Zurich:

Topics of Applied Risk Management, by Dr. Gerold Studer, 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: 2. March, 2018

Language: English

Addresses of the Lecturers

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