December 2019

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

Spring Semester 2020

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 and operational risk.

Topics:
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, Lecture
	Thursday, 12.15 to 13.00 h, Exercise session
Start Date:	20. February 2020

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:

[1] Wüthrich, M.V.: Market-Consistent Actuarial Valuation, 3rd edition (2016). EAA Series Textbook, Springer, Berlin. ISBN 978-3-319-46635-4
[2] Wüthrich, M.V., Merz, M.: Claims Run-Off Uncertainty: The Full Picture, SSRN Manuscript ID 2524352 (2015).
[3] Wüthrich, M.V., Embrechts, P., Tsanakas, A.: Risk margin for a non-life insurance run-off. Statistics & Risk Modeling 28 (2011), no. 4, 299-317.
[4] Wüthrich, M.V., Merz, M.: Financial Modeling, Actuarial Valuation and Solvency in Insurance. Springer Finance (2013). ISBN: 978-3-642-31391-2

Place: Main Building of ETH Zurich, Auditorium HG D1.1
Time: Monday, 16.15 to 18.00 h
Start Date: 17. February 2020

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: Main Building of ETH Zurich, Auditorium **HG D3.2**
Time: Wednesday, 16.15 to 18.00 h
Start Date: 19. February 2020

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 and gradient boosting machines.

We present the following chapters:
- generalized linear models (GLMs)
- generalized additive models (GAMs)
- neural networks
- credibility theory
- classification and regression trees (CARTs)
- bagging, random forests and boosting

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: 18. February 2020

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

Stochastic Models for 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: 21. February 2020

Risk and Insurance Economics, by Dr. Irina Gemmo, #363-1017-00L

The course covers economics of risk and insurance. Topics covered are fundamentals of risk, individual decision making under risk, fundamentals of insurance, information asymmetries in insurance markets, and the macroeconomic role of insurers.

Topics:
- fundamentals of risk
- individual decision making under risk
- fundamentals of insurance
- information asymmetries in insurance markets
- the macroeconomic role of insurers

Main literature:
[1] Eeckhoudt, L., Gollier, C., & Schlesinger, H. (2005). Economic and Financial Decisions under Risk. Princeton University Press.
[2] Zweifel, P., & Eisen, R. (2012). Insurance Economics. Springer.

Further readings:
[3] Dionne, G. (Ed.). (2013). Handbook of Insurance (2nd ed.). Springer.
[4] Hufeld, F., Koijen, R. S., & Thimann, C. (Eds.). (2017). The Economics, Regulation, and Systemic Risk of Insurance Markets. Oxford University Press.
[5] Niehaus, H., & Harrington, S. (2003). Risk Management and Insurance (2nd ed.). McGraw Hill.
[6] Rees, R., & Wambach, A. (2008). The Microeconomics of Insurance, Foundations and Trends® in Microeconomics, 4(1–2), 1-163.

Place: ETH Zurich, Auditorium **CAB G59**
Time: Tuesday, 10.15 to 12.00 h
Start Date: 18. February 2020

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

We discuss modern statistical methods for data analysis, including methods for data exploration, prediction and inference. We pay attention to algorithmic aspects, theoretical properties and practical considerations. The class is hands-on and methods are applied using the statistical programming language R.

Place: ETH Zurich
Time: Thursday, 13.15 to 15.00 h, Lecture at Auditorium **HG F1**
Friday, 09.15 to 10.00 h, Lecture at Auditorium **NO C60**
Friday, 10:15 to 11:00 h, Exercise session at Auditorium **HG G5**
Start Date: 20. February 2020

Advanced Statistical Modelling: Mixed Models, by Dr. Martin Mächler, #401-4626-00L

Mixed Models = (*| generalized| non-) linear Mixed-effects Models, extend traditional regression models by adding "random effect" terms.

In applications, such models are called "hierarchical models", "repeated measures" or "split plot designs". Mixed models are widely used and appropriate in an aera of complex data measured from living creatures from biology to human sciences.

The lecture will build on various examples, use R and notably the 'lme4' package, to illustrate concepts. The relevant R scripts are made available online.

Inference (significance of factors, confidence intervals) will focus on the more realistic *un*balanced situation where classical (ANOVA, sum of squares etc) methods are known to be deficient. Hence, Maximum Likelihood (ML) methods and its variant, "REML", will be used for estimation and inference.

Lecture notes and all R scripts are made available from
https://github.com/mmaechler/MEMo

Place: Main Building of ETH Zurich, Auditorium **HG F26.5**
Time: Tuesday, 08.15 to 10.00 h
Start Date: 18. February 2020

Causality, by Dr. Christina Heinze-Deml, #401-4632-15L

In statistics, we are used to search for the best predictors of some random variable. In many situations, however, we are interested in predicting a system's behavior under manipulations. For such an analysis, we require knowledge about the underlying causal structure of the system. In this course, we study concepts and theory behind causal inference.

Place: Main Building of ETH Zurich, Auditorium **HG E1.1**
Time: Wednesday, 10.15 to 12.00 h
Start Date: 19. February 2020

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

The course covers advanced methods of statistical learning:

- Variational methods and optimization. We consider optimization approaches for problems where the optimizer is a probability distribution. We will discuss concepts like maximum entropy, information bottleneck, and deterministic annealing.

- Clustering. This is the problem of sorting data into groups without using training samples. We discuss alternative notions of "similarity" between data points and adequate optimization procedures.
- Model selection and validation. This refers to the question of how complex the chosen model should be. In particular, we present an information theoretic approach for model validation.
- Statistical physics models. We discuss approaches for approximately optimizing large systems, which originate in statistical physics (free energy minimization applied to spin glasses and other models). We also study sampling methods based on these models.

Literature:

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

Place: Main building of the ETH Zurich
Time: Monday, 14.15 to 16.00 h, Lecture at Auditorium **HG G3**
Tuesday, 17.15 to 18.00 h, Lecture at Auditorium **HG G3**
Monday, 16.15 to 18.00 h, Exercise session at Auditorium **HG G3**
Start Date: 17. February 2020

Talks in Financial and Insurance Mathematics, Proff. P. Cheridito, M. Schweizer, J. Teichmann, M. 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: 20. February 2020

Additional Lectures at the University of Zurich:

Microeconomics of Insurance II, by Prof. Dr. Pablo Koch Medina, #2385

This is a continuation of the lecture Microeconomics in Insurance held in the winter semester. We explore additional selected topics.

Place: University of Zurich
Time: Monday, 08:00 to 09:45 h
Start Date: 24. February 2020

Capital Adequacy and Risk Measures, by Prof. Dr. Cosimo Munari, #0558

The aim of this lecture is to provide a comprehensive introduction to the theory of risk measures in a capital adequacy setting. We cover both theoretical and practical aspects. Special emphasis is given to the estimation and backtesting of Value at Risk and Expected Shortfall, the key risk measures in solvency regulation.

Place: University of Zurich
Time: Thursday, 08:00 to 09:45 h
Start Date: 20. February 2020

Topics of Applied Risk Management, by Dr. Gerold Studer, #3481

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
Time: Friday, 16.15 to 18.00 h
Start Date: 28. February 2020

Affiliation of the lecturers

Prof. Dr. Joachim Buhmann
D-INFK, ETH Zurich, CAB G69.2
jbuhmann@inf.ethz.ch

Dr. Christoph Buser
smile.direct versicherungen
christoph.buser@math.ethz.ch

Prof. Dr. Patrick Cheridito
D-MATH, ETH Zurich, HG G27.5
patrick.cheridito@math.ethz.ch

Dr. René Dahms
rene.dahms@math.ethz.ch

Dr. Irina Gemmo
D-MTEC, ETH Zurich, ZUE C13
igemmo@ethz.ch

Dr. Hansjörg Furrer
Swiss Re
hansjoerg.furrer@math.ethz.ch

Christina Heinze-Deml
D-MATH, ETH Zürich, HG G23.2
heinzedeml@stat.math.ethz.ch

Prof. Dr. Pablo Koch Medina
Department of Banking and Finance UZH
pablo.koch@bf.uzh.ch

Prof. Dr. Michael Koller
michael.koller@math.ethz.ch

Prof. Dr. Marloes Maathuis
D-MATH, ETH Zurich, HG G15.1
marloes.maathuis@stat.math.ethz.ch

Dr. Martin Mächler
D-MATH, ETH Zurich, HG G16
maechler@stat.math.ethz.ch

Prof. Dr. Cosimo-Andrea Munari
Department of Banking and Finance UZH
cosimo.munari@bf.uzh.ch

Prof. Dr. Martin Schweizer
D-MATH, ETH Zurich, HG G51.2
martin.schweizer@math.ethz.ch

Dr. Gerold Studer
New Reinsurance Company Ltd
gerold.studer@uzh.ch

Prof. Dr. Josef Teichmann
D-MATH, ETH Zürich, HG G54.2
josef.teichmann@math.ethz.ch

Prof. Dr. Mario Wüthrich
D-MATH, ETH Zurich, HG F42.2
mario.wuethrich@math.ethz.ch