Universität Bremen*

Leibniz Universität Hannover

CARL VON OSSIETZKY universität OLDENBURG

Joint PhD Seminar in Statistics, Financial and Actuarial Mathematics

Bremen University,
Leibnitz Univerisity, Hanover,
Carl von Ossietzky University, Oldenburg

February, 26 and 27, 2016
Oldenburg, Germany

Welcome

Dear attendees,

welcome to Oldenburg University for the first joint PhD Seminar in Statistics, Financial and Actuarial Mathematics among the universities of Bremen, Hanover, and Oldenburg. The scope of this seminar is to bring together PhD students from the Northern universities in the mentioned fields of study and to foster discussions among you both on topics of your research and on general PhD related questions. Moreover, the opportunity to present your results in an extended format of 35 minutes allows the colleagues from other places to get a deeper insight into current research of the other groups and will hopefully give you valuable feedback for your work on top of your advisors'. Of course, as any pressing deadline, such a presentation will also push forward your work and get you closer to successfully finishing your thesis.

Speakers

Kerstin Awiszus, Hanover University
Matthias Brückner, Bremen University, Institute for Statistics
Anna-Maria Hamm, Hanover University
Andreas Mändle, Oldenburg University, Institute for Mathematics
André Neumann, Bremen University, Institute for Statistics
Thomas Salfeld, Hanover University
Martin Scharpenberg, Bremen University, Institute for Statistics
Konstantin Schildknecht, Epiontis GmbH, Berlin
Natalia Sirotko-Sibirskaya, Bremen University, Institute for Statistics
Yi-Ting Tsai, Oldenburg University, Institute for Mathematics

Organizing Team

Werner Brannath
Thorsten Dickhaus
Angelika May
Peter Ruckdeschel
Stefan Weber

How to reach Oldenburg University

By Car:

Coming from Bremen, take the A28 to Oldenburg and use exit 12, Oldenburg Haarentor, turn right into the Ammerländer Heerstraße and follow the signs to Campus Wechloy, i.e., on Ammerländer Heerstraße, you drive straight on until the Mercedes merchant Rosier to your right, where you turn right into the Carl-von-Ossietzky-Straße. Keep on this street until you reach the parking lot of Campus Wechloy.

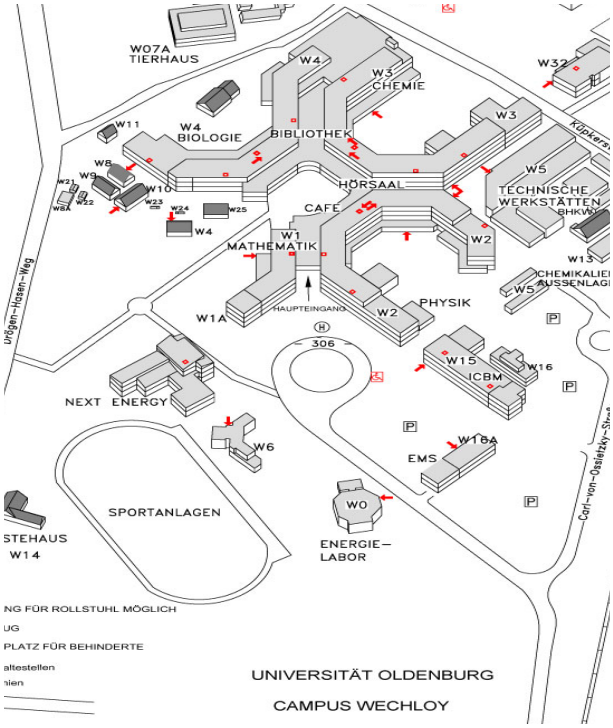
GPS: Carl-von-Ossietzky-Straße 9–11, 26129 Oldenburg

By rail and bus:

Coming from Bremen, almost all trains from Nordwestbahn to Oldenburg also call in Oldenburg Wechloy from where it is a 5min walk to the venue of the PhD Seminar. From Oldenburg Hauptbahnhof (main station), you may also take bus 306 which has Wechloy as final destination.

Both:

At the main entrance you turn left for the Institute for Mathematics, and there the room will be W01 1-117, i.e., on the first floor.



Programme Overview

Friday, February 26th, 2016 (Room W01 1-117)

12:50 - 13:00 **Welcome Session**
— *Peter Ruckdeschel*, Oldenburg University

Block 1: Identifying Risk Factors
— Chair: *Stefan Weber*, Hanover University

13:00 - 13:35 *Natalia Sirotko-Sibirskaya*, Bremen University: Simultaneous Statistical Inference in Dynamic Factor Models (Estimation, Simulation, Application)

13:45 - 14:20 *Anna-Maria Hamm*, Hanover University: Group Risk and Group Regulation

14:30 - 15:00 Coffee Break

Block 2: Semi-/Nonparametric Approaches in Parametric Contexts
— Chair: *Peter Ruckdeschel*, Oldenburg University

15:00 - 15:35 *Konstantin Schildknecht*, Epiontis, Berlin: Finite sample approach for empirical likelihood

15:45 - 16:20 *Martin Scharpenberg*, Bremen University: Mean impact analysis - a new (non-linear) measure of association

16:30 - 17:00 Coffee Break

Block 3: Hazard Rates in Finance and in Clinical Trials
— Chair: *Werner Brannath*, Bremen University

17:00 - 17:35 *Thomas Salfeld*, Hanover University: VECM of a 2-Factor Logistic-Type Hazard Rate Model

17:45 - 18:20 *Matthias Brückner*, Bremen University: Nonparametric Group-sequential and Adaptive Designs for Survival Data

19:30 - 21:00 Dinner at Casa Vecchia, Kleine Kirchenstraße 8, 23122 Oldenburg

Saturday, February 27th, 2016 (Room W01 1-117)

Block 4: Multivariate and Multiple Testing
— Chair: *Thorsten Dickhaus*, Bremen University

09:00 - 09:35 *André Neumann*, Bremen University: Statistical inference for Bernstein copulae with applications in multiple testing

09:45 - 10:20 *Andreas Mändle*, Oldenburg University: An Anderson-Darling approach for testing the goodness of fit of multivariate data

10:30 - 11:00 Coffee Break

Block 5: Dealing with Risk in Finance
— Chair: *Angelika May*, Oldenburg University

11:00 - 11:35 *Kerstin Awiszus*, Hanover University: Modeling and Measuring Systemic Risk

11:45 - 12:20 *Yi-Ting Tsai*, Oldenburg University: CPPI strategies and the problem of long-term guarantees

12:30 - 12:40 **Closing Session**
— *Peter Ruckdeschel*, Oldenburg University

13:00 - 14:30 Lunch Break at AliBaba, Ammerländer Heerstraße 120, 26129 Oldenburg

Abstracts

Modeling and Measuring Systemic Risk

Kerstin Awiszus

Hanover University

11:00 - 11:30, Saturday, February 26th, Block 5

Systemic risk refers to the risk that a financial system is susceptible to failures initiated by the characteristics of the system itself. If strong links between financial institutions are present, a shock to only a small number of entities might propagate through the system and trigger substantial financial losses. The talk presents a comprehensive model of a financial system that integrates local and global interaction of market participants through nominal liabilities, bankruptcy costs, fire sales, and cross-holdings. For the integrated financial market we prove the existence of a price-payment equilibrium and design an algorithm for the computation of the greatest and the least equilibrium. Systemic risk measures and the number of defaults corresponding to the greatest price-payment equilibrium are analyzed in several comparative case studies. These illustrate the individual and joint impact of the underlying factors.

Nonparametric Group-sequential and Adaptive Designs for Survival Data

Matthias Brückner

Bremen University, Institute for Statistics

17:45 - 18:20, Friday, February 26th, Block 3

In clinical trials survival endpoints are usually compared using the log-rank test. Sequential methods for the log-rank test and the Cox proportional hazards model are largely reported in the statistical literature. When the proportional hazards assumption is violated the hazard ratio is ill-defined and the power of the log-rank test depends on the distribution of the censoring times. The average hazard ratio was proposed as an alternative effect measure, which has a meaningful interpretation in the case of non-proportional hazards, and is equal to the hazard ratio, if the hazards are indeed proportional. We prove that the average hazard ratio based sequential test statistics are asymptotically multivariate normal with the independent increments property. This allows for the calculation of group-sequential boundaries using standard methods and existing software. The finite sample characteristics of the new method are examined in a simulation study in

a proportional and a non-proportional hazards setting. We will also discuss the use of this kind of test statistics in adaptive designs.

Group Risk and Group Regulation

Anna-Maria Hamm

Hanover University

13:45 - 14:20, Friday, February 26th, Block 1

Within individual insurance firms and insurance groups the allocation of capital to sub-entities is a key issue. From the point of view of companies, capital allocation provides a tool for the management of both risk and return. At the same time, the chosen procedures have to respect outside regulatory constraints as, for example, imposed by Solvency II. The paper develops a general framework for capital allocation in insurance groups. Conditional on any capital allocation in the insurance group, the sub-entities generate random net asset values at a fixed future time horizon. Insurance groups can shape these values not only via classical asset-liability management, but more fundamentally by the design of their structure in conjunction with suitable capital transfer agreements. From a regulatory point of view, the resulting random vector of net asset values of all entities needs to be acceptable. We measure group risk by the set of allocations of additional capital that lead to acceptable outcomes. As a consequence, the resulting group risk measures are set-valued. In a further step, we identify optimal capital allocations by optimizing the acceptable capital allocations subject to different objectives of the group's management.

An Anderson-Darling approach for testing the goodness of fit of multivariate data

Andreas Mändle

Oldenburg University, Institute for Mathematics

09:45 - 10:20, Saturday, February 27th, Block 4

In the fields of finance and insurance we often face the problem of modelling extremal events, e.g. when measuring the risk of holding an equity portfolio or the insurance risk of possible losses in different lines of business. This involves making distributional assumptions for multivariate, sometimes even high-dimensional data. It has been frequently observed that in practice tails are heavier than "normal" and extremes appear in clusters, indicating tail dependence. In such cases the assumptions of normality are violated. Therefore there is often uncertainty if the normal assumption can still be justified. In the univariate case a popular

method of testing the assumption of normality is by using the Anderson-Darling test. It is known for its strong power, especially when detecting deviations in the tails of a distribution. Here a possible generalization of the Anderson-Darling test to the multivariate case will be considered. Although some theoretical results about a multivariate extension of the multivariate Anderson-Darling statistic are already known, so far its application in a multivariate test seemed inconvenient, as the calculation of the n-variate test statistic required the calculation of an n-dimensional integral. Here, a calculation formula of this multivariate Anderson-Darling statistic for finite, multidimensional samples will be presented. Using this formula immensely simplifies the calculation and thus serves as one key ingredient to facilitate the practical use of the test. In order to evaluate the use of this new approach in comparison with the other tests, the test which is proposed here has run against widely used tests for multivariate normality in an example setting.

Statistical inference for Bernstein copulae with applications in multiple testing

André Neumann

Bremen University, Institute for Statistics

09:00 - 09:35, Saturday, February 27th, Block 4

A way to estimate continuous functions are Bernstein polynomials. Sancetta and Satchell (2004) established the approximation of copula functions using Bernstein polynomials. These so called Bernstein copulas are nonparametric estimates with some desirable features like smoothness. In this talk, we extend the statistical properties of Bernstein copulas proven in Janssen et al. (2012) to the multivariate case and study their impact on multiple tests. We can use them to derive asymptotic confidence regions similar to the parametric case as in Stange at al. (2015). Finally, we present results of a simulation study for the family-wise error rate and compare these results with common calibrations like the Bonferroni and Šidák correction.

VECM of a 2-Factor Logistic-Type Hazard Rate Model

Thomas Salfeld

Hanover University

13:45 - 14:20, Friday, February 26th, Block 1

In the talk we present a two stage stochastic mortality model. The first part contains a parametric logistic-type hazard rate and forms the static component of

the model. The second component forms the dynamic part and consists of a vector autoregressive times series to capture the time evolution of the mortality rates. We present some characteristics of the proposed logistic hazard rate model and illustrate some connections to other popular hazard rate models. Furthermore we present a sequential parameter estimation procedure and motivate the application a cointegrated time series for the dynamics of the logistic hazard rate factors.

Mean impact analysis - a new (non-linear) measure of association

Martin Scharpenberg

Bremen University, Institute of Statistics

09:45 - 10:20, Saturday, February 27th, Block 4

In this talk, we present a new (generally) non-linear measure of association (called "mean impact") which enables us to quantify the overall association between the target and independent variable. The idea is to consider the maximum change in the population mean of the target variable when the distribution of the covariates is changed in a suitably standardized way. We show that linear and non-linear regressions provide conservative estimates for our new model-independent measure of association. This immediately leads to a new interpretation of linear regression coefficients. Furthermore, the framework of the mean impact enables us to quantify the overall association between the variables from various types of non-linear regression analyses such as kernel smoothing and spline fitting. We derive confidence intervals for the new association parameter based on normal approximations as well as bootstrap based confidence intervals. The method is illustrated with examples and investigated in a simulation study.

Finite sample approach for empirical likelihood

Konstantin Schildknecht

Epiontis GmbH, Berlin

17:00 - 17:35, Friday, February 26th, Block 3

Empirical likelihood is a nonparametric statistical approach. It allows for making inference about statistical functionals that can be expressed as smooth functions of the mean while making almost no assumptions on the distribution of the random variables of interest. The approach is challenged by large dimensionality and/or small sample sizes. The calibration of derived tests or confidence intervals often relies on asymptotic results, neglecting error terms distorting the practical application. In this work we aim to transfer the results of the finite sample ap-

proach by Spokoiny (2012) to the empirical likelihood context and want to derive sharp probability bounds such that we can construct confidence regions which keep the desired significance level accurately.

Simultaneous Statistical Inference in Dynamic Factor Models (Estimation, Simulation, Application)

Natalia Sirotko-Sibirskaya

Bremen University, Institute for Statistics

13:45 - 14:20, Friday, February 26th, Block 1

In their paper "Simultaneous Statistical Inference in Dynamic Factor Models" Dickhaus and Pauly 2015 introduce a likelihood-based inference technique which allows for simultaneous testing in (exact) dynamic factor models. The newly introduced testing methodology is based on a multivariate central limit theorem for empirical Fourier transforms of observable time series which the authors prove in their work in the context of dynamic factor models. In my work I provide simulations for the methodology introduced by Dickhaus and Pauly 2015 and test it on economic data.

CPPI strategies and the problem of long-term guarantees

Yi-Ting Tsai

Oldenburg University, Institute for Mathematics

11:45 - 12:20, Saturday, February 26th, Block 5

Constant proportion portfolio insurance (CPPI) is one of the investment strategies that has been widely applied to structured credit products under principal guaranteed framework. Nevertheless, the guarantees are still likely to be unfulfilled due to market frictions. Since the guarantees are regarded as liabilities for issuers, e.g. life insurance companies, products with long-term guarantees should be handled more cautiously in order to reduce the possibility that claims fail to be met. Firstly, in the work we propose a new model concerning the gap risk in the risky asset, and loosen the traditional restriction on the non-risky asset, which is constantly assumed to evolve with risk-free rate. Secondly, the closed-form solutions to some risk measures are given under the new framework. Last but not least, we simulate the results of the model in which the gap risk is governed by a compound Poisson process with jump sizes log-Gumbel distributed, and compare this result with other known models, e.g. Kou and Merton models. The cushion dynamic is under the new framework driven by a bivariate Lévy process, the solution to the stochastic differential equation is a generalized Ornstein-Uhlenbeck

process. Hence we are able to derive explicitly the risk measures through stochastic integration. In matter of simulation the following parameter estimation methods are applied: empirical characteristic function method (ECF) and maximum likelihood estimation method (MLE). Moreover, we also combine the two methods in order to accelerate the speed of estimation. The performances of different initial values, chosen by experience and estimated from cumulant matching method (CMM), are also being investigated, respectively. From the aspect of estimated parameters we can see, on one hand, initial values obtained from CMM method not only do not bring out evident effects on better fit as expected, but also slow down the procedure of estimation in most cases; on the other hand, the result shows that it is appropriate to use ECF method as an auxiliary to locate a better set of initial values for the MLE method, since it improves distinctly the efficiency by saving 30-60% of elapsed time. If we look at the models themselves, we see that the model with log-Gumbel jumps outperforms the others with the parameters estimated from ECF and CMM/ECF methods under Akaike information criterion. The models are further examined for their forecasting ability.

Presentations

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On a voluntary base, after the workshop, the slides of the presentations will be made accessible under

`http://statolbre.synology.me:5000`

for

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user: PhDSem
password: HBHOL16
```

(valid until end of 2016). If you have difficulties with the upload, of course you can also send your presentation to `peter.ruckdeschel@uni-oldenburg.de` .