10th Workshop on New Developments in Econometrics and Time Series[1]

June 6–7, 2019

Venue:

Graz University of Technology
Rechbauerstrasse 12, Graz

Organizers:

Holger Dette (Ruhr-Universität Bochum)
Marc Hallin (ECARES-ULB)
Siegfried Hörmann (Graz University of Technology)

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Program

Thursday, June 6

08:45–09:15 Registration

09:15–09:30 Opening

Morning session (Chair: Manfred Deistler)

09:30–10:20 **Alexander Aue** (University of California, Davis)
Bootstrapping spectral statistics in high dimensions

10:20–11:10 **Hannes Leeb** (University of Vienna and DataScience@UniVienna)
Statistical inference with F-statistics when fitting simple models to high-dimensional data

11:10–11:40 Coffee break

11:40–12:30 **Tobias Kley** (University of Bristol)
Integrated copula spectral densities and their applications

12:30–14:00 Lunch break

Afternoon session (Chair: Alexander Aue)

14:00–14:50 **Efstathia Bura** (Vienna University of Technology)
Sufficient dimension reduction in econometrics

14:50–15:40 **Manfred Deistler** (Technical University of Vienna)
High frequency linear time series models and mixed frequency data

15:40–16:10 Coffee break

16:10–17:00 **Hans Manner** (University of Graz)
Model and moment selection in factor copula models

17:00–17:50 **Benedikt M. Pötscher** (University of Vienna)
Controlling the size of heteroskedasticity and/or autocorrelation robust tests

19:00–22:00 Conference dinner for invited speakers

Friday, June 7

Morning session (Chair: Holger Dette)

09:30–10:20 **Greg Rice** (University of Waterloo)
Inference for the autocovariance of a functional time series, and goodness-of-fit tests for fGARCH models

10:20–11:10 **Efstathios Paparoditis** (University of Cyprus)
Some recent developments in bootstrapping functional time series

11:10–11:40 Coffee break

11:40–12:30 **Tailen Hsing** (University of Michigan)
Space-time data, intrinsic stationarity and functional models

12:30–14:00 Lunch break

Afternoon session (Chair: Tailen Hsing)

14:00–14:50 **Antonio Cuevas** (Universidad Autónoma de Madrid)
On the advantages of using an RKHS approach in functional regression problems

14:50–15:40 **Dominik Liebl** (University of Bonn)
Super-Consistent Estimation of Points of Impact in Nonparametric Regression with Functional Predictors

15:40–15:50 Closing

Abstracts

Bootstrapping spectral statistics in high dimensions

Alexander Aue (University of California, Davis)

Spectral statistics play a central role in many multivariate testing problems. It is therefore of interest to approximate the distribution of functions of the eigenvalues of sample covariance matrices. Although bootstrap methods are an established approach to approximating the laws of spectral statistics in low-dimensional problems, these methods are relatively unexplored in the high-dimensional setting. The aim of this talk is to focus on linear spectral statistics (LSS) as a class of "prototype statistics" for developing a new bootstrap method in the high-dimensional setting. In essence, the method originates from the parametric bootstrap, and is motivated by the notion that, in high dimensions, it is difficult to obtain a non-parametric approximation to the full data-generating distribution. From a practical standpoint, the method is easy to use, and allows the user to circumvent the difficulties of complex asymptotic formulas for LSS. In addition to proving the consistency of the proposed method, I will discuss encouraging empirical results in a variety of settings. Lastly, and perhaps most interestingly, simulations indicate that the method can be applied successfully to statistics outside the class of LSS, such as the largest sample eigenvalue and others.
(The talk is based on joint work with Miles Lopes and Andrew Blandino (both UC Davis) which is available at https://arxiv.org/abs/1709.08251.)

Statistical inference with F-statistics when fitting simple models to high-dimensional data

Hannes Leeb (University of Vienna and DataScience@UniVienna)

We study linear subset regression in the context of the high-dimensional overall model $y = \vartheta + \theta' z + \epsilon$ with univariate response y and a d-vector of random regressors z, independent of ϵ. Here, 'high-dimensional' means that the number d of available explanatory variables is much larger than the number n of observations. We consider simple linear sub-models where y is regressed on a set of p regressors given by $x = M'z$, for some $d \times p$ matrix M of full rank $p < n$. The corresponding simple model, i.e., $y = \alpha + \beta' x + e$, can be justified by imposing appropriate restrictions on the unknown parameter θ in the overall model; otherwise, this simple model can be grossly mis-specified. In this paper, we establish asymptotic validity of the standard F-test on the surrogate parameter β, in an appropriate sense, even when the simple model is mis-specified.
(This is joint work with Lukas Steinberger (University of Freiburg).)

Integrated copula spectral densities and their applications

Tobias Kley (University of Bristol)

Copula spectral densities are defined in terms of the copulas associated with the pairs (X_{t+k}, X_t) of a process $(X_t)_{t\in\mathbb{Z}}$. Thereby they can capture a wide range of dynamic features, such as changes in the conditional skewness or dependence of extremes, that traditional spectra cannot account for. A consistent estimator for copula spectra was suggested by Kley et al. [Bernoulli 22 (2016)] who prove a functional central limit theorem (fCLT) according to which the estimator, considered as a stochastic process indexed in the quantile levels, converges weakly to a Gaussian limit. Similar to the traditional case, no fCLT exists for this estimator when it is considered as a stochastic process indexed in the frequencies. In this talk, we consider estimation of integrated copula spectra and show that our estimator converges weakly as a stochastic process indexed in the quantile levels and frequencies. Interestingly and in contrast to the estimator considered by Kley et al., estimation of the unknown marginal distribution has an effect on the asymptotic covariance.
(This is joint work with H. Dette, M. Hallin, R. Van Hecke and S. Volgushev.)

Sufficient dimension reduction in econometrics

Efstathia Bura (Vienna University of Technology)

Sufficient Dimension Reduction (SDR) summarizes a vector of predictors x as it relates to a univariate or multivariate response y, so that all the information in the conditional distribution of $y|x$ is preserved. SDR appeared in the early 90's and its methodology has grown significantly since then. SDR primarily comprises of moment based and model (distribution) methods for the inverse predictors. It encompasses both linear and non-linear reductions of the predictors and it is exhaustive. Nevertheless, SDR was developed for cross-sectional data. A general SDR framework for macro-forecasting and a comparison with widely used methods for analyzing large panels of macro-variables will be presented.

High frequency linear time series models and mixed frequency data

Manfred Deistler (Technical University of Vienna)

We consider identification of multivariate linear dynamic models from so called mixed frequency (MF) data, i.e. from data where the univariate components of the time series are sampled at different frequencies; in economic applications this occurs if e.g. unemployment data are sampled monthly and GNP is available only quarterly. Our interest is in the underlying "high frequency" (HF) model, i.e. in the model generating outputs at the highest sampling frequency. The model classes considered are multivariate AR and ARMA models (both with nonsingular and singular innovation variance) and linear dynamic factor models. We discuss problems of parameter identifiability and of estimation. In estimation, in particular MLE's and EM algorithms are analyzed, both w.r.t their asymptotic and finite sample properties.
(This is joint work with B.D.O. Anderson (ANU) and A. Braumann (TU Braunschweig).)

Model and moment selection in factor copula models

Hans Manner (University of Graz)

This paper develops a simultaneous model and moment selection procedure for factor copula models. Since the density of the factor copula is not known in closed form, widely used likelihood or moment based model selection criteria cannot be directly applied on factor copulas. The new approach is inspired by the methods for GMM proposed by Andrews (1999) and Andrews and Lu (2001). The consistency of the procedure is proved and Monte Carlo simulations show its good performance in finite samples. Our selection procedure shows considerable selection frequencies of the true models in different scenarios of sample sizes and dimensions. The impact of the choice of moments in selected regions of the support on model selection and Value-at-Risk prediction are further examined by simulation and an application to a portfolio consisting of ten stocks in the DAX30 index.
(This is joint work with Fang Duan, Technical University of Dortmund, Faculty of Statistics & Ruhr Graduate School in Economics and Dominik Wied (University of Cologne, Institute of Econometrics and Statistics).)

Controlling the size of heteroskedasticity and/or autocorrelation robust tests

Benedikt M. Pötscher (University of Vienna)

Commonly used heteroskedastictiy/autocorrelation robust tests are known to suffer from size distortions not infrequently. We discuss under which conditions and how such tests can be size-corrected.

Inference for the autocovariance of a functional time series, and goodness-of-fit tests for fGARCH models

Greg Rice (University of Waterloo)

Most methods for analyzing functional time series rely on the estimation of lagged autocovariance operators or surfaces. Testing whether or not such operators are zero is an important diagnostic step that is well understood when the data, or model residuals, form a strong white noise. When functional data are constructed from dense records of, for example, asset prices or returns, a weak white noise model allowing for conditional heteroscedasticity is often more realistic. Applying inferential procedures for the autocovariance based on a strong white noise to such data often leads to the erroneous conclusion that the data exhibit significant autocorrelation. We develop methods for performing inference for the lagged autocovariance operators of stationary functional time series that are valid under general conditional heteroscedasticity conditions, and apply these to conduct goodness-of-fit tests for fGARCH models.

Some recent developments in bootstrapping functional time series

Efstathios Paparoditis (University of Cyprus)

We review some recent developments in bootstrapping functional time series and focus on applications of the bootstrap to testing equality of distributional characteristics of several stationary functional processes. The testing problems considered include that of testing for equality of mean functions, of autocovariance operators and of spectral density operators for temporal dependent, Hilbert space valued random variables using fully functional test statistics. We prove asymptotic validity of classical and of novel bootstrap procedures applied to approximate the distribution of such test statistics under the null and under very general and easy to verify dependence assumptions on the underlying functional processes. We illustrate the finite sample behavior and the applicability of the bootstrap procedures considered by means of simulations and of real-life data sets.

References:

[1] A. Leucht, E. Paparoditis and T. Sapatinas (2018). Testing Equality of Spectral Density Operators for Functional Time Series. *Submitted.*

[2] E. Paparoditis (2018). Sieve Bootstrap for Functional Time Series, *Annals of Statistics, 46, 3510-3538.*

[3] E. Paparoditis (2019). Score Process Representations and the Functional Sieve Bootstrap. *Manuscript.*

[4] D. Pilavakis, E. Paparoditis and T. Sapatinas (2018). Moving Block and Tapered Block Bootstrap for Functional Time Series with an Application to the K-Sample Mean Problem. *Bernoulli, to appear.*

Space-time data, intrinsic stationarity and functional models

Tailen Hsing (University of Michigan)

The topic of functional time series has received some attention recently. This is timely as many applications involving space-time data can benefit from the functional-data perspective. In this talk, I will start off with the Argo data, which have fascinating features and are highly relevant for climate research. I will then turn to some extensions of stationarity in the context of functional data. The first is to adapt the notion of intrinsic random functions in spatial statistics, due to Matheron, to functional data. Such processes are stationary after suitable differencing, where the resulting stationary covariance is referred to as generalized covariance. A Bochner-type representation of the generalized covariance as well as preliminary results on inference will be presented. The second extension considers intrinsic stationarity in a local sense, viewed from the perspective of so-called tangent processes. Motivations of this work can be found from studying the multifractional Brownian motion.

On the advantages of using an RKHS approach in functional regression problems

Antonio Cuevas (Universidad Autónoma de Madrid)

The talk is concerned with functional regression models, in which the explanatory variable X is a trajectory drawn from a second-order stochastic process $\{X(t),\ t \in [0,1]\}$ with covariance function $K = K(s,t)$, and the response variable Y is scalar. We will specifically consider two cases of particular relevance: the linear model (where Y is expressed as a linear continuous functional of X plus a random noise) and the logistic model, where the response Y is binary and we aim at modelling the conditional probability $\mathbb{P}(Y = 1|X = x)$ as a suitable function of x. In both cases, the assumed model involves a "slope function" β to be estimated, and a major aim is predicting Y as a function of the explanatory variable X.
So far, the most popular approaches to these problems are L^2-based, that is, they rely on the use of the classical $L^2[0,1]$ space as the natural environment for the slope function β. While $L^2[0,1]$ looks as a quite obvious choice, we will show here that the Reproducing Kernel Hilbert Space (RKHS) generated by K is, in several aspects, a more convenient habitat for β. In particular, the use of such RKHS space leads in both models (linear and logistic) to some clear advantages in terms of interpretability and variable selection.
Some important problems regarding the estimation of β will be commented. These include some quite radical results of non-existence for the maximum likelihood estimator in the functional logistic model.
A few recent (yet unpublished) results on the RKHS-based estimation of β in the linear model will be also summarized.

Finally, some comments on the meaning of the coefficient of determination in a functional setting will be briefly discussed.

This talk is essentially based on joint papers (recently published and ongoing) with J. R. Berrendero, B. Bueno-Larraz (Universidad Autónoma de Madrid) and Alejandro Cholaquidis (Universidad de la República, Uruguay).

Super-Consistent Estimation of Points of Impact in Nonparametric Regression with Functional Predictors

Dominik Liebl (University of Bonn)

Predicting scalar outcomes using functional predictors is a classical problem in functional data analysis. In many applications, however, only specific locations or time-points of the functional predictors have an impact on the outcome. Such points of impact are typically unknown and have to be estimated besides the usual model components. In this paper we consider the case of nonparametric models and the practically relevant case of generalized linear models. We show that our point of impact estimators enjoy a super-consistent convergence rate and do not require knowledge or pre-estimates of the model components. This remarkable result facilitates the subsequent estimation of the remaining model components as shown in the theoretical part. The finite sample properties of our estimators are assessed by means of a simulation study. Our methodology is motivated by a novel psychological case study in which the participants were asked to continuously rate their emotional state while watching an affective online video on the persecution of African albinos.

This is joint work with Dominik Poß (University Bonn), Alois Kneip (University Bonn), Tor D. Wager (University of Colorado Boulder), Lisa Feldman Barrett (Harvard Medical School)