Workshop on Time Series and Extremes

May 16–17, 2019
Besançon, France

Organized by

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Introduction

This workshop will encompass recent research works on Time Series and Extremes.
A non exhaustive list of subjects covered is :

- time series modelling including long memory, non-causality or discrete value effects ;
- serially dependent extremes and regularly varying time series.

A short course on regularly varying time series will be given by Philippe Soulier.

Dates and places

The workshop will take place at the "Laboratoire de Mathématiques de Besançon" on May 16-17 2019. The conference opening is scheduled at 9:30 on May 16 and the conference ending at 16:00 on May 17.

The main conference room is room 316B. Lunches will be taken in room 324B. The conference dinner will take place on May 16 at 20 :30 in restaurant 1802 located place Granvelle.

Acknowledgement

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Program

Thursday May 16, 2019

09:30 Welcome & Coffee

10:00 Philippe Soulier, Université Paris Nanterre
Heavy tailed time series : models, limit theorems, estimation of extremal characteristics

11:30 Christian Francq, Université Lille 3 et CREST
Observation-driven count and duration time series models

12:30 Lunch

14:00 François Roueff, Telecom ParisTech
About linear and duration-driven long range dependence

15:00 Jean-Marc Bardet, Université Paris 1 Panthéon-Sorbonne
Local semi-parametric estimation for locally stationary process with infinite memory

16:00 Coffee break

16:30 Olivier Wintenberger, Sorbonne Université
Extreme Value Theory for the Diagonal BEKK-ARCH(1) Model

The conference dinner is in restaurant 1802 located place Granvelle at 20:30.

Friday May 17, 2019

09:00 Philippe Soulier, Université Paris Nanterre
Heavy tailed time series : models, limit theorems, estimation of extremal characteristics

10:30 Coffe break

11:00 Holger Drees, University of Hambourg
Block based extreme value statistics : disjoint vs moving blocks

12:00 Anja Janssen, Royal Institute of Technology in Stockholm
Dimension and complexity reduction for multivariate and serially dependent extremes

13:00 Lunch

14:00 Anne Philippe, Université de Nantes
Testing for long memory in panel random-coefficient AR(1) data

15:00 Jean-Michel Zakoian, CREST
Mixed Causal-Noncausal AR process and the modeling of bubbles

Heavy tailed time series : models, limit theorems, estimation of extremal characteristics

Philippe SOULIER, Université Paris Nanterre

Observation-driven count and duration time series models

Christian FRANCQ, Université Lille 3 and CREST

Joint work with Abdelhakim Aknouche.
We consider a positive-valued time series whose conditional distribution has a time-varying mean, which may depend on exogenous variables. The main applications concern count or duration data. Under a contraction condition on the mean function, it is shown that stationarity and ergodicity hold when the mean and stochastic orders of the conditional distribution are the same. The latter condition holds for the exponential family parameterized by the mean, but also for many other distributions. We provide conditions for the existence of marginal moments and for the geometric decay of the beta-mixing coefficients. Simulation experiments and illustrations on series of stock market volumes and of greenhouse gas concentrations show that it is worth relaxing the multiplicative-error form of usual duration models, as done in the present paper. We then study weighted least squares estimators of the conditional mean parameters and show that this estimation procedure offers important advantages over quasi-maximum likelihood estimators.

Local semi-parametric estimation for locally stationary process with infinite memory

Jean-Marc BARDET, University Paris 1, Pantheon-Sorbonne

We first prove the existence of a general non stationary model with infinite memory. In the case of local-stationarity and under Lipshitzian conditions, we obtain limit theorem for a general contrast convoluted by a kernel. We deduce the asymptotic behavior of a non-parametric estimator of the time-varying parameters of the model. Examples of least square, least absolute value or quasi-maximum likelihood are proposed as well for ARMA, GARCH processes as for integer-valued process...

About linear and duration-driven long range dependence

François ROUEFF, Telecom ParisTech

We consider long range dependent (LRD) time series in the sense usually adopted in statistical inference. Namely, LRD time series are weakly stationary and they admit a spectral density the behavior of which at the origin is mainly driven by a power law. The negated half of the exponent of this power law is called the long memory parameter. Linear processes, defined as the output of a linear filtering of a strong white noise, have been extensively used to model such time series. Other ways of generating long range dependence have been considered, many of them resorting to superimposing scattered independent processes with finite supports of (random) heavy tailed sizes. This is sometimes referred to as *duration-driven long range dependence*. Linear and duration-driven LRD processes enjoy similar or identical second-order structures. However their large scale behaviors are completely different. This can been seen by looking at the convergence of the centered and normalized partial sums. In all the known cases, different limits are obtained depending on the linear or duration-driven nature of the LRD. Such different behaviors are expected to have consequences on the statistical inference for estimating the long memory parameter. Although the theory for the parametric or semi-parametric estimation of the long memory parameter has been extensively developed for linear LRD processes, it cannot be said so as yet for duration-driven ones.

Extreme Value Theory for the Diagonal BEKK-ARCH(1) Model

Olivier WINTENBERGER, Sorbonne Université

In this talk, we study the regular variation properties of a multivariate GARCH model. In order to account for the possibility of different tail indices of the marginals, we consider the notion of vector scaling regular variation (VSRV), closely related to non-standard regular variation. We show that, despite a common randomness in the volatility equation, the marginals are asymptotically independent. The characterization of the tail behavior of the processes is used for deriving the asymptotic properties of the sample covariance matrices.

Block based extreme value statistics : disjoint vs moving blocks

Holger DREES, University of Hamburg

Consider a stationary time series $(X_t)_{1\le t\le n}$ of length n. Extreme value estimators are often constructed from blockwise defined statistics. Then one may either split the time series in disjoint blocks $(X_t)_{(i-1)l+1\le t\le il}$, $1 \le i \le [n/l]$, of length l, or one may use moving blocks $(X_t)_{i\le t\le i+l-1}$, $1 \le i \le n-l+1$. For specific statistics, it has been observed that the latter approach leads to a better asymptotic behavior ; see, e.g., Bücher and Segers (2018) and Robert et al. (2009).

We will discuss a general unifying framework in which both type of statistics can be analyzed asymptotically.

References

Bücher, A., and Segers, J. (2018). Inference for heavy tailed stationary time series based on sliding blocks. *Electr. J. Statist.* **12**, 1098–1125.

Robert, C.Y., Segers, J., and Ferro, C.A.T. (2009). A sliding blocks estimator for the extremal index. *Electr. J. Statist.* **3**, 993–1020.

Dimension and complexity reduction for multivariate and serially dependent extremes

Anja JANSSEN, Royal Institue of Technology in Stockholm

Partly based on a joint project with Phyllis Wan, Erasmus University Rotterdam.
Dimension reduction has become an important topic in statistics and has more recently also been applied in the context of extreme value theory. In this talk, we start by giving an overview over some approaches which have been pursued in this context so far and continue with discussing how the standard assumption of regular variation (both for multivariate data and for time series) can be used to construct simple and efficient ways to model and describe dependency structures of extremes both over time and between components. Finally, we will have a look at a few relevant data examples.

Testing for long memory in panel random-coefficient AR(1) data

Anne PHILIPPE, Université de Nantes

It is well known that random-coefficient AR(1) process can have long memory depending on the index β of the tail distribution function of the random coefficient, if it is a regularly varying function at unity. We discuss the estimation of β from panel data comprising N random-coefficient AR(1) series, each of length T. The estimator of β is constructed as a version of the tail index estimator applied to sample lag 1 autocorrelations of individual time series. Its asymptotic normality is derived under certain conditions on N, T and some parameters of our statistical model. Based on this result, we construct a statistical procedure to test if the panel random-coefficient AR(1) data exhibit long memory. A simulation study illustrates finite-sample performance of the introduced estimator and testing procedure.

Mixed Causal-Noncausal AR process and the modeling of bubbles

Jean-Michel ZAKOIAN, CREST

Joint work with Sébastien Fries, CREST.
Noncausal autoregressive models with heavy-tailed errors generate locally explosive processes and, therefore, provide a convenient framework for modelling bubbles in economic and financial time series. We investigate the probability properties of mixed causal-noncausal autoregressive processes, assuming the errors follow a stable non-Gaussian distribution. We show that the conditional distribution in direct time is lighter-tailed than the errors distribution, and we emphasize the presence of ARCH effects in a causal representation of the process. Under the assumption that the errors belong to the domain of attraction of a stable distribution, we show that a causal AR representation with non-i.i.d. errors can be consistently estimated by classical least-squares. We derive a portmanteau test to check the validity of the estimated AR representation. An empirical study on simulated and real data illustrates the potential usefulness of the results.