Waseda International Symposium on "Stable Process, Semimartingale, Finance & Pension Mathematics"

Organizers: Masanobu Taniguchi (Waseda Univ.), Dou Xiaoling (ISM)
and Kenta Hamada (Waseda Univ.)

March 3-5, 2014 Waseda University, Nishi-Waseda Campus,
Building 55S-2th Floor Meeting Room 3
(map http://www.sci.waseda.ac.jp/eng/access/)

Supported by Kiban (A) (23244011) (M.Taniguchi)
& Government Pension Investment Fund (GPIF), Japan

Waseda International Symposium on "Stable Process, Semimartingale, Finance & Pension Mathematics"

Organizers: Masanobu Taniguchi (Waseda Univ.), Dou Xiaoling (ISM)
and Kenta Hamada (Waseda Univ.)

Waseda University, Nishi-Waseda Campus, Building 55S-2th Floor Meeting Room 3
(map http://www.sci.waseda.ac.jp/eng/access/)

Supported by Kiban (A) (23244011) (M.Taniguchi)
& Government Pension Investment Fund (GPIF), Japan

March 3-5, 2014

Program

(* speaker)

March 3, 2014
13:00 - 14:40 : Chaired by X. Dou

13:00 - 13:30
(1) Generalized Periodogram and Its Statistical Inference for Time Series
Yan Liu (Waseda Univ.)

13:30 - 14:10
(2) Dimension reduction for locally stationary time series factor models
Junichi Hirukawa (Niigata Univ.)

14:10 - 14:50
(3) Estimation of autocopula with estimating function approach
Hiroaki Ogata (Waseda Univ.)

Coffee Break

15:10 - 17:20 : Chaired by J. Hirukawa

15:10 - 15:50
(4) Semiparametric statistics with infinite-dimensional martingales: Bridges between a stochastic maximal inequality and Cox's regression model
Yoichi Nishiyama (Inst. Statist. Math., Tokyo)

15:50 - 16:30
(5) Parameter change problem for diffusion processes
Ilia Negri (Univ. Bergamo)

16:30 - 17:20
(6) Inference for change point problems for fractional diffusion processes
B.L.S. Prakasa Rao (Univ. Hyderabad Campus)

March 4, 2014
9:30 - 10:50 : Chaired by T. Mikosch

9:30 - 10:10
(7) Empirical likelihood ratio for symmetric alpha-stable processes
Fumiya Akashi*, Yan Liu and Masanobu Taniguchi (Waseda Univ.)

10:10 - 10:50
(8) EM algorithms for estimating the Bernstein copula
Xiaoling Dou* (Inst. Stat. Math.), Satoshi Kuriki, Gwo Dong Lin and Donald Richards

Coffee Break

11:00 - 12:30 : Chaired by I. Negri

11:00 - 11:40
(9) LAD-based estimation of locally stable Ornstein-Uhlenbeck processes
H. Masuda (Kyushu Univ.)

11:40 - 12:30
(10) Nonparametric independence screening and structural identification for ultra-high dimensional longitudinal data
Ming-Yen Cheng, Toshio Honda* (Hitotsubashi Univ.), Jialiang Li and Heng Peng

Lunch

13:40 - 15:20 : Chaired by C. Klüppelberg

13:40 - 14:30
(11) Distributions of the maximum likelihood and minimum contrast estimators associated with the fractional Ornstein-Uhlenbeck process
Katsuto Tanaka (Gakusyuin Univ.)

14:30 - 15:20
(12) Extremogram and Ex-Periodogram for heavy-tailed time series
Thomas Mikosch* (Univ. Copenhagen), Richard A. Davis (Columbia Univ.) and Yuwei Zhao

Coffee Break

15:40 - 17:20 : Chaired by M.Taniguchi

15:40 - 16:30
(13) Continuous-time GARCH models
Claudia Klüppelberg (Munich Univ. Technology)

16:30 - 17:20
(14) Asymptotic Theory for the Sample Covariance Matrix of a Heavy-Tailed Multivariate Time Series
Richard A. Davis (Columbia Univ.)

Buffet Style Dinner
18:30 - Basyamichi (63 building 1st floor)

March 5, 2014
10:00 - 12:10 : Chaired by R. Davis

10:00 - 10:40
(15) Asymptotics of Realized Volatility with Non-Gaussian ARCH(∞) Microstructure Noise
Hiroyuki TANIAI*, T. Usami, N. Suto and M. Taniguchi (Waseda Univ.)

10:40 - 11:20
(16) Review of Statistical Portfolio Theory
Hiroshi Shiraishi (Jikei Medical Univ.)

11:20 - 12: 10
(17) Bayesian estimation of smoothly mixing time-varying parameter GARCH models
Cathy W. S. Chen* (Feng Chia Univ), Richard Gerlach and Edward M. H. Lin

Abstracts

(1) Generalized Periodogram and Its Statistical Inference for Time Series
Yan Liu (Waseda Univ.)
Abstract: Periodogram plays a crucial role in the parameter estimation in time series analysis. We generalize the idea of periodogram from a unified point of view of time series regression. The asymptotics for the periodogram of score function in M-estimation and the self-normalized periodogram are considered. Especially, the robust aspects of the former idea such as Laplace periodogram and generally quantile periodogram are provided. The statistical inference theory in time series with the periodogram is also developed.

(2) Dimension reduction for locally stationary time series factor models
Junichi Hirukawa (Niigata Univ.)
Abstract: The factor modeling for multivariate time series from a dimension-reduction viewpoint has been well developed under stationary and non-stationary setting. The inference is simple in the sense that both the number of factors and the factor loadings are estimated in terms of an eigenanalysis for a nonnegative definite matrix. However, many results are described by the consistency of the estimators. In this talk we will consider the factor modeling for multivariate locally stationary processes. Since we are interested in the comparison between stationary setting and locally stationary setting, the consistency results are not enough. The asymptotic normality or the mean squares error will be required. Here, we will consider the asymptotic normality of the estimators for locally stationary factor models. Furthermore, we will consider the dimension reduction for locally stationary factor models.

(3) Estimation of autocopula with estimating function approach
Hiroaki Ogata (Waseda Univ.)
Abstract: The autocorrelation is a basic, widely used measure for describing serial dependence of a stationary process. However, if the process has heavy-tailed distribution, and does not have a finite second order moment, the autocorrelation cannot be defined. One remedy for overcoming this drawback is to use the autocopulas proposed by Rakonczai et al. (2012). In this paper, we consider estimating problem of the autocopulas and give some Monte Carlo studies. The illustration to the real data is also given.

(4) Semiparametric statistics with infinite-dimensional martingales: Bridges between a stochastic maximal inequality and Cox's regression model
Yoichi Nishiyama (Inst. Statist. Math., Tokyo)
Abstract: As an alternative to the well-known methods of "chaining" and "bracketing" that have been developed in the study of random fields, a new stochastic maximal inequality is presented with a proof based on the formula for integration by parts. The main results in the talk are some central limit theorems in the space $\ell^\infty(T)$, the space of bounded functions on a set T equipped with the uniform metric, for some sequences of separable random fields of locally square-integrable martingales with the help also of entropy methods. As special cases, some new results for i.i.d. random sequences, including a new Donsker theorem and moment bounds for

suprama of empirical processes indexed by classes of sets or functions, are obtained. The latter part of the talk is concerned with some related topics of independent interest, such as seeking a sufficient condition for the existence of bounded continuous version of given separable, centered Gaussian random field and doing that for the VC-dimension of given countable class of sets to be finite, as well as statistical issues including an asymptotic representation theorem for semiparametric Z-estimators which leads to adaptive estimation and its applications to semiparametric model selection and change point problems. Illustrations for these results with Cox's regression models will be presented.

(5) Parameter change problem for diffusion processes
Ilia Negri (Univ. Bergamo)
Abstract: Testing on structural change problems has been an important issue in statistics. In the first part of this talk a test based on the continuous observation for detecting if a change of the parameter in the drift of a diffusion process takes place is proposed. The interest for this test is that the asymptotic distribution of the test statistics does not depend on the unknown parameter, so the test is asymptotically distribution free. It is also proved that the test is consistent against any alternative where the alternative means that at a certain instant the parameter specifying the drift coefficient change. In the second part of the talk we develop a general, unified approach, based on some partial estimation functions which we call "Z-process", and we apply it to the change point problems not only for ergodic models but also for some models where the Fisher infor- mation matrix is random. Applications to some diffusion process models observed discretely in time are discussed.

(6) Inference for change point problems for fractional diffusion processes
B.L.S. Prakasa Rao (Univ. Hyderabad Campus)
Abstract: There are some time series which exhibit long-range dependence as noticed by Hurst in his investigations of river water levels along Nile river. Long-range dependence is connected with the concept of self-similarity in that increments of a self-similar process with stationary increments exhibit long-range dependence under some conditions. Fractional Brownian motion is an example of such a process. We discuss statistical inference for stochastic processes modeled by stochastic differential equations driven by a fractional Brownian motion. These processes are termed as fractional diffusion processes. Since fractional Brownian motion is not a semimartingale, it is not possible to extend the notion of a stochastic integral with respect to a fractional Brownian motion following the ideas of Ito integration. There are other methods of extending integration with respect to a fractional Brownian motion. Suppose a complete path of a fractional diffusion process is observed over a finite time interval. We will present some results on inference for change point problems for such processes.

(7) Empirical likelihood ratio for symmetric alpha-stable processes
Fumiya Akashi, Yan Liu and Masanobu Taniguchi (Waseda Univ.)
Abstract: Empirical likelihood approach is one of non-parametric statistical methods. This method has been applied to the case of independent identically distributed random variables and second order stationary processes. In this talk, we apply this method to the hypothesis test-

ing or construction of confidence regions for pivotal unknown quantities of time series models. We often observe heavy-tailed and dependent data in many fields involving electrical engineering, hydrology, finance and physical systems. To model such data suitably, we consider symmetric α-stable linear processes generated by infinite variance innovation sequence. We derive the asymptotic distribution of the empirical likelihood ratio statistic for α-stable linear processes, and construct estimation and testing theory for heavy-tailed data. With the empirical likelihood statistic approach, the theory of statistical inference for second order stationary processes is nicely extended to heavy-tailed data analyses, not straightforward, and applicable to a lot of financial statistical analyses. Numerical studies are also provided, which confirm advantages of the empirical likelihood method.

(8) EM algorithms for estimating the Bernstein copula
Xiaoling Dou* (Inst. Stat. Math.), Satoshi Kuriki, Gwo Dong Lin and Donald Richards
Abstract: A method that uses order statistics to construct multivariate distributions with fixed marginals and which utilizes a representation of the Bernstein copula in terms of a finite mixture distribution is proposed. Expectation-maximization (EM) algorithms to estimate the Bernstein copula are proposed, and a local convergence property is proved. Moreover, asymptotic properties of the proposed semiparametric estimators are provided. Illustrative examples are presented using two real data sets and a 3-dimensional simulated data set. These studies show that the Bernstein copula is able to represent various distributions flexibly and that the proposed EM algorithms work well for such data.

(9) LAD-based estimation of locally stable Ornstein-Uhlenbeck processes
H. Masuda (Kyushu Univ.)
Abstract: We propose a very simple estimation procedure for a class of Ornstein-Uhlenbeck processes driven by a locally stable Levy process. The underlying process is supposed to be observed at high frequency with fixed terminal sampling time. We prove the asymptotic mixed normality of a LAD estimator. How to estimate other parameters in a simple way is also discussed. Especially if the driving Levy process is non-Gaussian stable, we prove the local asymptotic mixed normality. Due to the fixed-time asymptotics, we do not encounter the unit-root problem, entailing that we can estimate the auto-regressive parameter in a unified way even when the true model is a Levy process.

(10) Nonparametric independence screening and structural identification for ultra-high dimensional longitudinal data
Ming-Yen Cheng, Toshio Honda* (Hitotsubashi Univ.), Jialiang Li and Heng Peng
Abstract: Ultra-high dimensional longitudinal data are increasingly common and the analysis is challenging both theoretically and methodologically. We offer a new automatic procedure in hunting for a sparse semivarying coefficient model, which has been widely accepted for modeling longitudinal data. Our proposed method first reduces the number of covariates to a moderate order by employing a screening procedure, and then identifies both the varying and non-zero constant coefficients using a group SCAD estimator, which is then refined by accounting for the within-subject correlation. The screening procedure is based on working independence and

B-spline marginal varying coefficient models. Under weaker conditions than those in the literature, we show that with high probability only irrelevant variables will be screened out and the number of variables left can be bounded by a moderate order, thus the desirable sparsity and oracle properties of the subsequent variable selection step is allowed based on the group SCAD estimator. We also suggest ways to implement the method and to select the tuning parameters.

(11) Distributions of the maximum likelihood and minimum contrast estimators associated with the fractional Ornstein-Uhlenbeck process
Katsuto Tanaka (Gakusyuin Univ.)
Abstract: The non-semimartingale nature of the fBm makes the statistical analysis of related processes complicated. In this talk, dealing with the fractional O-U process, we discuss how to compute the distributions of the MCE and MLE for the drift parameter, where the ergodic and non-ergodic cases are treated. We also discuss the asymptotic distributions as the time span becomes large. We further conduct the unit root test under the error process following the fBm.

(12) Extremogram and Ex-Periodogram for heavy-tailed time series
Thomas Mikosch* (Univ. Copenhagen), Richard A. Davis (Columbia Univ.) and Yuwei Zhao
Abstract: The extremogram is a lagwise asymptotic autocorrelation function for extremal events in a time series. We consider the corresponding sample extremogram and discuss its statistical properties and problems arising when dealing with rare (extreme) events in a time series. The ex-periodogram is the Fourier transform of the sample extremogram and estimates the spectral density defined by the extremogram. We also consider integrated versions of the periodogram which find applications for goodness of fit tests based on the large values in a time series. The theory will be illustrated by financial data.

(13) Continuous-time GARCH models
Claudia Klüppelberg (Munich Univ. Technology)
Abstract: Modelling of stochastic volatility has triggered important research in the theory of stochastic processes. New models have been proposed to capture the "stylized facts" of volatility such as jumps, heavy-tailed marginals, long range dependence, and clusters in extremes. In recent years particular emphasis has been given to continuous-time modelling, since financial time series in liquid markets are irregularly spaced and high-frequency data. Natural candidates of continuous-time models with jumps are Lévy or Lévy-driven models, and we shall discuss the pros and cons of COGARCH (continous time GARCH) models.
References
Klüppelberg, C., Lindner, A., Maller, R. (2004). A continuous time GARCH process driven by a Lévy process: stationarity and second order behaviour. *J. Appl. Prob. 41(3)*, 601-622.
Behme, A., Chong, C., and Klüppelberg, C. (2013). Superposition of COGARCH processes. Submitted for publication.

(14) Asymptotic Theory for the Sample Covariance Matrix of a Heavy-Tailed Multivariate Time Series
Richard A. Davis (Columbia Univ.)

Abstract: In this paper we give an asymptotic theory for the eigenvalues of the sample covariance matrix of a multivariate time series. The time series constitutes a linear process across time and between components. The input noise of the linear process has regularly varying tails with index between 0 and 4; in particular, the time series has infinite fourth moment. We derive the limiting behavior for the largest eigenvalues of the sample covariance matrix and show point process convergence of the normalized eigenvalues. The limiting process has an explicit form involving points of a Poisson process and eigenvalues of a non-negative definite matrix. Based on this convergence we derive limit theory for a host of other continuous functionals of the eigenvalues, including the joint convergence of the largest eigenvalues, the joint convergence of the largest eigenvalue and the trace of the sample covariance matrix, and the ratio of the largest eigenvalue to their sum. (This is joint work with Thomas Mikosch and Oliver Pfaffel.)

(15) Asymptotics of Realized Volatility with Non-Gaussian ARCH(∞) Microstructure Noise
Hiroyuki TANIAI*, T. Usami, N. Suto and M. Taniguchi (Waseda Univ.)
Abstract: In order to estimate the conditional variance of some specific day, the sum of squared intradayreturns, as known as “realized volatility” or “realized variance”, is often used. Although this estimator does not converge to the true volatility when the observed price involves market microstructure noise, some subsample-based estimator is known to resolve this problem. In this paper, we will study the asymptotics of this estimator, assuming that market microstructure noise follows a non-Gaussian autoregressive conditional heteroskedastic model of order ∞ (ARCH(∞)). There we elucidate the asymptotics of realized volatility and subsample estimator, which are influenced by the non-Gaussian and dependent structure of the noise. Some numerical studies are given, and they illuminate interesting features of the asymptotics.

(16) Review of Statistical Portfolio Theory
Hiroshi Shiraishi (Jikei Medical Univ.)
Abstract: In this presentation, asymptotic properties for various portfolios will be presented. We divide this presentation into two parts. The first part is about “Single-Period Problem”. Especially, we discuss asymptotic properties for estimators of Mean-Variance optimal portfolios when the asset returns are various stochastic processes. The second part is about “Multi-Period Problem”. We consider statistical estimation for dynamic portfolio based on the dynamic programming.

(17) Bayesian estimation of smoothly mixing time-varying parameter GARCH models
Cathy W. S. Chen* (Feng Chia Univ), Richard Gerlach and Edward M. H. Lin
Abstract: Smoothly time-varying (TV) GARCH models via an asymmetric logistic function mechanism are proposed, which are incorporated into the conditional volatility equation for capturing smooth structural breaks in the volatility of financial time series. The proposed models allow smooth transitions of varying "speed" between multiple, persistent regimes. A Bayesian computational method is employed to identify the locations of smooth structural transitions, and for estimation and inference, simultaneously accounting for heteroskedasticity. An informative prior is proposed to help ensure identification and allow accurate inference. The proposed methods are illustrated using simulated data, and an empirical study provides evidence for significant

improvements in fit for the proposed smooth asymmetric time-varying volatility TV-GARCH models in two international stock market return series. A forecast study shows the proposed models significantly add to forecast accuracy for both volatility and Value-at-Risk.