Kanazawa Seminar

Organizer: Masanobu Taniguchi (Waseda University)

Date: February 9-11, 2023

Venue: Hotel Kanazawa https://www.hotelkanazawa.co.jp/

Supported by:

JSPS KAKENHI Kiban (S) Grand-in-Aid No. 18H05290

(M. Taniguchi)

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Program (*speaker)

February 9: 20:00 – 21:00

(1) 20:00- 20:30: Tong Liu* (Waseda Univ.), Yujie Xue and Masanobu Taniguchi
Characterization of time series models by various divergences

(2) 20:30 – 21:00: Yuichi Goto* (Kyushu Univ.), Xuze Zhang, Benjamin Kedem and Shuo Chen
The existence and uniqueness of lagged spectrum

February 10: 10:00 – 12:00

(3) 10:00 – 10:30: Junichi Hirukawa* (Niigata Univ.)
Rank tests for randomness against time varying MA alternative

(4) 10:30 – 11:00: Yan Liu* (Waseda Univ.), Lan Wu and Masanobu Taniguchi
Semiparametric empirical likelihood for circular distribution

(5) 11:00 – 11:30: Yujie Xue*(Waseda Univ.), Tong Liu and Masanobu Taniguchi
Shrinkage Estimators of BLUE for Time Series Regression Models

(6) 11:30 – 12:00: Yannick Baraud* (Univ. Luxemberg), Hélène Halconruy and Guillaume Maillar
Estimation of a density on the line under some intuition on its shape

12:00 – 14:00: Lunch

(7) 14:00 – 14:30: Matteo Barigozzi* (Univ. Bologna)
Modelling Large Dimensional Datasets with Markov Switching Factor Models

(8) 14:30 – 15:00: Kung-Sik Chan, Simone Giannerini* (Univ. Bologna), Greta Goracci and Howell Tong
Testing for threshold regulation in presence of measurement error with an

application to the PPP hypothesis

15:00 – 15:30: Coffee Break

(9) 15:30 – 16:00: Simone Giannerini, Greta Goracci* (Univ. Bolzano) and Anders Rahbek
The validity of bootstrap testing in the threshold framework

(10) 16:00 – 16:30: Illia Negri* (Univ. Bergamo)
The COGARCH model: some statistical applications in finance

February 11

(11) 10:00 – 10:30: Federico Maddanu and Tommaso Proietti* (Univ. Rome)
Trends in atmospheric ethane

(12) 10:30 – 11:30: Integrated Discussion (chaired by M.Taniguchi)

Abstracts

(1)

Title: Characterization of time series models by various divergences

Authors: Tong Liu*, Yujie Xue and Masanobu Taniguchi

Abstract: For stationary stochastic process, fitting parametric spectral models with finite dimensional unknown parameter vector, the estimation theory has been developed in many directions. The proposed parametric models are autoregressive (AR) models, moving-average (MA) models, autoregressive–moving-average (ARMA) models, Exponential models, etc. However, their meaning was not clear. In this paper, we characterize representative time series models which best fit under given constraints in the sense of maximizing three divergences. First, we show another understanding of the characterization of the maximum entropy spectral distribution via the Durbin-Levinson algorithm. In view of the prediction theory for stationary processes, the maximum spectral entropy is equivalent to the maximum linear prediction error, which motivates that we can use other divergences. Hence we characterize the spectral distribution as an AR spectral density by maximizing the minimum linear interpolation error, when autocovariances with a finite number of lags of a stationary process are known.

Also, we show that if a finite number of the Fourier coefficients are given, Bloomfield's exponential model minimizes the integral of the power transform of the log-spectral density.

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(2)

Title: The existence and uniqueness of lagged spectrum

Author: Yuichi Goto*, Xuze Zhang, Benjamin Kedem and Shuo Chen

Abstract: Coherence is a similarity measure between two time series and takes the form of the time series extension of Pearson's correlation. However, only a linear relationship between two time series can be measured by coherence.

In this talk, we introduce a lagged spectrum in order to measure non-linear relationships and show the existence and uniqueness of a lagged spectrum by decomposing the regression model we consider into orthogonal processes.

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(3)

Title: Rank tests for randomness against time varying MA alternative

Author: Junichi Hirukawa*

Abstract: In this talk, we extend the idea of the problem of testing randomness against ARMA alternative to a class of locally stationary process introduced by Dahlhaus. We use the linear serial rank statistics and apply the notion of the contiguity by LeCam for the testing problem. Under the null hypothesis, the joint asymptotic normality of the proposed rank test statistics and log-likelihood ratio is established by use of the local asymptotic normal property. Then, applying LeCam's third lemma, the asymptotic normality of test statistic under the alternative is automatically derived.

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(4)

Title: Semiparametric empirical likelihood for circular distribution

Authors: Yan Liu*, Lan Wu and Masanobu Taniguchi

Abstract: We consider the empirical likelihood of the data coming from the circular distribution. Many circular distributions have probability densities proportional to ones among the ARMA spectra family. However, many parameters of interest do not have explicit forms. We propose a semiparametric empirical

likelihood method for statistical inference for circular distributions. The empirical likelihood ratio has a chi-squared limiting distribution. The theoretical results are justified by numerical simulations and real data analysis. This is joint work with Lan Wu (Waseda Univ.) and Masanobu Taniguchi (Waseda Univ.).

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(5)

Title: Shrinkage Estimators of BLUE for Time Series Regression Models

Authors: Yujie Xue*, Tong Liu and Masanobu Taniguchi

Abstract: The least squares estimator (LSE) seems the natural estimator of a linear regression model. Whereas, if the dimension of the vector of regression coefficients is greater than 1 and the residuals are dependent. The best linear unbiased estimator (BLUE) has a different form with LSE, which uses the information of the covariance matrix Γ of residual process. As we know the unbiased estimators are generally inadmissible, such as Stein and James (1961) proposed a shrinkage estimator of sample mean. Senda and Taniguchi (2006) introduced a James-Stein type shrinkage estimator for the regression coefficients based on LSE, when the residual process is a Gaussian stationary process. In this

talk, we propose a shrinkage estimator based on BLUE. The sufficient conditions for this shrinkage estimator to improve BLUE are given. Since Γ is infeasible, assuming that Γ has a form of $\Gamma = \Gamma(\theta)$, we introduced a feasible version of that shrinkage estimator with replacing $\Gamma(\theta)$ by $\Gamma(\hat{\theta})$ which is introduced in Toyooka (1986). We also give the sufficient conditions where the feasible version improves BLUE.

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(6)

Title: Estimation of a density on the line under some intuition on its shape

Authors: Yannick Baraud*, Hélène Halconruy and Guillaume Maillar

Abstracts: We consider the problem of estimating a density on the line from i.i.d. data. We have no information on the smoothness of the density but only some intuition on its shape: for example unimodal or monotone or convex on some unknown interval, log-concave etc. Our aim is to design an estimator with good estimation properties when our intuition is at least approximately correct. Joint work with Hélène Halconruy and Guillaume Maillar.

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(7)

Title: Modelling Large Dimensional Datasets with Markov Switching Factor Models

Author: Matteo Barigozzi*

Abstract: We study a novel large dimensional approximate factor model with regime changes in the loadings driven by a latent first order Markov process. By exploiting the equivalent linear representation of the model we first recover the latent factors by means of Principal Component Analysis. We then cast the model in state-space form, and we estimate loadings and transition probabilities through an EM algorithm based on a modified version of the Baum-Lindgren-Hamilton-Kim filter and smoother which makes use of the factors previously estimated. An important feature of our approach is that it provides closed form expressions for all estimators. We derive the theoretical properties of the proposed estimation procedure and show their good finite sample performance through a comprehensive set of Monte Carlo experiments. An important feature of our methodology is that it does not require knowledge of the true number of factors. The empirical usefulness of our approach is illustrated through an application to

a large portfolio of stocks.

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(8)

Title: Testing for threshold regulation in presence of measurement error with an application to the PPP hypothesis

Authors: Kung-Sik Chan, Simone Giannerini*, Greta Goracci and Howell Tong

Abstract: Regulation is an important feature characterising many dynamical phenomena and can be tested within the threshold autoregressive setting, with the null hypothesis being a global non-stationary process. Nonetheless, this setting is debatable since data are often corrupted by measurement errors. Thus, it is more appropriate to consider a threshold autoregressive moving-average model as the general hypothesis. We implement this new setting with the integrated moving-average model of order one as the null hypothesis. We derive a Lagrange multiplier test which has an asymptotically similar null distribution and provide the first rigorous proof of tightness pertaining to testing for threshold nonlinearity against difference stationarity, which is of independent interest. Simulation studies show that the proposed approach enjoys less bias and higher power in detecting

threshold regulation than existing tests when there are measurement errors. We apply the new approach to the daily real exchange rates of Eurozone countries. It lends support to the purchasing power parity hypothesis, via a nonlinear mean-reversion mechanism triggered upon crossing a threshold located in the extreme upper tail. Furthermore, we analyse the Eurozone series and propose a threshold autoregressive moving-average specification, which sheds new light on the purchasing power parity debate.

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(9)

Title: The validity of bootstrap testing in the threshold framework

Authors: Simone Giannerini, Greta Goracci* and Anders Rahbek

Abstract: We consider bootstrap-based testing for threshold effects in non-linear threshold autoregressive (TAR) models. It is well-known that classic tests based on asymptotic theory tend to be oversized in the case of small, or even moderate sample sizes, or when the estimated parameters indicate non-stationarity, as often witnessed in the analysis of financial or climate data. To address the issue we propose a supremum Lagrange Multiplier test statistic (sLMb), where the null

hypothesis specifies a linear autoregressive (AR) model against the alternative of a TAR model. We consider a recursive bootstrap applied to the sLMb statistic and establish its validity. This result is new, and requires the proof of non-standard results for bootstrap analysis in time series models; this includes a uniform bootstrap law of large numbers and a bootstrap functional central limit theorem. These new results can also be used as a general theoretical framework that can be adapted to other situations, such as regime-switching processes with exogenous threshold variables, or testing for structural breaks. The Monte Carlo evidence shows that the bootstrap test has correct empirical size even for small samples, and also no loss of empirical power when compared to the asymptotic test. Moreover, its performance is not affected if the order of the autoregression is estimated based on information criteria. Finally, we analyse a panel of short time series to assess the effect of warming on population dynamics.

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(10)

Title: The COGARCH model: some statistical applications in finance

Author: Ilia Negri*

Abstract: One of the reason that suggest to use COGARCH models to fit financial log-return data is due to the fact that they are able to capture the so called stylized facts observed in real data: uncorrelated log-returns but correlated absolute log-return, time varying volatility, conditional heteroscedasticity, cluster in volatility, heavy tailed and asymmetric unconditional distributions, leverage effects. The aim of this talk is to present COGARCH models, to fit them to some real financial data sets, estimate the parameters of the models via the prediction based estimating functions and to look at the quality of these estimates.

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(11)

Title: Trends in atmospheric ethane

Authors: Federico Maddanu and Tommaso Proietti*

Keywords: Cyclical long memory, Missing data, State Space Model,
Kalman filter, Ethane trends.

Abstract: Understanding the dynamics of the underlying ethane (C2H6) trends has great significance in the context of climate change. The paper focuses on the time series of Fourier Transform Infrared (FTIR) solar spectra ethane column

measurements conducted from the ground and recorded at 15 stations in the Northern and Southern Hemispheres. In particular, it deals with assessing time trends in the presence of a strong and persistent annual seasonal component and a very large proportion of missing observations. Our approach proposes a structural model such that seasonality and trend evolve stochastically according to possibly nonstationary long memory models and can be estimated by linear state space methods. The results suggest the existence of a common pattern in the dynamics of ethane trends in both the Northern and Southern Hemispheres.

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