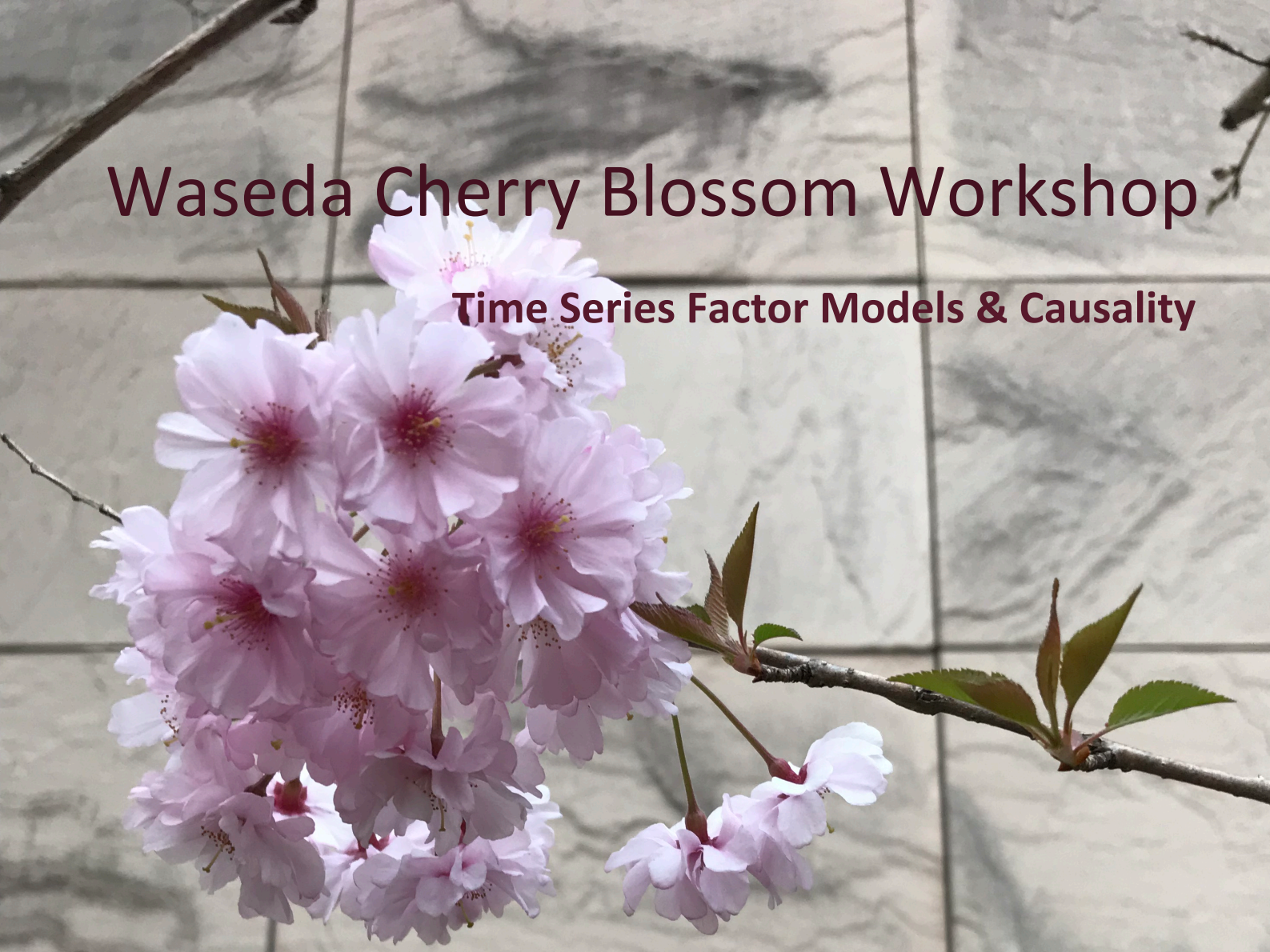
Waseda Cherry Blossom Workshop

Time Series Factor Models & Causality



Venue: Waseda University, Nishi-Waseda Campus
Building 63 - 1 Meeting Room
(Access map: http://www.sci.waseda.ac.jp/eng/access)

Date: March 19--21, 2019

Supported by "Introduction of General Causality to Various Data & Its Innovation of the Optimal Inference"
JSPS Kiban(S) (No. 18H05290) (M. Taniguchi, Waseda University)

Program

March 19 (Tues.) **Invited Session I** (Chaired by M. Hallin, Univ. Libre Brussels; Discussant X. Dou, Waseda Univ.)

(1) 10:00--11:00

Time series analysis with unsupervised learning (I)

Meihui Guo (National Sun Yat-sen University)

(2) 11:00--12:00

Stock Market Trend Prediction Using Functional Time Series Approach

Meihui Guo (National Sun Yat-sen University)

March 20 (Wed.) **Keynote Session for "General Dynamic Factors and Volatilities"** (Chaired by M. Taniguchi, Waseda Univ. ; Discussant B. Kedem, Univ. Maryland)

(3) 10:00--11:00

Recovering the market volatility shocks in high-dimensional time series

Marc Hallin (ECARES and Department of Mathematics, Université libre de Bruxelles)

(4) 11:00--12:00

Consistency, rates, and prediction intervals

Marc Hallin (ECARES and Department of Mathematics, Université libre de Bruxelles), joint work with M. Barigozzi

March 21 (Thur.) **Invited Session II** (Chaired by M. Guo, National Sun Yat-sen Univ.; Discussant A. Kimura, Waseda Univ.)

(5) 10:00--11:00

Investigation for special association between rorquals and predatory fish in the Norwegian high Arctic

Hiroko K. Solvang (Institute of Marine Research), joint work with B. Bogstad, H. Gjøsæter, S. Hartvedt, T. Haug, T. Knutsen, U. Lindstrøm and N. Øien

(6) 11:00--12:00

Integrated trend analysis in marine ecosystem

Hiroko K. Solvang (Institute of Marine Research), joint work with B. Planque

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The afternoon of March 19,20 & 21 is scheduled for discussions.

The discussants are:

Hirukawa, J. (Niigata Univ.)

Shiohama, T. (Tokyo Sci. Univ.)

Ogata, H. (Tokyo Metropolitan Univ.)

Akashi, F. (Waseda Univ.)

Abe, T. (Nanzan Univ.)

Shiraishi, H. (Keio Univ.)

Abstract

(1)

Time series analysis with unsupervised learning (I)

Meihui Guo (National Sun Yat-sen University, Kaohsiung, Taiwan), Jointwork with Ke-Jie Chen and Alan Chua

We consider the prediction problem for time series with unknown clusters. Unsupervised learning methods, such as hierarchical and K-means clustering techniques are applied to pre-cluster time series trend. And B-spline curves are used to fit the class-trends. We use the ARFIMA model and the long short-terms memory network (LSTM) models to fit the original and de-trend time series data and compare the prediction performance of these two models. In the empirical study, we analyze a daily power demand data. The results show that the ARFIMA models has better prediction performance than the LSTM model for holiday power demand, yet the LSTM models predict better for the weekday power demand.

(2)

Stock Market Trend Prediction Using Functional Time Series Approach

Meihui Guo (National Sun Yat-sen University, Kaohsiung, Taiwan), Jointwork with Shih-Feng Huang and May-Ru Chen

Thanks to advanced technologies, ultra-high frequency limit order book (LOB) data are now available to data analysts. An LOB contains comprehensive information on all transactions in a market. We use LOB data to investigate the high frequency dynamics of market supply and demand (S-D) and inspect their impacts on intra-daily market trends. The intra-daily S-D curves are fitted with B-spline basis functions. Technique of multiresolution is introduced to capture inhomogeneous curvature of the S-D curves and a lasso-type criterion is employed to select a common basis set. Based on empirical evidence, we model the time varying coefficients in the B-spline interpolation by vector

autoregressive models of order p (≧1). The Xgboost algorithm is employed to extract information from the areas under the S-D curves to predict the intradaily market trends. In the empirical study, we analyze the LOB data from LOBSTER (https://lobsterdata.com/). The results show that the proposed approach is able to recover the S-D curves and has satisfactory performance on both curve and market trend predictions.

(3)

Recovering the market volatility shocks in high-dimensional time series

Marc Hallin (ECARES and Department of Mathematics, Université libre de Bruxelles)

Decomposing volatilities into a common market-driven component and an idiosyncratic item-specific one is an important issue in financial econometrics. This, however, requires the statistical analysis of large panels of time series, hence faces the usual challenges associated with high-dimensional data. Factor model methods in such a context are an ideal tool, but they do not readily apply to the analysis of volatilities. Focusing on the reconstruction of the unobserved market shocks and the way they are loaded by the various items (stocks) in the panel, we propose a non-parametric and model-free two-step general dynamic factor approach to the problem, which avoids the usual curse of dimensionality. Applied to the S&P100 asset return dataset, the method provides evidence that a non-negligible proportion of the market-driven volatility of returns originates in the volatilities of the idiosyncratic components of returns.

(4)

Consistency, rates, and prediction intervals

Marc Hallin(ECARES and Department of Mathematics, Université libre de Bruxelles), joint work with Matteo Barigozzi (LSE)

Consistency, with rates, is established for the two-step general dynamic factor approach developed in I when both n and T tend to infinity. Those results are exploited in building one-step-ahead conditional prediction intervals with given

asymptotic (conditional) coverage probability for returns. The approach proposed is entirely non-parametric and model-free. Finally, we apply our methodology in order to build Value at Risk estimators for a panel of asset returns belonging to the S&P100 index.

(5)

Investigation for special association between rorquals and predatory fish in the Norwegian high Arctic

Hiroko K. Solvang[1], Bjarte Bogstad[1], Harald Gjøsæter[1], Siri Hartvedt[1], Tore Haug[2], Tor Knutsen[1], Ulf Lindstrøm[2] and Nils Øien[1]

[1]Institute of Marine Research, Bergen, Norway

[2]Institute of Marine Research, Tromsø, Norway

Recent warming in the Barents Sea has led to changes in spatial distribution of both zooplankton and fish, with boreal communities expanding northwards. A similar northward expansion is observed in several rorqual species that migrate into the northern waters to take advantage of high summer production and hence feeding opportunities. Based on ecosystem surveys performed in August-September in 2014-2017, we investigated the spatial associations between the three rorqual species blue, fin and common minke whales, the predatory fish cod, and their prey in the Arctic Ocean waters to the west and north of Svalbard. Based on existing knowledge about dive habits of the rorquals involved, attention was particularly paid to whale prey in the upper 100 m of the water column, but we also did some analyses of prey down to 200 m. During the surveys, whales were observed from the bridge of the vessel by dedicated whale observers, whereas the distribution and abundance of cod and prey species were assessed using trawling and acoustic methods. The spatial overlap and directional relationship between the rorquals, cod and potential prey species were explored by categorical data analyses.

(6)

Integrated trend analysis in marine ecosystem

Hiroko K. Solvang[1], Benjamin Planque[2]

[1]Institute of Marine Research, Bergen, Norway

[2]Institute of Marine Research, Tromsø, Norway

Integrated Ecosystem Assessments (IEA) is a set of approaches for organizing science to inform decision in ecosystem-based management at multiple scales and across sectors. Integrated trend analyses are used by IEA as a way to summary changes that have occurred in recent decades in ecosystems, and highlight the possible connections between physical, biological and human ecosystem components. The ‘trend’ in IEA does not only specify global fluctuation but also short/middle cyclic fluctuation in observed data that includes temporal and spatial resolution. Since the data is observed yearly, the time lengths are limited. Our challenge is how to estimate common trend and causal relationship from these data.