Workshop on Modelling Large-Scale Time Series

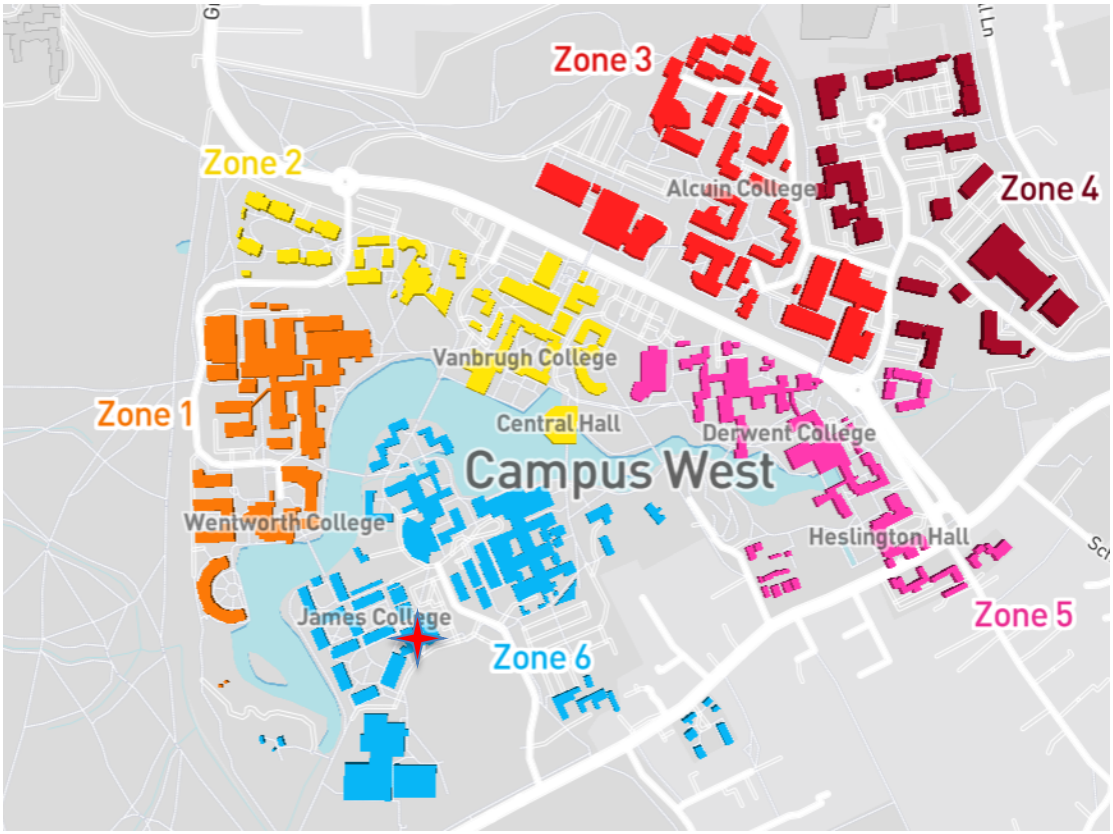
24 February 2023

PS/C/003, Psychology Building Block C, Ground floor, Campus West, University of York

11:00—11:15	**Welcome & refreshments**	
11:15—12:45	**Session 1, Chair: Degui Li**	
11:15—12:00	**Qiwei Yao** London School of Economics	Modelling Matrix Time Series via a Tensor CP-Decomposition
12:00—12:45	**Dennis Kristensen** University College London	Bootstrap Based Bias Correction of Estimators in Time Series Models
12:45—14:00	**Lunch**	
14:00—15:30	**Session 2, Chair: Wenyang Zhang**	
14:00—14:45	**George Kapetanios** King's College London	High-dimensional Generalised Penalised Least Squares
14:45—15:30	**Robert Taylor** University of Essex	Bonferroni Type Tests for Return Predictability and the Initial Condition
15:30—16:00	**Tea break**	
16:00—17:30	**Session 3, Chair: Chenlei Leng**	
16:00—16:45	**Mingli Chen** University of Warwick	High Dimensional Latent Panel Quantile Regression with an Application to Asset Pricing
16:45—17:30	**Yongcheol Shin** University of York	A Spatio-Temporal Autoregressive Factor Model of the Global Business Cycle
18:30	**Workshop dinner (by invitation)**	

Acknowledgement: This workshop is funded by Heilbronn Institute for Mathematical Research and supported by the Department of Mathematics, University of York.

Direction for workshop venue: Psychology Building Block C, Ground floor, Campus West (with). From the main reception area, the room is immediately on the left.



Modelling Matrix Time Series via a Tensor CP-Decomposition

Speaker: Qiwei Yao
Session 1, 11:15—12:00

Abstract

We consider to model matrix time series based on a tensor CP-decomposition. Instead of using an iterative algorithm which is the standard practice for estimating CP-decompositions, we propose a new and one-pass estimation procedure based on a generalized eigenanalysis constructed from the serial dependence structure of the underlying process. To overcome the intricacy of solving a rank-reduced generalized eigenequation, we propose a further refined approach which projects it into a lower-dimensional full-ranked eigenequation. This refined method significantly improves the finite-sample performance of the estimation. The asymptotic theory has been established under a general setting without the stationarity. It shows, for example, that all the component coefficient vectors in the CP-decomposition are estimated consistently with certain convergence rates. The proposed model and the estimation method are also illustrated with both simulated and real data, showing effective dimension-reduction in modelling and forecasting matrix time series.

Bootstrap Based Bias Correction of Estimators in Time Series Models

Speaker: Dennis Kristensen
Session 1, 12:00—12:45

Abstract

Estimators of non-linear models may suffer from substantial finite-sample biases. These biases are generally amplified by dependence in data. The existing literature on bias adjustment in such scenarios have focused on analytical bias adjustment on a case by case basis under correct specification. For more complex models and/or under misspecification, this approach is generally very difficult and tedious to implement. We propose a novel bootstrap method that circumvents these issues: It is fully general and can be applied to any time series model; it is easy to implement; and it can be adjusted to handle different degrees of misspecification. We demonstrate theoretically and numerically that the method has favourable properties compared to existing methods.

High-dimensional Generalised Penalised Least Squares

Speaker: George Kapetanios
Session 2, 14:00—14:45

Abstract

In this paper we develop inference for high dimensional linear models, with serially correlated errors. We examine the Lasso estimator under the assumption of strong mixing in the covariates and error processes, allowing for fatter tails in their distribution. While the Lasso estimator performs poorly under such circumstances, we estimate via GLS Lasso the parameters of interest and extend the asymptotic properties of the Lasso under more general conditions. Our theoretical results indicate that the non-asymptotic bounds for stationary dependent processes are sharper, while the rate of Lasso under general conditions appears slower as T, p→ ∞. Further we employ the debiased Lasso to perform inference uniformly on the parameters of inter-est. Monte Carlo results support the proposed estimator, as it has significant efficiency gains over traditional methods

Bonferroni Type Tests for Return Predictability and the Initial Condition

Speaker: Robert Taylor
Session 2, 14:45—15:30

Abstract

We develop tests for predictability that are robust to both the magnitude of the initial condition and the degree of persistence of the predictor. While the popular Bonferroni Q test of Campbell and Yogo (2006) displays excellent power properties for strongly persistent predictors with an asymptotically negligible initial condition, it can suffer from severe size distortions and power losses when either the initial condition is asymptotically non-negligible or the predictor is weakly persistent. The Bonferroni t test of Cavanagh et al. (1995), although displaying power well below that of the Bonferroni Q test for strongly persistent predictors with an asymptotically negligible initial condition, displays superior size control and power when the initial condition is asymptotically non-negligible. In the case where the predictor is weakly persistent, a conventional regression t test comparing to standard normal quantiles is known to be asymptotically optimal under Gaussianity. Based on these properties, we propose two asymptotically size controlled hybrid tests that are functions of the Bonferroni Q, Bonferroni t, and conventional t tests. Our proposed hybrid tests exhibit very good power regardless of the magnitude of the initial condition or the persistence degree of the predictor. An empirical application to the data originally analysed by Campbell and Yogo (2006) shows our new hybrid tests are much more likely to find evidence of predictability than the Bonferroni Q test when the initial condition of the predictor is estimated to be large in magnitude.

High Dimensional Latent Panel Quantile Regression with an Application to Asset Pricing

Speaker: Mingli Chen
Session 3: 16:00—16:45

Abstract

We propose a generalization of the linear panel quantile regression model to accommodate both sparse and dense parts: sparse means while the number of covariates available is large, potentially only a much smaller number of them have a nonzero impact on each conditional quantile of the response variable; while the dense part is represent by a low-rank matrix that can be approximated by latent factors and their loadings. Such a structure poses problems for traditional sparse estimators, such as the -penalised Quantile Regression, and for traditional latent factor estimator, such as PCA. We propose a new estimation procedure, based on the ADMM algorithm, consists of combining the quantile loss function with and nuclear norm regularization. We show, under general conditions, that our estimator can consistently estimate both the nonzero coefficients of the covariates and the latent low-rank matrix. Our proposed model has a "Characteristics + Latent Factors" Asset Pricing Model interpretation: we apply our model and estimator with a large-dimensional panel of financial data and find that (i) characteristics have sparser predictive power once latent factors were controlled (ii) the factors and coefficients at upper and lower quantiles are different from the median.

A Spatio-temporal Autoregressive Factor Model of the Global Business Cycle

Speaker: Yongcheol Shin
Session 3, 16:45—17:30

Abstract

To study the synchronicity of national business cycles, we propose a new heterogeneous-parameter approach in which the global business cycle is modelled as a spatio-temporal autoregressive process with a common factor error structure. To achieve consistent estimation in the presence of parameter heterogeneity and endogeneity, we develop a modified quasi maximum likelihood estimation approach. We show that the resulting estimators are consistent and asymptotically normally distributed. We employ Monte Carlo simulations to demonstrate that their finite sample performance is satisfactory. Based on the proposed estimator, we further develop network analysis tools at both individual and regional level using diffusion FEVDs and multipliers. These tools are then applied to analyse the business cycle synchronisation covering 79 countries in the world over the period 1970-2019 (50 years).