New Developments in Econometrics and Time Series

September 10-11, 2012

Einaudi Institute for Economics and Finance (EIEF), Rome

Organization:
Holger Dette (Ruhr-Universität Bochum), Marc Hallin (ECARES, Université libre de Bruxelles), Marco Lippi (EIEF, Universita di Roma La Sapienza)

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Tentative Program

September 10

08:30	Registration
09:00 - 09:15	Welcome Address
09:20 - 10:10	**Manfred Deistler**, Generalized linear dynamic factor models - the single and the mixed frequency case
10:10 - 11:00	**Søren Johansen**, Likelihood Inference for a Vector Autoregressive Model for fractional and cofractional processes
11:00 - 11:20	Coffee Break
11:20 - 12:10	**Paolo Zaffaroni**, Generalized least squares estimation of panel with common shocks
12:10 - 13:00	**Masanobu Taniguchi**, Shrinkage estimation and prediction for time series
Lunch	
14:30 - 15:20	**Dag Tjøstheim**, Testing for Independence, copula structure and Financial Contagion using local Gaussian correlation
15:20 - 16:10	**Markus Reiss**, Pointwise adaptive estimation for quantile regression
16:10 - 16:30	Coffee Break
16:30 - 17:20	**Roger Koenker**, Additive models for quantile regression: Model selection and confidence bandaids
17:20 - 18:10	**Ta-Hsin Li**, The magic of quantile regression for spectral analysis of time series
Conference Dinner	

September 11

09:00 - 09:50	**Michael Wolf**, Nonlinear shrinkage estimation of large-dimensional covariance matrices
09:50 - 10:40	**Matteo Barigozzi**, Which Model to Match?
10:40 - 11:00	Coffee Break
11:00 - 11:50	**Helmut Lütkepohl**, Disentangling demand and supply shocks in crude oil market: How to check sign restrictions in structural VARs
11:50 - 12:40	**Philip Preuss**, On discriminating between long-range dependence and non stationarity
Lunch	
14:30 - 15:20	**Stanislav Volgushev**, Empirical copula processes under serial dependence and weak smoothness condition
15:20 - 16:10	**Bas Werker**, Rank-based optimal testing for semiparametric cointegration models
16:10 - 17:00	**Wei Biao Wu**, Testing parametric assumptions of trends of nonstationary time series

Abstracts

- **Matteo Barigozzi**, The London School of Economics and Political Science (joint work with Roxana Halbleib and David Veredas)

  Which Model to Match?

Abstract

The asymptotic efficiency of indirect estimation methods, such as the efficient method of moments and indirect inference, depends on the choice of the auxiliary model. Up to date, this choice is somehow ad hoc and based on an educated guess. In this article we introduce a class of information criteria that helps the user to optimize the choice among nested and nonnested auxiliary models. They are the indirect analogues of the widely used Akaiketype criteria. A thorough Monte Carlo study based on two simple and illustrative models shows the usefulness of the criteria.

- **Manfred Deistler**, Vienna University of Technology (joint with B.D.O Anderson, E. Felsenstein, A. Filler, B. Funovits and M. Zamani)

  Generalized linear dynamic factor models - the single and the mixed frequency case

Abstract

We consider generalized linear dynamic factor models. These models have been developed recently and they are used for forecasting and analysis of high dimensional time series in order to overcome the curse of dimensionality plaguing traditional multivariate time series analysis.

We consider a stationary framework; the observations are represented as the sum of two uncorrelated component processes: The so called latent process, which is obtained from a dynamic linear transformation of a low dimensional factor process and which shows strong dependence of its components, and the noise process, which shows weak dependence of the components. The latent process is assumed to have a singular rational spectral density. For the analysis, the cross sectional dimension n, i.e. the

number of single time series, as well as the sample size are going to infinity; the decomposition of the observations into these two components is unique only for n tending to infinity.

We present a structure theory giving a state space or ARMA realization for the latent process, commencing from the second moments of the observations. The emphasis is on the zeroless case, which is generic in the setting considered. Accordingly the latent variables are modeled as a possibly singular autoregressive process and (generalized) Yule-Walker equations are used for parameter estimation. The Yule-Walker equations do not necessarily have a unique solution in the singular case, and the resulting complexities are examined with a view to find a stable and coprime system.

Finally we present some preliminary results for the mixed frequency case, where the time series components are sampled at different rates. We consider identifiability and estimation from mixed frequency data based on extended Yule-Walker equations.

- **Søren Johansen**, University of Copenhagen and CREATES

  Likelihood inference for a vector autoregressive model for fractional and cofractional processes

Abstract

For fractional data it is suggested to replace the usual CVAR model

$$\Delta X_t = \alpha(\beta' L X_t - \rho') + \sum_{i=1}^{k} \Gamma_i \Delta L^i X_t + \varepsilon_t$$

by the models

$$\Delta^d X_t = \Delta^{d-b} L_b \alpha \beta' X_t + \sum_{i=1}^{k} \Gamma_i \Delta^d L_b^i X_t + \varepsilon_t$$

$$\Delta^d X_t = L_d \alpha(\beta' X_t - \rho') + \sum_{i=1}^{k} \Gamma_i \Delta^d L_d^i X_t + \varepsilon_t$$

The lecture will present

1. A simple criterion for X_t to be fractional of order $d > 0$ and cofractional of order $d - b > 0$, that is, there exist vectors β for which $\beta' X_t$ is fractional of order $d - b$.
2. Model based inference for the parameters $(d, b, \alpha, \beta, \Gamma_1, \ldots, \Gamma_k, \Omega)$ based on the Gaussian likelihood.

The data $X_1, \ldots, X_T$ are modeled given initial values X_{-n}, $n = 0, 1, \ldots$, under the assumption that the errors are i.i.d. $(0, \Omega)$, and the conditional likelihood and its derivatives are considered stochastic processes in the parameters. It is proved that they converge in distribution when the initial values, X_{-n}, are zero for $n \geq T^\eta$ for some $\eta < 1/2$.

These results are applied to prove existence and consistency of the maximum likelihood estimator, and to find the asymptotic distribution of estimators and likelihood ratio test for cointegrating rank.

The main results are that the asymptotic distribution of the test for rank is a functional of fractional Brownian motion, and that $\hat{\beta}$ is asymptotically mixed Gaussian and the remaining parameter estimators asymptotically Gaussian. Thus the asymptotic inference is the same as for the CVAR model.

References

Johansen, S. and M.Ø.Nielsen (2010). *Likelihood inference for a fractionally cointegrated vector autoregressive model.* Discussion paper, University of Copenhagen.

- **Roger Koenker**, University of Illinois

Additive models for quantile regression: Model selection and confidence bandaids

Abstract

Additive models for conditional quantile functions provide an attractive framework for non-parametric regression applications focused on features of the response beyond its central tendency. Total variation roughness penalities can be used to control the smoothness of the additive components much as squared Sobelev penalties are used for classical L_2 smoothing splines. We describe a general approach to estimation and inference for additive models of this type. We focus attention primarily on selection

of smoothing parameters and on the construction of confidence bands for the nonparametric components. Both pointwise and uniform confidence bands are introduced; the uniform bands are based on the Hotelling (1939) tube approach. Some simulation evidence is presented to evaluate finite sample performance and the methods are also illustrated with an application to modeling childhood malnutrition in India.

- **Ta-Hsin Li**, IBM T. J. Watson Research Center

  The magic of quantile regression for spectral analysis of time series

Abstract

Quantile regression is a powerful technique that extends the capability of the traditional least-squares method for regression analysis. This talk gives an overview of some recent advances in quantile regression for spectral analysis of time-series data. In particular, it discusses a new type of periodogram which is constructed from quantile regression with harmonic (trigonometric) regressors based on a reformulation of the ordinary periodogram in terms of least-squares harmonic regression. The new periodogram, called quantile periodogram, is obtained by replacing the least-squares criterion with the quantile regression criterion. Like quantile regression in general, the quantile periodogram offers a richer view than the one provided by the ordinary periodogram for spectral analysis time-series data. The quantile periodogram at the median (also known as the Laplace periodogram) serves as a robust alternative to the ordinary periodogram, just like the sample median does to the sample mean. The quantile periodogram can be interpreted in terms of level-crossings. Application of the quantile periodogram to sunspot numbers and financial indices reveals some interesting properties of these data that cannot be seen in the ordinary periodogram.

- **Helmut Lütkepohl**, Freie Universität Berlin and DIW Berlin
  (joint with A. Netšunajev, European University Institute, Florence)

  Disentangling demand and supply shocks in the crude oil market: How to check sign restrictions in structural VARs

Abstract

Given the growing dissatisfaction with exclusion and long-run restrictions in structural vector autoregressive analysis, sign restrictions are becoming increasingly popular. So far there are no techniques for validating the shocks identified via such restrictions. Although in an ideal setting the sign restrictions specify shocks of interest, sign restrictions may be invalidated by measurement errors, data adjustments or omitted variables. We model changes in the volatility of the shocks via a Markov switching (MS) mechanism and use this devise to give the data a chance to object to sign restrictions. The approach is illustrated by considering a small model for the market of crude oil.

- **Philip Preuss**, Ruhr-Universität Bochum

  On discriminating between long-range dependence and non stationarity

Abstract

This paper is devoted to the discrimination between a stationary long-range dependent model and a non stationary process. We develop a nonparametric test for stationarity in the framework of locally stationary long memory processes which is based on a Kolmogorov-Smirnov type distance between the time varying spectral density and its best approximation through a stationary spectral density. We show that the test statistic converges to the same limit as in the short memory case if the (possibly time varying) long memory parameter is smaller than 1/4, and justify why the limiting distribution is different if the long memory parameter exceeds this boundary. Concerning the latter case, we provide a bootstrap-based test for stationarity which only requires the long memory parameter to be smaller than 1/2 which is the usual restriction in the framework of long-range dependent time series. We will investigate the finite sample properties of our approach in a comprehensive simulation study and apply the new test to a dataset containing log returns of the S&P 500.

- **Markus Reiss**, Humboldt Universität zu Berlin

  Pointwise adaptive estimation for quantile regression

Abstract

A nonparametric procedure for quantile regression, or more generally nonparametric M-estimation, is proposed which is completely data-driven and adapts locally to the regularity of the regression function. This is achieved by considering in each point M-estimators over different local neighbourhoods and by a local model selection procedure based on sequential testing. Non-asymptotic risk bounds are obtained, which yield rate-optimality for large sample asymptotics under weak conditions. Simulations for different univariate median regression models show good finite sample properties, also in comparison to traditional methods.

- **Masanobu Taniguchi**, Waseda University, Japan

  Shrinkage estimation and prediction for time series

Abstract

For independent samples, shrinkage estimation theory has been developed systematically. Although shrinkage estimators are biased, they improve the MSE of unbiased ones. In view of this, we will develop shrinkage estimation theory and prediction for dependent samples. First, we propose a shrinkage estimator for the coefficients of AR model, which improves the MSE of the least squares estimator. Second, we discuss the problem of shrinkage prediction, and propose a shrinkage predictor which improves the prediction error of the best linear predictor with finite lag length. The results are applied to portfolio estimation etc. We provide numerical studies, which show some interesting features of shrinkage problems in time series analysis.

- **Dag Tjøstheim**, University of Bergen
  (joint with Geir Drage Berentsen, Bård Støve)

  Testing for independence, copula structure and financial contagion using local Gaussian correlation

Abstract

Local Gaussian correlation is a local dependence concept that is based on approximating a bivariate density function by a bivariate Gaussian locally. The correlation of the approximating Gaussian at a given location is taken as a measure of local dependence at that location. In this talk the local Gaussian correlation will be used to test independence between non-Gaussian variables against nonlinear alternatives, to test goodness-of-fit of copula structures and to test contagion under financial crises.

- **Stanislav Volgushev**, Ruhr-Universität Bochum
(joint with A. Bücher, Ruhr-Universität Bochum, and J. Segers, Université catholique de Louvain

Empirical copula processes under serial dependence and weak smoothness condition

Abstract

The empirical copula process plays a central role for statistical inference on copulas. Recently, Segers (2012) investigated the asymptotic behavior of this process under non-restrictive smoothness assumptions for the case of i.i.d. random variables. In the first part of the talk, we extend his main result to the case of serial dependent random variables by means of the powerful and elegant functional delta method, and provide new ways to prove bootstrap consistency in this setting. We also show how these findings can be extended to the more general sequential empirical copula process under serial dependence. In the second part of the talk, we focus on the asymptotic properties of copula processes in settings where the copula does not have continuous partial derivatives and process convergence with respect to the supremum norm is known to fail [Fermanian, D. Radulović, M.Wegkamp (2004)]. In particular, we introduce a weaker metric that allows to obtain process convergence and discuss some applications.

References

J.D. Fermanian, D. Radulović, M. Wegkamp (2004), *Weak convergence of empirical copula processes*, Bernoulli, pp 847–860

J. Segers (2012) *Asymptotics of empirical copula processes under non-restrictive smoothness assumptions* Bernoulli, to appear

- **Bas J.M. Werker**, Econometrics and Finance Group, CentER, Tilburg University
  (joint with Marc Hallin, ECARES, Université Libre de Bruxelles and Ramon van den Akker, ORFE, Princeton University)

  Rank-based optimal testing for semiparametric cointegration models

Abstract

This paper discusses asymptotically efficient testing for hypotheses about the cointegrating rank or about the cointegrating vectors in a cointegration model with elliptically distributed innovations. The model is semiparametric in the sense that the radial density and scatter matrix of the innovations are both unknown. The tests developed use a multivariate notion of ranks and are asymptotically distribution-free. The tests are build on a reference density that can be chosen freely. Validity of the test, in terms of asymptotic size, is guaranteed irrespective of the reference density. The asymptotic power of the test improves when the chosen reference density happens to be closer to the actual innovation density. A suitably estimated reference density leads to fully semiparametrically efficient tests.

- **Michael Wolf**, Department of Economics, University of Zürich

  Nonlinear shrinkage estimation of large-dimensional covariance matrices

Abstract

Many statistical applications require an estimate of a covariance matrix and/or its inverse. When the matrix dimension is large compared to the sample size, which happens frequently, the sample covariance matrix is known to perform poorly and may suffer from ill-conditioning. There already exists an extensive literature concerning improved estimators in such situations. In

the absence of further knowledge about the structure of the true covariance matrix, the most successful approach so far, arguably, has been shrinkage estimation. Shrinking the sample covariance matrix to a multiple of the identity, by taking a weighted average of the two, turns out to be equivalent to linearly shrinking the sample eigenvalues to their grand mean, while retaining the sample eigenvectors. Our paper extends this approach by considering nonlinear transformations of the sample eigenvalues. We show how to construct an estimator that is asymptotically equivalent to an oracle estimator suggested in previous work. As demonstrated in extensive Monte Carlo simulations, the resulting *bona fide* estimator can result in sizeable improvements over the sample covariance matrix and also over linear shrinkage.

- **Wei Biao Wu**, Department of Statistics, University of Chicago
(joint with Ting Zhang)

  Testing parametric assumptions of trends of nonstationary time series

  Abstract

I will discuss testing whether the mean trend of a nonstationary time series is of certain parametric forms. A central limit theorem for the integrated squared error is derived, and with that a hypothesis-testing procedure is proposed. The method is illustrated in a simulation study, and is applied to assess the trend pattern in the central England temperature series.

- **Paolo Zaffaroni**, Imperial College London
(joint with Marco Avarucci, Maastricht University)

  Generalized least squares estimation of panel with common shocks

  Abstract

This paper considers GLS estimation of linear panel models when the innovation and the regressors can both contain a factor structure. A novel feature of this approach is that preliminary estimation of the latent factor structure is not necessary. Under a set of regularity conditions here provided, we establish consistency and asymptotic normality of the feasible GLS estimator as both the cross-section and time series dimensions diverge to infinity. Dependence, both cross-sectional and temporal, of the idiosyncratic innovation is permitted. Our results are presented separately for time regressions with unit-specific coefficients and for cross-section regressions with time-specific coefficients. Primitive conditions of our assumptions are established for Andrews' (2005) and Pesaran's (2006) regression models, as particular cases of our set up. Monte Carlo experiments corroborate our results.

References

D. Andrews (2005), *Cross-section regression with common shocks*, Econometrica 73, pp 1551-1585

M.H. Pesaran (2006), *Estimation and inference in large heterogeneous panels with a multifactor error structure*, Econometrica 74, pp 967-1012