**2nd Workshop on “Macroeconomic and Financial Time Series Analysis”**

**May 31 & June 1, 2018**

**Lancaster University Management School (LUMS), Lecture Theatre 3**

**Thursday, May 31st:**

11.30–12.25: **Registration and Lunch** – Lecture Theatres 2&3 Breakout space

12.25–12.30: **Welcome:** Maurizio Zanardi (Head of Economics Department, Lancaster University Management School)

12.30-13.30: **Keynote – David Miles** (Imperial College London)

“Houses Across Time and Across Place” joint with James Sefton (Imperial College London)

13.30–14.00: **Coffee Break**

**Session 1:**

Chair: Luca Fanelli

14.00–14.30: **George Deltas** (University of Illinois and Lancaster University Management School)

“Estimating Retail Gasoline Price Dynamics: The Effect of Country Heterogeneity, Time Trends and Data Structures” joint with M. Polemis (University of Piraeus)

14.30–15.00 **Michele Piffer** (Queen Mary University of London)

“Bayesian structural VAR models: an extended approach”

joint with Martin Bruns (DIW Berlin)

15.00–15.30 **Luca Fanelli** (University of Bologna)

“Uncertainty across volatility regimes” joint with G. Angelini (University of Bologna), E. Bacchiocchi (University of Milan), G. Caggiano (Monash University)

15.30-16.30: **Keynote – Marc Hallin** (ECARES, Universite' Libre de Bruxelles)

“A Simple R-Estimation Method for Semiparametric Duration Models”

joint with Davide La Vecchia (Geneva School of Economics and Management)

16.30–17.00: **Coffee Break**
Session 2:

Chair: Anindya Banerjee

17.00–17.30 Takashi Yamagata (University of York)
“Estimating Weak Factor Models”
joint with Y. Uematsu (University of Southern California)

17.30–18.00 Matteo Barigozzi (LSE)
“Determining the dimension of factor structures in non-stationary large datasets”
joint with L. Trapani (University of Nottingham)

18.00–18.30 Gert Mesters (Universitat Pompeu Fabra)
“Nonlinear Dynamic Factor Models with Interacting Level and Volatility”
joint with S. J. Koopman (VU Amsterdam; Tinbergen Institute) and B. Schwaab (ECB)

18.30–19.00 Anindya Banerjee (University of Birmingham)
“Targeted Impulse Responses”
joint with M. Marcellino (Bocconi University) and I. Masten (University of Ljubljana)

19.00 Dinner at the Lancaster House Hotel

Friday, June 1st:

Session 3:

Chair: Ingmar Nolte

9.00–9.30 Alessandro Galesi (Banco de España)
“The Rise and Fall of the Natural Interest Rate”
joint with Gabriele Fiorentini (Università di Firenze), Gabriel Pérez-Quirós (Banco de España), and Enrique Sentana (CEMFI)

9.30–10.00 Laura Coroneo (University of York)
“International Stock Comovements with Endogenous Clusters”
joint with L. E. Jackson (Bentley University) and M. T. Owyang (St. Louis Fed)

10.00–10.30 Ana Galvão (Warwick Business School)
“Credit Conditions and the Effects of Economic Shocks: Amplification and Asymmetries”
joint with A. Carreiro (Queen Mary University of London) and M. Marcellino (Bocconi University)

10.30–11.00 Ingmar Nolte (Lancaster University)
“High-Frequency Volatility Estimation and the Relative Importance of Market Microstructure Variables”
joint with Yifan Li (Lancaster University) and Sandra Nolte (Lancaster University)
11.00–11.30: Coffee Break

11.30-12.30: Keynote – Marco Lippi (Einaudi Institute for Economics and Finance)
“Aggregation, Fundamentalness, VAR and Factor Models”

12.30–13.45 Lunch – Lecture Theatre 2&3 Breakout space

Session 4:
  Chair: Christian Brownlees

13.45–14.15 Jia Chen (University of York)
“A New Semiparametric Estimation Approach of Large Dynamic Covariance Matrices with Multiple Conditioning Variables” joint with Degui Li (University of York) and Oliver Linton (Cambridge University)

14.15–14.45 Tassos Magdalinos (University of Southampton)
“Hypothesis testing under matrix normalization” joint with P.C.B. Phillips (Yale University, University of Auckland, University of Southampton, and Singapore Management University)

14.45–15.15 Dante Amengual (CEMFI)
“Normality tests for latent variables” joint with T. Almuzara and E. Sentana (CEMFI)

15.15–15.45 Christian Brownlees (Universitat Pompeu Fabra)
“Community Detection in Partial Correlation Network Models” joint with G. S. Gudmundsson and G. Lugosi (Universitat Pompeu Fabra)

15.45–16.15 Coffee Break

16.15–17.15 Keynote - Alastair Hall (University of Manchester)
“Inference in second-order identified models” joint with Prosper Dovonon (Concordia University) and Frank Kleibergen (University of Amsterdam)

19.00 Dinner at the Bay Horse

Organizers: David Kang, Giorgio Motta, Stefano Soccorsi
(Department of Economics, Lancaster University)

We thank for financial support the Society for Nonlinear Dynamics and Econometrics (SNDE), the Centre for Financial Econometrics, Asset Markets and Macroeconomic Policy and the Economics Department of Lancaster University.
Keynote 1
David Miles (Imperial College London)
“Houses Across Time and Across Place” joint with James Sefton (Imperial College London)

This paper develops a model of the evolution of housing and of housing costs over time and across locations. We use a framework that combines features of a Ramsey two-sector growth model with a model of the geography of residential development that tracks the change in location of the population over time. We find that taking account of the fixity of land supply, rising populations and the changing technology of transport are crucial. The future path of housing costs is extremely sensitive to two parameters elasticities of substitution between land and structure in creating housing services and substitutability between housing and consumption goods in utility. We find that in many countries it is plausible that house prices could now persistently rise faster than incomes.

Session 1
George Deltas (University of Illinois and Lancaster University Management School)
“Estimating Retail Gasoline Price Dynamics: The Effect of Country Heterogeneity, Time Trends and Data Structures” joint with M. Polemis (University of Piraeus)

The paper shows that much of the variation in the findings of the literature on the dynamics of the retail gasoline price is systematic rather than simply sample variation from using different data. Estimates of pass-through rates depend systematically on features of the data, such as the sampling frequency, the choice of upstream price, whether taxes are included or not, the sample length, and the postulated lag structure. In addition, there are systematic differences between time periods and countries. Using a 20-year-long dataset of 27 European countries we quantify the extent of estimate variation that arises from the choice of data structure from that arising from temporal and country heterogeneity and sampling variation. We also show that country heterogeneity itself has systematic components, with wealthier countries experiencing slower adjustments. Our results inform the interpretation of results on pass-through rates derived from Error Correction Models. They are also of relevance for the broader literature estimating the transmission of price shocks in the economy.

Michele Piffer (Queen Mary University of London)
“Bayesian structural VAR models: an extended approach” joint with Martin Bruns (DIW Berlin)

We provide an approach to derive the posterior distribution of SVAR models directly on the structural parameters. Our framework allows for restrictions not only on the contemporaneous relations among variables (as already in Sims and Zha (1998) and Baumeister and Hamilton (2015)), but also on impact impulse responses. In so doing, we enrich the tool available for the researchers who aim to set identify structural VAR models. Applying the methodology to simulated data on the New Keynesian model, we find that our approach recovers the true responses more tightly than the popular indirect orthogonal reduced form approach. We then apply our procedure to the
We propose a new non-recursive identification scheme for uncertainty shocks, which exploits breaks in the unconditional volatility of macroeconomic variables. Such identification approach allows us to simultaneously address two major questions in the empirical literature on uncertainty: (i) Does the relationship between uncertainty and economic activity change across macroeconomic regimes? (ii) Is uncertainty a major cause or effect (or both) of decline in economic activity? Empirical results based on a small-scale VAR with US monthly data for the period 1960-2015 suggest that (i) the effects of uncertainty shocks are regime-dependent, and (ii) uncertainty is an exogenous source of the decline of economic activity, rather than an endogenous response to it.

Modeling nonnegative financial variables (e.g. durations between trades or volatilities) is central to a number of studies across econometrics and finance, and still poses several statistical challenges. Among them, the efficiency aspects of semiparametric estimation remains pivotal. In this paper, we concentrate on estimation problems in autoregressive conditional duration models with unspecified innovation densities. Exponential quasi-likelihood estimators (QMLE) are the usual practice in that context, since they are easy-to-implement and preserve Fisher-consistency. However, the efficiency of the QMLE rapidly deteriorates away from the reference exponential density. To cope with the QMLE’s lack of accuracy, semiparametrically efficient procedures have been introduced. These procedures are obtained using the classical tangent space approach and require kernel estimation. We propose rank-based estimators (R-estimators) as a substitute. Just as the QMLE, R-estimators remain root-n consistent, irrespective of the underlying density, and rely on the choice of a reference density (which, however, needs not be the exponential one), under which they achieve semiparametric efficiency. Moreover, R-estimators, unlike the traditional semiparametric estimators, neither require tangent space calculations nor kernel estimation. Numerical results illustrate that R-estimators based on the exponential reference density outperform the QMLE under a large class of actual innovation densities, such as the Weibull or Burr densities. A real-data example about modeling the price range of the Swiss stock market index concludes the paper.
respectively). Their model assumes that the $r (<< N)$ largest eigenvalues of data covariance matrix grow as $N$ rises without specifying each diverging rate. This is weaker than the typical assumption on the recent factor models, in which all the $r$ largest eigenvalues diverge proportionally to $N$, and is frequently referred to as the weak factor models. We extend the sparse orthogonal factor regression (SOFAR) proposed by Uematsu et al. (2017) to consistently estimate the weak factors structure, where the $k$-th largest eigenvalue grows proportionally to $N^{a_k}$ with some unknown $0 < a_k \leq 1$ for $k=1,\ldots, r$. Importantly, our method enables us to consistently estimate $a_k$ as well. The finite sample evidence suggests that our method works well. In our experiment, the performance of the new estimator dominates that of the principal component estimators in terms of mean absolute loss, and its superiority gets larger as the factor components become weaker. We apply our method to analyze S&P500 firm security monthly returns, and the results show that the largest eigenvalue grows proportional to $N$, whilst the second and third much less slowly diverge.

**Matteo Barigozzi** (LSE)

"Determining the dimension of factor structures in non-stationary large datasets" joint with L. Trapani (University of Nottingham)

We propose a class of randomised testing procedures to determine the dimension of the common factor space in a large, possibly non-stationary, dataset. Our procedure is designed to determine whether there are (and how many) common factors (i) with linear trends, (ii) with stochastic trends, (iii) with no trends, i.e. stationary. Under the assumption of stationary idiosyncratic errors, this procedure can be used as a cointegration test for a large dataset. Our analysis is based on the fact that the largest eigenvalues of a suitably scaled covariance matrix of the data (corresponding to the common factor part) diverge, as the dimension $N$ of the dataset diverges, whilst the others stay bounded. Therefore, we propose a class of randomised test statistics for the null that the $p$-th eigenvalue diverges, based directly on the estimated eigenvalue. The tests only requires minimal assumptions on the data and no restrictions on the rate of divergence of $N$ are imposed. Monte Carlo evidence shows that our procedure has very good finite sample properties, clearly dominating competing approaches when no common factors are present. We illustrate our methodology through an application to US bond yields with different maturities observed over the last 30 years. A common linear trend and two common stochastic trends are found and identified as the classical level, slope and curvature factors.

**Gert Mesters** (Universitat Pompeu Fabra)

"Nonlinear Dynamic Factor Models with Interacting Level and Volatility" joint with S. J. Koopman (VU Amsterdam; Tinbergen Institute) and B. Schwaab (ECB)

Volatility is an important ingredient in economic and financial decision making and yet the interaction between the levels and volatilities of macroeconomic and financial variables is not well understood. We propose a class of nonlinear dynamic factor models that has factor structures for both levels and volatilities. Both sets of latent factors are modeled jointly in an unrestricted vector autoregressive model. We develop a computationally convenient approximate filtering method for the estimation of all factors. The algorithm relies on numerical integration and can be implemented by augmenting the Kalman filter with weighted least squares regressions. The deterministic model
parameters can be estimated by maximum likelihood. Some theoretical bounds and a simulation study show that the methodology is highly accurate when compared to feasible alternative methods. The model is applied in two empirical studies. First, we consider euro area government bond yields between 2008 and 2012 and show that the volatility factor became an economically significant predictor of the yield levels in several countries. Bond purchases by the European Central Bank reduced yields but not the dispersion of pricing errors. Second, the model is applied for forecasting the levels of U.S. macroeconomic variables. We show that the inclusion of interacting volatility factors improves out-of-sample forecasts.

**Anindya Banerjee** (University of Birmingham)

“**Targeted Impulse Responses**” joint with M. Marcellino (Bocconi University) and I. Masten (University of Ljubljana)

Our paper deals with the extraction of relevant information from large datasets to obtain theory-consistent impulse responses to structural shocks. Our starting point is the idea that while the ability of a factor augmented vector autoregression (FAVAR) to use information from a large dataset in principle solves the problem of the lack of informativeness of structural VARs, not all the information available to a researcher may be relevant for the parsimonious modelling of the transmission mechanism of structural shocks of interest. The use of irrelevant information may potentially contaminate the identification of structural shocks. To address this issue we consider preselecting variables for factors extraction with conventional principal components. We use Kelly and Pruitt’s (2015) 3PRF method to estimate potentially relevant factors using all possible factor proxies from a large dataset. These are used in a FAVAR model to identify structural shocks using conventional restrictions. The selection is then based on simple sign criteria on selected impulse responses. Extraction of factors from a pre-selected set of variables using conventional PCA proves to be successful in removing notable puzzling responses such as the positive response of prices to a restrictive monetary policy shock. Our procedure differs fundamentally from the sign restriction approach to identification as it is based on identifying the relevant information set given an identification restriction, and not on finding the set of sign-compliant identification schemes given the information set.

**June 1**

**Session 3**

**Alessandro Galesi** (Banco de España)

“**The Rise and Fall of the Natural Interest Rate**” joint with Gabriele Fiorentini (Università di Firenze), Gabriel Pérez-Quirós (Banco de España), and Enrique Sentana (CEMFI)

Using historical data for 17 advanced economies we document a rise and fall of the natural interest rate (r*), which starts in the 1960’s and peaks around the end of the 1980’s. The evolving demographics are key to explain this rise and fall. We reach to this conclusion after showing that the popular model of Laubach and Williams (2003) generally produces precise estimates of r* unless the IS and the Phillips curves are flat: these exceptions lead the model to fail the observability condition which ensures that the unobserved states can be uniquely determined by the data, so that precision dramatically falls. In these circumstances, we can resort to a generally less efficient univariate local level model which still meets the observability condition. The model decomposes the observed real
rate into its permanent and transitory components. The permanent component closes the interest rate gap and stabilizes the output gap and inflation. Since the estimated $r^*$ is silent about its drivers, we use a Panel ECM which exploits cross-country data on indicators of potential drivers of $r^*$. Through the lenses of the model, most of the rise and fall of the interest rate is attributable to the rise and fall of the young baby boomers.

Laura Coroneo (University of York)
“International Stock Comovements with Endogenous Clusters” joint with L. E. Jackson (Bentley University) and M. T. Owyang (St. Louis Fed)

We use an endogenous cluster factor model to examine international stock return comovements of country-industry portfolios. Our model allows country-industry portfolio comovements to be driven by a global and a cluster component, with the cluster membership endogenously determined. Results indicate that country-industry portfolios tend to cluster mainly within geographical areas that can include one or more countries. The cluster component was the main driver of country-industry portfolio returns for most of the sample, except from mid-2000 to mid-2010s when the global component had a more prominent role. At the end of the sample, a large cluster among European countries emerges.

Ana Galvao (Warwick Business School)
“Credit Conditions and the Effects of Economic Shocks: Amplification and Asymmetries” joint with A. Carreiro (Queen Mary University of London) and M. Marcellino (Bocconi University)

In this paper we address three empirical questions related to credit conditions. Do they change the dynamic interactions of economic variables by characterizing different regimes? Do they amplify the effects of economic shocks? Do they generate asymmetries in the effects of economic shocks depending on the size and sign of the shock? To answer these questions, we introduce endogenous regime switching in the parameters of a large Multivariate Autoregressive Index (MAI) model, where all variables react to a set of observable common factors. We develop Bayesian estimation methods and show how to compute responses to common structural shocks. We find that credit conditions do act as a trigger variable for regime changes. Moreover, demand and supply shocks are amplified when they hit the economy during periods of credit stress. Finally, good shocks seem to have more positive effects during stress time, in particular on unemployment.

Ingmar Nolte (Lancaster University)
“High-Frequency Volatility Estimation and the Relative Importance of Market Microstructure Variables” joint with Yifan Li (Lancaster University) and Sandra Nolte (Lancaster University)

In this paper we use an autoregressive conditional intensity approach to estimate local high-frequency volatility and examine to what extent a large universe of market microstructure variables affects local volatility. Our findings support the Mixture-of-Distribution hypothesis on a high-frequency level since we show that contemporaneous trading volume is positively related to local volatility. The use of a penalized likelihood method allows us to obtain a ranking in terms of the relative importance of all market microstructure variables considered. We find that, in a descending
order, contemporaneous order flow, number of transactions, bid-ask spread and volume carry the most important information for local volatility modelling.

**Keynote 3**

**Marco Lippi** (Einaudi Institute for Economics and Finance)  
“Aggregation, Fundamentalness, VAR and Factor Models”

I will argue that aggregation of microbehaviors, as opposed to the representative-agent practice, has not yet been considered systematically in the framework of VAR and DSGE models. When heterogeneity of individual responses and of exogenous variables are taken simultaneously into account, (i) aggregate equations may be quite far from their micro counterparts, (ii) the aggregate shocks are complicated moving averages of the shocks affecting the micro units. A second problem, little considered in VAR and DSGE models is fundamentalness of the structural shocks. Fundamentalness has been assumed as a convenient identification restriction, but elementary examples show that it has no solid ground in economic logic. Dynamic factor models of the form

\[ x_{it} = b_{11}(L)u_{1t} + b_{12}(L)u_{2t} + \cdots + b_{1q}(L)u_{qt} + \xi_{it} \quad \text{(*)} \]

provide a reasonable solution to both issues. Assuming that economic agents respond to variables that are driven by the common macroeconomic shocks \(u_{it}\), plus specific shocks, we see that aggregate variables take the form (*). Regarding fundamentalness, recent results on singular stochastic vectors, and singularity of the common component vector (only q shocks and large dimension), have the consequence that the structural shocks are fundamental for the common components of the variables \(x_{it}\).

**Session 3**

**Jia Chen** (University of York)  
“A New Semiparametric Estimation Approach of Large Dynamic Covariance Matrices with Multiple Conditioning Variables” joint with Degui Li (University of York) and Oliver Linton (Cambridge University)

This paper studies estimation of dynamic covariance matrices with multiple conditioning variables, where the matrix size can be ultra large (divergent at an exponential rate of the sample size). We introduce an easy-to-implement semiparametric method to estimate each entry of the covariance matrix via model averaging marginal regression, and then apply a shrinkage technique to obtain the large dynamic covariance matrix estimation. Under some regularity conditions, we derive the asymptotic properties for the proposed estimators including the uniform consistency with general convergence rates. We further consider extending our methodology to deal with the scenarios: (i) the number of conditioning variables is divergent as the sample size increases, and (ii) the large covariance matrix is conditionally sparse. Simulation studies are conducted to illustrate the finite-sample performance of the developed methodology. An application to financial portfolio choice is also provided.
Tassos Magdalinos (University of Southampton)
“Hypothesis testing under matrix normalization” joint with P.C.B. Phillips (Yale University, University of Auckland, University of Southampton, and Singapore Management University)

It is well known that systems of regression equations exhibiting different characteristics along each equation do not necessarily conform to standard asymptotic theory of estimation and testing. The key difference with the standard asymptotic framework of inference is that sample moment matrices require matrix-valued normalisations, a complication that may result to a reduction in the asymptotic rank of sample moment estimators and the associated test statistics. In hypothesis testing, an additional complication arises from the interaction between the matrix-valued normalisation and the matrix of restrictions imposed by the null hypothesis, which may lead to further asymptotic degeneracy and non-standard limit distributions for Wald type test statistics. The paper provides sufficient conditions that guarantee standard inference for Wald tests in this general multivariate modelling framework. Applications include regression models with deterministic components and cointegrated systems of near-integrated or fractionally integrated time series that induce potentially different persistence rates.

Dante Amengual (CEMFI)
“Normality tests for latent variables” joint with T. Almuzara and E. Sentana (CEMFI)

We exploit the EM rationale behind Louis’ (1982) score formula to derive simple to implement and interpret LM normality tests for the innovations of the latent variables in linear state space models against generalized hyperbolic alternatives, including symmetric and asymmetric Student ts. We decompose our tests into third and fourth moment components, and obtain one-sided likelihood ratio analogues, whose asymptotic distribution we provide. When we apply them to a common trend model which combines the expenditure and income versions of US aggregate real output to improve its measurement, we reject normality if the sample period extends beyond the Great Moderation.

Christian Brownlees (Universitat Pompeu Fabra)
“Community Detection in Partial Correlation Network Models” joint with G. S. Gudmundsson and G. Lugosi (Universitat Pompeu Fabra)

Many real-world networks exhibit a community structure: The vertices of the network are partitioned into groups such that the concentration of linkages is high among vertices in the same group and low otherwise. This motivates us to introduce a class of partial correlation network models with a community structure that replicates this empirical regularity. A natural question that arises in this framework is how to detect the communities from a random sample of observations. We introduce an algorithm called Blockbuster that recovers the communities using the eigenvectors of the sample covariance matrix. We study the properties of the procedure and establish consistency. The methodology is used to study real activity clustering in the U.S. and Europe.
Keynote 4

Alastair Hall (University of Manchester)

“Inference in second-order identified models” joint with Prosper Dovonon (Concordia University) and Frank Kleibergen (University of Amsterdam)

We explore the local power properties of different test statistics for conducting inference in moment condition models that only identify the parameters locally to second order. We consider the conventional Wald and LM statistics, and also the Generalized Anderson Rubin (GAR) statistic (Anderson and Rubin, 1949; Dufour, 1997; Staiger and Stock, 1997; Stock and Wright, 2000), KLM statistic (Kleibergen, 2002, 2005) and the GMM extension of Moreira’s (2003) (GMM-M) conditional likelihood ratio statistic. The GAR, KLM and GMM-M statistics are so-called “identification robust” since their (conditional) limiting distribution is the same under first-order, weak and therefore also second order identification. For inference about the model specification, we consider the identification-robust J statistic (Kleibergen, 2005) and the GAR statistic. Interestingly, we find that the limiting distribution of the Wald statistic under local alternatives not only depends on the distance to the null hypothesis but also on the convergence rate of the Jacobian. We specifically analyze two empirically relevant models with second order identification. In the panel autoregressive model of order one, our analysis indicates that the Wald test of a unit root value of the autoregressive parameter has better power compared to the corresponding GAR test which, in turn, dominates the KLM, GMM-M and LM tests. For the conditionally heteroskedastic factor model, we compare Kleibergen’s (2005) J and the GAR statistics to Hansen’s (1982) overidentifying restrictions test (previously analyzed in this context by Dovonon and Renault, 2013) and find the power ranking depends on the sample size. Collectively, our results suggest that tests with meaningful power can be conducted in second-order identified models.