

## PROGRAMME AND ABSTRACTS

Kick-off meeting of the ERCIM Working Group on  
Computing & Statistics  
and  
International Workshop on  
Computational and Financial Econometrics

Department of Econometrics, University of Geneva, Switzerland  
April 20-22, 2007  
<http://www.csdassn.org/europe/CFE07/>

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**Local organizing committee:**

M. Gilli (Chair), H. Hysi and I. Roko

Dear Friends and Colleagues,

Welcome to the Kick-off meeting of the ERCIM Working Group on Computing & Statistics and the International Workshop on Computational and Financial Econometrics (CFE07). The conference Co-chairs are happy to host this international conference in Geneva. The meeting takes place jointly at the same venue as the 4th International Conference on Computational Management Science.

The conference aims at bringing together researchers and practitioners to discuss recent developments in computational methods for economics, finance, and statistics in general. The programme consists of 45 regular sessions, 5 plenary talks and around to 200 presentations. There are over 250 participants. The Co-chairs have endeavored to provide a balanced and stimulating programme that will appeal to the diverse interests of the participants. The local organizing committee hopes that the conference venue will provide the appropriate environment to enhance your contacts and to establish new ones. The workshop will take place annually within the framework of the ERCIM WG on Computing & Statistics.

The conference is a collective effort of many individuals and organizations. The Co-chairs, the Scientific Programme Committee, the Local Organizing Committee and volunteers have contributed substantially to the organization of the conference. We are acknowledging the support of our sponsors and particularly the host Department of Econometrics, University of Geneva. We are especially grateful to Giuseppe Storti and Dora Cerbone from the University of Salerno. They have handled most of the technical and organizational aspects of the abstract submissions.

We hope that you enjoy the conference and your stay in Geneva.

The conference Co-chairs:

*Alessandra Amendola, David A. Belsley, Erricos John Kontoghiorghes, Peter Winker and Manfred Gilli (Local Organizer).*

## ERCIM Working Group on COMPUTING & STATISTICS

<http://www.dcs.bbk.ac.uk/ercim/>

### AIMS AND SCOPE

The working group (WG) focuses on all computational aspects of statistics. Of particular interest is research in important statistical applications areas where both computing techniques and numerical methods have a major impact. The aim is twofold: first, to consolidate the research in computational statistics that is scattered throughout Europe; second to provide researchers with a network from which they can obtain an unrivalled source of information about the most recent developments in computational statistics and applications. Emphasis will be given to computational methods with computational statisticians being the primary target of the WG.

The scope of the WG is broad enough to include members in areas of computing which have a major impact on statistical techniques and methods of data analysis. All aspects of statistics which make use, directly or indirectly, of computing are considered. Applications of computational statistics in diverse disciplines will be strongly represented. These areas include economics, medicine and epidemiology, biology, finance, physics, chemistry, climatology and communication.

The range of topics addressed and the depth of coverage will position the WG to be the essential research network in the niche area of advanced computational and numerical methods in statistics.

The WG will comprise a number of tracks (subgroups, teams) in various research areas of Computational Statistics. The teams will act autonomously within the framework of the WG in order to promote their own research agenda. The activities of the teams -including research proposals- will be endorsed by the WG. It is expected that the teams will be organizing sessions and workshops during the annual WG meeting.

There will be a strong link between the ERCIM WG, the ERS-IASC and the Journal of Computational Statistics & Data Analysis.

### Specialized Groups

Currently the ERCIM WG has approximately 300 members and the following specialized groups:

**MCS:** Matrix Computations and Statistics.

**CFE:** Computational Econometrics and Financial Time Series.

**SSEF:** Statistical Signal Extraction and Filtering.

**RDM:** Robust Analysis of Complex Data Sets.

**OHEM:** Optimization Heuristics in Estimation and Modelling.

**FSA:** Fuzzy Statistical Analysis.

**AlgSoft:** Statistical Algorithms and Software.

**SFD:** Statistics for Functional Data.

**FGen:** Functional Genomics.

**SEM:** Latent Variable and Structural Equation Models.

More specialized groups are currently under construction. You are encouraged to become a member of the WG. For further information please contact Erricos John Kontoghiorghes at: [matrix@dcs.bbk.ac.uk](mailto:matrix@dcs.bbk.ac.uk), or the Chairs of the specialized groups.

## SCHEDULE

All events, except the conference dinner, take place at the UniMail building (Boulevard du Pont d'Arve 40), Univ. of Geneva.

### Friday, 20th April 2007

12:30 - 12:45	Opening
12:45 - 13:35	Plenary Talk (John Mulvey)
13:40 - 15:20	Parallel Sessions A
15:20 - 15:50	Coffee Break
15:50 - 17:30	Parallel Sessions B
17:40 - 18:30	Plenary Talk (Peter Rousseeuw)
18:35 - 19:50	Parallel Sessions C
20:15	Reception

### Saturday, 21st April 2007

08:00 - 09:40	Parallel Sessions D
09:45 - 10:35	Plenary Talk (Dimitri Bertsekas)
10:35 - 11:00	Coffee Break
11:00 - 12:40	Parallel Sessions E
12:40 - 14:15	Lunch Break
14:15 - 15:55	Parallel Sessions F
16:00 - 16:50	Plenary Talk (Claudio Albanese)
16:50 - 17:20	Coffee Break
17:20 - 19:25	Parallel Sessions G
20:15	Conference Dinner

### Sunday, 22nd April 2007

08:30 - 10:10	Parallel Sessions H
10:10 - 10:40	Coffee Break
10:40 - 12:20	Parallel Sessions I
12:30 - 13:20	Plenary Talk (James G. MacKinnon)
13:20 - 13:25	Closing
13:25 - 15:00	Lunch Break

## MEETINGS AND SOCIAL EVENTS

### SPECIAL MEETINGS by invitation to group members

- CSDA Editorial Board Meeting , Friday 20th of April, Room M3250, 11:00 - 12:30.
- CSDA Editorial Board Lunch-Meeting, Saturday 21st of April, 12:40 - 14:15.
- ERCIM WG Meeting (open to all WG members), Sunday 22nd of April, Room MR170, 09:30 - 10:30.
- COMISEF meeting, Sunday 22nd of April, 15:00 - 17:00.

### SOCIAL EVENTS

- The coffee breaks will last one hour each (which adds fifteen minutes before and after to the times that are indicated in the program).
- Welcome Reception, Friday 20th of April, 20:15.  
The reception is open to all registrants. It will take place at the Main Hall of UniMail, i.e. at the conference venue. You must have your reception ticket and your conference badge in order to attend the reception. Additional reception tickets can be bought from the registration desk.
- Conference Dinner, Saturday 21st of April, 20:15.  
The Conference Dinner will take place at the Uni-Dufour building (24, rue du General Dufour). The building is 7 walking minutes from UniMail (Detailed information will be available at the conference registration desk). The conference dinner is optional and registration is required. Tickets can be obtained from the registration desk.  
You must have your dinner ticket and your conference badge in order to attend the conference dinner.
- Lunches will be served Saturday and Sunday at the conference site. You will find lunch tickets in your registration envelope.

## **GENERAL INFORMATION**

### **Lecture Rooms**

The paper presentations will take place at the Uni Mail, Department of Econometrics, University of Geneva. The plenary talks will take place in the lecture room MR380, and will last 50 minutes. Each regular presentation will be 25 minutes including questions. Chairs are requested to keep the session on schedule. Papers should be presented in the order they are listed in the programme for the convenience of attendees who may wish to switch rooms mid-session to hear particular papers. In the case of a no-show, please use the extra time for a break or a discussion so that the remaining papers stay on schedule.

### **Presentation instructions**

The lecture rooms will be provided with an overhead projector and a computer projector. Presenters must deliver five minutes before each session the files with the presentation in PDF (Acrobat) or PPT (Powerpoint) format on a USB memory stick. Preferably the session chairs should obtain copies of the talks by email prior to the conference beginning.

Please bring a copy of your presentation on overhead transparencies, in case of technical failures. Swiss plugs/power outlets are different from those in the rest of Europe, including Germany. We cannot provide adapters, so do not forget to take your adapters if needed.

### **Internet**

There will be access to PC rooms connected to the Internet. The wireless Internet connection is also freely available at UniMail.

### **Messages**

You may leave messages for each other on the bulletin board by the registration desks.

## **SUPPORTERS**

ERCIM (European Research Consortium for Informatics and Mathematics)

The Society for Computational Economics

International Association for Statistical Computing

Journal of Computational Statistics & Data Analysis

Elsevier

Department of Econometrics, University of Geneva, Switzerland

Department of Public and Business Administration, University of Cyprus

Department of Economics and Statistics, University of Salerno, Italy

School of Computer Science and Information Systems  
Birkbeck College, University of London, UK

## PUBLICATIONS OUTLETS

### Journal of Computational Statistics & Data Analysis

Papers containing strong computational statistical or econometric components or substantive data analytic elements will be considered for publication in a special peer-reviewed, or regular, issue of the journal of Computational Statistics & Data Analysis.

Papers will go through the usual review procedures and will be accepted or rejected based on the recommendations of the editors and referees. However, the review process will be streamlined in every way possible to facilitate the timely publication of the papers. As always, papers will be considered for publication under the assumption that they contain original unpublished work and that they are not being submitted for publication elsewhere.

Papers should be submitted electronically to David Belsley: [belsley@bc.edu](mailto:belsley@bc.edu), or Erricos John Kontoghiorghes: [csda@dcs.bbk.ac.uk](mailto:csda@dcs.bbk.ac.uk). Please be sure that all submissions are DOUBLE SPACED. Single-spaced papers will be returned.

The deadline for paper submissions is the 30th of July 2007.

Any questions may be directed via email to: [csda@dcs.bbk.ac.uk](mailto:csda@dcs.bbk.ac.uk)

### CSDA Aims and Scope

Computational Statistics & Data Analysis (CSDA), the official journal of the International Association of Statistical Computing (IASC), is an international journal dedicated to the dissemination of methodological research and applications in the areas of computational statistics and data analysis. The journal consists of three refereed sections, and a fourth section dedicated to news on statistical computing. The refereed sections are divided into the following subject areas:

1. **Computational Statistics** - Manuscripts dealing with: 1) the explicit impact of computers on statistical methodology (e.g., Bayesian computing, bioinformatics, computational econometrics, computer graphics, computer intensive inferential methods, data exploration, data mining, expert systems, heuristics, knowledge based systems, machine learning, neural networks, numerical and optimization methods, parallel computing, statistical databases, statistical systems), and 2) the development, evaluation and validation of statistical software and algorithms. Software and algorithms can be submitted with manuscripts and will be stored together with the online article.
2. **Statistical Methodology for Data Analysis** - Manuscripts dealing with novel and original data analytical strategies and methodologies applied in biostatistics (design and analytic methods for clinical trials, epidemiological studies, statistical genetics, or genetic/environmental interactions), chemometrics, classification, data exploration, density estimation, design of experiments, econometrics, environmetrics, education, image analysis, marketing, model free data exploration, pattern recognition, psychometrics, statistical physics, image processing, robust procedures.  
 Statistical methodology includes, but not limited to: bootstrapping, classification techniques, clinical trials, data exploration, density estimation, design of experiments, pattern recognition/image analysis, parametric and nonparametric methods, statistical genetics, Bayesian modeling, outlier detection, robust procedures, cross-validation, functional data, fuzzy statistical analysis, mixture models, model selection and assessment, nonlinear models, partial least squares, latent variable models, structural equation models, supervised learning, signal extraction and filtering, time-series modelling, longitudinal analysis, multilevel analysis and quality control.
3. **Special Applications** - Manuscripts at the interface of statistics and computing (e.g., comparison of statistical methodologies, computer-assisted instruction for statistics, simulation experiments). Advanced statistical analysis with real applications (economics, social sciences, marketing, psychometrics, chemometrics, signal processing, finance, medical statistics, environmetrics, statistical physics).

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Friday, 20/04/2007 12:45-13:35 Room: MR380 Plenary talk 1

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APPLYING STOCHASTIC PROGRAMMING MODELS TO IMPROVE THE PERFORMANCE OF HEDGE FUNDS

Speaker: **John Mulvey, Princeton University, USA**

Chair: Berc Rustem

A multi-stage stochastic program provides an ideal framework for improving investor performance over time. These stochastic optimization models are especially pertinent for aggressive investors such as hedge funds. The primary goal is to enhance diversification so that leverage can be applied to increase portfolio growth. Careful risk management is essential. Recently introduced securities on the futures markets can be exploited by the optimizer. Several illustrative examples will be discussed.

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Friday, 20/04/2007 17:40-18:30 Room: MR380 Plenary talk 2

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ALGORITHMS FOR ROBUST MULTIVARIATE STATISTICS

Speaker: **Peter Rousseeuw, University of Antwerp, Belgium**

Chair: Erricos J. Kontoghiorghes

This talk gives an introduction to two highly robust multivariate estimators, the least trimmed squares (LTS) regression method and the minimum covariance determinant (MCD) estimator of multivariate location and scatter. Both are robust against even a large number of outliers. The outliers can then easily be detected by their distance from the robust fit, i.e. their residuals from LTS or their robust (Mahalanobis) distances from MCD. In a regression, applying MCD to the x-variables detects leverage points. The resampling-type algorithms for these methods were very time-consuming due to the large number of subsets required. Recently faster algorithms were constructed, FAST-MCD and FAST-LTS. These are now available in S-PLUS, R, and SAS. Some examples will be shown.

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Saturday, 21/04/2007 09:45-10:35 Room: MR380 Plenary talk 3

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VERY LARGE SYSTEMS OF LINEAR EQUATIONS: APPROXIMATE SOLUTION AND APPLICATIONS IN DYNAMIC PROGRAMMING

Speaker: **Dimitri Bertsekas, MIT, USA**

Chair: Anna Nagurney

We consider linear fixed point equations, and approximation of the solution by projection on a low-dimensional subspace. We propose stochastic iterative algorithms, based on simulation, which converge to the approximate solution and are suitable for very large-dimensional problems. The methodology generalizes recent approximate dynamic programming methods, which solve a projected form of Bellman's equation by using simulation-based approximations to this equation, or by using a projected value iteration method.

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Saturday, 21/04/2007 16:00-16:50 Room: MR380 Plenary talk 4

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OPERATOR METHODS AND LONG DATED STRUCTURED PRODUCTS

Speaker: **Claudio Albanese, Imperial College, UK**

Chair: Manfred Gilli

There are a number of reasons motivating the development of operator methods for derivative pricing. Firstly, pricing long dated structured products requires is much more sensitive to model specification than short dated derivatives and it is important to calibrate pricing measures which closely resemble historical measures. Non parametric model specifications without the benefit of partial analytic solvability are thus a necessity. Secondly, multi-core architectures and GPUs nowadays offer terabyte performance out of mass produced game consoles at the condition that the code bottleneck is in Level 3 BLAS routines and methods are stable under single precision. This talk reviews a modelling framework based on operator methods based on fast exponentiation of Markov generators, block-diagonalization algorithms for Abelian path dependent options and dynamic conditioning for baskets containing possibly hundreds of correlated processes. I discuss two applications, one to a stochastic monetary model for callable CMS spread range accruals, the second regarding a credit-equity structural model for bespoke CDOs.

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Sunday, 22/04/2007 12:30-13:20 Room: MR380 Plenary talk 5

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BOOTSTRAP TESTING

Speaker: **James MacKinnon, Queen's University, Canada**

Chair: Russel Davidson

This paper discusses bootstrap and Monte Carlo testing in econometrics. Several ways of computing bootstrap P values are discussed, including the double bootstrap and the fast double bootstrap. The paper also discusses several ways of generating bootstrap samples for regression models and other types of model. As an illustration, a simulation experiment examines the performance of several methods of bootstrapping the supF test for structural change with an unknown break point.

Friday, 20/04/2007

13:40-15:20

Parallel Session A

SN13 Room: MR380 SIGNAL EXTRACTION AND FILTERING - 1

Chair: Tommaso Proietti

**#49: Growth accounting for the Euro area: a structural approach**

*Presenter:* ..... Tommaso Proietti@University of Rome Tor Vergata, Italy  
*Co-authors:* ..... Alberto Musso

The paper is concerned with the estimation of the Euro area potential output growth and its decomposition according to sources of growth. The growth accounting exercise is based on a multivariate structural time series model which combines the decomposition of total output according to the production function approach with a price and wage equations that embody a Phillips type relationship linking inflation and nominal wage dynamics to the output gap and cyclical unemployment, respectively. Assuming a Cobb-Douglas technology with constant returns to scale, potential output results from the combination of the trend levels of total factor productivity and factor inputs, capital and labour (hours worked), which is decomposed into labour intensity (average hours worked), the employment rate, the participation rate, and population of working age. The nominal variables (prices and wages) play an essential role in defining the trend levels of the above variables, as they should pose no inflationary pressures on prices and wages. The structural model is further extended to allow for the estimation of potential output growth and the decomposition according to sources of growth at different horizons (long-run, medium run and short run); in particular, we propose and evaluate a model-based approach to the extraction of the low-pass component of potential output growth at different cutoff frequencies. The approach has two important advantages: the signal extraction filters have an automatic adaptation property at the boundaries of the sample period, so that the real time estimates do not suffer from what is often referred to as "the end-of-sample bias". Secondly, it is possible to assess the uncertainty of the potential output growth estimates with different degrees of smoothness.

**#123: State space models for time series with patches of unusual observations**

*Presenter:* ..... Jeremy Penzer@London School of Economics, UK

An alternative to leave-k-out diagnostics for detecting patches of outlying points in time series is developed. We propose that unusual behaviour should be modelled by the addition of shocks. By including shocks in the transition equation of a state space model, we admit the possibility of a persistent change associated with a patch of outliers. Persistent change may take the form of a level shift or a change in seasonal pattern. We provide an efficient mechanism for computing diagnostic statistics associated with the addition of k shocks using a simple adaptation of the Kalman filter. Statistics for detecting unspecified patterns of shocks and an interpretation of the output of the associated smoothing algorithm are derived. Illustrations using real series are given.

**#113: The performance of subspace algorithm cointegration analysis: new tests, simulation performance and application to interest rate data**

*Presenter:* ..... Martin Wagner@University of Bern, Germany  
*Co-authors:* ..... Dietmar Bauer

This paper complements and augments theoretical results established in earlier work by five additional better performing tests for the cointegrating rank, one better performing order estimation criterion, a detailed simulation study and an application to interest rate data. The simulations investigate four issues: order estimation, performance of the tests, the accuracy of the estimation of the cointegrating space and the forecasting performance. All results are compared with Johansen VAR results as benchmark. The simulations show advantages of subspace cointegration analysis with respect to the small sample performance of the tests on the one hand and certain weaknesses in the estimation of the cointegrating space on the other. The forecasting performance is comparable for the state space models estimated with subspace algorithms and VAR models. The application on the interest rate data delivers favorable results supporting the cointegration formulation of the expectations hypothesis of the term structure. The appendix provides critical values for the test statistics.

**#65: The Dutch business cycle: a finite sample approximation of selected indicators**

*Presenter:* ..... Ard Den Reijer@De Nederlandsche Bank, The Netherlands

In this study we construct a business cycle indicator for the Netherlands. The Christiano-Fitzgerald band-pass filter is employed to isolate the cycle using the definition of business cycle frequencies as waves with lengths longer than 3 years and shorter than 11 years. The main advantage of band-pass filtering is the unambiguous concept of a business cycle, to which the filtered approximation will eventually converge as more and more observations become available. The coincident business cycle index is based on industrial production, household consumption and staffing employment. These three variables represent key macroeconomic developments, which are also analysed by both the CEPR and NBER dating committees. For the indicator to be useful in practice, a timely update and therefore a limited publication delay is a crucial constraint. The composite leading index consists of eleven indicators representing different sectors in the economy: three financial series, four business and consumer surveys and four real activity variables, of which two supply and two demand-related.

**#28: Economic and statistical gains from classical and Bayesian forecast combinations**

*Presenter:* ..... Francesco Ravazzolo@Erasmus University, The Netherlands  
*Co-authors:* ..... Herman K. Van Dijk, Marno Verbeek

The interest of this work is to combine forecasts of the same events to out-perform individual forecasts, and to provide new evidence in favor of time varying combining methods. Considerable literature finds that combining procedures can often improve forecasting accuracy over the original procedures, but also that indiscriminate combining can reduce the performance dramatically as a result of several factors. The paper compares several well known averaging strategies, and tests their performances over different simulation exercises. Results show that time varying strategies statistically outperform other strategies when the underlying data generating process is subject to location shifts. In an empirical application to the S&P 500 index returns, time varying strategies are shown to be also economically profitable.

**#32: A component GARCH model with time varying weights**

*Presenter:* ..... Giuseppe Storti@University of Salerno, Italy  
*Co-authors:* ..... Luc Bauwens

We present a novel GARCH model that accounts for time varying, state dependent, persistence in the volatility dynamics. The proposed model generalizes the component GARCH model (CGARCH). The volatility is modelled as a convex combination of unobserved GARCH components where the combination weights are time varying as a function of appropriately chosen state variables. In order to make inference on the model parameters, we develop a Gibbs sampling algorithm. Adopting a fully Bayesian approach allows to easily obtain medium and long term predictions of relevant risk measures such as value at risk and expected shortfall. Finally we discuss the results of an application to a series of daily returns on the S&P500

**#66: Improved option pricing: combining parametric and non-parametric methods**

*Presenter:* ..... Lennart Hoogerheide@Universite Catholique de Louvain, Belgium  
*Co-authors:* ..... Herman K. Van Dijk

Much of the success of the market for options is due to the well-known Black-Scholes formula. However, the Black-Scholes formula relies on restrictive parametric assumptions such as log-normality of the underlying asset's price process. As an alternative, non-parametric methods have been used to directly obtain a relationship between option price and relevant economic variables (e.g. current underlying asset's price, strike price, time-to-maturity) from historical data. However, these methods require large quantities of historical prices. Moreover, even if an accurate approximation of the 'true' option pricing formula has been obtained, the option pricing formula's derivatives (that are relevant for hedging purposes) may be unreliable, as the surface of its graph may be rather 'bumpy'. In this paper, we propose an alternative option pricing method that does not suffer from the above mentioned problems. Our method starts with a Bayesian analysis of a model for the underlying asset's price process, e.g. an asymmetric GARCH model. An advanced simulation method is used to efficiently generate draws from the predictive density of the underlying asset's price at maturity. The simulation output is used to construct an artificial neural network (ANN) function providing option price (or its derivative) as a function of relevant economic variables and model parameters. The construction of such an ANN may be quite time consuming, but this can be performed 'in advance'. Only quick posterior simulation of GARCH parameters is required 'in real time'. The flexible, fast and reliable option pricing method is applied to the pricing and delta-hedging of S&P 500 futures options.

**#38: On the practice of Bayesian near-boundary analysis in basic models for macro-economic time series**

*Presenter:* ..... Herman K. Van Dijk@Erasmus University, The Netherlands  
*Co-authors:* ..... Michiel De Pooter, Rene Segers

We present a road map for effective application of Bayesian analysis in the context of well-known dynamic econometric models when a substantial posterior probability mass is at the boundary of the parameter region. Members belonging to this class are the Cochrane-Orcutt model for serial correlation, the Koyck distributed lag model, the Unit Root model and as Hierarchical Linear Mixed Models, the State-Space model and the Panel Data model. We discuss issues involved when drawing Bayesian inference on equation parameters and variance components and show that one should carefully scan the shape of the criterion function for irregularities. Analytical, graphical, and Gibbs sampling as well as empirical results are used along the way.

**#98: Two-step versus simultaneous estimation of survey-non-sampling error and true value components of small area sample estimators**

*Presenter:* ..... Swamy Paravastu@The U.S. Bureau of Labor Statistics, USA  
*Co-authors:* ..... Tamara Zimmerman, Jathinder Mehta

It is usual to use a model that relates the true value of a population characteristic for a small domain to some auxiliary variables to improve the precision of an imprecise sample estimator of the true value. It may not be possible to obtain such improvements if the model is misspecified and sample data contain non-sampling errors. In this paper, a time series model for state employment or unemployment is used to demonstrate the limitations of a two-step method of estimating survey errors and the corresponding true values. A cross-sectional model for state employment or unemployment is used to explain the advantages of simultaneously estimating a true value and the sums of sampling and non-sampling errors in two or more sample estimators of the true value.

**#160: Testing for serial correlation: generalized Andrews-Ploberger tests**

*Presenter:* ..... John Nankervis@University of Essex, UK  
*Co-authors:* ..... Gene Savin

This paper considers testing the null hypothesis that a time series is uncorrelated when the time series is uncorrelated but statistically dependent. This case is of interest in economic and finance applications. The GARCH (1, 1) model is a leading example of a model that generates serially uncorrelated but statistically dependent data. The tests of serial correlation introduced by Andrews and Ploberger (hereafter AP) are generalized for the purpose of testing the null. The rationale for generalizing the AP tests is that they have attractive properties for case for which they were originally designed: They are consistent against all non-white noise alternatives and have good all-round power against nonseasonal alternatives compared to several tests in the literature, which includes the Box-Pierce tests. These properties are inherited by the generalized AP tests. Our findings indicate that the generalized AP tests provide substantial improvements in power compared to the generalized Box-Pierce tests.

**#139: Generalized maximum entropy estimation of dynamic spatial panel data models**

*Presenter:* ..... Rosa Bernardini Papalia@University of Bologna, Italy

In this work we focus on dynamic models for spatial panels, a family of models for which there is an increasing interest in estimation problems. A dynamic spatial panel data model takes the form of a linear equation extended with a variable intercept, a serially lagged dependent variable and either a spatially lagged dependent variable or a spatially autoregressive process incorporated in the error term. The need to account for spatial heterogeneity is that spatial units are likely to differ in their background variables, which are usually space-specific time-invariant variables that affect the dependent variable, but are difficult to measure or hard to obtain. Omission of these variables leads to bias in the resulting estimates. To overcome these problems, one possibility is to introduce a variable intercept representing the effect of the omitted variables that are peculiar to each spatial unit considered. In the fixed effects model, a dummy variable is introduced for each spatial unit as a measure of the variable intercept, while, in the random effects model, the variable intercept is treated as a random variable that is independently and identically distributed with zero mean. The homogeneity assumptions that are often imposed on the coefficients of the lagged dependent variables can lead to serious biases when in practice the dynamics are heterogeneous across the cross section units. The proposed entropy-based formulation includes first spatial autoregressive processes in either the dependent variable and residuals by taking into account jointly structural instability and differentiated spatial effects between and within spatial cross sectional units. Our model specification allows for much more flexibility of the coefficients across units than do traditional models and also contributes to avoid the simultaneity biases that arise from constraining the coefficients on the lagged dependent variable to be constant across units, and to provide a diagnostic tool to investigate the presence of some type of heterogeneity in panel data sets. This procedure is able to produce consistent estimates in models where the number of parameters exceeds the number of data points and in models characterized by a non-scalar identity covariance matrix. Prior information can be introduced by adding suitable constraints in the formulation without imposing strong distributional assumptions.

**#56: The efficiency of seemingly unrelated regression estimator in econometric production models**

*Presenter:* ..... Melike Kaya@Hacettepe University, Turkey  
*Co-authors:* ..... Mehmet Uysal, Serpil Aktas

The least squares method, based on the assumptions of the ordinary linear regression model, is applied successfully in the estimation of coefficients. However, the potential relations between the error terms of regression equations which are homologous in structure are omitted. This situation causes the estimations by the least squares to be unbiased and consistent but not be efficient. It is accepted that there is a relationship between the error terms of equations in the seemingly unrelated regression (SUR) method. When the error terms of different equations at the same time point are highly related, and the independent variables in different equations are not highly related, the SUR estimator is more efficient than the least square estimator. In this study, by using the original data set pertaining to some agricultural products (e.g. barley and wheat) in Turkey, linear and Cobb-Douglas production models were developed. The model selection was performed in order to find the best model among these models. In addition by applying the least squares and the SUR methods to these production models, coefficients were estimated. After the variances of these estimated coefficients were calculated, the efficiencies of these estimators were examined. It was observed that the coefficient of determination values of each equation did not change considerably. It was suggested that for efficient coefficient estimations, the SUR method should be used among the models, with two or more regression equations developed for agricultural data.

**#19: Simulating term structure of interest rates with arbitrary marginals**

*Presenter:* ..... Andrea Consiglio@University of Palermo, Italy

The term structure of interest rates is a key economic factor for analysts and financial managers. Pension funds, insurance policies, financial family plans are bound to the evolution of the spot rates. In the last years, we have been observed a flourish of models to describe the dynamics of the term structure. In such models the interest rate (usually, the short one) is outlined through a stochastic differential equation. In general, these models assume that the distribution underneath is normal or lognormal. In a different literature strand, models based on the vector auto-regression framework have been extensively used to fit and forecast interest rates. These models too implicitly assume that the marginal distributions of the variates are Gaussian. However, empirical studies

show that the distribution of the interest rates are leptokurtic and asymmetric. More precisely, given that the yields are usually non-stationary, and that the first differences are used in their place, we have to handle series which exhibit very fat tailed distributions. Stochastic differential equations and vector auto-regression models, and in general any model postulating a Gaussian distribution of the interest rate changes, are apt to simulate or forecast the short term behavior of such factors. It is reasonable that, conditionally to the information available today, the one-step ahead distribution is Gaussian. This is the reason why such models are used to price options or to forecast the economic conjuncture in the near future. It is, on the contrary, very questionable their application to problems with a medium-long term horizon. In such cases, the real distribution of the yields play a crucial role. Portfolio selection models, pricing models of implicit options (e.g., the minimum guarantee option for insurance policies) will strongly depend on the scenarios generated, and, definitely, the Gaussian models cited above will provide scenarios whose unconditional distribution is far from the one observed. We propose in this paper a vector auto-regression model whose marginal distributions are fitted to the observed series of the interest rate changes. We will show that our model is able to simulate paths of the entire term structure with distributional properties very close to those found in the empirical data.

#### #14: EIS for the estimation of SCD models

*Presenter:* ..... Fausto Galli@University of Lugano, Switzerland  
*Co-authors:* ..... Luc Bauwens

Efficient Importance Sampling (EIS) is a technique developed by Richard and al. to solve numerically large multidimensional integrals like the ones that appear in the likelihood function of the Stochastic Conditional Duration (SCD) models. This work shows the capability of EIS to deliver precise and relatively fast estimates of the parameters of the models. The performance of EIS is evaluated first in a simulated case, and then in the estimation of a set of price and volume durations reveals surprisingly low MC sampling variances. Moreover, to show the flexibility of this method to different specifications, a model with a different baseline duration and one with a leverage effect are specified and estimated.

#### #209: Statistical properties of threshold ARMA models

*Presenter:* ..... Marcella Niglio@University of Salerno, Italy  
*Co-authors:* ..... Alessandra Amendola, Cosimo Vitale

In the wide class of threshold models, our work focuses the attention on the Self Exciting Threshold Autoregressive Moving Average model (SETARMA). Its structure is suitable to fit data related to phenomena with changes in regimes (such as business cycles, river flows) where the linearity of the generating process cannot be longer sustained. In particular the statistical properties of the model are investigated and new issues are given using both analytic and simulated results.

#### #130: Combining parametric and nonparametric approaches for time series prediction

*Presenter:* ..... Christian Francq@University Lille 3, France  
*Co-authors:* ..... Sophie Dabo-Niang, Jean-Michel Zakoian

We introduce a two-step procedure for more efficient nonparametric prediction of a strictly stationary process admitting an ARMA representation. The procedure is based on the estimation of the ARMA representation, followed by a nonparametric regression where the ARMA residuals are used as explanatory variables. Compared to standard nonparametric regression methods, the number of explanatory variables can be reduced because our approach exploits the linear dependence of the process. We establish consistency and asymptotic normality results for our estimator. A Monte Carlo study suggests that significant gains can be achieved with our approach.

#### #147: Computing a low-rank approximation of a tensor by optimization on a manifold

*Presenter:* ..... Lars Elden@Linkoping University, Sweden  
*Co-authors:* ..... Berkant Savas

We investigate various properties of the best rank- $(r_1, r_2, r_3)$  approximation of a tensor, and their implications in the development of algorithms for computing the approximation. The problem is formulated as an optimization problem on a product of Grassmann manifolds, which we solve by Newton's method. We develop a notation that makes it possible to derive the Newton equation without extensive index manipulation (which is rather common in tensor contexts). Numerical examples are given, where we compare the Newton method with the alternating least squares method.

#### #143: Some optimization problems in multivariate statistics

*Presenter:* ..... Tamas Rapcsak@Computer and Automation Institute of HAS, Hungary

Interesting and important multivariate statistical problems containing principal component analysis, statistical visualization, dynamic factor analysis and singular value decomposition, furthermore, least squares estimations, the characterization of the structural stability of dynamic systems, and many other problems lead to a new class of global optimization problems where the question is to find optimal orthogonal matrices. A special class is in which the problem consists in finding, for any  $2 \leq k \leq n$ , the dominant  $k$ -dimensional eigenspace of an  $n \times n$  symmetric matrix in the  $n$ -dimensional Euclidean space where the eigenspaces are spanned by the  $k$  largest eigenvectors. This leads to the maximization of a special quadratic function on the Stiefel manifold  $M_{n,k}$ . Based on the global Lagrange multiplier rule, the global optimality conditions of this smooth optimization problem are obtained, then they are applied in concrete cases.

**#192: Geometric optimization methods for the analysis of gene expression data***Presenter:* ..... Pierre-Antoine Absil@Universite Catholique de Louvain, Belgium*Co-authors:* ..... Michel Journee, Andrew Teschendorff, Simon Tavaré, Rodolphe Sepulchre

We present results of a research project, in collaboration with Addenbrooke's Hospital and the University of Liege, that aims at studying cancer-related gene pathways by applying both well-known and recently-developed independent component analysis (ICA) techniques to gene expression data. Unlike the genome, which is roughly similar for all the cells of an organism, gene expression in each cell is determined by a complex interplay of cooperative and counteracting biological processes. Gene expression levels are evaluated by means of the recent microarray technology, which makes it possible to measure the concentration of messenger RNA (mRNA) created by each gene. Gene expression data sets are often so large that a direct interpretation of them is infeasible. Unsupervised methods are required to reduce the dimension of the data set and to provide some biological insight in an automatic way. ICA provides a means to tackle this task. Most ICA algorithms can be viewed as the combination of two elements: (i) a contrast function, which can be thought of as an estimator of the level of statistical dependence between signals; (ii) an optimization method that attempts to compute an optimizer of the contrast function and thereby extract components that are "as independent as possible". In this talk, we will show that the underlying optimization problems in ICA can be naturally phrased as optimization problems on differentiable manifolds. A key reason lies in the inherent invariance properties of contrast functions: the level of dependence between signals must not be altered by scaling or permutation of these signals. This geometric formulation opens avenues for exploiting recently-developed optimization techniques on manifolds. In particular, a new trust-region method on the oblique manifold will be briefly discussed. We will also comment on the adequacy of various contrast functions in the context of gene expression analysis. Overall, our study shows that ICA provides a framework needed for a more biologically relevant interpretation of gene expression data. In particular, we have shown that ICA significantly outperforms Principal Component Analysis, in that ICA-components map closer to known cancer-related regulatory modules and cancer phenotypes. ICA thus helps elucidate the relations between gene activity and cancer taxonomy.

**#53: Continuous-time approach to common principal components estimation***Presenter:* ..... Nickolay Trendafilov@Open University, UK

The common principal components (CPC) model has been introduced and studied by B. Flury. It is one of many possible generalizations of the standard principal component analysis (PCA) of several covariance matrices. The motivation for introducing CPC is to study discrimination problems where the group covariance matrices are not equal as required by linear discriminant analysis, but more generally share common principal axes. There are considered several populations and it is assumed that their covariance matrices are all positive definite. The hypothesis of the CPC model is that these covariance matrices are simultaneously diagonalizable. In other words, there exists a common orthogonal matrix for all populations which diagonalizes all covariance matrices to positive diagonal matrices specific for each population. The CPC estimation problem is for given sample covariance matrices to find their common eigenvectors and corresponding (different) eigenvalues. B. Flury proposed the maximum likelihood procedure for their estimation. It is realized in the highly efficient FG algorithm based on Jacobi rotations. He also established a number of useful properties for these estimators: e. g. the statistic for testing the CPC null hypothesis has asymptotically chi-square distribution, etc. The least-squares setting of the CPC estimation problem is very similar to the well-known INDSCAL problem. Aim of this work is a comparative study of these two methods to fit the CPC model to the data. Continuous-time approach is employed to unify the analysis. The CPC model is not always completely appropriate. The partial CPC was introduced by B. Flury to handle situations when only few components can be regarded as common. The rest of the components are "partial" for each group. The adaptation of the FG algorithm to find PCPC is "neither elegant nor highly efficient". Continuous-time approach is employed to give not very efficient but straightforward solution to the PCPC problem.



Friday, 20/04/2007

15:50-17:30

Parallel Session B

SN18 Room: MR380 NONLINEAR TIME SERIES ANALYSIS

Chair: Alessandra Luati

**#157: An empirical strategy to distinguish structural breaks from long memory: a simulation study**

*Presenter:* ..... Francesca Di Iorio@Universita di Napoli Federico II, Italy  
*Co-authors:* ..... Carmela Cappelli

Distinguishing long memory and level shifts are nowadays a popular subject of research. Indeed, there is evidence that a stationary short memory process that encounters occasional level shifts can exhibit a slow rate of decay in the autocorrelation function and other properties of long memory processes. On the other hand, when the data generating process is a break-free integrated or fractionally integrated process, several breaks can be spuriously detected. In this paper we show the results of a simulation study on a simple empirical strategy that can be applied as a first check, to get an insight in "what is what". This strategy consists in fitting long memory and structural break models separately; in case both provide plausible explanation of the DGP of the data at hand, the long memory and structural break analysis are repeated on the series break-free and on the filtered series, respectively. Since there's a positive relation between the number of breaks and the estimated value of fractional integrated parameter, detecting multiple structural breaks is crucial to correctly identify the model. For this reason our empirical strategy is based on the atheoretical regression trees (ART), a very fast procedure able to locate multiple breaks occurring at unknown dates. Such procedure is suitable for routinely analysis of large numbers of time series or for long series which are hard to analyse with current methods due to the expensive computing time.

**#144: Robust LM tests in time series analysis**

*Presenter:* ..... Fabrizio Laurini@University of Parma, Italy  
*Co-authors:* ..... Luigi Grossi

Fitting nonlinear components in financial time series requires their identification through a statistical test. Engle, in his seminal paper of 1982, derived a test for identification of ARCH components which is based on Lagrange multipliers (LM), but similar methods are used to account for leverage effects as in Exponential GARCH and Threshold GARCH. All such tests are based on auxiliary regression models of squared residuals obtained from a conditional mean fit, and they all have low power, very often due to the presence of extreme returns. This motivated the introduction of weighted LM tests for assessing the presence of nonlinear components which compares estimates based on the whole sample with estimates obtained removing a unit subset. Such procedure suffers from masking effect and can be computationally unfeasible when we deal with multiple outliers in high frequency time series. In this paper we suggest to use the forward search, in order to compute weights which are not affected by the masking effect. The forward search is an iterative algorithm which at very begin splits the data into a small part of clean data (CDS) and a bigger part of potential outliers. Observations join the CDS according to their closeness to the underlying model so that the effect on estimates of any observation which joins the CDS can be monitored. Graphical displays provide a set of trajectories corresponding to each units which can be compared to theoretical or simulated quantiles in order to asses the degree of outlyingness. The main idea of this work is to compute robust LM tests, weighting residuals of the auxiliary regression with a measure of the distance between forward search trajectories and the confidence bands of the underlying distribution under the null hypothesis. Numerical results of the suggested robust test are good, at least when the classical test does not identify properly the presence of nonlinear components. From simulation experiments it is clear that using the weighted regression is useful, at least by increasing the power of the standard LM tests. Finally, the method has been applied to real financial (SP/MIB index of Italian stock exchange) and economic (Japanese industrial production index) time series.

**#92: Sequential Monte Carlo methods for stochastic volatility models with jumps**

*Presenter:* ..... Davide Raggi@University of Bologna, Italy  
*Co-authors:* ..... Silvano Bordignon

In this paper we propose a sequential Monte Carlo algorithm to estimate a stochastic volatility model with leverage effect, non constant conditional mean and jumps. Our idea relies on the auxiliary particle filter algorithm together with the Markov Chain Monte Carlo (MCMC) methodology. Our method allows to sequentially evaluate the parameters and the latent processes involved in the dynamic of interest. An empirical application on simulated data and on the Standard & Poor's 500 index is presented to study the performance of the algorithm implemented.

**#195: Local polynomial trend-cycle predictors for current economic analysis**

*Presenter:* ..... Silvia Bianconcini@University of Bologna, Italy  
*Co-authors:* ..... Estela Bee Dagum

The Henderson smoother and the Loess filter have been traditionally applied to estimate the short-term trend of socioeconomic indicators and implemented in several nonparametric seasonal adjustment software. The main purpose of this study is to introduce a RKHS representation of the Henderson and Loess smoothers with particular emphasis on the asymmetric ones applied to most recent observations. The filters obtained by means of the RKHS are shown to have superior properties relative to the classical ones from the view point of signal passing, noise suppression and revisions. We compare the performance of the kernel representations relative to the classical filters using real life series.

**#15: Dynamic and structure of the 30 largest North American companies**

*Presenter:* ..... Juan Gabriel Brida@University of Bolzano, Italy  
*Co-authors:* ..... Wiston Adrian Risso

In this paper we apply the methods introduced in (Brida et al. 2007) to describe dynamic and structure of the 30 largest North American companies. The method combines the tools of Symbolic Time Series Analysis with the nearest neighbor single linkage clustering algorithm. Data symbolization allows to obtain a metric distance between two different time series that is used to construct a Minimal Spanning Tree permitting to compute an ultrametric distance. By analyzing the data of companies include in Dow Jones Industrial Average, we derive a hierarchical organization. From this analysis we detect different clusters of companies which correspond with their common production activities or their strong interrelationship. The obtained classification of companies can be used to study deep relationships among different branch of economic activities and in portfolio construction.

**#80: Studying interactions without multivariate modelling**

*Presenter:* ..... Gianluca Cubadda@Universita di Roma "Tor Vergata", Italy  
*Co-authors:* ..... Alain Hecq, Franz Palm

We propose in this paper an approach that aims at providing guidance for checking the data admissibility of multivariate linear time series models (VAR or VARMA) and their implied individual ARIMA specifications. Indeed, we show that the presence of different kinds of common cyclical features restrictions, leading to reduced rank in the short run dynamics, explains to a large extent why we can identify such parsimonious univariate ARIMA models in applied research, a paradox that the profession had problems to explain before. This allows us to develop a new strategy for studying interactions between variables without modelling these relationships in a multivariate setting. Indeed, we develop tools to study features of individual time series with the aim to infer features of the complete system, as individual series keep a print of the system as a whole. In particular a test for poolability in panel data as well as cross-sectional aggregations of ARIMA series whose autoregressive roots are alike, will inform about co-movements existing in a vector autoregressive model. The advantages of our approach are many: 1) determining co-movements while we cannot work with a complete system, 2) enhancing the accuracy of forecasts, 3) its easy and cheap implementation in complex situations, 4) the potential empirical studies in many fields.

**#204: Computational issues in the estimation of higher-order panel vector autoregressions**

*Presenter:* ..... Jan Mutl@Goethe University Frankfurt, Germany  
*Co-authors:* ..... Michael Binder, M. Hashem Pesaran

In this paper we consider a number of computational issues that arise in the Quasi Maximum Likelihood (QML) estimation of higher-order panel vector autoregressions (PVARs) under fixed effects when the time dimension of the panel is finite and the cross-sectional dimension is large. The computational augmentations are as follows: First, we propose a Schur decomposition based method to rule out parameter estimates implying explosive roots. Second, we derive non-recursive characterizations of initialization restrictions both under stationarity and in the presence of unit root and cointegrating relations. Third, we obtain analytical derivatives for the likelihood criterion function. We find that with these three computational augmentations QML estimation is feasible for PVARs even when the parameter set is quite large. We adduce Monte Carlo evidence suggesting that also for higher-order PVARs the QML estimator outperforms various GMM estimators popular in the applied literature.

**#169: Estimation of multivariate probit models by exact maximum likelihood: a new computational approach**

*Presenter:* ..... Jacques Huguenin@University of Lausanne, Switzerland  
*Co-authors:* ..... Alberto Holly, Florian Pelgrin

A common problem in multivariate Probit model is the curse of dimensionality—an  $m$ -choice model requires numerical evaluation of an  $(m-1)$ -variate integral. To solve this issue, full information maximum likelihood methods are frequently used. In so doing, a first strategy is to assume special structures of the variance-covariance matrix for which closed-form expressions for the probabilities are available and for which the multiple integration problem is greatly reduced (see Ashford and Sowden; Sickles and Taubman; Bock and Gibbons). This assumption is relaxed when using simulation-based methods or Bayesian techniques. But evaluation of multivariate Normal probabilities becomes extremely time-intensive even for low-dimension problems. In this paper, we provide an alternative computational method to estimate a multivariate Probit model. The appeal of our approach is that we resort on the exact maximum likelihood based on reduction formulae, which allows us for greatly reducing the computing time and for obtaining a higher level of accuracy than standard techniques. More specifically, using the results of Holly and Holly, which exploit the Fourier transform of the multivariate Normal distribution, and those of Plackett, which accounts for the partial derivatives of the Multivariate Normal distribution, we show that the high-dimension integration problem of the cumulative Normal distribution function can be decomposed into a sum of lesser order multiple finite range integrals. Multivariate Normal probabilities can thus be evaluated by Gauss-Legendre quadrature using a limited number of evaluation points. This methodology can be generalized to any problem related to the evaluation of multivariate normal probabilities at least up to a certain dimension of the initial multivariate distribution. To assess the usefulness of our methodology, we compare the run-time needed for the estimation among different methods. Then, we conduct Monte-Carlo simulations and analyze the finite-sample properties of the FIML estimator based on our computational approach.

**#146: Testing for restricted stochastic dominance: some further results**

*Presenter:* ..... Russell Davidson@McGill University, Canada

Extensions are presented to the results of Davidson and Duclos (2007), whereby the null hypothesis of restricted stochastic non dominance can be tested by both asymptotic and bootstrap tests, the latter having considerably better properties as regards both size and power. In this paper, the methodology is extended to tests of higher-order stochastic dominance. It is seen that, unlike the first-order case, a numerical nonlinear optimisation problem has to be solved in order to construct the bootstrap DGP. Conditions are provided for a solution to exist for this problem, and efficient numerical algorithms are laid out. The empirically important case in which the samples to be compared are correlated is also treated, both for first-order and for higher-order dominance. For all of these extensions, the bootstrap algorithm is presented. Simulation experiments show that the bootstrap tests perform considerably better than asymptotic tests, and yield reliable inference in moderately sized samples.

**#124: Small area estimation under Fay-Herriot models with nonparametric estimation of heteroscedasticity**

*Presenter:* ..... Domingo Morales@Universidad Miguel Hernandez de Elche, Spain  
*Co-authors:* ..... Wenceslao Gonzalez-Manteiga, Maria Jose Lombardia, Isabel Molina, Laureano Santamaria

Fay-Herriot models (area level linear mixed models) are often used in small area estimation when data are available at the area level. Due to the lack of replications or disaggregated data, the error variances cannot be estimated, and thus they are often assumed to be known, but in practical applications they must be approximated. Here we assume that the error variance is an unknown function either of the design or of the mean response. We propose an algorithm for computing a non-parametric estimator of this error variance function. Model parameter estimators are derived, and their asymptotic properties are studied. Moreover, small area estimators that account for the present heteroscedasticity are obtained. The problem of bandwidth selection is addressed. Further, three estimators of the mean squared error of the small area estimators are proposed; the first is based on an analytical approximation and the remaining two are obtained by bootstrapping. Simulation experiments are carried out in order to assess the precision of the derived small area estimators and to compare the three estimators of the mean squared errors. Finally, the results are applied to the estimation of tourist expenditure in counties of the Spanish region of Galicia.

**#55: Testing for stochastic dominance efficiency**

*Presenter:* ..... Nikolas Topaloglou@Athens University of Economics & Business, Greece  
*Co-authors:* ..... Olivier Scaillet

We consider consistent tests for stochastic dominance efficiency at any order of a given portfolio with respect to all possible portfolios constructed from a set of assets. We propose and justify approaches based on simulation and the block bootstrap to achieve valid inference in a time series setting. The test statistics and the estimators are computed using linear and mixed integer programming methods. The empirical application shows that the Fama and French market portfolio is FSD and SSD efficient, although it is mean-variance inefficient.

**#165: Optimal bootstrap block length for unknown data generating processes: an empirical assessment for exchange rate data**

*Presenter:* ..... Vahidin Jeleskovic@University of Giessen, Germany

Recently, it has been shown in a large number of papers that the bootstrap methods can be a powerful tool for statistical inference. Although the asymptotic properties of parametric bootstraps for some models have been proven, the iid-assumption and the asymptotic independence condition are often not satisfied (typically for financial market data). Until now, the true data generating process for financial market data (thus, for exchange rates as well) is unknown. Hence, the block bootstrap method appears to be more appropriate. The block length should be chosen so as to capture the time dependence in the time series. However, the bias and the variance of block bootstrap estimators depend crucially on the block length which serves as the smoothing parameter in this case. In this paper, a method is proposed for choosing optimal bootstrap block length for an unknown data generating process of financial market data. We assume that the unknown data generating process can be described sufficiently by its characteristic and robust statistical properties (that are the well known "stylized facts" of financial market data). Those robust statistics are used to build an objective function. The objective function depends then only on the block length. Under standard assumptions, the distribution of objective function should converge to the theoretical chi-squared-distribution. We find out for which block length the empirical bootstrap distribution of the objective function obtains the best approximation of the theoretical one. This block length should be used for statistical inference through block bootstrap.

**#62: Modelling dynamic demand and supply curves of electronic markets**

*Presenter:* ..... Wing Lon Ng@University of Muenster, Germany

This paper focuses on the dynamic behaviour of bid and ask curves of electronic stock markets. For decades, the literature on financial econometrics and quantitative finance has been used to focus only on the stochastic process of daily prices or returns on assets and their volatility. Generally, most studies only pays little attention to other essential variables in financial markets. With the appearance of ultra-high frequency data and the increased interest in market microstructure of modern electronic markets,

researcher have paid more attention on the detailed evolution of the underlying transaction process. Although the (transaction) price is economically defined as the intersection of the supply and demand curve, only a few authors, however, have seriously paid attention to the market curves of limit orderbooks. This paper models the step functions of both supply and demand curves at each instant of time as stable "processes" (a special type of mixed Poisson processes) driven by quantity, not by time. The steps of both curves are described with a gamma random variable describing the stochastic consumer or producer surplus of both market sides at time  $t$ . The main objective is to explain the entire transaction process and, thus, the resulting price process and its volatility in relationship with the price elasticity implied by the slope of the supply and demand curve. The dynamics of both curves are captured by means of the ACD model.

**#100: Monte Carlo derivative pricing with partial information in a class of doubly stochastic Poisson processes with marks**

*Presenter:* ..... Silvia Centanni@University of Verona, Italy

*Co-authors:* ..... Marco Minozzo

In this work we propose a modelling framework for intraday stock price movements in which we specify a class of doubly stochastic Poisson processes with marks, and we take explicitly into account the link between the information release and the changes in price volatility and trading activity. In our framework, this link is embodied by the intensity process governing the speed of price changes. Assuming that in every bounded time interval only a finite, although random, number of pieces of news reaches the market, we suppose that for each piece of news there is a sudden jump in the intensity process, depending on the importance and unexpectedness of the news. The particular structure chosen for the intensity process, while permitting tractability, allows to specify a rich class of models. As far as the problem of pricing contingent claims is concerned, we describe the price behavior directly under an equivalent martingale measure  $Q$ , under which the problem of pricing a contingent claim is reduced to taking the expected value of the final payoff. As usual, it is natural to allow market agents to observe only the history of the stock price, that is, all past times and sizes of price changes, but not the history of the intensity process. In this context, pricing a contingent claim means taking the expected value of the final payoff conditioning only to the history of the stock price. This problem is linked to the filtering problem, that is, to the evaluation of the conditional distribution of the intensity, given a past realization of the times and sizes of price changes. For our models, a Monte Carlo filter can be constructed by resorting to the reversible jump Markov chain Monte Carlo algorithm (RJMCMC). A particularly interesting situation arises when we consider the so called minimal martingale measure. It can be shown, under some conditions, that the probabilistic structure of the model is the same under both the natural and the minimal probability measures. This allows us to perform parameter estimation under the natural probability measure, using stock price observations, with a stochastic version of the EM algorithm which embeds the RJMCMC filter in the simulation step.

**#134: Time series forecasting using shrinkage techniques and focused selection criteria**

*Presenter:* ..... Christian Brownlees@University of Florence, Italy

*Co-authors:* ..... Giampiero Gallo

Nonlinear time series models may exhibit components (long range trends, seasonality components, etc.) that are suitable to be modeled in a semi-parametric fashion (e.g. splines, flexible functional forms, trigonometric polynomials, etc.). The resulting unconstrained maximum likelihood estimator may be too heavily parameterized and thus not optimal for forecasting purposes. Constraints are imposed in a likelihood context jointly with some model selection procedure or, alternatively, penalized likelihood approaches (shrinkage estimation) can be adopted. In this paper we consider a class of shrinkage estimators that includes the Ridge, Generalised Ridge and some variants of the Bridge estimators. We show that shrinkage estimators are biased but have smaller variance in large samples than the MLE. Shrinkage techniques can thus lead to an overall risk improvement under different loss functions. Moreover, the large sample analysis of the estimators' risk suggests a class of focused information criteria: they consist of picking up the model which minimizes the estimated risk (e.g. MSE) of a given smooth function of the parameters of interest to the forecaster. As examples, consider that precision in the estimation of a (nonlinear) function of the parameters (e.g. a single parameter, the persistence, the unconditional variance or the half-life of a shock in a GARCH model) may be more important than that of single parameters. For illustrative purposes, we provide a simulation exercise adopting a Multiplicative Error Model (MEM) where the conditional expectation mimics ultra-high frequency dynamics with a time-of-day seasonal component specified with trigonometric polynomials. Cross-validation and focused information criteria with variants from different loss functions form the basis for choosing the amount of shrinkage to adopt in the estimation. The resulting performance shows an improvement from the approach when contrasted against the MLE as a baseline. The empirical application refers to a MEM applied to financial durations which exhibit a seasonal pattern due to trading habits. In our prediction exercise, the model parameters are estimated all at once, rather than extracting the seasonal component first and then estimating the parameters for the dynamics of the conditional expectation. The evaluation of the results is performed on the basis of a rolling one-step ahead forecasting exercise showing that shrinkage estimation beats MLE.

**#162: Persistence and seasonality in intradaily volatilities of stock index futures**

*Presenter:* ..... Eduardo Rossi@Universita di Pavia, Italy

*Co-authors:* ..... Dean Fantazzini

This paper investigates the intradaily pattern of volatilities of the two most traded American Stock Index futures, i.e. the E-mini SP500 and the E-mini Nasdaq100, quoted at the Chicago Mercantile Exchange. The data set includes hourly returns for both contracts. The aim is to find a parametric model which can describe the seasonality and persistence in the hourly returns, when we consider European, Asian and American trading hours. To this end we introduce two new models. The Periodic Fractionally Integrated EGARCH (PeFIEGARCH), which is an extension of the Fractionally Integrated EGARCH and the Seasonal Fractional

Periodic EGARCH (SeFPEGARCH). Both models account for the observed strong seasonal dependence in volatilities. For both we compute the population kurtosis and autocorrelation functions of absolute returns. We estimate the PeFIEGARCH under the assumption of a flexible distribution like the generalized  $t$ , which allows for conditional skewness and kurtosis. We found that during the Asian and European trading time the volatilities of both contracts are lower than during the American trading time when we observe a sharp increase. The results seem to confirm the fact that hourly returns sampled over the 24 hours across different markets are characterized by a strong seasonal pattern with a statistically significant persistence.

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 SN10 Room: MR150 ROBUSTNESS
 

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Chair: Christophe Croux

#### #104: Robust PCA for flat data

*Presenter:* ..... Peter Filzmoser@Vienna University of Technology, Austria

Flat data are characterized by data matrices where the number of variables is (much) larger than the number of observations. Since the covariance matrix for this type of data is singular, approaches to robustify PCA with a robust covariance estimator (e.g. the MCD) are not possible. We give an overview of alternative estimators, the most prominent being based on the projection-pursuit principle. We discuss and compare algorithms for the computation of the robust PCs. Finally, an R implementation of the very precise Grid algorithm is demonstrated at real data.

#### #101: Robust subsampling

*Presenter:* ..... Olivier Scaillet@HEC Geneve and Swiss Finance institute, Switzerland

*Co-authors:* ..... Lorenzo Camponovo, Fabio Trojani

We compute the breakdown point of the subsampling quantile of a general statistic, and show that it is increasing in the subsampling block size and the breakdown point of the statistic. These results imply fragile subsampling quantiles for moderate block sizes, also when subsampling procedures are applied to robust statistics. This instability is inherited by data driven block size selection procedures based on the minimum confidence interval volatility (MCIV) index. To overcome these problems, we propose for the linear regression setting a robust subsampling method, which implies a sufficiently high breakdown point and is consistent under standard conditions. Monte Carlo simulations and sensitivity analysis in the linear regression setting show that the robust subsampling with block size selection based on the MCIV index outperforms the subsampling, the classical bootstrap and the robust bootstrap, in terms of accuracy and robustness. These results show that robustness is a key aspect in selecting data driven subsampling block sizes.

#### #102: Robust bootstrap model selection for MM-estimators

*Presenter:* ..... Stefan Van Aelst@Ghent University, Belgium

*Co-authors:* ..... Matias Salibian-Barrera

Bootstrap model selection for least squares estimation has already been studied, but not yet for robust regression estimators. Recently Müller and Welsh extended bootstrap model selection by adding a penalty term for the model dimension to a robustified bootstrap selection criterion and by developing a stratified bootstrap methodology that can be used for a large class of M-type robust regression estimators. The resulting model selection procedure is shown to be robust but also time consuming which severely limits its use. In this talk we use the fast, robust bootstrap for MM-estimators to calculate the selection criterion for each of the models. The conditions for consistency of the robust bootstrap selection will be given in the case that a true model exists. Simulations and examples show that the robust bootstrap model selection generally performs similarly or better than the stratified bootstrap model selection for MM-estimators. Moreover, the selection criterion based on the robust bootstrap is much faster to compute, so larger scale problems can be handled. Some examples will be given to illustrate the selection method.

#### #45: Robust estimation of a general bivariate GARCH volatility model

*Presenter:* ..... Kris Boudt@K.U.Leuven, Belgium

*Co-authors:* ..... Christophe Croux

It is widely recognized that the cross-product of two vector return series of financial assets may exhibit a lot of dependence. This stylized fact can be replicated by a bivariate GARCH volatility model in which the innovations in the mean vector drive the time-variation in the conditional volatility and cointegration of the two series. An important empirical finding is that even after correcting the returns for GARCH volatility clustering, the marginal distribution of the residual time series is still heavy tailed. This feature can be seen as an indication of deviation from normality and possible presence of outliers in the data set. The effect of outliers on estimating univariate GARCH models has been studied in the literature and robust estimators have been proposed. We extend this research to the bivariate case. We choose to focus on the BEKK volatility model because of its generality, its parsimony in terms of parameters and the ease to impose identification, positive definiteness and covariance stationarity conditions. We propose robust M-estimators for this model and discuss computational aspects of estimating the BEKK model. In a Monte Carlo experiment, we then compare the robust M-estimators with the classical Gaussian quasi-maximum likelihood estimator for different levels of contamination. We conclude with an empirical application, in which the M-estimator is used to find robust estimates of the conditional covariance matrix of the returns on the US and German stock market indices.

Friday, 20/04/2007

18:35-19:50

Parallel Session C

SN41 Room: MR380 BAYESIAN MODELLING

Chair: Alessandra Amendola

**#44: Bayesian analysis of autoregressive models with multiple structural breaks**

*Presenter:* ..... Loukia Meligotsidou@Lancaster University, UK  
*Co-authors:* ..... Elias Tzavalis, Ioannis Vrontos

Detecting structural changes in time series has attracted much attention over the last years. To a large extent, this can be attributed to the sensitivity of unit root tests to the presence of structural breaks in the level and the error variance of financial and economic time series. In this context, there are two issues related to the study of structural changes. First, it is of interest to detect break-points in the series and to infer their number. Second, it is also important to investigate the presence of a unit root allowing for possible structural breaks. There are two approaches to dealing with both of these issues; the one of hypothesis testing and that of model selection. The former is a classical approach, while the latter has been adopted within a Bayesian framework. Bayesian methods are particularly attractive for inferring the number of structural breaks since this can be naturally achieved in a Bayesian model comparison setting. Within this framework, all the unknown quantities in the model are treated as parameters. Therefore, the joint posterior distribution summarizes all the available information about the number and the positions of the breaks as well as about the model parameters. We propose a Bayesian approach to inference for stationary autoregressive models of order  $p$  [AR( $p$ )] subject to multiple structural breaks occurring at unknown time points. Our approach is based on a set of efficient recursions, which are similar to those of the forward-backward algorithm. The forward recursion can be used to calculate the marginal likelihoods of the break-point models. These marginal likelihoods can be used for inference on the number of breaks. The backward recursion enables us to simulate from the marginal posterior distribution of the positions of the breaks. Based on the above approach we also propose a Bayesian model comparison method to detect stationarity from unit autoregressive roots allowing for multiple structural breaks. This method can be proven useful in economic applications where evidence for unit roots is seriously influenced if the presence of multiple breaks is ignored. Simulation experiments are conducted with the aim to assess the performance of the suggested inferential procedure. The proposed method is applied to real economic series, such as the ex-post US real interest rates, the inventories index and the 10-year US nominal interest rates, frequently used in practice to detect structural breaks.

**#120: Bayesian estimation of the Markov-switching GARCH(1,1) model with Student-t innovations**

*Presenter:* ..... David Ardia@University of Fribourg, Switzerland

In this article, we propose the Bayesian estimation of the regime-switching GARCH(1,1) model. More precisely, we consider the Markov-switching (henceforth MSGARCH) specification by Haas, Mittnik and Paolella (2004). We introduce a new MCMC scheme which can be viewed as an extension of the sampler by Nakatsuma (1998). This allows to generate the parameters of the MSGARCH model in blocks which may enhance the sampler's efficiency. As an application, we fit an asymmetric GARCH and a Markov-switching GARCH model to Swiss Market Index log-returns. We use the random permutation sampler of Fruhwirth-Schnatter (2001) to find suitable identification constraints for the MSGARCH model and show the presence of two distinct volatility regimes in the time series. The generalized residuals are used to test the models for misspecification. By using the Deviance information criterion of Spiegelhalter, Best, Carlin and Linde (2002) we show the in-sample superiority of the MSGARCH model. To test the predictive performance of the models, we run a back testing analysis based on the VaR. In particular, we compare the MSGARCH model to a single regime GARCH model which relies on the rolling window methodology and show that both models perform equally well. However, contrary to the single regime model, the Markov-switching model is able to anticipate structural breaks in the conditional variance process.

**#203: Electricity spot price forecasting with sparse Bayesian recurrent neural networks**

*Presenter:* ..... Derrick Mirikitani@Goldsmiths College, University of London, UK  
*Co-authors:* ..... Mohammed Daoudi

In deregulated markets, electricity spot price forecasting is essential for planning and operation of power companies. Producing reliable forecasts of electricity spot prices from time series data is a nontrivial task as spot price series are known to exhibit non-linear, non-stationary, and chaotic behavior. Due to these characteristics, the forecasting of electricity spot prices is severely ill posed. Previous approaches to the forecasting problem have utilized linear and nonlinear autoregressive models. Two major limitations to the past approaches have been the lack of the use of regularization, and the absence of a mechanism to track the non-stationary behavior of the system. This has led to models that over fit the in-sample data, and perform poorly on out-of-sample forecasts. In this paper, a Bayesian approach to recursive second order training of a recurrent neural network (RNN) is introduced for prediction of noisy electricity spot prices. The internal state of the RNN allows for the learning of temporally extended dependencies and chaotic behavior. To promote generalization, we adopt a Bayesian prior that includes a single local regularization hyper-parameter for each weight, allowing for pruning of the irrelevant weights. As each new data sample arrives, the model parameters and regularization hyper-parameters are re-estimated sequentially, alleviating the need to reconsider the entire training set. Experimental investigations using historical electricity spot price data from show that the developed algorithm outperforms the following models: the standard linear ARMA model, a feed forward neural network trained with an extended Kalman filter, a recurrent neural network trained with real time recurrent learning, a recurrent network trained with the extended Kalman filter, and a time delayed finite impulse response neural network.

**#33: Econometric asset pricing modelling**

*Presenter:* ..... Fulvio Pegoraro@Banque de France, France  
*Co-authors:* ..... Henri Bertholon, Alain Monfort

The purpose of this paper is to propose a general econometric approach to asset pricing modelling based on three main ingredients : (i) the historical discrete-time dynamics of the factor representing the information, (ii) the Stochastic Discount Factor (SDF), and (iii) the discrete-time risk-neutral (R.N.) factor dynamics. Retaining an exponential-affine specification of the SDF, its modelling is equivalent to the specification of the factor loading vector and of the short rate, if the latter is neither exogenous nor a known function of the factor. In this general framework, we distinguish three modelling strategies: the Direct Modelling, the Risk-Neutral Constrained Direct Modelling and the Back Modelling. In all the approaches we study the internal consistency constraints, implied by the absence of arbitrage opportunity (AAO) assumption, and the identification problem. We also propose interpretations of the factor loading vector in terms of market price of risk. The general modelling strategies are applied to two important cases: security market models and term structure of interest rates models. In the context of security market models, we show the relevance of our methods for various kinds of specifications: switching regime models, stochastic volatility models, Gaussian and Inverse Gaussian GARCH-type models (with or without regime-switching). In the interest rates modelling context, we consider several illustrations: VAR modelling, Switching VAR modelling and Wishart modelling. We also propose, using a Gaussian VAR(1) approach, an example of joint modelling of geometric returns, dividends and short rate. In these contexts we stress the usefulness of the Risk-Neutral Constrained Direct Modelling approach and of the Back Modelling approach, both allowing to conciliate a flexible historical dynamics and a Car R.N. dynamics leading to explicit or quasi explicit pricing formulas for various derivative products. Moreover, we highlight the possibility to specify asset pricing models able to accommodate non-affine historical and R.N. factor dynamics with tractable pricing formulas.

**#215: Estimation and testing in threshold cointegrated systems using reduced rank regression**

*Presenter:* ..... Jaya Krishnakumar@University of Geneva, Switzerland  
*Co-authors:* ..... David Neto

The paper generalises estimation and inference procedures for a threshold VECM with more than one cointegrating relation. We derive long-run parameters and loading factors estimators by means of a reduced rank regression. We provide their asymptotic distributions and propose a testing procedure for the cointegrating rank. The asymptotic distributions of the test statistics are derived and tabulated. In order to improve finite sample inference, we also compute bootstrap approximation to the distribution of the test statistics. Monte-Carlo experiments are conducted to evaluate the finite-sample performance of the tests and their power. Applying our methods to test the uncovered interest rate parity and the expectations hypothesis of the term structure for the U.S. and Switzerland case, we find results consistent with the theory and strong evidence for a threshold effect.

**#27: The impact of news on higher moments**

*Presenter:* ..... Eric Jondeau@University of Lausanne, Switzerland  
*Co-authors:* ..... Michael Rockinger

In this paper, we extend the concept of News Impact Curve of volatility developed by Engle and Ng (1993) to the higher moments and co-moments of the multivariate GARCH model with non-normal innovations. For this purpose, we present a new methodology to describe the joint distribution of GARCH processes in a non-normal setting. Then we provide the expressions for the response of the characteristics of the subsequent distribution to a stock. This tool enhances the understanding of the temporal evolution of the joint distribution. We use our methodology to provide stylized facts on the four largest international stock markets. In particular, we document the persistence of large (positive or negative) daily returns. In a multivariate setting, we find that foreign holdings provide a good hedge against changes in domestic volatility after good shocks but a bad hedge after crashes. Using generalized impulse responses, we also consider the temporal dimension of the problem.

**#117: Indirect inference and efficient method of moments: practical issues and finite sample comparison**

*Presenter:* ..... Veronika Czellar@University of Washington, USA  
*Co-authors:* ..... Eric Zivot

Indirect inference (II) and efficient method of moments (EMM) are two widely used simulation-based estimation procedures. Under suitable conditions, these two estimation procedures are asymptotically equivalent to maximum likelihood. However, not much is known about the relative performance of these two methods in finite samples. In this paper we provide a comprehensive finite sample comparison of II and EMM using Monte Carlo methods. We consider three different ways of computing II estimators and two different ways of computing EMM estimators. For these estimation methods, we provide a simple rule for determining how large a simulation sample should be to obtain a given asymptotic efficiency of the structural model parameters relative to the auxiliary model parameters. For the estimation of continuous time models, we provide a method for choosing the Euler discretization to control the asymptotic bias of the II and EMM estimators. Using a discrete time first order moving average (MA(1)) model and a continuous time one factor diffusion model as evaluation models, we investigate a number of issues in the

practical application of II and EMM and evaluate estimation and inference performance. In terms of estimation, we only find substantial differences between II and EMM for the MA(1) model when the MA parameter is near the noninvertibility region. In terms of inference on structural parameters, we find that the asymptotic approximation of the distribution of classical LR-type statistics can be highly inaccurate and can lead to misleading test results both for EMM and II, but especially in the case of EMM. For improved finite sample inference, we propose saddle point tests based asymptotically equivalent M-estimators of the II and EMM estimators. We show that the finite sample performances of the saddle point tests are superior to the LR-type tests based on the II and EMM estimates.

#### #40: An objective function for simulation based inference on exchange rate data

*Presenter:* ..... Peter Winker@University of Giessen, Germany  
*Co-authors:* ..... Manfred Gilli, Vahidin Jeleskovic

The assessment of models of financial market behaviour requires evaluation tools. When complexity hinders a direct estimation approach, e.g., for agent based microsimulation models or complex multifractal models, simulation based estimators might provide an alternative. In order to apply such techniques, an objective function is required, which should be based on robust statistics of the time series under consideration. Based on the identification of robust statistics of foreign exchange rate time series in previous research, an objective function is derived. This function takes into account stylized facts about the unconditional distribution of exchange rate returns and properties of the conditional distribution, in particular, autoregressive conditional heteroscedasticity and long memory. A bootstrap procedure is used to obtain an estimate of the variance-covariance matrix of the different moments included in the objective function, which is used as a base for the weighting matrix. Finally, the properties of the objective function are analyzed for two different agent based models of the foreign exchange market, a simple GARCH-model and a stochastic volatility model using the DM/USD exchange rate as a benchmark. It is also discussed how the results might be used for inference purposes.

#### #180: Assessing the predictive ability of broker-dealers using a multivariate multinomial logit (MNL) with latent factors

*Presenter:* ..... Maria-Pia Victoria-Feser@University of Geneva, Switzerland  
*Co-authors:* ..... Olivier Scaillet, Philippe Huber

In exchange for directed trades made by institutional investors, most of the brokerage houses make also so-called "soft dollars", i.e. payments for products or services other than execution of the orders. Soft dollars are costly, and it should be interesting for an institutional investor to determine whether these soft dollar inputs are worth being used (and indirectly paid for) or not, from a statistical point of view. For example, Geneva University pension fund collects data of financial forecasts of several broker-dealers about the mid-term evolution of respectively the stock markets in 5 countries and the bonds market in 4 zones. These broker-dealers are asked each trimester to provide their forecasts for each country in terms of market trends (stock and bond indices) for the next 6 months: strong bear, bear, neutral, bull, strong bull. The responses are recorded on an ordinal scale from 1 to 5. The actual evolutions of the corresponding markets are also recorded on the same ordinal scale. The issue is to determine whether the forecasts made by the broker-dealers are in some sense "near" the realized market evolutions six months later. In a statistical framework, this comparison can be made through the study of the association between two random vectors. If the variables are normal, the canonical correlation coefficient can be used. When this is not the case, for example when the data are collected on scales with limited number of points, the canonical correlation is no longer appropriate. In this paper we propose to construct a measure of association between two ordinal random vectors. We do that through the specification of a multivariate multinomial logit (MNL) with latent factors, which belongs to the generalized linear latent variable models. This is done in the spirit of structural equation modelling (SEM) with latent variables and generalized linear latent variable models. The resulting association measure is similar to the canonical correlation coefficient in the normal case and similar to the polychoric correlation in the univariate case. Our association measure corresponds to a model parameter which is estimated (together with other parameters) using an approximated maximum likelihood estimator for which we develop its asymptotic properties. Consequently, statistical inference for the association measure can be performed using the properties of the estimator.

#### #90: Selecting factors with bootstrap tests in approximate factor models empirical applications

*Presenter:* ..... Daniel Grenouilleau@Paris School of Economics, France

The paper introduces two bootstrap tests to select factors in approximate factor models, which aim to complement standard information criteria for empirical applications with very large cross-section of noisy data. This research is motivated by the fact that numerous predictors are available with short time-span in practice and, yet, information criteria typically fail in such setups. Cross-sectional bootstrapping is used to generate empirical distributions for the eigenvalues of the data covariance matrix and for the loadings for a series of interest in the dataset (e.g. that to be forecasted). Where an eigenvalue is significantly different from the nearest eigenvalues, we reject the hypothesis that the corresponding eigenvector is not a latent factor of the dataset. A nullity test on the loadings also allows us to identify common factors for a series of interest. The tests properties are screened with Monte-Carlo simulations based on data generating processes for static and dynamic factors, that are realistic, i.e. which yields eigenvalues and residuals distributions similar to those of empirical data. Both bootstrap tests outperform extant information criteria where the number of series is far greater than the number of observations, both in Monte-Carlo simulations and in a pseudo real-time empirical application using about 2000 series covering the Euro area business cycle



**#88: Screening identifiability of DSGE models?**

*Presenter:* ..... Marco Ratto@European Commission, Italy  
*Co-authors:* ..... Andrea Pagano

In this paper aims to build a general methodology to assess identifiability of the parameters of DSGE models, prior to any estimation. Our idea is to analyse identifiability by quantifying the impact of the model parameters on synthetic key characteristics of DSGE models. The impact is quantified by mapping the relationships between such key characteristics and the parameters, using global sensitivity analysis (GSA) methods. Since GSA methods allow to extract such an impact by exploring the entire prior parameter space, we avoid to confine our analysis to, e.g., some local measure of curvature of loss function or likelihood. The synthetic characteristics used for the mapping represent short run dynamics, like time constants or half-life measures of speed of adjustment, as well as long run restrictions implied by the model, like steady state gains. The procedure allows an informed choice about which and how many parameters are more likely to be best identifiable. This aspect is particularly important when large-scale DSGE models are under analysis. In this context, among the different GSA methods available, we concentrate on global screening methods that allow to reduce the computational cost of the analysis at a modicum.

**#168: Computing optimal policy in Dynare**

*Presenter:* ..... Michel Juillard@Paris School of Economics and Univ. Paris 8, France

This paper presents the automatic computation of Ramsey policy in Dynare, for any model describing the equilibrium relations of the economy. Special attention is given to the problems arising in large models, in particular the computation of the steady state and the possibility for this optimization problem not to be dynamically stable.

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SN34 Room: MR150 SIGNAL EXTRACTION AND FILTERING - 2

Chair: Stephen Pollock

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**#185: Higher order correlation nonlinear stochastic filters**

*Presenter:* ..... Oliver Grothe@University of Cologne, Germany  
*Co-authors:* ..... Christoph Mueller

Nonlinear stochastic filters are powerful tools for simultaneous estimation of parameters and unobserved states from noisy data. To estimate parameters they can be used for both a maximum likelihood approach and a sequential Bayesian approach by augmenting the state vector with the parameters. The basic idea is to apply the Kalman filter to nonlinear systems. These nonlinearities require approximations of densities and equations which divide filtering approaches into two classes: Gaussian filters (e.g. the extended Kalman filter), which reduce the densities to their first two moments, and filters which capture more information about the densities (e.g. simulation based filters). While the first approaches profit from computational simplicity since they rely on linear updates of Gaussian densities, filters of the second type are computationally burdensome due to simulations or numerical integration methods. Since computational aspects are of special importance in real-time applications with financial high frequency data, we focus on extensions of Gaussian filtering methods. Gaussian filters face one major problem when estimating parameters using the Bayesian approach: They are not able to update parameters that are not linearly correlated with the measurement or the prediction error. In financial applications, a typical example is stock price volatility. Generally, there is no linear correlation for states that enter the measurement equation only by the diffusion coefficient of another state. In order to estimate diffusion parameters, we use the correlation between the squared prediction error for the measurement update. Therefore, we extend the standard moment based filters with a higher order correlation update and the propagation of asymmetric dependence structures. We show the validity of our approach in simulation studies, where the algorithm is applied to estimate parameters of an Ornstein-Uhlenbeck model using the Bayesian approach.

**#154: Human capital and regional business cycles in Italy**

*Presenter:* ..... Camilla Mastromarco@University of Lecce, Italy  
*Co-authors:* ..... Ulrich Woitek

The decision to invest in non compulsory education involves the interaction of two main economic factors, both of which may exhibit significant variability over business cycle: the expected rate of return on human capital investments and the ability to finance schooling. The expected return on education depends, among other things, on opportunity cost (forgone income) and the ability to pay. Both of these factors move in a procyclical manner. Income foregone due to the pursuit of education is lower during recessions. On the other hand the ability to purchase education may be procyclical in presence of financial market imperfections. Liquidity constraints might prevent individuals to undertake the desired amount of education. More recent studies confirm the finding that the decision to invest in education is countercyclical. Our paper aims at adding evidence to this ongoing debate by analyzing annual time series data for Italy in the period 1960 to 2000. Looking at the relationship between the regional secondary and tertiary school enrolment rates data and regional real GDP fluctuations, we want to shed some light on this issue. The method of choice is a 2-variable VAR approach for school enrolment rate and business fluctuations measured as deviations of regional GDP from a trend. We calculate the spectral representation of a VAR model with time varying parameters. This allows us to look at correlation and phase shift between the variables in the system frequency-by-frequency and to study the stability of the relationship over time.

**#194: A Euro area estimate of monthly GDP**

*Presenter:* ..... Gian Luigi Mazzi@European Commission, Luxembourg

*Co-authors:* ..... Cecilia Frale, Massimiliano Marcellino, Tommaso Proietti

A real-time monitoring of the economic activity requires timely and reliable information on the whole economy. Main requirements of such exercise are a clear representation of the macro-economic cyclical behaviour and the possibility of performing reliable short-term forecasting and econometric modelling. In the past years most short-term investigations relied on the industrial production index or on some of its proxies. Nowadays it is widely recognized that also non-industrial activities are characterized by economic fluctuations, so that an accurate short-term macro-economic analysis has to take them into account. In this respect GDP seems to represent the most appropriate indicator for short-term business cycle analysis and forecasting. Unfortunately GDP is only available on quarterly basis with a few exceptions (i.e. UK), which is considered a too low frequency from the analysts point of view. For those reasons, an increasing interest of institutional and non-institutional users on the availability of a monthly estimate of GDP is considerably rising. This paper describes an innovative multivariate approach, fully consistent with National Accounts constraints allowing the derivation of a statistically robust estimate of the Euro area GDP on a monthly basis. Output side and expenditure components of GDP are dynamically estimated by means of parametric dynamic factor models in a state-space framework. The multivariate models are cast in the state space form and computational efficiency is achieved by implementing univariate filtering and smoothing procedures. The final estimate of the Euro area GDP is then obtained by combining the two estimates with optimal weights, reflecting their relative precision. Results of an extensive simulation study are also presented to show the performance of this approach and the dynamic properties of the monthly estimates of the Euro area GDP. Moreover, the model forecasting accuracy as well as its ability to timely detect turning points were investigated.

Saturday, 21/04/2007

08:00-09:40

Parallel Session D

SN03 Room: MR380 NONLINEAR FINANCIAL TIME SERIES MODELLING

Chair: Zhengjun Zhang

**#109: Robust likelihood methods based on the skew-t and related distributions**

*Presenter:* ..... Marc Genton@University of Geneva, Switzerland  
*Co-authors:* ..... Adelchi Azzalini

We propose the multivariate skew-t distribution as a robust parametric class of models and show that it is a sensible general purpose compromise between robustness and simplicity, both of treatment and of interpretation of the outcome. Indeed, it is flexible enough to match the behavior of the observed data in a variety of practical cases because it includes parameters to regulate skewness and kurtosis. We provide some theoretical arguments, outcomes of a few simulation experiments and various wide-ranging examples with real data in support of the above claims. In particular, we present a robust analysis of a time series of interest rates.

**#7: Jumps and microstructure noise in realized volatility: an FDA approach**

*Presenter:* ..... Rituparna Sen@University of California at Davis, USA

The paper proposes principal component analysis of functional data approach to separate the volatility of a process from microstructure noise. This approach can be used to detect days on which the stock price process has jumps and to measure the size of jumps. Thus we can separate the jump component from the integrated volatility in the quadratic variation process. This separation leads to better prediction of integrated volatility. This result is particularly useful for high-frequency data, because existing measures like realized variation and bipower variation require sampling at long horizons to get rid of microstructure noise. We develop the theory and present simulation as well as real data examples.

**#6: Modeling dependence between extremes of financial returns. An alternative to GARCH(1,1) models**

*Presenter:* ..... Jose Olmo@City University, London, UK  
*Co-authors:* ..... Oscar Martinez

One of the main implications of the efficient market hypothesis (EMH) is that expected future returns on financial assets are not predictable. This hypothesis however does not preclude the existence of models to predict future uncertainty regimes. While returns are not predictable their conditional volatility it is. This has been long exploited by researchers and practitioners using models to predict volatility - specially nonlinear models of ARCH, GARCH type. Future volatility is positively correlated with past volatilities and/or other features of financial data such as the sign of previous returns or their magnitude. These models however say nothing about predicting expected future returns or about simply predicting their sign. In this paper we argue that financial time series offer more information than that the efficiency of markets seems to supply. In particular we postulate that runs of very large returns are predictable for small time periods. In order to prove this we propose a SETAR(1,3)-GARCH(1,1) model that is able to distinguish and describe two different types of extreme events: a first type generated by large uncertainty regimes where runs of extremes are not predictable and a second type where extremes come from isolated dread/joy events. The effect of these extreme events is somehow persistent in the sense that is characterized by an AR(1) process with a low dependence parameter. This model is tested with data from international equity indexes and from foreign exchange markets. We find that dreadful events are more persistent and have a larger effect than joy events where the market speedily absorbs new pieces of information and runs of positive extreme returns are less likely.

**#116: Extreme co-movements and extreme impacts in high frequency data in finance**

*Presenter:* ..... Zhengjun Zhang@University of Wisconsin, USA  
*Co-authors:* ..... Kazuhiko Shinki

Extreme co-movement and extreme impact problems are inherently stochastic control problems, since they will influence the decision taken today and ultimately influence a decision taken in the future. Extreme co-movements among financial assets have been reported in the literature. However, extreme impacts have not been carefully studied yet. In this paper, we use the newly developed methodology to further explore extreme co-movements and extreme impacts in financial market. Particularly, two FX spot rates are studied. Based on the results of our analysis with FX returns, we conclude that there exist extreme co-movements and extreme impacts in FX returns and care has to be taken when we employ portfolio optimization models, especially models without the ability of handling extreme dependencies.

SN09 Room: MR080 GLOBAL FINANCIAL MARKETS AND ECONOMETRIC MODELLING

Chair: Sotiris K. Staikouras

**#16: An investigation of the interest rate risk and exchange rate risk of the European financial sector: Euro zone versus non-Euro zone countries**

*Presenter:* ..... Robert Faff@Monash University, Australia  
*Co-authors:* ..... Amalia Di Iorio, Harald Sander

This paper investigates the relation between unanticipated changes in long-term interest rates, short-term interest rates and exchange rates; and equity returns in three financial sectors of several Euro zone and non-Euro zone countries. We assess whether the interest rate risk and exchange rate risk of five Euro zone countries with significant financial sectors changed with the introduction

of the single currency and compares the impact of these changes with four non-Euro countries. Further we investigate the nature of interest rate and exchange rate exposure across increasing time horizons, enabling us to examine both its short and long-term effects on stock returns. Generally, our findings suggest that while Banks are more sensitive to short-term interest rates, the Financial Services and Insurance sectors are more sensitive to long-term interest rates. There is no notable trend in sensitivity pre-/post-Euro and differences in terms of the impact of interest rate changes across countries seem to suggest (i) some evidence of integration, and (ii) differences in financial structures and regulation. Further, interest rate sensitivity increases significantly with increasing time intervals. Evidence of exchange rate exposure is weak across all countries and sectors although there is some evidence that it increases with increasing time intervals. Differences in sensitivity can be related to differences in international activities.

**#20: Modeling the investment decision of the entrepreneur in the tanker sector, between purchasing a second hand vessel and building a new one**

*Presenter:* ..... Anna Merika@Deree College, Greece  
*Co-authors:* ..... Andreas Merikas, Giorgos Koutrouboussis

This paper argues that in the investment decision of the entrepreneur (if he should purchase a second hand vessel or build a new one), what matters is not the second hand price and its determinants per se, but instead the relative price ratio (SP/NP) second hand price over the new building price and its movement. We investigate the determinants of this ratio across different ship sizes in the tanker sector and show that it can be used as an effective tool in investment decision making as well as in asset appraisal. We employ monthly data between 1995 and 2006 for four different ship sizes, VLCC, Suezmax, Aframax and Handysize in the tanker sector and implement a GARCH(1,1) model. It is found that the perception of riskiness directly impacts upon the ratio (SP/NP). An increase in freight volatility leads to an increase in the risk premium across ship sizes and therefore the ratio under examination rises. Furthermore, in the case of Suezmax, the mean ratio is strongly affected by the volatility of shocks to this ratio. Overall we claim that the cyclical nature of the shipping sector together with expectations formed by the agents operating in it (the entrepreneur, the ship-owner and the broker), determine the movement of the ratio and hence the decision of the entrepreneur.

**#11: Market information and the feedback effect of the CBOE S&P500 variance futures on the underlying asset**

*Presenter:* ..... Sotiris Staikouras@City University London, UK  
*Co-authors:* ..... Paul Dawson

The present study delves into the issue of whether the newly cultivated platform of derivatives volatility trading has altered the behavior of the underlying asset. The empirical evidence presented unveils interesting market realities and opens avenues for future research. The onset of variance futures trading has lowered the cash market volatility, and significantly reduced the impact of shocks to volatility. The latter are of considerably lower magnitude and time-persistence in the post-futures phase. The volatility process is characterized by long-memory effects regardless of the period under examination and the estimator employed. The correlation between the equity index level and return volatility remains low. The latter strengthens the role of these instruments to facilitate portfolio diversification. Finally, the findings unveil that volatility is mean reverting, while market data do not support the impact of leverage effects on conditional volatility.

**#24: Relative valuation and fundamental factors. The case of the Greek listed firms**

*Presenter:* ..... Panayiotis Artikis@University of Piraeus, Greece

The objective of the present paper is to investigate in depth the relationship between the most commonly used relative valuation measures, the Price Earnings ratio (PE), the Price to Book Value ratio (PBV), and the Price to Sales ratio (PS) and the fundamental factors that determine these multiples. The sample that was used consisted of the two hundred largest firms in terms of market capitalization listed in the Athens Stock Exchange (ASE) and the time period was five years from 2001 to 2005. The first step of the analysis was to decompose the PE, PBV and PS ratios into the fundamental factors that affect them using a discounted cash flow model. It was shown that, from a theoretical point of view, the main fundamental factors that affect the PE, PBV and PS ratios of a firm are the earnings per share (EPS) growth rate, the beta coefficient, the payout ratio, the return on equity (ROE) and the net profit margin (NPM). The next step was to perform a multiple regression analysis for each one of the three relative valuation measures. Specifically, the first regression analysis used had as the dependent variable the PE ratio and as independent variables the EPS growth rate, the b factor, and the payout ratio. The second regression analysis had as the dependent variable the PBV ratio and as independent variables the EPS growth rate, the b factor, the payout ratio, and the ROE. The third regression analysis had as the dependent variable the PS ratio and as independent variables the EPS growth rate, the b factor, the payout ratio, and NPM. The results showed that for companies listed in the ASE: a) the PE ratio has a significant positive coefficient with the payout ratio and the growth rate in EPS and significant negative coefficient with the beta, b) the PBV ratio has a significant positive coefficient with the payout ratio, the growth rate in EPS, and the ROE while it is has a significant negative coefficient with the beta, and c) the PS ratio of a firm has a significant positive coefficient with the payout ratio, the growth rate in EPS, and the NPM while it is significant negative coefficient with the beta.

**#77: Bayesian analysis for jumps, leverage and heavy-tails in stochastic volatility and EGARCH models**

*Presenter:* ..... Yasuhiro Omori@University of Tokyo, Japan  
*Co-authors:* ..... Jouchi Nakajima

This paper first proposes the efficient and fast Markov chain Monte Carlo (MCMC) estimation method for the stochastic volatility

(SV) models with leverage, jump components and heavy-tailed errors. We also develop the MCMC algorithm for the SV model with correlated jumps and superposition model. Second, as an alternative approach to the volatility dynamics, we propose the Bayesian inference for the EGARCH model with jumps and heavy-tails. We illustrate our method using simulated data and analyze daily stock returns data on S&P500 index and TOPIX (Tokyo Stock Price index). Model comparisons are provided using the marginal likelihood computations over the SV and GARCH class. Third, we investigate an extension to the multivariate factor stochastic volatility models with jumps, leverage and heavy-tails.

#### #78: Estimating stochastic volatility models using daily returns and realized volatility simultaneously

*Presenter:* ..... Toshiaki Watanabe@Hitotsubashi University, Japan  
*Co-authors:* ..... Makoto Takahashi, Yasuhiro Omori

The financial return volatility, defined as the variance or the standard deviation of returns, plays a central role in the modern finance such as option pricing and Value-at-Risk (VaR). Realized volatility, which is the sum of squared intraday returns over a certain interval such as a day, has recently attracted the attention of financial economists and econometricians as an accurate measure of the true volatility. The daily return may, however, provide additional information on the true volatility because it is less subject to microstructure noise than the intraday return. From this perspective, this article models the daily returns and realized volatility simultaneously by extending well-known stochastic volatility models. We assume that the realized volatility includes microstructure noise. It is difficult to evaluate the likelihood of our model analytically and hence to estimate the parameters in our models by the maximum likelihood method. We develop a Bayesian method for estimating the parameters in our models using the Markov chain Monte Carlo (MCMC) technique. To make the estimation method efficient, we extend the multi-move sampler. We illustrate our models and estimation method by applying them to the daily data on returns and realized volatility of the Tokyo Stock Price Index (TOPIX). Modeling returns and realized volatility simultaneously has a certain advantage compared with modeling them separately because the former enables us to estimate the distribution of returns, which is important in VaR, jointly with the parameters in the volatility equation. We also apply our models to VaR by assuming the Student's t distribution as well as the normal distribution for the return distribution.

#### #72: Bayesian analysis of the HMM-GARCH model

*Presenter:* ..... Teruo Nakatsuma@Keio University, Japan

Financial time series such as stock prices, interest rates, and foreign exchange rate are known to have the following properties: (i) volatility clustering (their volatilities are time-varying and show strong positive auto-correlations), (ii) heavy-tailed distribution (the kurtosis exceeds three), and (iii) non-linearity (their stochastic processes are not linear), which we should take into account in modeling those time series. One of the most popular models for such financial time series is the generalized autoregressive conditional heteroskedasticity (GARCH) model, and a favored alternative to the GARCH model is the hidden Markov mixture (HMM) model. The HMM model is known as the Markov-switching model in econometrics. These two types of models have all of the above properties and have been used in academic research as well as in business practice for modeling those time series. In recent studies, researchers try to combine the GARCH model and the HMM model into a more general non-linear model, the HMM-GARCH model, for financial time series. This kind of model is referred as a Markov-switching GARCH model or switching GARCH model in the literature. In this paper, I propose a new Bayesian Markov chain Monte Carlo (MCMC) procedure for the HMM-GARCH model. My new MCMC procedure utilizes the multi-move sampler for drawing the state variables and the multiple-try Metropolis algorithm for drawing the parameters from their posterior distribution, and achieves faster convergence to the posterior distribution.

#### #128: Test of unbiasedness of the integrated covariance estimation in the presence of noise

*Presenter:* ..... Kosuke Oya@Osaka University, Japan  
*Co-authors:* ..... Masato Ubukata

We can analyze the properties of the stock price and the exchange rate using high frequency data or tick data. Estimating volatility matrix of two diffusion processes is especially important since it plays a key role in option pricing, measuring value at risk and evaluating portfolios. Daily realized volatility calculated by summing the square of continuously compounded intraday returns provides a consistent estimate of the integrated volatility. We expect that the realized volatility gives an accurate estimate of the integrated volatility in an idealized world. However, it is well known that the realized volatility is not empirically robust when the sampling interval is small. A possible explanation of the unrobustness is the presence of the observational noise which contaminates the true price. The noise can be an obstacle since we are interest to estimate the variance of latent true price process. This undesirable feature is also observed for the estimators of the integrated covariance such as the realized covariance estimator and the cumulative covariance estimator. In addition, several studies report that the realized covariance estimator suffers from the bias caused by data synchronization. Thus, the appropriate estimator of the integrated covariance is the cumulative covariance estimator since it suits for non-synchronous observations if there is no observational noise which causes a measurable bias. We propose the test statistic to detect whether the observational noise causes a measurable bias in the cumulative covariance estimator. The test statistic proposed in this paper is asymptotically distributed as standard normal under null hypothesis and does not require the exact specification of the noise structure. The finite sample performance of the test statistic is investigated through Monte Carlo simulation. We find that our test statistic has the good size and power according to the magnitude of covariances of the noises which cause the bias.

**#60: Estimation in a nonlinear cointegration model**

*Presenter:* ..... Hans Arnfinn Karlsen@University of Bergen, Germany

We analyse a nonlinear cointegration type model for a bivariate time series using Markov theory. Consistency and a CLT using a kernel estimate of the relationship between the series are established. We also try to formulate a more general definition of nonlinear cointegration for a vector time series of general dimension. Basically, we assume that the vector series is of type  $I(1)$  which means that it is null recurrent in a Markov setting. This means that we are restricted to the case corresponding to one common trend in the linear case which means one unit root in that case. We try to define cointegration in directly in terms of the invariant density and this can be seen as an extension of linear cointegration. Nonparametric estimators are proposed and asymptotic results for these estimators are discussed. The classical Nadaraya-Watson estimator is compared to a first order local polynomial estimator.

**#41: Variable selection for high-dimensional data: two-stage convex optimization and statistical consistency**

*Presenter:* ..... Peter Bühlmann@ETH Zurich, Switzerland

In many application areas, the number of covariates is very large (e.g. in the thousands) while the sample size is quite small (e.g. in the dozens). Standard exhaustive search methods for variable selection quickly become computationally infeasible, and forward selection methods are typically very unstable. We will show that in generalized linear models, L1-penalty methods (Lasso) can be very powerful as a first step: with high probability, the (mathematical) true model is a subset of the estimated model. Moreover, some adaptations to correct Lasso's overestimation behavior yield consistent variable selection. Since they are based on two-stage convex optimization, their exhaustive computation can be done very efficiently. Our illustrations cover both theory and methodology as well as concrete applications.

**#17: Testing temporal constancy of the spectral structure of a time series**

*Presenter:* ..... Efstathios Paparoditis@University of Cyprus, Cyprus

Statistical inference for stochastic processes with time varying spectral characteristics has received considerable attention during the last decades. We develop a nonparametric test for stationarity against the alternative of a smoothly time-varying spectral structure. The test is based on a comparison between the sample spectral density calculated locally on a moving window of data and a global spectral density estimator based on the whole stretch of observations. Asymptotic properties of the nonparametric estimators involved and of the test statistic under the null hypothesis of stationarity are derived. Power properties under the alternative of a time varying spectral structure are discussed and the behavior of the test for fixed and for different sequences of local alternatives belonging to the locally stationary process class are investigated. Some numerical examples illustrate the capability of the proposed methodology to detect temporal changes in the spectral structure of an observed time series.

**#35: Ridge estimation for INAR(p) models**

*Presenter:* ..... Konstantinos Fokianos@University of Cyprus, Cyprus

The integer autoregressive model of order  $p$  can be employed for the analysis of discrete-valued time series data. The model is fitted by least squares regression since it can be shown, under some conditions, that its correlation structure is identical to that of the usual autoregressive process. However, consider an alternative estimation scheme, which is based on minimizing the least squares criterion subject to some constraints on the parameters of interest. The ridge type of constraints are used in this work and it is shown that under some reasonable conditions on the penalty parameter, the resulting estimates have less mean square error than that of the ordinary least squares. A real data set and some limited simulations support further the results.

**#71: Reconsidering the macroeconomics of the oil price in Germany - testing for causality in the frequency domain**

*Presenter:* ..... Marc Gronwald@University of Hamburg, Germany

This paper investigates the macroeconomics of the oil price in Germany from the frequency domain perspective. It builds on the following two streams of thought: first, the much debated question of whether or not a causal relationship exists between the oil price and both fundamental macro and financial market variables; and second, within this causality debate, the relevance of frequency domain concepts, as illustrated by the application of time series spectral decompositions. It addresses the question of whether bivariate causality between the oil price and a choice of both macro and financial market variables differs between frequency bands. It has been found that short-run causality exists between the oil price and the short term interest rates or the German share price index, while long-run causality is found between the oil price and long term interest rates. moreover, the oil price predicts the consumer price index at a high number of different frequencies, while no significant causality is found to run from the oil price to industrial production or the unemployment rate.

**#186: A diffusion model for dynamic flow of foreign direct investment**

*Presenter:* ..... Yi-Hui Chiang@National Chiao Tung University, Taiwan  
*Co-authors:* ..... Chih-Young Hung, Yiming Li

In this work, we for the first time study the dynamic flow of the foreign direct investment (FDI) with a diffusion theory. We define the FDI flow as the process which is transmitted throughout a given social system, by means of certain communication channels. The notion of diffusion and growth on products has received spectacularly attention in market recently. However, the evolution of capital flow has never been explored from dynamic diffusion point of view. Most of literatures for FDI flows focus on the relationship of economic variables, financial factors based on the statistical and regression methods. Unfortunately, these studies did not simultaneously consider the internal and external influences when studying the dynamics of FDI flow. In the model formulation, the foreign capital policy of the host country is considered as an external influence and the investment policy of the investing country is modeled as an internal influence. The total amount of possible capital is now set to be a constant in the investing country. The resulting nonlinear dynamical model is solved numerically and successfully applied to explore the dynamics of TDI flow of Taiwan's electronics industry in China (i.e., FDI flow from Taiwan to China). The preliminary results show agreement between the model simulated results and collected data during 2001-2006.

**#212: Managerial Human Capital Return: Empirical method and evidence from Chinese emerged market**

*Presenter:* ..... Xiaowei Kong@The University of Hong Kong, China

This paper empirically test the effect of managerial human capital on firm performance under different ownership structures using a panel data from China's publicly listed firms in the past five years. It demonstrates that managers' education generated a positive effect on firm's market performance, which is consistent to human capital theory. In order to solve the endogeneity problem we build two groups of instrumental variables: the institutional set and no-institutional ones. Based on the empirical evidence, a Monte Carlo simulation experiment is carried to test the model again. The research also implies that state controlling is detrimental to the marginal contribution of managers' human capital, while the existence of powerful large minority shareholders has positive impacts. Some institutional facts and their potential impact on managerial education efficiency are explored based on empirical results.

**#52: Using finite mixtures of beta distributions for improving accuracy of LGD prediction intervals**

*Presenter:* ..... Susana Alvarez@University of Murcia, Spain  
*Co-authors:* ..... J. Samuel Baixauli

The decisive role of the business cycle and macroeconomic factors in measuring LGD is absolutely accepted in the related literature. In this sense, credit risk measurement models, as the Moody's KMV model (MKMV), have begun to address the cyclicity in LGD. In this paper we are particularly interested in analyzing the accuracy of prediction intervals based on the widespread assumption of a single beta distribution when modelling recovery rates over the business cycle in the MKMV framework. There is no theoretical grounding why using beta distribution. The richness and flexibility of beta mixture could compensate this and approximate well the observed behaviour of LGD data over the business cycle. By assuming two regimes characterizing the business cycle, expansion and recession, we treat the LGD as a stochastic variable modelled through a mixture of an expansion and a recession distributions. More than two regime structures for LGD data are possible. In order to determine the number of components of a beta mixture we propose a bootstrap-based likelihood ratio test statistic. Our results show that it yields a correct empirical size in all cases while the  $t$ -based likelihood ratio test statistic shows significant oversizing. We provide alternative prediction intervals assuming that the underlying distribution is a mixture of two beta distributions, distinguishing between secured and unsecured securities which are strongly or weakly sensitive to the business cycle. The usual Normal/Student- $t$  approximation could be inaccurate because of non-normality in the error term, so we design bootstrap versions of prediction intervals which are some better alternative than analytical prediction intervals. We carry out a simulation performance evaluation where the mixture structure hypothesis is significant and provides better accuracy than MKMV single distribution method.

**#133: A regional study on the Italian behaviour towards the consumer credit**

*Presenter:* ..... Giorgio Skonieczny@University of Catania, Italy  
*Co-authors:* ..... Benedetto Torrisi, Sebastiano Piccolo

During the last years, consumer credit access, has registered a great interest in the academic world. In Italy a different behavior is recorded according to the region of residence of the applicant for a loan. Consumer credit is a credit extended to individuals for personal or household use, rather than businesses. It includes all forms of Installment Credit other than loans secured by real estate such as home mortgages, plus Open-End Credit such as credit cards and household appliance, vacations, wedding expenses. For these reasons, credit for individuals is divided in real estate financing and consumer credit. The scenario where we today live is that of a society that purchases without real needs. The society diffuses behavior models characterized by status symbol. Everybody leave out of consideration the real needs and aspire to models diffused from the mass media. The aim of this work is to analyze how predictor variables (structural, economic, social) can interact with consumer credit and how they classifies Italian regions in relationship with the consumer credit. This aim will be reached with different methods of multivariate statistics: principal components analysis (PCA), general linear model (GLM) and the SED's algorithm (Social Economic Distance) to appraise economic and social distances in classification problems.

Saturday, 21/04/2007

11:00-12:40

Parallel Session E

SN21 Room: MR380 SIGNAL EXTRACTION AND FILTERING - 3

Chair: Esther Ruiz

**#148: Inspecting the cyclical properties of the Italian manufacturing business survey data***Presenter:* ..... Tatiana Cesaroni@ISAE, Italy

The aim of this paper is to empirically investigate the cyclical features of the main Italian Manufacturing Business Survey indicators using time and frequency domain techniques. In particular we analyze the dynamics of each survey variable over time and with respect to different benchmark business cycles. Our findings show that important changes have occurred in the periodicity and volatility of Manufacturing Survey data throughout the years. As expected, the contemporary cross-correlation of each Survey indicator is higher with respect to the industrial production than to the GDP cyclical component. Evidence of significant differences in the co-movements between each indicator with respect to GDP and industrial production is found. The cross-spectral analysis seems to reveal the existence of a common periodicity of all cyclical indicators with both the manufacturing and the whole economy business cycle. This last result confirms the strength of Business Survey data used as short-run policy indicators.

**#136: Using Kalman-filtered radial basis function networks to forecast changes in the ISEQ index***Presenter:* ..... David Edelman@University College Dublin, Ireland

A Kalman-Filtered Feature-space approach is taken to forecast changes in the ISEQ (Irish Stock Exchange Equity Overall) Index using the previous five days' lagged returns solely as inputs. The resulting model is tantamount to a time-varying (adaptive) technical trading rule, one which achieves an out-of-sample Sharpe ('reward-to-variability') Ratio far superior to the 'buy-and-hold' strategy and its popular 'crossing moving-average' counterparts. The approach is contrasted to Recurrent Neural Network models and with other previous attempts to combine Kalman-Filtering concepts with (more traditional) Multi-layer Perceptron Network models. The new method proposed is found to be simple to implement, and, based on preliminary results presented here, might be expected to perform well for this type of problem.

**#135: Specification of trend and seasonal components for time series data***Presenter:* ..... Ed Godolphin@Royal Holloway University of London, UK

There has been much attention devoted to modelling and decomposition of time series observations, recorded at roughly equal intervals of time, into independent trend and seasonal component time series. This presentation will consider several recent developments in this area involving both the model-based SARIMA specification and the state-space structural representation. In particular, the use of the information matrix to measure individual assessments of the precision of various components is explored, which is valuable knowledge if there is doubt concerning the validity of the modelling specification or its decomposition.

**#142: Local polynomial regression in real time***Presenter:* ..... Alessandra Luati@University of Bologna, Italy*Co-authors:* ..... Tommaso Proietti

We deal with the real time estimation of the underlying trend in a time series by means of filters that arise from fitting a local polynomial of a given degree with a constant bandwidth. We show that for real time estimation of signals (i.e. exactly at the boundary of the time support) we cannot rely on the automatic adaptation of the local polynomial smoothers, since the direct real time filter turns out to be strongly localised, and thereby yields extremely volatile estimates. As an alternative, we evaluate a general family of asymmetric filters that minimises the mean square revision error subject to polynomial reproduction constraints; in the case of the Henderson filter it nests the well known Musgrave's surrogate filters. The class of filters depends on unknown features of the series such as the slope and the curvature of the underlying signal, which can be estimated from the data. Several empirical examples illustrate the effectiveness of our proposal. We also discuss the merits of using a nearest neighbour bandwidth as opposed to a fixed bandwidth for improving the quality of the approximation.

SN32 Room: MR080 VEC MODELS AND MCMC METHODS

Chair: Anna Staszewska

**#91: Cointegration in high-dimensional VAR: the structure of Germans short-term bank interest rates***Presenter:* ..... Pu Chen@University of Erfurt, Germany*Co-authors:* ..... Johannes Jaenicke

This paper analyzes the interest rate linkages between short-term loan, deposit, and bank interest rates in a 7-dimensional VECM. For the time period February 1975 to June 2003, we use two short-term credit rates, two short-term deposit rates, and three Frankfurt interbank rates. The bank interest rates were supplied by the Deutsche Bundesbank as average rates for the whole banking sector. Our estimation period is the longest possible time span with a consistent bank interest rate data set. Applying the Johansen-trace test, we find four cointegration vectors in our bank interest rates. However, our data shows significant deviations from the normal distribution. We especially find thick tails in the residuals. The Johansen test can suffer from size distortions if the thick tail property is not taken into account. Additionally, the Johansen test is sensitive with respect to the specification of deterministic



components. Therefore, we apply the recently proposed subsampling technique to conduct a cointegration test in VAR models with infinite variance errors. Our subsampling cointegration test confirms the rank of cointegration of the Johansen test. This result shows that it is possible for universal banks to calculate short-term credit and deposit rates by using only the information of the three money market rates.

### #153: Robust Bartlett adjustment for test of hypotheses on cointegrating vectors: a bootstrap approach

*Presenter:* ..... Alessandra Canepa@Brunel University and UK DMO, UK

Johansen's Bartlett correction factor for the LR test of linear restrictions on cointegrated vectors is derived under i.i.d. Gaussian assumption of the innovations. However, the distribution of most data relating to financial variables are fat tailed and often skewed, there is therefore a need to examine small sample inference procedures that are subject to weaker assumptions on the innovation term. In this paper we examine the performance of the LR test for linear restrictions on cointegrating space, the Bartlett corrected LR test, the bootstrap p-value test and the proposed bootstrap Bartlett corrected LR statistic under weak assumption on the distribution of the innovations. We consider innovation structures that are typically found in financial data such as fat-tailed and conditionally heteroskedastic (i.e. ARCH and GARCH) innovations. Our objective is to decide which inference procedure performs better in finite samples under weak assumptions on the innovations. We interpret "better" in terms of the empirical sizes of the inference procedures under consideration. It is found that the bootstrap Bartlett correction serves two purposes at once: i) it is able to control for the size distortion generated by a slow speed of adjustment to the cointegrated equilibrium as well as other crucial parameters of the data generating process, ii) it is robust to violations on the i.i.d. Gaussian assumption: no matter the distribution of innovations considered (i.e. mixture of normals, chi-squared, Student t, ARCH or GARCH) there is little evidence that the size of the bootstrap Bartlett statistic depends in any important way on the form of innovations. Both these results constitute an important improvement with respect to the analytical Bartlett correction, particularly in the light of the fact that in empirical applications the true underlying data generating process is not known. In this sense, any inference procedure that overtakes the specificity of the data generating process has to be welcomed.

### #39: Multivariate time series analysis with categorical and continuous variables in an LSTR model

*Presenter:* ..... Ginger Davis@University of Virginia, USA

*Co-authors:* ..... Katherine Ensor

We develop a methodology for multivariate time series analysis when our time series has components that are both continuous and categorical. Our specific contribution is a logistic smooth transition regression (LSTR) model whose transition variable is related to a categorical time series (LSTR-C). This methodology is necessary for series that exhibit nonlinear behavior dependent on a categorical time series. The estimation procedure is investigated both with simulation and an economic time series. It is found to be both feasible and accurate. The economic time series studied is the US unemployment rate, and the nonlinear variable which governs its behavior is the categorical time series variable representing the state of the economy. We obtain superior or equivalent model fits as compared to another smooth transition regression model. These results are encouraging since we did not perform any exploratory analysis for determining the transition variable; the selection of this variable was automatic. Furthermore, even when the nonlinear behavior of the time series is dependent on a continuous time series, we propose a simplification of the modeling process which is the automatic formulation of the transition variable from the categorical time series, thus saving computational time regarding model selection. We are able to capture this nonlinear dependence on a continuous time series by using regression theory for categorical time series. Our nonlinear model has the same benefits of a Markov switching autoregressive model and with the added benefit of a more parsimonious representation. We are still able to capture the key structure and allow for exogenous variables in our model. This methodology is a new development for transition variables which are categorical.

### #108: Inferring the shape of impulse response paths

*Presenter:* ..... Anna Staszewska@University of Lodz, Poland

*Co-authors:* ..... Mateusz Pipien

Impulse response analysis is widely used for understanding the working of a macroeconomic system. The usual way of presenting the results of an impulse response analysis for a vector autoregressive model is to plot the expected response for successive periods with upper and lower lines showing the limits of the 95% probability intervals associated with each response; these are Bayesian terms but the classical treatment is organised around an analogous three-plot. However there is a mismatch between what the macroeconomist is interested in and what these plots provide. The plots convey information about the marginal distribution of responses for each period. Macroeconomists, however, are often most interested in the properties of the response path, that is, their questions are about the joint distribution of the responses, the shape of the response paths. They may want to compare the responses of different variables and again the usual graphs which treat one variable at a time are not much help. This paper describes these problems and suggests ways of better meeting the needs of the macroeconomist. Two approaches to answering questions about the shape of response paths are presented corresponding to two standard approaches to representing uncertainty about response paths: Bayesian analysis and classical bootstrapping.

**#208: An efficient adding row algorithm for large-scale least trimmed squares regression**

*Presenter:* ..... Marc Hofmann@University of Neuchatel, Switzerland  
*Co-authors:* ..... Cristian Gatu, Erricos J. Kontoghiorghes

A new adding row algorithm (ARA) to compute the least trimmed squares regressors for a range of coverage values is presented. The ARA employs a tree-based strategy. New nodes are generated by updating the QR decomposition after adding one observation to the linear model. A priori knowledge of the coverage parameter is not required. The ARA can be used to identify the degree of contamination of the data. A branch-and-bound algorithm (BBA) is designed based on the ARA. The BBA is an exhaustive algorithm that uses a cutting test to prune subtrees. It significantly improves upon the ARA in computational performance. The heuristic BBA loosens the cutting test by means of a tolerance parameter. The  $k$ -updating ARA ( $k$ -ARA) is extended to permit the investigation of large-scale datasets. In each node, the new algorithm adds  $k$  observation to the model. The order of complexity is reduced from  $2^m$  to  $2^{m/k}$ , where  $m$  is the number of observations. A novel strategy to identify influential observations in large-scale data sets is designed around the  $k$ -ARA. The space of observations to investigate is narrowed and  $k$  reduced iteratively. The strategy is illustrated by an example. Experimental results confirm the computational efficiency of the proposed algorithms.

**#207: Subset selection of the linear regression model with constraints**

*Presenter:* ..... Cristian Gatu@University of Neuchatel, Switzerland  
*Co-authors:* ..... Erricos J. Kontoghiorghes

The problem of subset selection of the linear regression model with constraints is considered. The motivation is within the general framework of stock selection for index tracking. Specifically, the selected regression coefficients (stock weights) are required to be non-negative and sum up to one. A Branch-and-bound strategy that both optimizes a statistical criterion and satisfies the constraints is discussed. The strategy is based on a regression tree. It utilizes recent advances in selecting an unconstrained subset of regression coefficients and optimization strategies for estimating a linear regression with inequality constraints.

**#74: New results for the effectiveness of residuals as a diagnostic tool in the general linear model**

*Presenter:* ..... Janet Godolphin@University of Surrey, UK

The use of residuals for detecting departures from the assumptions of the linear model has long been recognized as an important diagnostic tool, particularly once it became computationally feasible to obtain them in a straightforward way, and several recent contributions to the literature have focussed on their underlying properties and effectiveness. Residuals that are uncorrelated and share a common variance have occupied much attention, most notably the BLUS residuals, and other variations proposed by the Dutch school, and the recursive residuals which are particularly attractive in econometric applications where there is a natural ordering among the observations through time. New criteria for assessing the effectiveness of these residual representations are described, providing insight into their properties with interesting theoretical and computational implications. In particular, results uncovering the connection between residuals of different types are established.

**#82: Outlier detection for skewed distributions**

*Presenter:* ..... Mia Hubert@Katholieke Universiteit Leuven, Belgium

So far, many techniques have been developed to detect univariate and multivariate outliers. However, these methods usually assume that the bulk of the data are normally distributed, or at least that they are sampled from an elliptical distribution. First we present a general method to detect univariate outliers at skewed distributions. Our approach is based on an adjustment of the standard boxplot, by incorporating a robust measure of skewness. Using projection-pursuit techniques, we extend this procedure to detect multivariate outliers at skewed distributions. We apply our techniques to construct robust PCA (principal component analysis) and ICA (independent component analysis) methods.

**#25: A comparison of two mortgage insurance pricing techniques**

*Presenter:* ..... Orhan Erdem@Istanbul Bilgi University, Turkey

Option pricing methodologies in mortgage derivatives pricing is very popular. The valuation of default, prepayment as well as mortgage insurance are the most common ones that has been studied in the literature. But examining the comparative advantages of the models has been missing. This study tries to compare two methodologies that are used to price mortgage insurance: Bivariate binomial (BB) option pricing technique, and forward pricing (FP) technique which uses Black-Scholes formula. The former one takes two processes that can be correlated, construct a binomial lattice for these two processes and using the usual backward deduction process, they price any mortgage derivative. The latter one calculate the insurance premium assuming a constant interest rate and exogenous probability of prepayment and default. The only state variable here is the house prices. What we do here is to review and interpret these methodologies and compare them by means of simulation and calibration analysis for a specific country. The FP technique has a closed form solution and easy to understand and use. Even though BB technique is more complicated than FP technique, but the results are closer to reality. This may be due to the fact that it uses two state variables that may be correlated, namely house prices and interest rates. This study is highly important in two senses: First, to our knowledge it is the only study who investigates the comparative advantages of mortgage insurance methodologies. And second it can be used in determining mortgage insurance policy in any country.

**#94: Separability of loan and deposit policy of German banks: some multi-step Granger causality results***Presenter:* ..... Johannes Jaenicke@University of Erfurt, Germany

In banking literature, a strict separation between a bank's credit and deposit policy is typically either assumed or is the result of a restrictive model structure. We investigate the question of separation empirically for the interest rate policy of the German universal banking system. We use a recently proposed one- and multi-step Granger-causality test that is designed for possibly cointegrated time series. If information about the interest rate policy of one side of the balance sheet has predictive power for the other, the separation property has to be rejected. For estimation periods that includes different monetary regimes, we find clear evidence of intertemporal dependence between different loan and deposit rates.

**#189: Adaptive Monte Carlo technique for dynamical asset price simulation***Presenter:* ..... Yiming Li@National Chiao Tung University, Taiwan*Co-authors:* ..... Chih-Young Hung, Yi-Hui Chiang, Shao-Ming Yu, Su-Yun Chiang

In this study, we propose a novel simulation technique to compute the sample paths for the dynamical asset price. The assumption of constant volatility in the dynamical theories, such as the Black-Scholes model has been shown inconsistent with the market behavior in most empirical studies. Various investigations try to relax the assumption of constant volatility by using the autoregressive conditional heteroskedalized (ARCH) or generalized ARCH pricing model. Monte Carlo (MC) simulation has also been adopted for a board range of derivative valuation problems for which no closed form solution. Numerical methods with nonuniform mesh for the solution of dynamical asset price (and option) models have been reported with a fixed expected rate of the return of the stock price ( $\mu$ ) and volatility of the return of the stock price ( $\sigma$ ). However, the values of ( $\mu$ ,  $\sigma$ ) vary with time and affect the accuracy of simulation results significantly. Our MC simulation is thus performed with a variable coefficient method for ( $\mu$ ,  $\sigma$ ) in the solution scheme. The explored dynamical asset pricing model follows the formulation of geometric Brownian motion. With the method of simultaneously updating ( $\mu$ ,  $\sigma$ ), more than 5,000 runs of MC simulation are performed to fulfill the accuracy of the large scale computation and suppress statistical variance. Daily changes of stock market index in Taiwan and Japan are analyzed in 2006. Compared with the result of MC simulation using constant values of ( $\mu$ ,  $\sigma$ ), our result shows good agreement with the real data (collected data are from TAIEX - the Taiwan Stock Exchange Capitalization Weighted Stock Index and Nikkei-225 which is a price-weighted average of 225 top-rated Japan Tokyo Stock Exchange). The dramatic fluctuations of the stock prices of Taiwan and Japan within the past year have successfully been simulated. The preliminary improvement of accuracy is mainly based upon the variable ( $\mu$ ,  $\sigma$ ) for each equally partitioned time slot, where a set of time-dependent ( $\mu$ ,  $\sigma$ ) has been extracted. This computational effective adaptive simulation technique not only provides good accuracy of simulation but also allows us to forecast the short-term dynamical paths for the asset price. Applications of the simulation methodology to the exchange rates and returns are currently under examined.

**#200: Investment strategies based on supervised learning***Presenter:* ..... Patricia Casqueiro@Universidade Nova de Lisboa, Portugal*Co-authors:* ..... Antonio Rodrigues

The most common neurocomputational approaches to support trading decisions are based on price returns forecasting through supervised neural networks. The corresponding two-step procedure, including separate forecasting and trading modules, may lead to significantly suboptimal investment strategies. On the other hand, some alternative neurocomputational approaches, including reinforcement learning and neurodynamic programming, have been proposed in the literature, in which the two modules are incorporated into a single system directly optimized with respect to some trading performance measure. However, in these approaches the learning process can be very difficult to accomplish successfully and efficiently. In this paper, we seek to demonstrate that, while preserving computational efficiency, it is possible to improve the financial performance of the forecast-based approach through not only a better optimization of the trading module, but also by considering more appropriate neural forecasting models. In particular, we propose more appropriate ways of designing the training patterns from the nonstationary price data, and discuss new trading rules based on different forecast horizons, the optimal combination of several trading strategies, and the use of adaptation rules able to account for any transaction costs. These new proposals are then tested and compared to previous ones, under different criteria, for several price time series, as well as with artificial data generated according to different stochastic models.

**#43: UseR in the financial sector***Presenter:* ..... Bernhard Pfaff@Invesco, Frankfurt, Germany

This talk consists of two parts. In the first part, we will discuss why and how R is used at Invesco, Frankfurt am Main. The second part of the talk can be coined: Back to the roots by kiss (i.e. keep it simple, Sam). A multiple, dynamic, interdependent structural equation model for forecasting the major equity and bond markets one month ahead is presented, as well as back-testing results based upon a financial future strategy. As a technical aside, it is shown how R is used with the Fair-Parke program thereby showing Rs flexibility.

**#197: Accuracy of GARCH model estimation and forecasting***Presenter:* ..... Diethelm Wuertz@ETH Zurich, Switzerland*Co-authors:* ..... Yohan Chalabi, Ladislav Luksan

GARCH models have become important tools in the analysis of heteroskedastic financial time series processes. These models are especially useful when the goal of the study is to analyze and forecast volatility. During the last 20 years there has been a vast quantity of research uncovering the properties of competing volatility models. Wide-ranging applications to financial data have discovered important stylized facts and illustrated the strengths of the models in many fields like high frequency data analysis, pricing and hedging of options, or portfolio selection and optimization, among others. Along with the development of these models computational power has highly improved, so that problems which were previously infeasible can now be solved with a desktop computer. The popularity of the GARCH models has also encouraged econometric software developers to implement routines for parameter estimation and forecasting in commercial software packages. However, it is well known that not all econometric packages give the same numbers. Even more, in many situations those numbers are inaccurate, which could have potential disastrous consequences when these models are used as input to financial risk management systems. We report on concepts and methods to implement the family of GARCH models in the framework of the open source statistical software environment R/Rmetrics. We discuss the highly non-trivial requirements to create a reliable GARCH package. The implementation is tested against several commercial software packages and benchmarked with well investigated models and data sets reported in literature.

**#29: Fast and accurate asymptotic p-values for the KPSS tests and related statistics***Presenter:* ..... Christian Kleiber@Universitat Basel, Switzerland

Many test statistics arising in time-series econometrics have non-standard limiting distributions. Leading examples include the KPSS tests for level and trend stationarity, where the limiting distributions are given by the distributions of certain quadratic functionals of Brownian motion. Several authors obtained critical values for these tests via extensive simulations, and many econometric software packages still rely on their tabulations. However, there exist alternative expressions of the limiting distributions as distributions of quadratic forms in normal random variables, suggesting that methods for the evaluation of these objects can be used for the problem at hand. We provide algorithms for the computation of asymptotic p-values along these lines. Apart from improving on current routines in econometric software packages, these methods might also be useful in the analysis of nonstationary panels, where one line of research proposes to combine p-values of individual tests.

**#9: Currency regime classification with structural change methods***Presenter:* ..... Achim Zeileis@Wirtschaftsuniversitaet Wien, Austria*Co-authors:* ..... Ajay Shah, Ila Patnaik

The so-called Frankel-Wei regression model is the popular workhorse for "de facto" currency regime classification, i.e., for determining whether a certain currency is pegged to one or more other currencies. Typically, central banks only provide limited (or wrong) information about the currency regime in operation and about changes of it. Therefore, practitioners routinely use rolling regressions to track the evolution of the currency regime in operation. To embed these techniques into an inferential framework for currency regime classification, several tools from the structural change literature are adapted to Frankel-Wei regressions. More precisely, we suggest tools for assessing the stability of a Frankel-Wei regression in historical data ("testing") and in incoming data ("monitoring") and for determining the breakpoints of shifts in the currency regime ("dating"). All tools are made available based on the package "strucchange" written in the R system for statistical computing. To illustrate how the tools can be applied in practice, we investigate the currency regimes for China (after giving up on a fixed exchange rate to the US dollar (USD) on 2005-07-21) and India.

Saturday, 21/04/2007

14:15-15:55

Parallel Session F

SN35 Room: MR380 MATRIX COMPUTATIONS AND STATISTICS - 2

Chair: Constantine Bekas

**#191: Dimensionality reduction using sparse approximations over redundant dictionaries**

*Presenter:* ..... Effrosyni Kokiopoulou@EPFL, Switzerland  
*Co-authors:* ..... Pascal Frossard

We propose the use of (adaptive) nonlinear approximation for dimensionality reduction. Nonlinear approximation refers to the type of subspace approximation method, where the subspace is adapted to the vector that is approximated. In particular, we propose a dimensionality reduction method for learning a parts based representation of the data using redundant dictionaries. A redundant dictionary is an overcomplete set of basis vectors that spans the input subspace. We formulate dimensionality reduction as a matrix factorization problem and we use greedy algorithms for simultaneous sparse approximation to solve it. The design of the dictionary is flexible and enables the direct control on the shape and properties of the basis functions. Moreover, it allows to incorporate a priori and application-driven knowledge into the basis vectors, during the learning process. We apply our dimensionality reduction method to images and compare it with Principal Component Analysis (PCA) and Non-negative Matrix Factorization (NMF) and its variants, in the context of handwritten digit image recognition and face recognition. The experimental results suggest that the proposed dimensionality reduction algorithm is competitive to PCA and NMF and that it results into meaningful features with high discriminant value.

**#213: Univariate descent methods on manifolds**

*Presenter:* ..... Elena Celledoni@NTNU, Norway

We consider optimization methods on manifolds based on the use of Lie group actions. The original optimization problem is broken down into simple univariate optimization problems which require the computation of exponentials of elementary low-rank matrices. The methods have been applied in problems of statistical signal processing.

**#214: A Riemannian approach to the regularization of symmetric positive-definite matrix-valued data**

*Presenter:* ..... Maher Moakher@National Engineering School at Tunis, Tunisia

In this talk we present a Riemannian framework for the smoothing of data that are constrained to live in the differential manifold of symmetric positive-definite matrices. We start by giving the differential geometry of this space. We then use the harmonic map and minimal immersion theories to construct three flows that drive a noisy field of symmetric positive-definite data into a smooth one. The harmonic map flow is the equivalent of the heat flow or isotropic linear diffusion which smooths data everywhere. A modification of the harmonic flow leads to a Perona-Malik like flow which is a selective smoother that preserves edges. The minimal immersion flow gives rise to a nonlinear system of coupled diffusion equations with anisotropic diffusivity.

**#163: An estimator for the diagonal of a matrix**

*Presenter:* ..... Constantine Bekas@IBM Research, Switzerland  
*Co-authors:* ..... Effrosyni Kokiopoulou, Yousef Saad

The problem of computing the diagonal of a matrix, or its trace, when the matrix is known only via its actions on arbitrary vectors, arises in a number of important applications. A typical example is in regularized solutions of least-squares problems, in which one is required to estimate a certain regularization parameter. For example, the Generalized Cross-Validation approach to this problem in image restoration consists of seeking a regularization parameter which minimizes a certain function of the trace of the inverse of a matrix. This trace is difficult to compute as it involves the inverse of a matrix. Other interesting situations that require the estimation of the diagonal or the trace of a matrix involve diverse applications such as uncertainty analysis in ad-hoc sensor-nets and data analysis of spatio-temporal databases. Here, we describe methods for estimating diagonals and traces of matrices in these situations. The goal is to obtain a good estimate of the diagonal by applying only a small number of matrix-vector products, using selected vectors. We begin by considering the use of random test vectors and then explore special vectors obtained from Hadamard matrices. We show a very interesting connection of our diagonal estimator with line packing in Grassmannian spaces and the design of optimal code-books in telecommunication systems that allow us to state theorems of correctness of our approach.

SN23 Room: MR080 AGGREGATION AND IDENTIFICATION

Chair: Lynda Khalaf

**#57: Combining disaggregate forecasts versus disaggregate information to forecast an aggregate**

*Presenter:* ..... Kirstin Hubrich@European Central Bank, Germany  
*Co-authors:* ..... David Hendry

We compare combining disaggregate forecasts to forecast the aggregate variable of interest with combining disaggregate information, that is including disaggregate variables or their estimated factors in the aggregate model, and with only using lagged aggregate information in forecasting the aggregate. We show theoretically that combining disaggregate information in predicting the aggregate should in most cases outperform the alternative methods in population. We present analytical results on the effects of changing coefficients, mis-specification and estimation uncertainty on the relative forecast accuracy of the different approaches to forecast an aggregate. We also consider the role of changing weights and a changing correlation structure, and present conditions

under which a ranking between different approaches to forecast an aggregate is possible. Additionally, we analyse the effect of estimation uncertainty and misspecification as well as the stochastic structure of the disaggregate components and their co-variances on the relative forecast accuracy by Monte Carlo simulations. We investigate whether our theoretical predictions can explain our empirical findings by analysing the relative forecast accuracy of combining disaggregate information versus disaggregate forecasts or just using past aggregate information to forecast aggregate US inflation.

#### #64: **Structural multi-equation macroeconomic models: a system-based estimation and evaluation approach**

*Presenter:* ..... Maral Kichian@Bank of Canada  
*Co-authors:* ..... Jean-Marie Dufour, Lynda Khalaf

The decision of whether to use a limited or full information (LI or FI) approach is often occur in the estimation of dynamic stochastic general equilibrium macroeconomic models. Even though the LI/FI problem has often been presented as one of weighing specification bias versus efficiency, recent theoretical work on weak-instruments and weak-identification has shown that new challenges must be faced since these problems plague LI and FI methods equally. In this paper we examine how well FIML methods stand up to the weak-identification test. For this purpose we propose a multivariate extension of the Anderson-Rubin test, that when inverted, will yield to a confidence set whose significance level can be controlled (at least asymptotically) in the presence of endogeneity and nonlinear parameter constraints, even under identification difficulties. We conduct our applications using a version of the popular New Keynesian trinity model. Robustness to: (i) the specification for the reduced form, (ii) missing instruments, (iii) contemporaneous correlation of disturbances, (iv) errors-in-variables, (v) missing instruments, and perhaps most importantly, (vi) weak identification and weak IV, is achieved while formally taking into account the constraints on the parameters and/or error terms, as implied by the underlying theoretical model.

#### #34: **Aggregating rational expectations models**

*Presenter:* ..... Florian Pelgrin@University of Lausanne, Switzerland  
*Co-authors:* ..... Eric Jondeau

Our paper addresses the question of how the estimation of an aggregate dynamic model can provide information about microeconomic behaviours when only macro data are available. We propose two consistent estimators that account not only for the poor finite-sample properties of the estimator developed by Lewbel - namely to correct the aggregation bias by adding lags in the aggregate regression - but also allow to infer the moments of all sectoral parameters distributions. The first method relies on a flexible parametric specification of the cross-sectional distribution of the micro-coefficients and on the estimation of the unknown parameters of the cross-sectional distribution. Our second method is based on a minimum distance estimator. These two methods are developed in general linear dynamic model with forcing variables, which encompasses linear aggregate rational expectations models, as for instance the new Keynesian Phillips curve or any Euler equations. Therefore, we do not assume independence between the various parameters of the model. Finally, we propose an application where we infer the distribution of the sectoral parameters of the new Keynesian Phillips curve based on aggregate data.

#### #61: **Testing three-moments based asset pricing models: an exact non-Gaussian multivariate regression approach**

*Presenter:* ..... Lynda Khalaf@Carleton University, Canada  
*Co-authors:* ..... Jean-Marie Dufour, Marie-Claude Beaulieu

We propose identification-robust inference methods for asset pricing models with unobservable risk-free rates and coskewness, specifically, the quadratic market model (QMM) which incorporates the effect of asymmetry of return distribution on asset valuation. In this context, exact inference is appealing given: (i) the increasing popularity of such models in finance, (ii) the fact that traditional market models (which assume that asset returns move proportionally to the market) have not fared well in empirical tests, (iii) available related studies are only asymptotic so there is no guarantee that results are non-spurious; exact QMM tests are unavailable even with Gaussian errors. We consider an empirical model where the procedure to assess the significance of coskewness preference is LR-based, and relates to the statistical and econometric literature on dimensionality tests which are interesting in their own right. We obtain exact QMM test and identification-robust confidence sets for model parameters. Our results underscore the importance of accounting for identification problems.

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SN31 Room: MR160 COMPUTATIONAL ECONOMETRICS AND FINANCE IN R - 2

Chair: Achim Zeileis

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#### #164: **Plm: a R package for panel data econometrics**

*Presenter:* ..... Yves Croissant@Universite Lumiere Lyon 2, France  
*Co-authors:* ..... Giovanni Millo

The aim of package plm is to provide an easy way to estimate panel models. Some panel models may be estimated using package nlme or using the lm function to transformed data, but not in an intuitive way for an econometrician. plm provides methods to read panel data, to apply different transformations, to estimate a wide range of models and to make some tests. A special class called pdata.frame is provided to store the data with several attributes which describe the structure of the data (the name of the time and individual indexes, the number of observations for each individual and each time period) Data transformation is easy to implement with functions that have been rewritten to behave correctly with panel data (lag and diff) and with new functions that implement the within and the between transformations. Four functions are provided for estimation which share, for consistency, a lot of common arguments in the call of the functions and in the results. plm is a general function which implements panel data estimators that can be obtained using the lm function to transformed data. This includes within and random effect models, with

or without instrumental variables. `pvcmm` estimates variable coefficients models, with fixed or random coefficients. `pggls` estimates the general feasible gls model. `pgmm` use the general method of moments estimator and can be used to estimate consistently dynamic panel models. Tests are implemented with several functions that test the presence of individual and/or time effects (F and Lagrange multiplier tests), the consistency of the estimation and the poolability of the data. Robust inference can be applied using the `pvcovHC` function which computes robust covariance matrix estimator for panel data. This function can be passed as an argument to other functions, like `coefest` or `waldtest` of package `lmtest` and `linear.hypothesis` of package `car`.

**#140: SDE: an R package for simulation and inference of stochastic differential equations**

*Presenter:* ..... Stefano Iacus@University of Milan, Italy

In this talk we will introduce the package `sde` which contains generic function for simulation and inference on stochastic differential equations. In particular, stochastic differential equations corresponding to diffusion processes driven by the Wiener process are considered. The basic setup of the package is the one of one dimensional stochastic differential equations in which drift and diffusion coefficient maybe parametric and the parameters are d-dimensional. The main function `sde.sim` implements several simulation methods for one dimensional stochastic differential equations although it can return multiple samples in one call, i.e. `m` independent trajectories of the same stochastic differential equation useful in Monte Carlo analysis. Simulation techniques implemented comprise: Euler scheme, first and second Milstein scheme, Ozaki and Shoji-Ozaki local linearization methods, the Exact Sampling scheme and Kloden-Platen-Soerenen method. It is also possible to simulate according some user defined distribution of increments of the discretized diffusion. Some distributions are already included like the ones corresponding to the following classic models: Cox-Ingersoll-Ross, Vasicek, Ornstein-Uhlenbeck and Black and Scholes. Some exact likelihoods are already coded in the library for direct use with `mle`-like functions in R. Other methods like estimating functions (of first and second type), Ait-Sahalia approximation scheme, Kessler and Elerian pseudo-likelihood etc are also included. The work contained in the package is still in progress and expanding and we will present the latest development at the conference.

**#118: Copula Implementation with R**

*Presenter:* ..... Xiaochen Sun@Brunel University, UK

In this paper we first provide the notion of copulas, which describes a way of separating the marginal behaviour of individual risks and their dependence between several random variables. We present some examples of classical families of copulas and provide several illustrations of the usefulness of copulas for financial applications. The procedures were implemented with R software environment using `copula` package.

**#196: End-to-end performance analysis of network services from an operational risk management point of view**

*Presenter:* ..... David Masson@ETH Zurich, Switzerland

*Co-authors:* ..... Diethelm Wuertz, Martin Hanf

The environment in which financial service institutions and insurance companies operate are rapidly changing. Automation and globalization are creating conditions that put operations and business continuity at a greater risk. Especially, network applications provide services where an adequate performance becomes an increasingly critical issue. The characteristics of the network traffic which one observes exhibits widely heavy-tailedness response times which often lead to long delays for network tasks, to unsatisfied users, and even to communication failures and losses. The requirements in terms of connection time and bandwidth, size and number of downloaded objects, access times to data base management systems, computation time of web requests are among the most important ones. All these components add up to a need to assess and manage the operational risk involved in network services more effectively. In this talk we present an analysis of the performance of network services from an operational risk management point of view. We provide an overview of the role of extreme value theory, EVT, as a method for analyzing and measuring end-to-end performance of network services. The peaks-over-threshold model, POT, is our tool of choice to estimate the operational risk. In particular we show how the POT method may be used as a mathematical framework to obtain useful estimates of the Value-at-Risk, VaR, and the expected shortfall risk, ES, when dealing with end-to-end performance measurements in networks. We give reliable answers to questions like "What is the probability that a request is delivered after n-Seconds?" or "What is the maximum request time for 99.9% of all requests?".

**#21: Risk estimation using the multivariate normal inverse Gaussian distribution**

*Presenter:* ..... Kjersti Aas@Norwegian Computing Center, Norway

*Co-authors:* ..... Ingrid Hobaek Haff, Xeni Dimakos

Appropriate modelling of time-varying dependencies is very important for quantifying financial risk, such as the risk associated with a portfolio of financial assets. Most of the papers analysing financial returns have focused on the univariate case. The few that are concerned with their multivariate extensions are mainly based on the multivariate normal assumption. The idea of this paper is to use the multivariate normal inverse Gaussian (MNIG) distribution as the conditional distribution for a multivariate GARCH model. The MNIG distribution belongs to a very flexible family of distributions that captures heavy tails and skewness in the distribution of individual stock returns, as well as the asymmetry in the dependence between stocks observed in financial time series data. The usefulness of the MNIG-GARCH model is highlighted through a VaR application on a portfolio of European, American and Japanese equities. Backtesting shows that for a 1-day holding period this model outperforms a Gaussian-GARCH model and a Student's t-GARCH model. Moreover, it is slightly better than a skew Student's t-GARCH model.

**#8: Representations and applications of multivariate stochastic orderings**

*Presenter:* ..... Sergio Ortobelli Lozza@University of Bergamo, Italy  
*Co-authors:* ..... Svetlozar Rachev, Cesarino Bertini, Stoyan Stoyanov, Frank Fabozzi

In this paper we propose multivariate stochastic orderings of risk positions that are consistent with the preferences of investors. We draw upon a recent classification of risk measures and orderings that is based on the theory of probability metrics. Employing the techniques of probability metrics theory, we then present further extensions and representations of probability functionals which are consistent with classic and dual orderings. Finally, we discuss some potential applications in finance of the new orderings.

**#137: The volatility of realized volatility**

*Presenter:* ..... Stefan Mittnik@University of Munich, Germany  
*Co-authors:* ..... Fulvio Corsi, Christian Pigorsch, Uta Pigorsch

Using unobservable conditional variance as measure, latent-variable approaches, such as GARCH and stochastic-volatility models, have traditionally been dominating the empirical finance literature. In recent years, with the availability of high-frequency financial market data modeling realized volatility has become a new and innovative research direction. By constructing "observable" or realized volatility series from intraday transaction data, the use of standard time series models, such as ARFIMA models, have become a promising strategy for modeling and predicting (daily) volatility. In this paper, we show that the residuals of the commonly used time-series models for realized volatility exhibit non-Gaussianity and volatility clustering. We propose extensions to explicitly account for these properties and assess their relevance when modeling and forecasting realized volatility. The results show that the incorporation of the time-varying volatility of volatility clearly improves models and forecasts and that the distributional assumption for residuals plays a crucial role in density forecasting.

**#13: Thresholds, news impact surfaces and dynamic asymmetric multivariate GARCH**

*Presenter:* ..... Massimiliano Caporin@Universita di Padova, Italy  
*Co-authors:* ..... Michael McAleer

DAMGARCH extends the VARMA-GARCH model by introducing multiple thresholds and time-dependent structure in the asymmetry of the conditional variances. DAMGARCH models the shocks affecting the conditional variances on the basis of an underlying multivariate distribution. It is possible to model explicitly asset-specific shocks and common innovations by partitioning the multivariate density support. This paper presents the model structure, describes the implementation issues, and provides the conditions for the existence of a unique stationary solution, and for consistency and asymptotic normality of the quasi-maximum likelihood estimators. The paper also provides the news impact surface implied by DAMGARCH and an empirical example.

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 SN26 Room: MR150 FUZZY STATISTICS

Chair: Maria Angeles Gil

**#205: Managing uncertainty in fuzzy regression: a least squares approach**

*Presenter:* ..... Renato Coppi@Universita di Roma "La Sapienza", Italy

The dependence relationship of an LR fuzzy response variable on a set of crisp explanatory variables is investigated. To this purpose an appropriate distance between LR fuzzy variables is introduced and applied to a Least Squares objective function, in order to find the estimates of the regression coefficients. These are computed by means of a suitable iterative algorithm. The uncertainty about the obtained estimates is managed by a "side model", based on the use of fuzzy arithmetic relationships. Appropriate indices for assessing the goodness of fit of the model are suggested. Finally, the uncertainty due to the data generation process is dealt with by means of suitable bootstrap estimates of the standard errors associated with the estimated regression coefficients. Some considerations about alternative ways of modelling fuzzy regression and managing the various sources of uncertainty conclude the presentation.

**#161: A characterizing functional representation of continuous distributions focussed on relevant parameters**

*Presenter:* ..... Ana Colubi@Universidad de Oviedo, Spain  
*Co-authors:* ..... Gil Gonzalez-Rodriguez, Maria Angeles Gil, Maria Rosa Casals

A family of fuzzy representations of real-valued random variables has been recently introduced leading to a functional characterization of variables distribution. This functional characterization takes on values on a space endowed with powerful and manageable statistical tools. Nevertheless, the graphical display of this type of functional characterization is not illuminating and informative enough either about the relevant parameters of the distribution or about the characterizing process itself. A new class of fuzzy representations for random variables is presented, and two aspects are analyzed. On one hand, it is shown that the fuzzy representation of a continuous random variable having finite second order moment characterizes its distribution. On the other hand, the graphical display in this case is examined and it is verified that some of the most relevant parameters (namely, the mean value, variance, and asymmetry) can be immediately identified.



**#172: Approaches to prototype-less fuzzy clustering**

*Presenter:* ..... Christian Borgelt@European Center for Soft Computing, Spain

While in standard fuzzy clustering one optimizes a set of prototypes, one for each cluster, I study fuzzy clustering without prototypes. The basic idea is that data points that are far away from each other should not have high degrees of membership to the same cluster, while for data points that are close together, high degrees of membership to the same cluster are not only acceptable, but actually desirable. A natural way to code this intuitive goal is an objective function that depends only on the pairwise distances of the data points and the elements of the fuzzy partition matrix. The specific version I am studying contains two parameters: the standard fuzzifier and a new parameter alpha. Setting the latter parameter is 0 yields a fairly standard objective function, which I explore in particular w.r.t. local neighborhood schemes (that is, only a subset of the points is used in the update computations). In addition, I investigate the influence of the parameter alpha (if it differs from 0). As a closer inspection and experiments reveal, negative values are particularly interesting and provide an alternative to the fuzzifier.

**#159: Conditions for the uniqueness of a linear model with fuzzy random variables**

*Presenter:* ..... Gil Gonzalez-Rodriguez@European Centre for Soft Computing, Spain

*Co-authors:* ..... Ana Colubi, M. Asuncion Lubiano

A linear model between two general fuzzy random variables is considered. This model is based on the fuzzy-valued arithmetic (which means an extension of the usual set-valued arithmetic). One of the advantages of this model is associated with its ease of manageability, in contrast to other models which become quite complex in practice. Whereas usual linear models between fuzzy random variables usually involve the conditional expectation (regression function), the one which is considered here is assumed to be held in a wider setting by the variables themselves. This fact entails a remarkable simplification in the associated estimation problems concerning the regression/correlation analyses. Since the space of fuzzy values is not linear, some pathological cases arise, namely, the possibility of a double theoretical linear model in some special situations. The conditions under which the double model exists are identified and characterized. For this purpose, the extension to the general fuzzy-valued case of the concepts of mid-point and spread of an interval is introduced. The conditions above allow us to explain the non-uniqueness behaviour.

Saturday, 21/04/2007

17:20-19:25

Parallel Session G

SN20 Room: MR380 SIGNAL EXTRACTION AND FILTERING - 4

Chair: Stephen Pollock

**#5: Stochastic volatility models and the Taylor effect**

*Presenter:* ..... Esther Ruiz@Universidad Carlos III de Madrid, Spain  
*Co-authors:* ..... Alberto Mora-Galan, Ana Perez

It is often observed that the autocorrelations of powers of absolute financial returns are larger when the power parameter is close to one. In this paper, we show that the ARSV(1) is able to explain this property, known as Taylor effect, for the parameter values often encountered in the analysis of real time series of financial returns. Only when the kurtosis of returns are very close to 3 the autocorrelations are maximized for squares while when the kurtosis is too large, they are maximized for values of the power parameters smaller than one. We also show that the Taylor effect cannot be attributed to sampling biases when estimating the sample autocorrelations. We consider the order  $k$  autocorrelations of powers of absolute returns as a function of the power parameter and show that they are maximized at the same value of this parameter regardless of whether we look at the sample or model based autocorrelations. Consequently, we propose to use as a diagnostic for the adequacy of an estimated ARSV model, the discrepancy between the sample and plug-in power parameters that maximized the autocorrelations. All the results are illustrated in several real series of financial returns.

**#96: Online analysis of time series by the Qn estimator**

*Presenter:* ..... Robin Nunkesser@University of Dortmund, Germany  
*Co-authors:* ..... Karen Schettlinger, Roland Fried, Ursula Gather

We investigate statistical online monitoring of noisy time series which are measured with high sampling frequencies. The aim is to extract the time-varying level underlying the time series (the signal) and to detect relevant changes in it. The task of online signal extraction is often rendered difficult by measurement problems or unusual events leading to atypical observations, and by the need for automatic monitoring in real time. Accordingly we prefer robust methods which however can be computationally too demanding for online application if efficient algorithms are not available. The  $Q_n$  is a robust scale estimator which possesses a breakdown point of 50 percent, i.e. the effect of less than 50 percent outliers is bounded. Additionally, the Gaussian efficiency of the  $Q_n$  estimator is 82 percent in large samples, which is much higher than for most other robust scale estimators such as e.g. the median absolute deviation (MAD). We find the  $Q_n$  to be highly useful for robust time series analysis. Firstly, we can apply it for estimation of the autocorrelation at lag  $h$  from the sums and the differences of subsequent observations lagged by  $h$  time points. Secondly, the high efficiency of the  $Q_n$  increases the power of tests for level shift detection which apply a robust scale estimator for standardization. The  $Q_n$  can even be used twice in this context since the thresholds for the standardized test statistic should be chosen depending on the (estimated) autocorrelations in the time series. We consider the online application of  $Q_n$  to time series data and show its good performance via simulations. We present a fast online algorithm which can also be used to compute the Hodges-Lehmann location estimator online. The algorithm is easy to implement and improves the online applicability of these estimators.

**#103: Real-time signal extraction: a generalized error criterion emphasizing turning points**

*Presenter:* ..... Marc Wildi@ZHW, Switzerland

Signal extraction is concerned with the definition and the estimation of interesting components of a time series. Real-time signal extraction focuses on the practically relevant concurrent signal estimates which convey a strong prospective content: so for example an early assessment of 'turning points' is likely to be informative about the future evolution of a system. Unfortunately, traditional model-based approaches (such as ARIMA) are subject to methodological weaknesses because their optimization criteria do not match the relevant estimation problem. As a consequence, ARIMA-models perform poorly in the vicinity of turning points, as is well known in practice. Therefore, the paper proposes a new method which emphasizes specifically turning point issues. More precisely, it is shown that the new optimization criterion generalizes the ordinary mean-square error criterion by emphasizing mean-square performances of the resulting causal filter in the vicinity of turning points (at costs of the remaining time points). Of course, in order to be useful this selective regard on the time axis is obtained without requiring a priori knowledge of the location of turning-points.

**#141: Testing for Granger causality in the frequency domain**

*Presenter:* ..... Christophe Croux@K.U.Leuven, Belgium  
*Co-authors:* ..... Aurelie Lemmens, Dekimpe Marnik

A series is said to Granger cause another series if it has incremental predictive power when forecasting it. The strength of the Granger causality can be decomposed over the time domain, but also over the frequency domain. A spectral approach to Granger causality has the distinct advantage that it allows to disentangle (potentially) different Granger-causality relationships over different frequencies. We study a bivariate spectral Granger-causality test, originally proposed by Pierce, that can be applied at each individual frequency of the spectrum. We compare this testing procedure to existing Granger causality tests, in the time and in the frequency domain, and study their power by means of Monte Carlo simulations. We also apply this test to investigate the predictive value of the European production expectation surveys. Our results indicate that the predictive content of these surveys varies along the frequency band.

**#152: Investigating economic trends and cycles**

*Presenter:* ..... Stephen Pollock@Queen Mary, University of London, UK

In many macro econometric data sequences, the low-frequency fluctuations that surround the trend, which are known as business cycles, correspond to spectral structures that subsist within isolated frequency bands with distinct upper limits. One may wish to characterize the dynamics a business cycle via the parameters of an estimated ARMA model. In that case, it is reasonable to postulate that the forcing function is a band-limited white-noise sequence. By ignoring the limitation on the frequencies of the forcing function, in the process of fitting a conventional ARMA model, one is liable to derive estimates that are severely biased. Such biases are avoided whenever the process is sampled at a rate corresponding to the maximum frequency of the forcing function. In that case, there will be a direct correspondence between the parameters of the band-limited ARMA model and those of an equivalent continuous-time stochastic process. This paper describes the theory of band-limited stochastic processes, it shows how the corresponding models may be estimated. Since the rate at which econometric data is recorded is predetermined, techniques of sample-rate conversion must be deployed in order to obtain the appropriate estimates. These are also described.

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SN28 Room: MR080 FAT TAILS, VAR AND PORTFOLIO CHOICE

Chair: Peter Winker

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**#84: Parametric skewness and kurtosis modeling and its application to financial analysis**

*Presenter:* ..... Yevhen Pentsak@University of Lausanne, Switzerland

*Co-authors:* ..... Alberto Holly

It has been widely recognized that some dependent variables such as health care expenditures, incomes, wages, asset returns etc. possess specific characteristics which violate the normality assumption. In particular, a distribution of health care expenses is usually highly skewed, highly peaked, and its far-right tail is too long even for a lognormal distribution. These characteristics are often captured by the normalized third (skewness) and fourth moment (kurtosis). High skewness and excess kurtosis are often present when one considers the distribution of asset returns. In this paper we focus on their common modeling using different extensions of well known parametric families of density functions. On the way of evolution of frequency curves systems we should note the normal, gamma, beta, normal inverse Gaussian, generalized gamma, Weibull, generalized Weibull, Burr, exponential, Pareto, generalized lambda, generalized F and generalized Student-t as the most known. Recently many other parametric extensions have been advocated in econometric literature. The skew exponential power distribution, different skew generalizations of Student-t distribution, Pearson's type IV distribution are among many others. The authors have found that good prediction properties of econometric models very much relate with the ability of a specified parametric family of densities to capture empirical dispersion of skewness and kurtosis of the disturbance term. A theoretical foundation for the characterization of the possible domain of skewness and kurtosis measures is based on the so-called Hamburger problem. Particularly, it has been noted that for a given level of kurtosis only a finite range of skewness may be spanned. Empirical patterns of skewness and kurtosis are rather different, however, preserve their average magnitude when analyzing specific type of financial data sets. In this paper we find skewness-kurtosis boundaries for recently frequently used extended families of parametric densities and illustrate them in comparison with the theoretical boundary. This information may serve as a good indicator for a researcher which parametric specification provides the best fit to empirical data set at hand. Some examples illustrate this concept.

**#111: The maximum Lq-Likelihood estimator in extreme value theory with applications to financial risk measures**

*Presenter:* ..... Sandra Paterlini@University of Modena and Reggio E., Italy

*Co-authors:* ..... Davide Ferrari

Recently, extreme value theory has found extensive application in finance to estimate tail-related risk measures, such as value at risk or expected shortfall. The two prevailing parametric approaches for modeling extreme events are the Block Maxima (BM) and Peaks-Over-Threshold (POT) methods. The BM method relies on the Generalized Extreme Value (GEV) distribution to model the maximum value that a variable takes in a given period of time (block), while the POT method exploits the Generalized Pareto Distribution (GPD) for modeling the exceedances over a certain threshold. Although Maximum Likelihood Estimation (MLE) is the standard approach, often the number of observations available to estimate GEV and GPD parameters is too small to guarantee the desirable large sample properties of MLE; thus, inference might not be trustworthy. In order to handle this issue, we employ the Maximum Lq-Likelihood estimator (MLqE). Such estimator generalizes the traditional log-likelihood maximization procedure: it preserves its desirable asymptotic properties, while allows for a peculiar type of distortion introduced by the extra parameter  $q$ , providing a gain in terms of precision (Mean Squared Error) when the sample size is small. First, we show that the new estimator is more efficient than the standard MLE when BM and POT approaches are employed to estimate the probability of an extreme event. The comparison is carried out through Monte Carlo simulations, where the performance of the two estimators is evaluated for different choices of the tail probability and sample size. We show that when the distortion parameter  $q$  is properly chosen, the Mean Squared Error of the MLqE is sensibly smaller than that of MLE. Second, the MLqE is used to estimate the value at risk and the expected shortfall for different financial stock market indexes. The empirical results show that the MLqE has smaller prediction error than the MLE, supporting our findings from the simulation study.

**#48: A dynamic grouped-t copula approach for high-dimensional portfolios**

*Presenter:* ..... Dean Fantazzini@University of Pavia, Italy

Recent theoretical and empirical literature underlined the ability of the grouped t-copula to take the tail dependence present in a large set of financial assets into account, particularly when the assumption of one global parameter for the degrees of freedom

(as for the standard t-copula) may be over-simplistic. We generalize the constant grouped-t by allowing the copula dependence structure to be time-varying and we show how to estimate its parameters. Furthermore, we prove the consistency and asymptotic normality of this estimator under some special cases and we examine its finite samples properties via simulations. We apply this methodology for the estimation of the VaR of a portfolio composed of thirty assets and we show that the new model outperforms both the constant grouped-t-copula and the dynamic Student's T copula when long positions are of concern. As for short positions, a dynamic multivariate normal model is already a proper choice, instead.

#### #158: **Multivariate distributions and financial applications**

*Presenter:* ..... Javier Perote@Universidad Rey Juan Carlos, Spain  
*Co-authors:* ..... Del Brio Esther, Trino-Manuel Niguez

This paper extends the densities based on Gram-Charlier and Edgeworth expansions to the multivariate framework and explores the utility of this new family of multivariate distributions for capturing financial data behaviour. We show that this family of distributions encompasses many of the univariate Edgeworth-Sargan or Gram-Charlier densities provided in the financial literature as the marginal distributions of different specifications. Thus, implementing an estimation method that takes the parameter estimates for the univariate distributions as initial values of the multivariate general formulations is straightforward. The theoretical properties of these distributions are analysed focusing mainly on the conditions that guarantee positivity and their implications on (i) the inclusion of conditional moments and (ii) the computation of the cumulative distribution function. The importance of these two issues is highlighted when forecasting Value at Risk, which is theoretically studied in the paper. Regarding the empirical applications, the in-sample performance of different specifications nested on the family are tested and compared to the multivariate Student's t. The results obtained for various stock indices returns show that the multivariate Gram-Charlier densities outperform the multivariate Student's t, owing to their flexible parametric structure. However, they do not necessarily improve the specifications that are not constrained to achieve positivity. Therefore this family of densities seems to be a useful tool for risk management but the use of the "positive" versions depends on other econometric considerations rather than on accuracy. In a further stage the out-of-sample performance can be implemented as well as a new method of forecasting portfolio's Value at Risk by taking into account the theoretical properties of the multivariate distributions defined in the paper.

#### #115: **Portfolio optimization under VaR constraint based on dynamic estimates of the variance-covariance matrix**

*Presenter:* ..... Katja Specht@University of Applied Sciences, Pforzheim, Germany  
*Co-authors:* ..... Peter Winker

Within the framework of portfolio optimization in the traditional mean-variance world, the search is on for either a weighting system that maximizes the portfolio return under given portfolio variance or for the portfolio that minimizes variance under given return. In this work, we are interested in the portfolio with the highest expected return. However, instead of considering the portfolio variance, the Value at Risk (VaR) is taken into account. The concept of VaR is popular among investors because it is eminently intuitive and easy to interpret. Nevertheless, there are two major problems in its practical application: first, reliable estimations are difficult to perform and second, using the VaR as a constraint in portfolio optimization causes enormous computational problems because it cannot be formulated as a quadratic programming problem as in the mean-variance approach. In our study, we take account of both problems. First, we calculate the VaR based on estimates of the conditional variance-covariance matrix (Principal Components GARCH model). Second, we apply recent advances in heuristic optimization (a modified version of Memetic Algorithms) to deal with the computational problems. Instead of a complicated simultaneous estimation of all variances and covariances of the asset returns, just a few variance equations are estimated independently in the Principle Components GARCH model. Independent of the VaR estimation method, the fact that the VaR is given, combined with the non-negativity constraint and the integer constraint on the number of assets traded, results in an optimization problem that cannot be solved analytically. Therefore, we use a modified version of Memetic Algorithms, in which principles of heuristic local search are combined with evolutionary strategies. The computational study is based on daily returns of twenty DAX stocks for the period January 1996 through July 2006. In a moving window we performed historical and conditional variance-covariance estimations to calculate the VaR, followed by heuristic portfolio optimization. Descriptive analyses show that the conditional estimation of the variance-covariance structure is superior to the historical estimation. One noticeable feature of the portfolio optimization with VaR constraint is that portfolios based on conditional variance-covariance matrices are characterized by higher yields, combined with higher risk

#### #114: **Foreign exchange, fractional cointegration and the implied-realized volatility relation**

*Presenter:* ..... Neil Kellard@University of Essex, UK  
*Co-authors:* ..... Christian Dunis, Nicholas Sarantis

Almost all relevant literature has characterized implied volatility as a biased predictor of realized volatility. This paper provides new time series techniques to assess the validity of this finding within a foreign exchange market context. We begin with the empirical observation that the fractional order of volatility is often found to have confidence intervals that span the stationary/non-stationary boundary. However, no existing fractional cointegration test has been shown to be robust to both regions. Therefore, a new test for fractional cointegration is developed and shown to be robust to the relevant orders of integration. Secondly, employing a dataset that includes the relatively new Euro markets, it is shown that implied and realized volatility are fractionally cointegrated with a slope coefficient of unity. Moreover, the non-standard asymptotic distribution of estimators when using fractionally integrated data

is overcome by employing a bootstrap procedure in the frequency domain. Strikingly, tests then show that implied volatility is an unbiased predictor of realized volatility!

#### #131: Long memory and structural breaks in commodity futures basis and market efficiency

*Presenter:* ..... Jian Dollery@University of Essex, UK  
*Co-authors:* ..... Jerry Coakley, Neil Kellard

Commodity futures market efficiency has commonly been investigated using the standard cointegration framework and this has provided inconclusive and conflicting results. Notably, empirical studies on other asset classes have found that the spot-futures basis is a fractionally integrated process, providing an explanation of previously indeterminate results. Given a stationary spot return, this implies market inefficiency. Therefore, the first contribution of this paper is to examine the order of fractionally integration in the commodity basis. However, recent literature has suggested that apparent fractional orders of integration are illusory in the sense that they are generated by the presence of structural breaks. Thus, the second contribution is to evaluate the evidence for a fractionally integrated basis after using the stochastic multiple break model. Daily spot and futures prices are obtained for a range of US futures contracts over the 1/1/1996-31/12/2005 sample period. The conventional cointegration approaches to test the unbiasedness hypotheses are first applied, confirming the extant literature by showing mixed results. Subsequently, our non-standard methodology actually reveals that the statistical properties of the basis can be characterized by both long memory and structural breaks. This new finding is not consistent with market efficiency. Finally, we illustrate that nonstorable commodities tend to perform better than storable commodities in terms of price discovery.

#### #95: Realized volatility fixings

*Presenter:* ..... Xiaoquan Liu@University of Essex, UK  
*Co-authors:* ..... Shiu-Yan Pong

Banks and data vendors record data at different times of the day. This is known as 'fixing'. With daily exchange data, we first show that different fixings give rise to significantly different estimations of realized volatility, and that some series are consistently higher/lower than others, which has important implications for trading volatility derivatives. We propose that the pattern is due to the intraday seasonality of volatility and hence use high frequency data of 30-minute exchange rates to explore the issue. Empirical and simulation results support our conjecture that the fixings are different mainly due to the intraday variation in volatility.

#### #127: Forecasting Euro exchange rates volatility at high frequency data

*Presenter:* ..... Ying Jiang@University of Essex, UK  
*Co-authors:* ..... John Nankervis, Georgios Chortareas

This paper focuses on forecasting volatility of high frequency Euro exchange rates. Four 15 minute frequency Euro exchange rate series, including Euro/CHF, Euro/GBP, Euro/JPY and Euro/USD, are used to test the forecast performance of six models, including both traditional time series volatility models and the realized volatility model. Besides the normally used regression test and accuracy test, an equal accuracy test, the HLN-DM test, and a superior predictive ability test are also employed in the out-of-sample forecast evaluation. The FIGARCH model is found to be superior in almost all exchange rate series. Although the widely preferred ARFIMA model shows better performance than the traditional daily volatility models, generally speaking, it cannot surpass the FIGARCH model and the intraday GARCH model. Furthermore, the SVX model does not significantly outperform the SV model in the accuracy test, which contradicts the results of some earlier research. The paper confirms the advantage of using high frequency data and modelling the long memory factor. It also analyses the characteristics of Euro exchange rates and compares the test results with the conclusions drawn by previous studies.

#### #112: Double bootstrap confidence intervals for parameters of interest in the two-stage DEA approach

*Presenter:* ..... Dimitrios Chronopoulos@University of Essex, UK  
*Co-authors:* ..... John Nankervis, Claudia Girardone

In any realistic situation the performance of a firm is not merely a function of the underlying production technology and its management's ability to optimise the production process. External influences may also have a considerable effect on the firm's productive efficiency. Knowledge about these relationships is of key importance to both managers and policy-makers alike. There is therefore the need to identify these sources and determine their effects on firms productive efficiency. Accordingly, the efficiency estimates obtained with non-parametric frontier methods like Data Envelopment Analysis (DEA) are often subjected to regression analysis in what is known as a two-stage approach. This, however, is problematic given that the dependent variable is serially correlated. The existing literature suggests the use of two different bootstrap algorithms that allow for valid statistical inference in this context. This paper extends this work by proposing a double bootstrap algorithm for obtaining confidence intervals for the parameters of interest with improved coverage rates. Acknowledging the computational burden associated with iterated bootstrap procedures we provide an algorithm based on deterministic stopping rules that is less computationally demanding. Monte Carlo evidence shows a considerable improvement in the coverage probabilities after calibrating the bootstrap procedure. The results also suggest that in small samples, percentile confidence intervals perform better than their basic counterpart.

**#175: Diagnostics for mean reversion in stock volatilities***Presenter:* ..... Gianna Figa-Talamanca@University of Perugia, Italy

Since its first introduction many suggestions have been proposed for the generalization of Black and Scholes option pricing model. One of the most widely spread approaches is allowing for random volatility of the underlying stock price process. It has been shown that stochastic volatility models account for many stylized facts observed in the stock and derivatives markets. Among stochastic volatility models a common specification for the dynamics of the instantaneous variance of returns is the Constant Elasticity of Variance (CEV) model which nests both the model by Heston and the GARCH diffusion. The CEV model assumes that the instantaneous variance of returns is mean reverting towards a long-run value; this assumption is considered to be in agreement with empirical results found on stock prices data. In this paper we derive explicitly the theoretical autocorrelation function for the mean integrated variance in the CEV volatility framework; this function is shown to be exponentially decaying with lags. Further, it depends only upon the product of the mean reversion speed and the prices observation step. Applying limit results available in the literature it is possible to show that, if the data generating process is the CEV stochastic volatility process, then the empirical autocorrelation function of the squared returns of stock prices should be a valid approximation of the theoretical autocorrelation function for the mean integrated variance. Confidence bands can also be constructed for the theoretical autocorrelation function. Based on these results it is straightforward to introduce a diagnostics tool for mean reverting volatility based on the comparison between the theoretical autocorrelation and its empirical counterpart. Preliminary results show that for many stock indices the mean reversion of volatility is not a valid assumption when data are observed daily since the autocorrelation function of the squared returns decays slowly. Our results agree with the evidence obtained in other papers of a long memory effect in the squared returns autocorrelation which cannot be explained by a discrete stochastic volatility model such as GARCH.

**#12: Mean reversion and news sensitivity: a mean impact analysis***Presenter:* ..... Saikat Sarkar@Tampere University, Finland  
*Co-authors:* ..... Antti Kanto, Vance Martin

This paper defines the mean impact curve which measures how news are incorporated into mean estimates. With the help of the mean impact curve, this study demonstrates that in the presence of non-synchronous trading, extreme movements in the returns of individual assets eventually revert, as long as part of these movements is accounted for by positive feedback trading. But when we eliminate the effect of non-synchronous trading, returns of individual assets avert from their fundamental value. This paper also shows that the mean reversion of stock returns is visible when we consider a market of smart money, but mean reversion is sensitive to the risk return relationship.

**#105: Liquidity, information asymmetry and short sales constraints: evidence from the Hong Kong stock market***Presenter:* ..... Le Xia@University of Hong Kong, China

I use a natural experiment occurred on Hong Kong stock market to examine the effects of removing short sales constraints on several trading characteristics of underlying stocks. I find that the trading of underlying stocks become less active after the lift of short sales constraints; meanwhile the liquidity of underlying stocks is tightened and the information asymmetry among the investors aggravates. But I fail to find any evidence indicating that the lift of short sales constraints seriously destabilizes the market. I further provide a story of noise traders to explain these empirical findings.

**#201: Non-parametric analysis of hedge fund risk: new insights from high frequency data***Presenter:* ..... Loriana Pelizzon@University of Venice, Italy  
*Co-authors:* ..... Monica Billio, Mila Getmansky

This paper examines and compares the distributional properties of a set of hedge fund indices using monthly and daily data on different sample periods. The aim is to investigate density probability distribution and hedge fund exposure to market risk factors. Hedge funds engage in short-selling, dynamic trading, the use of derivatives and exotic instruments, application of leverage, regime-switching and market-timing. Given these structural non-linearities, hedge fund returns are not distributed according to a random sample from a Gaussian distribution with zero mean and finite variance. Using monthly data, consistent with previous research, we document negative skewness, high kurtosis (heavy tails) and serial correlation for both individual and index hedge fund returns. However, all previous literature concentrated on using monthly hedge fund returns, due to limitations of the data. With the recent availability of the daily hedge fund data, we are able to analyze hedge fund return distribution on a higher frequency. Contrary to the previous studies conducted on monthly returns, our investigations on daily returns depict that daily return distribution is closer to normality and more similar to the distribution of S&P 500 daily returns. Moreover, surprisingly, the level of serial correlation on daily data is lower than the one observed for monthly data. Nevertheless, our analysis shows that the daily return distribution still presents some non-normal features. In addition to non-normal features of return distribution, we find that hedge funds have non-linear and time-varying risk exposure to the market risk. Therefore, static linear regression models with Gaussian-distributed variables provide biased results. In order to address these biases, we propose to substitute linear parametric models with a more general functional form, i.e. a non-parametric regression model. Our analysis shows that the linear parametric regression is able to capture the real relationship between hedge fund returns and market risk only for the returns that characterize the central part of the distribution. In the tails of the distribution, the exposure of hedge fund returns to market risk is qualitatively and statistically different. The last result of our analysis is that serial correlation of returns does not affect the estimation of the real exposure to the market risk factor.

**#173: Extended logistic discrimination**

*Presenter:* ..... Farid Beninel@ENSAI, France  
*Co-authors:* ..... Christophe Biernacki

Usually in discriminant analysis we are faced with the prediction of labels of individuals from a population given their descriptive parameters. The prediction is realized using a rule estimated on the basis of a learning sample from the same population. We are concerned here by the situation where data consists in two learning samples from two distinct subpopulations. The problem is to predict labels of individuals from one subpopulation given their descriptive parameters and a learning sample from an other subpopulation. This problem occurs in biology for example when one wants to predict the sex given biometric parameters and the two learning samples are respectively from young birds and adult ones. In insurance and finance for instance, we deal with the same problem in the prediction of the risk groups using characteristic parameters. The two samples come from two subpopulations of member-cum-consumers. We present models of extended logistic procedure. These models are based on acceptable relations between the score functions associated to subpopulations.

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SN06 Room: MR150 FINANCIAL ENGINEERING FOR ASSET MANAGEMENT

Chair: Ana-Maria Fuertes

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**#99: Constructing hedge fund portfolios: an application of copula**

*Presenter:* ..... Yaw-Huei Wang@National Central University, Taiwan  
*Co-authors:* ..... Xiaoquan Liu, Shiu-Yan Pong

There is strong evidence that asset returns are more closely correlated in a down-market than in an up-market. In this article, we use time-varying copula functions to construct hedge fund portfolios that explicitly capture this asymmetry. Empirical results indicate that portfolios formed by the copula method outperform those constructed by the traditional mean-variance approach.

**#110: An out-of-sample recursive residuals graphical test for equity premium and stock return prediction: Monte Carlo evidence**

*Presenter:* ..... Fotios Papadimitriou@University of Essex, UK  
*Co-authors:* ..... John Nankervis, Neil Kellard

Recent empirical work has introduced a graphical procedure which can act as a powerful diagnostic test for equity premium and stock return prediction. This paper contributes to the extant literature and conducts a Monte Carlo study with the purpose of assessing empirically the robustness of the graphical procedure. Simulated out-of-sample forecasts from two models are obtained (i.e. the historical moving average model and the dividend-price ratio model) enabling us to construct the graphical diagnostic. We generate the series based on normally distributed errors but we also broaden the analysis to include the case of GARCH (1, 1) errors. A positive point in the graph is an indication of predictive ability; therefore, the percentage of positive points (out-of-sample) is computed at each replication. Allowing for different levels of correlation between the innovations in the returns and the dividend-price processes, we find that the graph is affected in smaller samples but it is quite robust when sufficiently large data sets are employed. In order to more thoroughly examine the (unknown) behaviour of the graphical diagnostic, we derive empirical critical values under the null hypothesis of no predictability and we explore its finite-sample size and power properties. This facilitates a formal comparison between the graphical method and the more conventional tests of out-of-sample predictive ability. We report size and power results for various sample sizes and for empirically relevant combinations of out-of-sample and in-sample portions. Our findings indicate that once appropriate critical values are used, all statistics exhibit good size properties. The graphical diagnostic in particular, is found to be well sized in most cases. Nevertheless, with respect to power experiments, a recently developed conventional statistic is found to be the most powerful outperforming nearly in all cases. When GARCH (1,1) innovations are used to generate the series, the graphical diagnostic exhibits better size properties in large samples and this result holds when even larger data sets are employed. Still, it does not outperform in terms of power. Overall, our study shows that the graphical diagnostic can be an important complement to more conventional methods seeking to assess out-of-sample predictive ability. However, it also suggests that in practice, it may be difficult to detect any predictability due to limitations in data availability and biases in small samples.

**#89: Using the bootstrap for VaR forecasts from MS-GARCH models**

*Presenter:* ..... Rasoul Sajjad@Essex University, UK  
*Co-authors:* ..... John Nankervis, Jerry Coakley

The purpose of this paper is to quantify the magnitude of the uncertainty in Value-at-Risk (VaR) measures estimated from a Markov regime-switching (MS)-GARCH framework. A bootstrap method is suggested to construct confidence intervals around the point VaR forecasts. These confidence intervals are compared, through a Monte Carlo study, with the bootstrap intervals obtained from two single-regime methods: GARCH and historical simulation. This enables us to analyze and assess the potential loss of accuracy from the estimation error as well as the magnitude of model specification error (risk) caused by ignoring structural changes in data. The simulation results indicate that ignoring regime shifts in the data can give rise to a significant upward bias as well as poor coverage rate of confidence interval in forecasting VaR. We find that the size of both the bias and the under-coverage depends on the magnitude of the switch in the unconditional variances within each regime rather than the degree of persistence due to the Markov effects.

**#138: De-noising option prices with the wavelet method**

*Presenter:* ..... Liya Shen@University of Essex, UK

*Co-authors:* ..... Emmanuel Haven, Xiaoquan Liu

High frequency financial time series data are known to be noisy and it is important to use appropriate techniques to de-noise such data. Wavelet analysis has been widely used in science and engineering to de-noise data. In this paper, we show using Monte Carlo simulations how useful the wavelet method is for de-noising option prices. We also demonstrate how the wavelet method improves on risk-neutral density estimation and out-of-sample price forecasting compared with standard methods.

**#151: Dynamic factor analysis of industry sector default rates and implication for portfolio credit risk modelling**

*Presenter:* ..... Andrea Cipollini@University of Essex, UK

*Co-authors:* ..... Giuseppe Missaglia

In this paper we use a Dynamic Factor model fitted to a large dataset of default rates and macro-variables for Italy. This model is shown to have a more accurate out of sample forecasting performance regarding scenarios of financial distress relative to both AR and bivariate VAR models. In a second stage of the analysis, we carry stochastic simulation of the Dynamic Factor model to generate density forecast for sector specific default rates, and, consequently of the unconditional bank loan portfolio loss density. The simulation results suggest a value of the minimum capital requirement (through the cycle) lower than the one obtained by the analytic formula recommended by Basel 2. Finally, we find that the benefits in terms of credit risk diversification diminish when the number of principal components and of systemic common shocks (e.g. dynamic factors) increase.



Sunday, 22/04/2007

08:30-10:10

Parallel Session H

SN25 Room: MR380 EXACT TESTS AND GOODNESS OF FIT

Chair: Lynda Khalaf

**#46: Uniformly consistent and exact tests for semiparametric single-index models**

*Presenter:* ..... Frederic Jouneau@GREMARS Universite Lille 3, France  
*Co-authors:* ..... Olivier Torres

We propose new methods for testing the index parameter in very general specifications of the semiparametric single index model. Our procedures provide exact uniform control of the type-1 risk and are uniformly consistent. They are derived from the maximum rank correlation (MRC) criterion proposed by Han in the context of nonparametric generalized regression models. Once the MRC estimation of the parameter has been performed, implementation of our techniques is a straightforward exercise. In particular, estimation of an asymptotic variance-covariance matrix is unnecessary.

**#150: Testing conditional distributional assumptions: a L-moments approach**

*Presenter:* ..... Ba Chu@University of Warwick, UK  
*Co-authors:* ..... Mark Salmon

Stein provides a flexible method for measuring the deviation of the distribution of a random element from a given distribution; thus, the method effectively gives the upper bounds of the approximation error that does not involve the distribution. Hosking proposes the concept of L-moments that are more robust measures of characteristics of a distribution than conventional moments (C-moments). The purpose of this paper is to propose a test for conditional parametric distribution functions with weakly dependent stationary time-series data. The test is based on moment conditions which can be uniquely determined by Stein's equations and the L-statistics of conceptual ordered subsamples drawn from the population sample of a distribution; hereafter referred to as the generalized method of L-moment (GMLM) test. Test limiting distributions are nonstandard depending on the scale parameter; the covariance kernels in the test reflect parametric dependence specification and parameter estimation error. Since L-moments can be represented as the moments of the quantiles of a distribution, the test functions in the Stein approach can be represented as the functions of the quantiles of the conditional distribution. In addition, an application to elliptical conditional distribution for autoregressive processes is provided. Finally, we provide some Monte Carlo simulation to examine the size, the power and the robustness of the GMLM test and compare it with both existing parametric and bootstrap conditional distribution tests.

**#167: A quasi-likelihood approach based on eigenfunctions for a bounded-valued Jacobi process**

*Presenter:* ..... Pascale Valery@HEC-Montreal, Canada  
*Co-authors:* ..... Jean-Marie Dufour, Christian Gourieroux

In this paper we consider a discretely sampled Jacobi process appropriate to specify the dynamics of a process with range  $[0,1]$ , such as a discount coefficient, a regime probability, or a state price. The discrete time transition of the Jacobi process does not admit a closed form expression and therefore the exact maximum likelihood is infeasible. We first review a characterization of the transition function based on nonlinear canonical decomposition. They allow for approximations of the log-likelihood function which can be used to define a quasi-maximum likelihood estimator. The finite sample properties of this estimator are compared with the properties of other existing estimators.

**#166: Point-optimal instruments and generalized Anderson-Rubin procedures for nonlinear models**

*Presenter:* ..... Jean-Marie Dufour@Universite de Montreal, Canada  
*Co-authors:* ..... Mohamed Taamouti

We develop finite-sample inference procedures for nonlinear regressions and structural models. We propose simple exact tests based on linear regressions (auxiliary linear regressions) which may be inverted to obtain confidence sets for the vector of unknown parameters. This class of tests generalizes the procedure proposed by Anderson and Rubin for linear structural models and the method of Hartley for hypothesis testing and confidence set construction in nonlinear regressions. Under the null hypothesis, the test statistics follow standard central Fisher distributions when the errors are i.i.d. Gaussian. By construction, the procedures are robust to the presence of weak or excluded instruments. We also study the problem of building optimal instruments for testing purposes in this context. The optimal instruments are those that maximize the power of the proposed test. This can be contrasted with "optimal instruments" as typically defined in the econometric literature, which refers to the minimization of the asymptotic variance of an estimator. The optimal instruments depend on the alternative hypothesis, yielding point-optimal instruments. As the matrix of optimal instruments is unknown in general, we propose a split-sample technique to approximate optimal instruments while retaining a finite-sample validity result. The exact distribution of the test is derived under the assumptions of independence and normality of the disturbances, but the tests remain valid asymptotically under weaker assumptions similar to those usually assumed to derive asymptotic distributions. A simulation study demonstrating the advantages of the proposed procedure is presented.

**#37: Bootstrapping long memory tests: some Monte Carlo results**

*Presenter:* ..... Marwan Izzeldin@Lancaster University, UK  
*Co-authors:* ..... Anthony Murphy

We investigate the bootstrapped size and power properties of five long memory tests, including the modified R/S, KPSS and GPH tests. In small samples, the moving block bootstrap controls the empirical size of the tests. However, for these sample sizes, the power of bootstrapped tests against fractionally integrated alternatives is often a good deal less than that of asymptotic tests. In larger samples, the power of the five tests is good against common fractionally integrated alternatives - the FI case and the FI with a stochastic volatility error case.

**#54: Prediction of ratings using information from equity and debt markets**

*Presenter:* ..... Paraskevi Dimou@European Commission, Italy

The increased importance of credit ratings in financial markets triggered the development of various models to predict firms credit ratings. Given the drawbacks of accounting models that have been used traditionally for the prediction of corporate default, researchers and practitioners focus on the use of equity or debt markets for the timely prediction of rating changes. In this paper, we empirically investigate the performance of two proprietary models that have been developed, Moody's/KMV and BARRA, in terms of their ability to predict in a timely fashion changes in credit quality. Both of these models use information from the equity and debt market respectively and derive market implied ratings that can be updated continuously. We employ a sample of 5246 bonds issued by 500 firms mainly from US for a period of 3 years. We compare the predictive power of these two models and at the end we answer the question of whether the equity or the debt market summarizes better publicly available information on firms credit quality.

**#36: Nonlinearity in the British interest rate transmission mechanism**

*Presenter:* ..... Elena Kalotychou@City University London, UK  
*Co-authors:* ..... Ana Maria Fuertes, Shelagh Heffernan

This paper explores several nonlinear aspects in the interest rate transmission mechanism on the basis of a large disaggregated sample of British monthly deposit and loan rates 1993-2005 for seven key products. The focus is on the adjustment speed towards the long run equilibrium rate. A sizeable proportion of UK deposits and credit products are found to have a time-varying adjustment speed, driven by the policy rate changes. Tests based on regime-switching models indicate that the adjustment speed has four states defined by the sign of the policy rate changes and the sign of the gap. The magnitude of the policy rate changes also influences the adjustment speed in a regime-switching manner, but this nonlinear aspect is less pervasive across products than the sign asymmetry. Furthermore, mainly for deposit products there is curvature in the catch-up effect towards equilibrium; the error correction is disproportionately large for big gaps. The wide variation in the nonlinearities uncovered across financial institutions and products raises important questions about the monetary transmission and the effectiveness of monetary policy.

**#155: Monetary policy analysis with agents**

*Presenter:* ..... Gottfried Haber@Klagenfurt University, Germany

A special feature of the fully specified macroeconomic multi-agent model AS1 is rather unique, the detailed modeling of the monetary sector of the economy, including banking, central banks, and the transactions on monetary markets. In contrast to the simple assumption of a single interest rate and the illusion of possible direct control over monetary aggregates as explicitly formulated in most of the traditional economic models, the institutional design of the monetary sphere (as it can be found mainly in Europe) is included in the model. Agents in the model keep track of all the financial positions against each other, and there is a rich set of financial contracts available to the agents. There is a liquidity constraint for all agents; if this constraint is violated, the agents have to borrow money from a bank. All these features make the model especially useful for analyzing monetary policies, alternative institutional monetary designs, and of course for evaluating alternative rules, cooperation issues and the relations among the monetary policy makers and the fiscal policy makers. From this point of view, the model could be seen as having a strong focus on the monetary part of the economy. This contribution analyses monetary policy effects in AS1 and compares the results with the results obtained from traditional economic models. The agent-based model provides much more detailed insights in the processes of monetary transmission than the other models.

**#190: An application of hidden Markov models to asset allocation**

*Presenter:* ..... Jan Bulla@Göttingen University, Germany

Modeling daily return series with hidden Markov models (HMMs) has been investigated by several authors in the past decade. We show how HMMs can be used to identify high-risk periods and construct optimal portfolios for a risk-averse investor. Several models and estimation techniques are taken into account and their weaknesses and advantages are presented. Inter alia, we present methods to increase the robustness and performance of the estimation procedures, to draw inference about the underlying state sequence, and to estimate so-called structured hidden Markov models. These models are subject to certain, economically motivated restrictions and allow for fitting models with a larger number of states than ordinary HMMs.

**#198: Quantile forecasting for credit risk with possibly mis-specified hidden Markov models***Presenter:* ..... Konrad Banachewicz@Vrije Universiteit Amsterdam, The Netherlands*Co-authors:* ..... Andre Lucas

In this paper we employ HMMs for predicting quantiles of corporate default rates. We focus on the bias and variability of quantile forecasts under mis-specification in (i) the dimension of the unobserved state space and (ii) the possible asymmetry in the hidden layer dynamics. Quantiles of default rates play an important role in the financial industry via capital buffer determination. As defaults typically behave in a non-Gaussian way due to their discrete nature and infrequent timing, HMMs come in naturally via a non-Gaussian state-space model formulation. In this paper we examine the performance of different specifications for the state-space part in a controlled simulation experiment and an empirical illustration. We consider discrete-state HMMs of the familiar Hamilton type, where we vary the number of discrete states (i.e., regimes). Such models have been suggested in the empirical default literature, but their adequacy in producing accurate quantile forecasts has been questioned. We also consider models with a continuous state space. Such models typically have more flexibility in the range of the state space, but are less suitable for introducing credit cycle asymmetries. Whereas the discrete-state HMM can be estimated by a relatively easy estimation method (EM), the continuous state models require more elaborate importance sampling techniques. We review both techniques and their computational application to quantile forecasting. We find that underestimating the number of regimes has a significant impact on forecast quality. At the high quantiles typically used in practice, the differences appear economically significant. Overestimating the number of regimes appears to have less effect. Three and four-dimensional discrete-state models typically perform well for longer-horizon forecasts than the commonly used 1 year. They are also more apt in picking up asymmetries in the default dynamics.

**#73: Non-homogeneous Markov mixtures of preiodic autoregressions for the Bayesian analysis of sulphur dioxide concentrations***Presenter:* ..... Luigi Spezia@Universita del Piemonte Orientale, Italy*Co-authors:* ..... Roberta Paroli

Markov mixture of autoregressions have been introduced in econometric literature. We generalize these models in three directions: i) the hidden Markov chain is non-homogeneous, that is the transition probabilities are time-varying and modelled via logit functions of explanatory variables; ii) the number of exogenous variables affecting the dynamics of the hidden state and the observed process are state-dependent, that is the number and the kind of variables can be different in any state; iii) harmonic components are also added to describe periodicities whose amplitude depend on the hidden states; iv) missing observations can occur within the observed time series and they will be handled as unknown parameters and estimated numerically. Bayesian inference for this class of models is proposed here and it is performed within a Markov chain Monte Carlo framework, along four consecutive steps: the specification of the identifiability constraint; the selection of the exogenous variables which influence the observed process and the time-varying transition probabilities of the hidden Markov chain; the choice of the cardinality of the hidden Markov chain state-space and the autoregressive order; the estimation of the parameters. Variable selection is performed in the complex case of correlation between variables, by means of a new procedure we called Metropolized-Kuo-Mallick. An application study on a real data set is introduced in the environmental context. In the town of Venice (Italy) there are ten air pollution monitoring stations. Nine of them are on the dry land and one in the lagoon, on the Isle of Giudecca; from January 1st, 2001 to September 30th, 2003 this last station recorded hourly concentrations of sulphur dioxide (SO<sub>2</sub>) much higher than those recorded on the dry land. So, it is of great importance to the public authorities to understand both the relationships between SO<sub>2</sub>; and the meteorological variables and which of them have more influence on the dynamics of SO<sub>2</sub>, to be able to predict, in the future, when the alarm level can be exceeded. The main features of SO<sub>2</sub>; time series are: i) non-Normality, ii) daily periodicity, iii) occurrence of missing values within the series, iv) presence of six meteorological variables which could influence the dynamics of the data, v) alternation of different unobserved regimes which influence the observed levels of pollution.

**#67: Hidden Markov extension of mixture transition distribution models***Presenter:* ..... Alessio Farcomeni@University of Rome La Sapienza, Italy*Co-authors:* ..... Francesco Bartolucci

The Mixture Transition Distribution (MTD) model can be used to parsimoniously and flexibly model discrete sequential data. We propose to embed an hidden Markov model in the MTD, deriving an hybrid HMM-MTD. The HMM-MTD model is even more parsimonious in certain applications, in that it allows to model the data in dependence to fewer lags with comparable fit to the classical MTD; and particularly useful in modelling persistent or repulsive behaviours of the current observation with respect to the past. We derive basic recursions, fitting strategies, and illustrate the new model on a real data application.

SN16 Room: MR030 RISK MEASUREMENT AND ESTIMATION RISK

Chair: Marc Paoletta

**#122: Hedge fund portfolio construction with estimation risk***Presenter:* ..... Daniel Giamouridis@Athens University of Economics and Business, Greece*Co-authors:* ..... Ioannis Vrontos, Loukia Meligotsidou

The hedge fund or alternative investments sector has been the most rapidly growing sector of financial services over the recent years. This has stimulated considerable research activity in several aspects of hedge fund investing. One prime issue has been the search for adequate procedures in the construction of hedge fund portfolios. A well established approach for portfolio selection involves making an assumption for investors' preferences or the distribution of returns and computing the portfolio structure that

maximizes investor’s end-of-period expected utility. This approach is followed in numerous studies in the literature of hedge fund portfolio construction. Most often, investors’ preferences are assumed quadratic, which reduces the problem to Markowitz’s (1952) mean-variance principle for portfolio selection. In the above setting it is common practice to use sample moments as best estimates of the population moments in order to determine the composition of the optimal portfolio. However, several researchers have pointed out that this approach introduces uncertainty, which can degrade the desirable properties of the constructed portfolio. The problem is termed estimation risk and is commonly addressed by employing Bayesian techniques. We explore the effect of addressing estimation risk in the construction of optimal hedge fund portfolios. We employ appropriate multivariate models, i.e. a full factor multivariate GARCH model and a mixture model and investigate whether addressing estimation risk improves our ability to construct optimal hedge fund portfolios. Several aspects associated with the Bayesian approach, e.g. computation of the portfolio return predictive distribution, are shown to be advantageous in our practical experiment.

**#125: Hedge fund return predictability in the presence of estimation risk and model uncertainty**

*Presenter:* ..... Ioannis Vrontos@Athens University of Economics and Business, Greece  
*Co-authors:* ..... Daniel Giamouridis

This analysis investigates hedge fund return predictability in the classical sense but also in the presence of estimation risk and in the presence of model uncertainty with an eye to explore the implications of hedge fund return predictability in terms of tactical style/asset allocation. The proposed model allows for the time-varying dynamics of hedge fund return variances and covariances/correlations by introducing an appropriate multivariate GARCH specification. A complete analysis of the proposed model is presented consisting of parameter estimation, model selection and volatility prediction. Classical and Bayesian techniques are used for the estimation of the model parameters. The construction of the proposed model allows easy maximum likelihood estimation and well mixing Markov chain Monte Carlo algorithms. Bayesian model selection is addressed using a MCMC stochastic search algorithm that explores the model space. We examine the impact of our statistical analysis in an applied investment framework, i.e. in hedge fund style portfolios. We provide implementation details and illustrations using Equity Hedge, Equity Market Neutral, Merger Arbitrage, Convertible Arbitrage, and Distressed Securities investment opportunities.

**#23: Time-varying quantiles**

*Presenter:* ..... Giuliano De Rossi@UBS, UK  
*Co-authors:* ..... Andrew Harvey

A time-varying quantile can be fitted to a sequence of observations by formulating a state space model and iteratively applying a suitably modified signal extraction algorithm. Quantiles estimated in this way provide information on various aspects of a time series, including dispersion, asymmetry and, for financial applications, value at risk. Estimates of the quantiles at the end of the series are the basis for forecasting. As such they offer an alternative to conditional quantile autoregressions and, at the same time, give some insight into their structure and potential drawbacks.

**#121: Different risk measures for vanilla and path dependent American options**

*Presenter:* ..... Ghulam Sorwar@University of Nottingham, UK  
*Co-authors:* ..... Kevin Dowd

This paper calculates the Value at Risk, Expected Shortfall and the Spectral Risk measures for vanilla and path dependent American option. It uses trinomial lattice to price both single factor and two-factor American options. Specifically it uses the constant elasticity variance model for single factor models and the lognormal model for the two factor options. It then uses Monte Carlo simulation with antithetic variables to generates different scenarios from which the three different risk measures. This study finds that the risk measures vary from one category of options to another and that all three risk measures generally lead to the same conclusion

**#176: Volatility spillovers: a new approach**

*Presenter:* ..... Margherita Velucchi@University of Florence, Italy  
*Co-authors:* ..... Robert Engle, Giampiero Gallo

Transmission mechanisms in financial markets have been extensively investigated, especially in conjunction with some crisis episodes. Volatility behaves differently across quiet and turbulent periods, but in similar ways within integrated markets. The traditional literature on contagion focuses on variations in these links during crisis periods via an increase of correlations of returns across markets; the GARCH literature analyzes the behavior of conditional variances and covariances, possibly inserting a Markov switching behavior to account for sudden surges in volatility. In this paper we part from these approaches, suggesting a model which is suitable for the conditional expectation of a volatility proxy (the market daily range), rather than modeling second moments of returns. Such a model, the Multiplicative Error Model (MEM), specifies the evolution of a positive valued process as the product of a scale factor which evolves in an autoregressive GARCH-type fashion and an iid innovation with unit mean. In the present context, the dynamics of the expected volatility of one market is extended to include interactions with the past daily ranges of other markets, thus building a fully interdependent model. The size of estimated coefficients represent the different strength that links across markets have in influencing each other. We analyze eight East Asian markets in the period 1995-2006, devoting particular attention to the treatment of the 97-98 turbulence period. We show that for some of the markets there is no evidence of changes in the dynamic impacts within the crisis and without and for other markets such a change is limited to a

level shift: this suggests that the links may be stable across subperiods. The MEM we specify can be interpreted as a nonlinear Vector Autoregressive Model and, as such, the properties of the transmission mechanisms can be investigated in forecasting and through impulse response functions (IRFs). The forecasting profiles and IRFs crucially depend on the initial conditions: we analyze specific episodes in order to identify which markets show a stronger impact on others and the time needed for the transmission to be fully developed. The forecasting exercise is used to put some dating details on the outbreak of turbulence in the 97-98 crisis and the impulse response functions can provide some insight in the time lag with which shocks observed in a single market have transmitted throughout the region.

#### #184: **Market linkages, variance spillover and correlation stability: empirical evidences of financial contagion**

*Presenter:* ..... Monica Billio@Universita di Venezia, Italy  
*Co-authors:* ..... Massimiliano Caporin

This paper introduces a new approach in testing for contagion. Differently from traditional approaches based on two-days moving averages of stock market returns, we model by a simultaneous equation system the overlapping and contemporaneous market relationships, introducing also lagged values to include in the model mean effects up to a week. Furthermore, we model variance spillovers by a special multivariate GARCH model built on the general representation of Ling and McAleer (2003). In our model only the ARCH part has a multivariate structure while the GARCH one has only one source of persistency, the one of the considered series. We thus evaluate the correlation matrix over rolling windows and introduce a correlation matrix distance which allows both the graphical analysis and the development of a statistical test for correlation movements. In particular, we analyse correlations on a non-parametric basis using the Fischer z-transformation. This transformation allows the construction of a test for changes in correlations taking advantage of its asymptotic distribution. We employ the test in the analysis of the contagion issue between Asian and American stock markets. In the empirical analysis, we demonstrate the advantages of our approach evidencing contagion and flight to quality phenomena. As an additional result, we also identify mean relations and variance spillovers. Finally, our analysis allows us to disentangle the effects absorbed by exchange rate movements from those directly transmitted to stock markets. The proposed statistics have power both for the dating and potentially for the real time detection of contagion.

#### #179: **Behavior of realized volatility and correlation**

*Presenter:* ..... Amir Safari@University of Karlsruhe, Germany  
*Co-authors:* ..... Detlef Seese

We study time-varying realized volatility and related correlation measures, which are based on the sum of squared or absolute-transformed high frequency values, as proxies for the true volatility and correlation. We propose measures of Two-Scale realized Absolute Volatility (TSAV) and correlation (TSACOR<sub>xy</sub>) which help us to cope effectively with the problem of market microstructure effects at very high frequency returns of financial time series. To construct an error-free measure for the true volatility under the usual diffusion assumptions, our measure of volatility is constructed based on subsampling and averaging procedure so that it works comparatively unbiased even in presence of market microstructure effects. Absolute against squared transformation of returns has been proved to be more robust against outliers. We apply Support Vector Regression to approximate a nonparametric CHARN model of volatility clustering and fat tails for evaluating accuracy and bias behavior of volatilities. This basic CHARN model is also extended to capture the leverage effect. It is indicated that the extended Asymmetric CHARN model affords less bias and more symmetric residuals than that of the basic one. Since realized squared correlation is conditionally built on square-transformed volatility, it apparently inherits the problem of presence of outliers from realized squared volatility. More important, with respect to some stylized facts of markets, it does not behave dynamically. Thus, motivated by robustness of realized absolute volatility, we study an alternative measure of correlation, built on absolute-transformed volatility. This measure of correlation exhibits experimentally dynamical behaviors and hence predictability capability. We show that the distribution of realized correlation series computed based on TSACOR<sub>xy</sub> tends to comply a rightward asymmetric shape implying that upside comoves are greater than downside ones. Moreover we study the association between realized volatility and correlation. Our findings empirically suggest that when NASDAQ is highly volatile, the relation between NASDAQ and CAC is strong, and when NASDAQ calms down, the relationship relaxes. Applying such an association between returns of ROS as a single stock and of NASDAQ as an index also suggests that the relationship is strong, when NASDAQ is volatile and inversely. These findings suggest that the systematic risk or Beta in the CAPM model should be time-varying and instantaneous.

#### #193: **Functional modelling of the volatility in the Swedish limit order book**

*Presenter:* ..... Suad Elezovic@Umea University, Sweden

The publicly available electronic limit order books at the Stockholm stock exchange consist of five levels of prices and quantities of a given stock with a bid and ask side. All changes in the books during one day can be recorded with a time quote. In this paper we aim at studying prices returns, liquidity (difference between the ask and bid prices) as function of quantity. In particular, we are interested in discovering and modelling dynamic behaviours in the volatility of prices and liquidity measures. The limit order book can be summarized by an ask and a bid price impact curves (functions of quantity). These curves are measures of the price for buying or selling a given quantity of shares. From both curves one can look at mid-quotes curves, average of bid and ask prices, and spread curves, difference between bid and ask prices, again as functions of quantity of shares. This leaves us with a collection of functions, whose evolution is observed in real time. From this collection of curves we can compute realized quadratic variations as measures of daily volatility. Due to the recent theoretical developments (e.g., Barndorff-Nielsen and Shephard, 2002), realized quadratic variation has become one of the most popular estimators of volatility based on high frequency financial data. We study the applicability of the theoretical results on the Swedish data, and in particular which time interval within one day must be used

to compute the realized quadratic variation. Using a functional time series analysis approach we model and estimate the dynamic behaviour of the volatility of the mid-quotes and spreads. For that purpose we used the functional regression models and estimation techniques developed by Fan and Zhang (2000) extending them to our time series context. The models and estimation techniques are also studied by simulating from a square diffusion process where the limit distribution is known.

Sunday, 22/04/2007

10:40-12:20

Parallel Session I

SN38 Room: MR380 COMPUTATIONAL INTENSIVE METHODS IN STATISTICS

Chair: Erricos John Kontoghiorghes

**#42: Forecast selection and evaluation using automated procedures***Presenter:* ..... Romulo Chumacero@Central Bank of Chile and University of Chile, Chile

This paper provides a rigorous framework for selecting and evaluating forecasting models. Forecast evaluation is performed in terms of point, interval and density forecasts. Fast and efficient algorithms are proposed. An executable program using GAUSS Engine is developed. An application for the Chilean inflation rate is presented.

**#126: Computational efficiency in Bayesian model averaging and variable selection***Presenter:* ..... Jana Eklund@Bank of England, UK*Co-authors:* ..... Sune Karlsson

This paper is concerned with the efficient implementation of Bayesian model averaging (BMA) and Bayesian variable selection when the number of candidate variables and, hence, models is large. At first glance, BMA is straightforward to implement: one needs the marginal distribution of the data, the prior probabilities of the models and the posterior distribution of the quantity of interest conditional on each model. In linear regression, for nicely behaved prior distributions, all these components are available in closed form. However, even if one has the closed form, the size of the model space may be too large to allow enumeration of all models, and estimation of posterior model probabilities and BMA must be based on a subset of the models, ideally with non-negligible posterior probabilities. Markov chain Monte Carlo methods are the tool of choice for this purpose as they can be used to draw directly from the model posterior distribution to obtain a sample of models which have high posterior probability. Efficient implementation is essentially concerned with two issues: the efficiency of the MCMC algorithm itself and the efficient computation of the quantities needed to obtain a draw from the MCMC algorithm. It is desirable that the chain moves well and quickly through the model space and takes draws from regions with high probabilities. In this context there is a natural trade-off between local moves, which make use of the current parameter values to propose plausible values, and more global transitions, which potentially allow exploration of the distribution of interest in fewer steps, but where each step is more computationally intensive. We assess the convergence properties of samplers based on local moves and some recently proposed algorithms intended to improve on the basic samplers. Results show that simple samplers that allow for swapping variables in the model perform well but the Swendsen-Wang algorithm can offer better performance when there is a high degree of multicollinearity. Secondly, we focus on the important case of linear models where the computations essentially reduce to least squares calculations. When the chain makes local moves, adding or dropping a variable, substantial gains in efficiency can be made by updating the previous least squares solution. We find that as well as being numerically accurate, Cholesky based algorithms and the Sweep operator are considerably more efficient than the commonly used QR decomposition.

**#107: Soft computing for foreign exchange rate forecasting***Presenter:* ..... Chokri Slim@ISCAE, Tunisia

Statistical methods and neural networks are commonly used for financial time series forecasting. Empirical study have shown that Neural Networks outperform linear regression since stock markets are complex, nonlinear, dynamic and chaotic. Neural networks are reliable for modelling nonlinear, dynamic market signals. Neural Network makes very few assumptions as opposed to normality assumptions commonly found in statistical methods. Neural network can perform prediction after learning the underlying relationship between the input variables and outputs. Backpropagation neural network is commonly used for price prediction. Gradient is an extremely local pointer and does not point to global minimum and leading to slow convergence. To overcome these deficiencies, the purpose of this paper is to use the soft computing methods in modelling and forecasting of stock returns time series. The emphasis is put on the neuro-fuzzy logic and genetic computing. This paper presents neuro-fuzzy network architecture based on genetic computing. To test the performance and applicability of the proposed model, extensive simulation studies of nonlinear complex dynamic systems are carried out. The proposed method is verified in the challenging area of financial markets. The platform of evaluation of the novel model involves comparisons with ARIMA model, Tong's Model, a feed-forward neural network trained with the classical back-propagation algorithm and the ANFIS model. Through the experiments for exchange rate prediction, multiple issues are analyzed about the given problem of financial markets modelling and forecasting.

**#178: Developing web-based and parallelized bioinformatics applications***Presenter:* ..... Ramon Diaz-Uriarte@Spanish National Cancer Research Centre, Spain*Co-authors:* ..... Andres Canada, Edward Morrissey, Oscar Rueda, Andreu Alibes, Mariana Neves

For over two years we have been developing Asterias, a set of open source, freely-accessible web tools for the analysis of genomic data. Our objective has been to implement state-of-the-art methods, accessible from a web browser, and that, by using parallel and distributed computing, permit us to harvest computational resources rarely available to individual researchers. Asterias runs on a computing cluster with 60 CPUs. Most applications use MPI from R and/or C++ for parallelization. Parallelization results in significant decreases in users' wall time and, together with load-balancing of sequential computations, allows us to handle large numbers of simultaneous users with acceptable response times. Because of its heavy usage of parallelization in a web-based application Asterias is a unique example in bioinformatics and web-based statistical computing. Setting up and maintaining the system,

however, presents several difficulties. We will discuss two main problems. First, the "impedance mismatch problem", where building web-based applications requires the mastering of several languages/technologies, many of which might not be of any intrinsic interest for the statistician. Second, the difficulties associated with using LAM/MPI from unattended web-based applications, with many simultaneous users and occasional server failure. We will suggest possible solutions to both of these issues, which should lead to developing a general framework (or at least a large enough set of case examples) that will make it much simpler for any bioinformatician/biostatistician to take new ideas and developments from the primary methodological research and make them quickly available as web-based applications. These web-based applications should be capable of using advances in computing and hardware (multicore CPUs, computing clusters built with off-the-shelf components, parallel computing) and web-technologies (e.g., AJAX).

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 SN14 Room: MR080 TIME SERIES SMOOTHING AND MODELLING
 

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Chair: Ioannis Demetriou

**#79: Necessary and sufficient conditions for a best L1 convex fit to univariate data**
*Presenter:* ..... Sotirios S. Papakonstantinou@University of Athens, Greece

*Co-authors:* ..... Ioannis C. Demetriou

If plotted values of measurements of function values show some gross errors and away from them the function seems to be convex, then it is suitable to make the least sum of absolute change to the data subject to the condition that the second divided differences of the smoothed data are nonnegative. Note that: (1) it is a constrained L1 approximation problem, which can be expressed as a linear programming calculation, (2) the constraints enter by the assumption of non-decreasing returns of the underlying function, which implies convexity, (2) the piecewise linear interpolant to the smoothed data is a convex curve, (4) the corresponding least squares and minimax problems have been characterized long ago, and (5) convexity is a property that occurs in several disciplines, as, for example, in estimating a utility function that is represented by a finite number of observations that are corrupted by random errors. Necessary and sufficient conditions for a solution to this L1 problem are presented that allow the development of a special algorithm that is much faster than general linear programming procedures.

**#81: A distributed lag estimator derived from smoothness priors and nonnegative divided differences**
*Presenter:* ..... Evangelos E. Vassiliou@University of Athens, Greece

We consider noisy measurements from a time series that follow a linearly distributed lag model. It is usual to assume that the lag coefficients lie on some curve and then specify the curve by a least squares calculation. However, we define the  $r$ -th order smoothness priors by requiring nonnegative divided differences of order  $r$  for the lag coefficients. Such priors do not imply any parameterization of the lag curve and provide a more accurate representation of the prior knowledge. For the calculation of the solution we propose an algorithm that gives the least squares change to the data subject to nonnegative divided differences of the lag coefficients of order  $r$ , where  $r$  is a prescribed positive integer. The problem is a strictly convex quadratic programming calculation, where each of the constraints functions depends on  $r+1$  adjacent components of the smoothed values of the lag coefficients. We take account of this special structure and use a special active set method that is more efficient than general quadratic programming algorithms. In fact we construct a basis that reduces the equality-constrained minimization calculations that appear during the quadratic programming iterations to unconstrained minimization ones, which depend on much fewer variables.

**#149: A control systems approach for credit risk simulation and control of a loan portfolio**
*Presenter:* ..... Sophia Stavraki@University of Athens, Greece

*Co-authors:* ..... John Leventides, Haralambos Pandis

We study the problem of measurement and control of credit risk in a loan portfolio. We develop a control systems methodology in order to examine the dynamic behavior of a loan portfolio by modeling it as a dynamical system which in turn is used for the definition of an appropriate Optimal Control problem. In fact, we develop two discrete dynamical systems, which describe the process and the evolution of the loan portfolio by following two different approaches. First we construct a linear time invariant discrete system in state space form, where the state variables are the amount of current loans, the amount of past due loans and the amount of bad credit loans. The input of the system is the amount of new loans. The coefficients of the system reflect the credit quality, the repayment of due loans, the recoveries of bad credit and the percentage of repayment of current loans. The construction of the dynamical model is based on the historical data. For the identification of this system, we solve an error minimization problem with respect to the parameters of the system. Subsequently, we examine the stability and the step response of the system and, by simulating the system; we compute basic indices of the loan portfolio for every time period. Secondly we enhance the above mentioned approach by using a refined set of variables reflecting the variety of risk categories in the loan portfolio. The dynamical system includes seven risk categories and the parameters of the transitions between them. The inputs of the system are the new loans for each risk category whereas the outputs are the various quality parameters of the loan portfolio such as bad loans ratio, profitability vs. risk etc. This approach may lead to portfolio planning and budgeting either through simulations of the above dynamic model or via determination of an open or closed loop policy using some optimality criterion. According to our approach we define an optimal control problem of maximizing the profit of the portfolio under the constraints of the equations of the dynamical system and an additional inequality for restraining the risk of the portfolio. This problem is proved to be equivalent to a linear programming problem and its solution may lead to an optimal closed or open loop policy. This policy may be interpreted as the optimal distribution of new loans for each risk category that maximizes profit of the portfolio keeping in the same time credit risk within acceptable limits.



**#76: Separation of extrema of piecewise monotonic time series**

*Presenter:* ..... Ioannis Demetriou@University of Athens, Greece

If time series data include uncorrelated errors, then piecewise monotonic trends in time series may be captured by a least squares fit to the data so that the sequence of the first differences of the components of the fit includes at most  $k-1$  sign changes. The best fit is composed of at most  $k$  monotonic sections, alternately increasing and decreasing, whereas the positions of its extrema are integer variables of the optimization calculation. We prove that as the time series data increase, the positions of the corresponding extrema of the best fit increase as well. One strong corollary is that the local maxima of a best fit with  $k-1$  monotonic sections are separated by the local maxima of the best fit with  $k$  monotonic sections, and local minima separate similarly. Interesting applications of these results may be found in local analyses, in extrema forecasting concerning future events of the time series and in developing fast procedures for smoothing the time series.

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SN24 Room: MR160 ESTIMATION AND VALIDATION OF MULTIVARIATE FINANCIAL MODELS

Chair: Lynda Khalaf

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**#75: Efficient estimation of copula-GARCH models**

*Presenter:* ..... Richard Luger@Emory University, USA

*Co-authors:* ..... Yan Liu

Copula-GARCH models capture the dependency between financial asset returns by producing potentially complex joint distributions from the specification of a copula function and GARCH models for marginal return distributions. In such a context, the dependency parameter is easily rendered conditional and time-varying. This methodology is especially useful when marginal dynamics are complicated and cannot be easily extended to a multivariate setup. Copula-GARCH models are usually estimated by the method of inference functions for margins (IFM), which proceeds in two steps: (i) estimate the parameters pertaining to the marginal distributions separately, and (ii) estimate the parameters pertaining to the copula function conditional on the first-step estimates. The major drawback of this method is that there is some loss of efficiency in estimation. This paper adapts and examines an iterative (fixed-point) algorithm for the estimation of copula-GARCH models. The algorithm exploits the structure of certain models that yield a natural decomposition of a very complicated likelihood function. In the case of copula-GARCH models, we strategically decompose the full likelihood into two parts. The first part is the likelihood function under the independence correlation structure and only involves the parameters of the marginal GARCH processes. The second part is used to update estimates from the first part in such a way that its second-order derivatives are not needed. It is interesting to note that IFM corresponds to the first step of the iterative algorithm. As the number of iterations increases, the algorithm yields the full maximum-likelihood estimates. We show that the iterative algorithm admits closed-form expressions for the iterations of both marginal and correlation parameters under the Gaussian copula. The properties of the iterative algorithm and of estimators are evaluated in simulation studies for asymmetric copula-GARCH models with time-varying correlations. The results show that very few iterations are needed to improve on the efficiency of the initial IFM estimates, and as the sample size increases, the improvement becomes more significant. This suggests that the commonly used strategy for estimating copula-GARCH models can be improved using the iterative algorithm, even in high-dimensional cases. An empirical application examines the dependency structure between daily returns on two major stock market indexes.

**#132: Evaluating Value-at-Risk models with desk-level data**

*Presenter:* ..... Denis Pelletier@North Carolina State University, USA

*Co-authors:* ..... Jeremy Berkowitz, Peter Christoffersen

We present new evidence on disaggregated profit and loss and VaR forecasts obtained from a large international commercial bank. Our dataset includes daily P/L generated by four separate business lines within the bank. All four business lines are involved in securities trading and each is observed daily for a period of at least two years. Given this rich dataset, we provide an integrated, unifying framework for assessing the accuracy of VaR forecasts. A thorough Monte Carlo comparison of the various methods is conducted to provide guidance as to which of these many tests have the best finite-sample size and power properties. The Caviar test of Engle and Manganelli (2004) performs best overall but duration-based tests also perform well in many cases.

**#174: Semiparametric multivariate density estimation for positive data**

*Presenter:* ..... Taoufik Bouezmarni@HEC, Montreal, Canada

*Co-authors:* ..... Jeroen V.K. Rombouts

In this paper we estimate multivariate density functions for positive multivariate data. We propose a semiparametric approach. The estimator is based on a gamma kernel or a local linear kernel, also called boundary kernels and uses copulas to model the dependence. The semiparametric approach is robust to the well known boundary bias problem. For this estimator, the mean integrated squared error properties, including the rate of convergence, the uniform strong consistency and the asymptotic normality are investigated. A simulation study investigates the performance of the estimator. Applications in the field of economics and finance are provided.

**#69: Markov Chain Monte Carlo methods for parameter estimation in multidimensional continuous time Markov switching models**

*Presenter:* ..... Markus Hahn@Austrian Academy of Sciences, Austria  
*Co-authors:* ..... Sylvia Fruehwirth-Schnatter, Joern Sass

We present Markov chain Monte Carlo methods for estimating the parameters of multidimensional, continuous time Markov switching models. The observation process can be seen as a diffusion where the drift and the volatility coefficients are modeled as continuous time, finite state Markov chains with a common state process. The states for the drift, for the volatility, and for the rate matrix of the underlying Markov chain have to be estimated. Markov switching models are widely used in finance, but are also applied in many other areas such as in biophysics. Applications to simulated data indicate that the proposed algorithm can outperform the expectation maximization algorithm for difficult cases, e.g. for high rates. Application to financial market data shows that the Markov chain Monte Carlo method indeed provides sufficiently stable estimates.

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SN15 Room: MR030 MODELING FINANCIAL ASSET RETURNS

Chair: Marc Paoletta

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**#18: Indirect estimation of elliptical fat-tailed distributions**

*Presenter:* ..... David Veredas@University of Brussels, Belgium  
*Co-authors:* ..... Marco Lombardi

We present an indirect estimation approach for elliptical stable distributions which relies on the use of a multivariate student-t distribution as auxiliary model. This distribution is also elliptical and we show that its parameters have a one-to-one relationship with those of the elliptical stable, therefore making the proposed indirect approach especially suitable. Standard asymptotic properties are also shown and we analyze the finite sample behavior of the estimators via a comprehensive Monte Carlo study. An application to 27 emerging markets stock indexes concludes the paper.

**#30: Modeling fat tails in daily exchange rates: a multivariate Stable-GARCH approach**

*Presenter:* ..... Matteo Bonato@University of Zurich, Switzerland

It is a very well known fact that time series returns on financial assets and exchange rates present features like volatility clustering and excess kurtosis. To capture the phenomenon of heavy tails, Mandelbrot (1963) and Fama (1965) first introduced stable distributions to model the unconditional distributions of financial returns. Despite the theoretical appeal and the empirical goodness of fit of the stable class of models in describing highly leptokurtic financial return data, they do not seem to be adequate to explain the phenomenon of volatility clustering. The class of GARCH models has been very successful in modeling such behavior. In this paper we present a new multivariate volatility model which combines the ability of the stable Paretian distribution to model heavy tails and the class of GARCH models to capture the volatility clustering. We use a sub-Gaussian distribution, which is a particular multivariate stable distribution, to fit the joint distribution of financial returns. One difficulty when working with multivariate stable distributions is that the density function has no close form solution. However, under the sub-Gaussian assumption, the characteristic function has a tractable expression and the density function can be recovered by numerical methods. A multivariate GARCH structure is then adopted to model the covariance matrix of the Gaussian vectors underlying the sub-Gaussian system. Finally, the model is fitted to a bivariate series of exchange rates and used to compute the Value-at-Risk of different portfolios and for long and short positions. The contribution of the paper is manifold. First, we use a multivariate stable distribution to model the joint distribution of financial returns. Stable distributions have fatter tails than the Gaussian distribution, thus in our formulation we keep in account the phenomenon of excess kurtosis. Second, we introduce heteroskedasticity in the model to capture the phenomenon of volatility clustering. A third contribution of this paper is the extension, under the sub-Gaussian assumption, of the method in Mittnik, Doganoglu and Chenyao (1999) to the multivariate case. This allowed us to estimate the parameters of the model via maximum likelihood.

**#22: An ARCHAIC approach to portfolio VaR forecasting**

*Presenter:* ..... Simon Broda@University of Zurich, Switzerland  
*Co-authors:* ..... Marc Paoletta

The generalized hyperbolic distribution provides an excellent parametric description of financial returns data, but its widespread use has been prohibited by its relative computational complexity. The problem is even more acute if Value at Risk forecasts for a portfolio of assets are desired, requiring tail probabilities of sums of generalized hyperbolic variates. This paper derives a saddle point approximation to the required distribution function, which is both computationally trivial and extremely accurate — most notably in the tail, which is crucial for risk calculations. Moreover, in an important special case (the normal inverse Gaussian), the approximation is in closed form, implying essentially instantaneous calculation of the desired tail probability. The dependence structure between assets can be successfully modelled using independent component analysis, thus alleviating the dimensionality problems associated with multivariate GARCH models.

**#145: An econometric analysis of emission trading allowances***Presenter:* ..... Marc Paoella@University of Zurich, Switzerland*Co-authors:* ..... Luca Taschini

World power and gas markets have a natural relationship with global tradable carbon permits markets, including the U.S. Clean Air Act Amendments and the EU Emissions Trading Scheme, the latter officially launched in January 2005. Electric utilities operate their power plants based in part on the price of the power and the relative cost of coal and natural gas. As both carbon dioxide and sulphur dioxide are by-products of the coal burning process, the new factors of SO<sub>2</sub> and CO<sub>2</sub> emissions allowances come into play in a carbon constrained economy. Now that a price has been put on such allowances, the differences in carbon intensity for coal and gas could potentially change the way companies run their power plants. Moreover, knowledge of the statistical distribution of emission trading allowances, and its forecastability, becomes crucial in constructing optimal hedging and purchasing strategies in the carbon market. This paper provides an in-depth analysis of available data addressing the unconditional tail behavior and the inherent heteroskedastic dynamics in the returns on the emissions allowances.

SN04 Room: MR150 SPATIAL AND/OR TEMPORAL MODELING

Chair: Janette Walde

**#83: Small sample properties of maximum likelihood versus generalized method of moments based tests for spatially autocorrelated errors***Presenter:* ..... Mario Larch@Ifo Institute for Economic Research, Germany*Co-authors:* ..... Peter Egger, Michael Pfaffermayr, Janette Walde

Many applied researchers have to deal with spatial autocorrelated residuals (SAR). In order to identify spatial spillovers captured by a significant SAR parameter, tests are available based on either MLE or GMM estimates. This paper illustrates both the small and large sample properties of various tests for the null hypothesis that the SAR parameter is zero. To assess the small sample properties, we set up a Monte Carlo study using a Cliff and Ord type model. The main finding is that the Wald-tests perform well regarding both size and power even in small samples. The Monte Carlo study indicates that the GMM-based Wald-test is correctly sized even for normally distributed errors and small samples, and it exhibits a similar power as its MLE-based counterpart. Hence, for the applied researcher the GMM Wald-test is recommended, because it is easy to implement.

**#85: Performance of diagnostic tests for spatial models***Presenter:* ..... Janette Walde@University of Innsbruck, Austria*Co-authors:* ..... Mario Larch

Theory often suggests spatial correlations without being explicit about the exact form. Hence, econometric tests are used for the model choice. So far, mainly Lagrange multiplier tests based on ordinary least squares residuals are used to decide whether and in which form spatial correlation is present. In this paper, maximum likelihood and generalized method of moments estimators for the general model are employed and the model selection is based on likelihood ratio and Wald tests. The sensitivity of the general model on the choice of the weighting scheme is investigated. The results of the conducted large Monte Carlo study suggest that Wald tests on the spatial parameters after estimation of the general model is the most reliable approach to reveal the nature of spatial correlation.

**#93: Structured additive regression: a unifying perspective on smoothing, spatial statistics, and mixed models***Presenter:* ..... Stefan Lang@University of Innsbruck, Austria*Co-authors:* ..... Christiane Belitz, Thomas Kneib

Extensions of classical parametric regression models are frequently desired in practice to allow for realistically complex descriptions of empirical phenomena such as undernutrition or early childhood mortality in developing countries. In this talk we discuss complex semiparametric regression models that can deal simultaneously with nonlinear covariate effects and time trends (based on penalized splines), spatial effects (based on stationary Gaussian or Markov random fields), unit or cluster specific heterogeneity (based on i.i.d. random effects) and complex interactions (e.g. two dimensional surfaces based on bivariate penalized splines, varying coefficient models, space-time interactions etc.). The models combine and unify methodology from different branches in statistics and econometrics, e.g. smoothing, dynamic models, spatial statistics, random effects models, multilevel models and hierarchical Bayes models to name just the most important ones. In the first part of the talk we highlight four different views on the models: A penalized likelihood approach, the Bayesian point of view, a mixed model perspective and an approach based on marginal models with correlated errors. The different viewpoints on the model result in a variety of alternative inference techniques for the parameters of the models. We highlight the close connections between the four modeling perspectives and discuss inference based on maximum penalized likelihood including simultaneous model and variable selection, inference based on a mixed model representation, and finally a fully Bayesian approach based on Markov-Chain-Monte-Carlo simulation techniques. In the second part of the talk we present a case study where we apply the methodology to investigate the determinants of undernutrition and mortality in South-Asia and Africa. We are particularly interested in the investigation of sex-differences of undernutrition and mortality that can be observed in South-Asia.

**#58: Markov Chain Monte Carlo estimation of issuer-specific and bond-specific components of credit and liquidity risk**

*Presenter:* ..... Leopold Soegner@Vienna University of Technology, Austria

*Co-authors:* ..... Manfred Fruehwirth, Paul Schneider

Credit risk literature and industry represent the difference between risky bonds and risk-free bonds in the form of spreads. These spreads, in general, include credit risk, liquidity risk and any market microstructure related differences. The main objective of this article is to model interest rate risk, issuer-specific and bond-specific risk and to develop an econometric methodology to separate and analyze these three types of risk. One of the standard procedures in the preceding literature to separate between issuer-specific and bond-specific components assumes for each issuer the observation of a benchmark bond, where for this particular bond no bond specific component is included. We refine this approach by an estimation technique that allows identification and estimation of issuer-specific components on the one hand and bond-specific components on the other hand without having to make this strong assumption. The model we are going to apply is based on the Duffie/Singleton credit risk framework. It consists of three building blocks: the first for the risk-free term structure, the second for the issuer specific component of one particular issuer and the third is a bond specific factor. By the model assumptions the number of observable time series (yields and/or bond prices) is smaller than the number of latent processes, such that direct maximum likelihood estimation becomes impossible. We solve this problem by means of data augmentation and estimate the model parameters along with the latent processes by means of Markov Chain Monte Carlo methods. Since the autocorrelations of the sample paths are high and each simulation step of the sampler also requires to solve a system of ordinary differential equations, the computational effort of our analysis becomes very high. On the other hand side, this methodology neither requires a benchmark bond nor any discretization schemes, such that an exact Bayesian analysis can be performed. MCMC runs with simulated data show that the parameters of our model can be estimated with high precision. Furthermore, we apply our methodology to empirical data. We infer a risk-free term structure process from liquid swapmarket data. Based on these estimates, issuer-specific and bond-specific risk are estimated from corporate bond data from the German corporate bond market.

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