

ISF 2000
The 20th International Symposium on Forecasting
Lisbon, Portugal • June 21-24, 2000



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In collaboration with the **International Institute of Forecasters**

MESSAGE FROM THE GENERAL CHAIR

On behalf of the ISF 2000 organizers and the International Institute of Forecasters, I welcome you to the International Symposium on Forecasting in Lisbon.

This is our twentieth symposium and one that takes place in times of change and of new challenges to forecasters.

As you browse through our program, you will see the rich variety and high quality of many contributions, which enrich the tools forecasters are continuously creating and perfecting. We are happy to be hosting these discussions.

At our symposia, forecasters have always presented new tools for anticipating and changing the future. The same will surely happen at ISF 2000.

We are proud to receive you in Lisbon, a capital city with both a unique rich history and a vibrant and progressive modern life. We hope you will enjoy your stay, taking advantage of the many historical sites that this city offers.

We hope you will find the 20th International Symposium on Forecasting to be both an interesting scientific meeting and an enjoyable and memorable event.

Sincerely,

Nuno Crato
General Chair, ISF 2000

SESSIONS AND ABSTRACTS
— THURSDAY —

Keynote speech 1

Chair: Nuno Crato (ISEG, Technical University of Lisbon, Portugal)

The Accuracy of European Growth and Inflation Forecasts

Lars-Erik Öller

National Institute of Economic Research and Stockholm School of Economics, Sweden

Abstract: One-year-ahead forecasts by the OECD and by national institutes of GDP growth and inflation in 13 European countries are analysed. RMSE was large: 1.9 % for growth and 1.6 % for inflation. Six (11) OECD and 10 (7) institute growth forecast records were significantly better than an average growth forecast (the current year forecast). All full record-length inflation forecasts were significantly better than both naive alternatives. There was no significant difference in accuracy between the forecasts of the OECD and the institutes. Two forecasts were found to be biased and one had autocorrelated errors. Directional forecasts were significantly better than a naive alternative in one-half of the cases. Overall, inflation forecasts were significantly more accurate than growth forecasts, and in contrast to growth forecasts, they generally improved over time. This has implications for economic policy. Positively biased revisions reveal large errors in data.

(Talk based on joint work with Bharat Barot — National Institute of Economic Research, Sweden.)



Lars-Erik Öller is Director of Research at the National Institute of Economic Research, Sweden, an institute that has made macroeconomic forecasts since 1937. He has been engaged in both forecasting research and practice for 30 years, first in Finland and for the last 10 years in Sweden. His research interests include leading indicators, forecast memory, forecast evaluation and econometric modelling. Publications include articles in the *International Journal of Forecasting*, *Journal of Forecasting* and *Journal of Business and Economic Statistics*. He is a director of the International Institute of Forecasters, an Associate Editor of the *International Journal of Forecasting* and a lecturer of the University of Helsinki and Åbo Akademi University, Finland.

Estimation and Prediction I

Chair: **Kamil Feridun Turkman** (University of Lisbon - Portugal)

How to obtain the best predictions with time series models

S. de Waele — Department of Applied Physics; Delft University of Technology; P.O. Box 5046; 2600 GA Delft; The Netherlands

P. M. T. Broersen — Delft University of Technology; The Netherlands

The Maximum Likelihood (ML) principle can be used to estimate parameters in parametric models for a stationary stochastic process. It is suggested in literature that a better model can be obtained by using a better approximation of the ML estimator. This hypothesis has been tested by comparing the exact ML estimator to approximate ML estimators in finite samples. Although some exact results have been obtained, a theoretical analysis of the ML estimator in finite samples is difficult. Therefore, simulations are used to study its behavior in practice. The quality of the estimate is established by using the estimated model for prediction. This study showed that the exact ML estimator performs worse than some carefully selected approximate ML estimators. Hence, it can be concluded that a closer approximation of ML does not automatically produce better predictions. Another methodology has to be developed for improving predictions with time series models.

GLS Estimation of Regression Models With Misspecified Serial Correlation Structures

Sergio Koreisha — Lundquist College of Business; University of Oregon; Eugene, OR 97403 ; USA

Yue Fang — University of Oregon; USA

The regression literature contains hundreds of studies on serially correlated disturbances. Most of these studies assume that the structure of the error covariance matrix W is known or can be estimated consistently from data. Surprisingly, few studies investigate the properties of estimated GLS procedures when the structure of W is incorrectly identified and the parameters are inconsistently estimated. In this article we compare the finite-sample efficiencies of OLS, GLS, and incorrect GLS (IGLS) estimators. We also establish theoretical efficiency bounds for IGLS relative to GLS and OLS. Furthermore results from an exhaustive simulation study are used to evaluate the small sample performance of IGLS estimates vis-à-vis OLS and GLS estimates constructed for models with known and estimated (but correctly identified) W .

Forecasting with the Linear Trend Model

Barry Falk — Department of Economics; Iowa State University; 260 Heady Hall; Ames, IA 50014; USA

Anindya Roy — University of Maryland at Baltimore; USA

This paper is concerned with forecasting time series that can be explained in terms of a regression model with trending regressors and an autoregressive error process, which may have unit root. We use Monte Carlo methods to compare point forecasts and forecast intervals generated by ordinary least squares, generalized least squares, and feasible generalized least squares procedures. In constructing the GLS and FGLS forecast intervals, we use standard GLS standard error estimates for the regression coefficients and we use a Gauss-Newton standard error estimator that we recently developed for this model.

Decreasing of the Mean Time to Detection Concerning Different Sampling Intervals in Statistical Quality Control

J. Rodrigues Dias — Department of Mathematics; University of Évora; 7000 Évora; Portugal

Paulo Infante — University of Évora; Portugal

Previously we have presented a new method to obtain different sampling intervals in statistical quality control, which is very simple. Also, we have obtained a very important decreasing of the associated expected total costs by cycle, if we compare it with the usual periodic sampling method.

In this paper, considering a process variability, and for any sample size, we present a simple and interesting relationship to predict the decreasing of the mean time to detection, in terms of the process standard deviation change.

An Algorithm for the Exact Likelihood of a Stationary Vector Autoregressive-Moving Average Model

Jose Alberto Mauricio — Departamento de Economía Cuantitativa; Facultad de Economicas; Universidad Complutense de Madrid; Campus de Somosaguas; 28223 - Madrid; Spain

In this article, the so-called 'innovations' form of the likelihood function implied by a stationary vector autoregressive-moving average model, is considered without directly using a state-space representation. Specifically, it is shown in detail how to compute the exact likelihood by an adaptation to the multivariate case of the innovations algorithm of Ansley (1979) for univariate models. Comparisons with other existing methods are also provided, showing that the algorithm described in this article is computationally more efficient than the fastest methods currently available in many cases of practical interest.

Unit Roots

Chair: **Ismael Sanchez** (Universidad Carlos III de Madrid - Spain)

Rank unit root test under structural breaks

F. Marmol — Dpt. of Statistics and Econometrics; Universidad Carlos III de Madrid; Madrid; Spain

Miguel A. Arranz — Universidad Carlos III de Madrid; Spain

The aim of the paper is the analysis of different rank unit root tests. As it has been pointed out in the literature, this kind of tests should be insensitive to the presence of one-time outliers in the mean of the series. We generalize the analysis to the presence of permanent outliers (level shifts) and breaking trends.

Do seasonal unit roots matter for forecasting monthly industrial production?

Philip Hans B.F. Franses — Econometric Institute; Erasmus University Rotterdam; P.O.Box 1738; NL-3000 DR Rotterdam; The Netherlands

Yoshinori Kawasaki — The Institute of Statistical Mathematics; Japan

We investigate the seasonal unit root properties of monthly industrial production series for sixteen OECD countries within the context of a structural time series model. This model assumes that there are eleven such seasonal unit roots. We propose to use model selection criteria (AIC and BIC) to examine if one or more of these are in fact stable. For the sixteen series we generally find that when AIC or BIC indicate that a smaller number of seasonal unit roots should be assumed and hence that some roots are stable, the corresponding model also gives more accurate static and dynamic forecasts. This shows that in-sample model selection can lead to better out-of-sample forecasts.

On the power of seasonal unit root tests against fractional alternatives

Olivier Darne — LAMETA - CNRS UPRESA 5474; Université de Montpellier I - Faculté des Sciences Economiques; Espace Richter - Avenue de la Mer - BP 9606; 34000 Montpellier; France

Vivien Guiraud — LAMETA, University of Montpellier; France

Michel Terraza — LAMETA, University of Montpellier; France

We examine the probability of rejecting the seasonal unit root tests developed by Hylleberg et al. (1990) when they are applied to fractionally integrated time series. The Monte Carlo simulations are based on data generating processes in which we vary the parameters in order to approach progressively the unit root. We find that these tests have quite low power and involve an important risk of over-differencing. We also analyze standard and fractional seasonal integrated models for quarterly observed time series in an empirical forecasting study. Results show that the Periodical AutoRegressive Fractionnally-Integrated Moving Average (PARFIMA) model improves forecasting accuracy, compared with the standard seasonal ARIMA model.

Testing for Unit Roots in the Presence of Seasonal Heteroscedasticity

Kevin Albertson — Manchester Metropolitan University; Manchester; UK

Jonathan Ayles — University of Salford; UK

The process of testing for unit roots in time series data using, for example, the Dickey Fuller, DF, test procedure, is arguably one of the most common preliminary analysis techniques employed in modern time series econometrics. It is well known that the DF procedure is not robust to departures from its underlying assumptions. The cases of AR and MA errors in the DF regression are well known, however the potential problem of heteroscedasticity is often ignored. Yet it is known that macroeconomic time-series may often display such. In this paper we consider the effects of uncorrected seasonal heteroscedasticity on the DF and Augmented DF tests for unit roots. We also examine a number of UK macroeconomic series to determine the extent of the seasonal heteroscedasticity problem. Finally we propose a simple correction for heteroscedasticity of this sort, should it be present.

Efficient Forecasting in Nearly Nonstationary Processes

Ismael Sanchez — Universidad Carlos III de Madrid; Butarque 15, 28911 Leganes; Madrid; Spain

This paper proposes a procedure to make efficient predictions of a nearly nonstationary process. The method is based on the adaptation of the theory of optimal combination of forecasts to nearly nonstationary processes. The proposed combination method is simple to apply and have better performance than the classical combination procedures. It also has better average performance than a differenced predictor, a fractional differenced predictor, or a optimal unit-root pretest predictors. In the case of a process that has a zero mean, only the non-differenced predictor is slightly better than the proposed combination method. In the general case of a non-zero mean, the proposed combination method has a better overall performance than all of its competitors.

Judgemental Forecasting I

Chair: **Michael Lawrence** (University of New South Wales - Australia)

Using Judgment to Forecast Air Collisions

Damien Forrest — UCL Psychology Department; Gower Street; London WC1E 6BT; UK

Nigel Harvey — University College London; UK

Air Traffic Control Officers (ATCOs) are responsible for the safe and expeditious movement of air traffic through the volume of airspace for which they control. Their ability to accomplish this depends to a large extent on their ability to forecast potential problems before they arise. Timely and effective judgment and resolution, sometimes hundreds of miles in advance of the two aircraft meeting, is the key to avoiding any compromise to safety. Novice and expert controllers provided judgments and respective confidence ratings of the closest point of approach (CPA) between aircraft in several static scenarios. Results showed that experts were significantly better able to judge potential air collisions than novices. However both groups were over-confident in their judgments. Results also showed that the type of conflict had an impact upon the controllers' judgments: side-on conflicts were the most difficult to predict.

Looking and weighting in forecasting: Overusing redundant information or sticking to consistent advice

Clare Harries — Department of Psychology; University College London; Gower Street; London WC1E 6BT; UK

Nigel Harvey — University College London; UK

Ilan Yaniv — Hebrew University; Israel

Arguments can be made both to reduce the weight given to highly dependent (and therefore redundant) forecasts or to increase it (agreement might indicate relevant contextual knowledge). This study was designed to examine both how people consider, and how they weight such information, independent of its accuracy. Ninety-six participants combined forecasts from four advisors over a number of trials. Two of the advisors were either in high or low agreement but were equally accurate. Advice was available to participants either simultaneously or sequentially. Although participants spent longer looking at the redundant information (when the advisor was in strong agreement with another advisor), they did not weight this information any differently. Looking, it appears, is different from weighting. When information was available sequentially, participants spent longer looking at information, but both accuracy and consistency were worse and participants under-weighted the information of the best advisor.

Does Updating Judgmental Forecasts Improve Forecast Accuracy?

William Remus — University of Hawaii; 2404 Maile Way; Honolulu, HI 96822; USA

Marcus O'Connor — University of New South Wales

Kenneth Griggs — California Polytechnic; San Luis Obispo, CA USA

This study investigates whether updating judgmental forecasts of time series leads to more accurate forecasts. The literature is clear that accurate contextual information will improve forecast accuracy. However, forecasts are sometimes updated when pure temporal information like the most recent time series value becomes available. The key assumption in the latter case is that forecast accuracy improves as one gets closer in time to the event to be forecasted; that is, accuracy improves as new time series values become available. There is evidence both to support and to question this assumption. To examine the impact of temporal information on forecast accuracy, an experiment was conducted. The experiment found improved forecast accuracy from updating time series forecasts when new temporal information arrived if the time series was trended. However, there appeared to be no value in updating time series forecasts when the time series were relatively stable.

Money for Advice: An experimental investigation of the effects of payment options on Advisor and Judge Behavior in a judgmental forecasting task

Gunnar E. Schrah — University of Illinois at Urbana-Champaign; 603 E. Daniel St., Psychology Department; Champaign, IL 61820; USA

Reeshad S. Dalal — University of Illinois at Urbana-Champaign; USA

Janet A. Sniezek — University of Illinois at Urbana-Champaign; USA

Decision makers who must make their own forecasts often consult with an advisor who has as much if not more expertise concerning the events being forecasted. The Judge Advisor System paradigm (Sniezek & Buckley, 1995) can be used to study various aspects of the behavior of the decision maker (Judge) and Advisor as well as their relationship. In the present research, Judges could decide if and how to split any money resulting from accurate forecasts by the Judge. Two arrangements for the exchange of money for advice were used: the Judge decision about monetary allocation to the Advisor either before or after consultation between them. Results showed significant effect of the timing of the allocation decision vs. consultation on expert Advisors' confidence and Judge's utilization of their advice. Results are discussed in terms of sunk-cost effects and social influence, and implications for client-consultant relationships.

Judgemental Forecasting in the presence of asymmetric loss functions

Marcus O'Connor — School of Information Systems, Technology & Management; University of New South Wales; Sydney 2052; Australia

Michael Lawrence — University of New South Wales; Australia

Past evidence suggests that sales forecasts are often deliberately biased in a direction associated with a loss function that is appropriate for the organisation. Whilst this evidence shows us the direction of the bias, it does not allow us to investigate how appropriately people are able to adjust their forecasts for these conditions. This paper reports the results of an experiment where the direction of the loss function (positive vs negative) and the shape of the loss function (ramped vs step) were manipulated in order to understand how people react to the existence and shape of the loss function.

Forecasting with Neural Networks

Chair: **António José Rodrigues** (University of Lisbon - Portugal)

Ozone episodes forecasting by neural networks

Emil Pelikan — Institute of Computer Science; Czech Academy of Sciences; Pod vodarenskou vezi 2; 182 07 Prague; Czech Republic

Josef Keder — Czech Hydrometeorological Institute; Czech Republic

An ozone information system based on the EU ozone directive has been established in the Czech Republic. Information and recommendations for the public how to modify its behaviour are issued in cases when ozone concentration exceeds the EU information threshold $180 \mu\text{g.m}^{-3}$ at any monitoring station over the country. Such information is required to be available in near real time or some time in advance. The CHMI in collaboration with the Institute of Computer Science developed and tested forecasting methods for the maximal hourly ozone concentration of the following day based on the artificial neural networks and on the other statistical models. Three types of multilayered feedforward neural networks have been developed, separately for urban, rural and mountain measurement stations. The classification of these stations was made with the help of Kohonen maps. The prediction results will be demonstrated using the real data from the summer seasons 1994-1999. The future trends in our research in the framework of the EU project 'APPETISE – Air Pollution Episodes: Modelling Tools for Improved Smog Management' will be also discussed.

Inductive Self-Organizing GMDH Algorithms in Twice-Multilayered Neural Networks for Complex Systems Forecasting

Ivakhnenko G.A. — National Institute for Strategic Studies; Volodymirska 51/53, kv.14; Kyiv 01034; Ukraine

The paper describe twice-multilayered neural networks intended to handle the tasks of forecasting, recognition and complex systems analysis. Their salient feature is that active neurons realize twice-multilayered structure: neurons are multilayered and they are connected into multilayered structure. During learning active neurons self-organize the structure of the entire neural network and automatically define interrelations in data sample. Original approach with many successful applications - the Group Method of Data Handling is described. At present, inductive GMDH algorithms, used as active neurons, give us the way to increase the accuracy of identification and forecasting of different complex processes in the case of noised and short input samples. Example of ukrainian demographic-macroeconomy processes forecast is considered.

Bio-Inspired approaches for Time Series Forecasting

Paulo Cortez — Departamento de Informática ; Universidade do Minho ; Largo do Paço; 4709 Braga Codex ; Portugal

Miguel Rocha — Universidade do Minho; Portugal

José Neves — Universidade do Minho; Portugal

New, alternative approaches for Time Series Forecasting (TSF) emerged from the Artificial Intelligence arena, where optimization algorithms inspired on natural processes, such as Neural Networks (NNs) and Genetic and Evolutionary Algorithms (GEAs) are popular. NNs are connectionist models that mimic the central nervous system, being innate candidates for TSF due to capabilities as nonlinear learning, noise tolerance and adaptability. Indeed, comparative studies have shown that NNs perform as well as conventional TSF models or even the more complex ones such as ARIMA. On the other hand, GEAs can be used to evolve a population of trial solutions or forecasting models, based on mechanisms abstracted from natural selection. The present work reports on several TSF models inspired on both strategies where Feature Analysis will be used for Time Series decomposition (eg. trend or seasonal components), aiming at dimensionality reduction, being the results compared with other TSF methods (eg. Holt-Winters).

Time Series Forecasting by Using Neural Networks, ARIMA Methodology and Kalman Filtering

Isabel Fernández Quesada — Universidad de Oviedo; Dpto. de Admón. de Empresas y Contabilidad; E.T.S.I.I. de Gijón; Campus de Viesques, Edificio de Energía; 33204- Gijón.(Asturias); Spain

Nazario García Fernández — Universidad de Oviedo; Spain

Manuel Monterrey Meana — Universidad de Oviedo; Spain

Needless to say that, predicting the future on the basis of the past has been always very difficult no matter in which area. The aim of the present work is to investigate and to compare the behaviour of three different statistical procedures such as, Neural networks, ARIMA methodology (Box-Jenkins modelling) and Kalman filtering, as tools by means of with obtaining adequate forecasts of the temporal series under study.

Stationary and non stationary time series have been studied and after finding the respective models ARIMA, Neural Networks were applied, using the so-called Multilayer Perceptrón architecture, by means of which any continuous function can be modelled up to any accuracy level.

Regarding the Kalman filter, after identifying the transition and measurement matrix, forecasts were obtained. As a conclusion and after considering different statistical validation tests, we can asses that in many cases, Kalman Filter came out to be considerably adequate.

Evolutionary Identification of Predictive Models

Ivan Zelinka — Technical University of Brno; Faculty of Technology (Zlín); Department of Automatic Control; nám T.G.M. 275, 762 72 (Zlín); Czech Republic

In this contribution are explained two new algorithms - Self-Organizing Migrating Algorithm (SOMA) and Differential Evolution (DE), which can be classified like evolutionary algorithms. Principle of this algorithm is explained and then compared with differential evolution on various tested functions and real-world examples. This article discusses solving non-linear programming problems containing integer, discrete and continuous variables. A novel mixed integer-discrete-continuous, non-linear optimization method based on SOMA algorithm is described as well as the required handling techniques for integer, discrete and continuous variables are described. Techniques needed to handle boundary constrains as well as those needed to simultaneously deal with several non-linear and non-trivial constrains functions.

Panel Session 1

Organizer: **Leonard Tashman** (University of Vermont, USA)
Chair: **Anne B. Koehler** (Miami University, USA)

Diffusion of Forecasting Principles Via Software

Panel members:

Leonard Tashman — University of Vermont, USA

J. Scott Armstrong — Wharton School, University of Pennsylvania, USA

David Reilly — AFS, Inc., USA (Autobox)

Robert Goodrich — Business Forecast Systems, Inc., USA (Forecast Pro)

Michael Leonard — SAS Institute, Inc., USA (SAS-ETS)

Charles Smart — Smart Software, Inc., USA (SmartForecasts)

To what extent do forecasting software programs incorporate basic principles of forecasting? Tashman and Hoover, in a recently completed review of forecasting software, concluded that software represents the primary means for the transmission of principles to practitioners. In comparison with textbooks, software programs incorporate more principles, adopt the principles more quickly, and make them easier to use. Nevertheless, there are still some omissions.

Following a brief overview of the findings by Leonard Tashman, University of Vermont (paper available in full text on the website <http://hops.wharton.upenn.edu/forecast/tofc.html>), a discussion will be provided on ways to increase the rate of diffusion in software and how the principles might be more effectively used.

The discussants include J. Scott Armstrong, from the Wharton School, University of Pennsylvania, who assembled the list of principles. In addition there are representatives for the four programs that have been among the most successful in implementing forecasting principles:

Thursday, 10:40-12:20 — Room: Cristal A

Long-Memory Forecasting I

Session Organizer and Chair: **Nuno Crato** (NJIT and ISEG - Portugal)

On the influence of data gaps on long memory forecasts

Wilfredo Palma — Pontificia Universidad Catolica de Chile; Casilla 306, Santiago 22; Chile

Short and long run forecasting of irregularly observed long range dependent time series is addressed in this paper. Long memory models are used for prediction purposes in a wide variety of scientific disciplines and in many cases the data is incomplete. Thus, the study of the influence of data gaps and missing observations on the performance of such forecasts is highly relevant. The theoretical results discussed in this work are illustrated with real life examples.

Do Long-Memory Models have Long Memory?

Michael K. Andersson — National Institute of Economic Research; PO Box 3116SE-103 62; Stockholm; Sweden

This paper examines the theoretical predictability memory of fractionally integrated ARMA processes. Very long memory is found for positively fractionally integrated processes with large positive AR parameters. However, negative AR parameters absorb, to a great extent, the memory generated by a positive fractional difference. An MA parameter may also reduce the predictability memory substantially, even if the parameter alone provides hardly any memory.

We also discuss the practical predicability memory using some ARMA and ARFIMA estimation procedures. Finally an empirical example is given.

A Robust Nonparametric Test for Dominant Low-Frequency Behavior in Time Series

Felipe M. Aparicio Acosta — Dpt. de Estadística y Econometría; Universidad Carlos III de Madrid; C/Madrid, 126-128; 28903 Getafe (Madrid); Spain

Alvaro Escribano Sáez — Universidad Carlos III de Madrid; Spain

Ana Garcia Sipols — Universidad Carlos III de Madrid; Spain

Usually, any overwhelming low-frequency component in time series is attributed to the presence of unit roots in their data generating process (DGP). Such time series are said to be integrated and more generally, strongly dependent. Unit root time series tests such as Dickey-Fuller's may help us one step forward in the construction of a useful parametric time series model. However, parametric models impose severe restrictions on the DGP's which could be difficult to assess in a given sample of data. In practice, time series analysts are often faced with real-world time series having nonlinearities and, in general, much more complicated structures. For example, nonlinearities in time series exhibiting dominant low-frequency behavior are common in many fields such as econometrics, where theories sometimes postulate nonlinear relationship between different economic variables, or in communications engineering, when research often deals with the processing of signals transmitted through a distorting communication channel, many of which has long-range correlations. In these cases, it is neither uncommon nor surprising to see the unit root hypothesis being rejected by standard tests. This problem fools the analyst, since (s)he is left with no hint as to what type of DGP produced the data. Rejection of the unit root hypothesis by standard tests together with the acceptance of a wider null may provide us with some complementary knowledge about the structure in the time series. This suggests the need to propose, first, a more general definition of dominant low-frequency behavior in time series, encompassing the classical or linear definition of integration, and second, an appropriate testing framework for this wider null. In this paper, we propose a model free definition of strong serial dependence, which we refer to as Dominant Low-Frequency Behavior (DLFB) and a nonparametric device for testing this null, which we baptized as the Range Test (RT), since the test statistic is constructed from some linear functions of order statistics called the ranges. The RT has similar power performances as standard unit root tests on stationary time series, but in addition, it is robust to nonlinear monotonic transformations. In addition to a set of graphical tools for exploratory data analysis, we study the small sample performance of our testing device with the help of Monte Carlo experiments, and derive the null distribution of the test statistic.

Forecasting with Generalized Long Memory Processes

Laurent Ferrara — Université de Paris XIII, CNRS UMR 7539; RATP - Departement Commercial; LAC A73, 54 Quai de la Rapee; 75599 Paris Cedex 12; France

Dominique Guegan — Université de Reims; France

Starting from an empirical data-based approach, it turns out that many economic or financial time series present a persistent cyclical behaviour which cannot be caught by the classical long memory FARIMA process. To solve this problem, some authors (see e.g.: Gray et al. (1989)) have proposed a generalization of FARIMA processes able to take into account in modelling both long range dependence and periodic components. Despite the extensive literature on the theory concerning estimation methods, few investigations on these generalized long memory processes were carried out from the forecasting point of view. We focus our attention on forecasting with the k-factor GARMA process and we give the analytic expression of the prediction function and its mean squared error. We provide applications to financial and economic time series, which point out the efficiency of generalized long memory processes, by improving forecasting ability in comparison with other short and long memory processes.

Quality Control Charts and Persistent Processes

Nuno Crato — ISEG; R. do Quelhas 6; 1200 Lisbon; Portugal

Radhika Ramjee — Stevens Institute of Technology; USA

Bonnie K. Ray — New Jersey Institute of Technology; USA

Quality control chart interpretation is often based on the assumption that the observed data are uncorrelated. The presence of autocorrelation in process data has adverse effects on the performance of control charts. The objective of this paper is to assess the behavior of control charts on data having correlation that is persistent over very long horizons, i.e., is long-range dependent. We find that the Shewhart and EWMA charts do not perform well at detecting process shifts in long-range dependent data. We then introduce a new type of control chart, the Hyperbolic Weighted Moving Average (HWMA) chart, designed specifically for long-range dependent data. The HWMA chart works better than the standard charts at detecting changes in the level of a long-memory process, and also provides competitive performance for process data having standard short-range dependence.

Nonparametric Methods

Chair: **Estela Bee Dagum** (University of Bologna - Italy)

A nonparametric approach for analyzing international cyclical comovements

Jose Ramon Cancelo — Dpto. Economía Aplicada II; Facultad C. Economicas; Campus de La Zapateira; 15071 La Coruña; Spain

Pilar Uriz — Universidade da Coruña; Spain

We investigate the degree of cyclical comovements in sixteen countries based on industrial production. In each country we isolate the cyclical component with a band-pass filter, and build a binary expansion / recession indicator by applying a simplified version of the Bry Boschan procedure to remove spurious cycles. We assume that each indicator is a Markov process and discuss how the standard testing procedure to determine its order changes to accommodate the constraints imbedded in the Bry Boschan method. Nonparametric techniques are used to characterize contemporaneous and dynamic comovements between pairs of countries: we test for independence, compute binary measures of association, discuss a causality test for binary variables and allow for asymmetric behavior by considering expansions and recessions separately.

Nonparametric Multi-step Ahead Prediction in Time Series Analysis

Lijian Yang — Department of Statistics and Probability; Michigan State University; East Lansing, MI 48824; USA

Rong Chen — The University Illinois at Chicago; USA

Christian Hafner — Electrabel, R&D Energy Markets; Belgium

We consider the problem of multi-step ahead prediction in time series analysis using nonparametric smoothing techniques. Forecasting is always one of the main objectives in time series analysis. Recent research has shown that nonlinear time series models have certain advantages in multi-step ahead forecasting. Traditionally, nonparametric k-step ahead least squares prediction for nonlinear AR(d) models is done via nonparametric smoothing of the k-step ahead observation directly on the predictor observations. In this paper we propose a multi-stage nonparametric predictor. We show that the new predictor has smaller asymptotic mean squared error than the direct smoother, though the convergence rate is the same. Hence, the proposed predictor is more efficient. Some simulation results, advice for practical bandwidth selection and a real data example are provided.

A Relative Forecasting Assessment by Parametric and Nonparametric Methods: An Application with Canadian Monthly Interest Rates

Burak Saltoglu — Department of Economics; Marmara University; Kuyubasi, Kadiköy, 81040; Istanbul; Turkey

The primary objective of this paper is to compare the forecasting ability of some recent parametric and nonparametric estimation methods by using monthly Canadian interest rate data between 1964-1999 (with 420 observations). The long and short interest rate series are used to estimate the continuous time estimation technique developed by Bergstrom (1990), the multivariate Simultaneous equations GARCH model developed by Engle and Kroner (1995), and two nonparametric estimation methods namely, Nonparametric Kernel Smoothing, and Artificial Neural Networks. A VAR(1) system is used to constitute a benchmark. Forecasts generated from these techniques are assessed by using the forecast evaluation methods summarised by Fair (1986) and a recent technique developed by Diebold and Mariano (1995). The empirical findings of this study have shown that even though the forecasting performance of Artificial Neural Networks and the Continuous Time methods developed by Bergstrom are marginally better than that of benchmark model, a sure winner could not be found.

Testing the Forecasting Ability of Parametric and Non-Parametric Models

Theodore Panagiotidis — University of Sheffield; Department of Economics; 9 Mappin Str; Sheffield S1 4DT; UK

This paper investigates whether the exchange rates of three countries that belong to the EU but not participate in EURO are characterised by nonlinearities, namely the currencies of Denmark, Greece, Sweden against the dollar and the DM. Denmark and Greece participate in the ERM II whereas Sweden does not. We model the behaviour of these series using two parametric models (ARMA and GARCH-M (1,1)) and one nonparametric (nearest neighbours regression). The out-of-sample performances of the two parametric models and the nonparametric were compared using the statistics developed by Diebold & Mariano (1995) for comparing predictive accuracy and Mizraeh (1995) for evaluating improvement in forecast performance.

A Comparison of the Predictive Performance of Linear and NonLinear Smoothers for time series

Estela Bee Dagum — Faculty of Statistical Sciences; University of Bologna; Via delle Belle Arti 41; (40126) Bologna; Italy

Alessandra Luati — University of Bologna; Italy

Smoothers are often applied to reduce noise in time series data in order to increase forecasting accuracy.

The purpose of this study is to evaluate the predictive performance of several linear and nonlinear smoothers when applied to series contaminated with different levels of noise.

We have chosen three typical series characterized by, respectively, a low, medium and high signal to noise ratio and applied : (a) LOESS (a locally weighted regression smoother), (b) Cubic Smoothing Spline functions,(c) Kernel-type smoothers (d) Supersmothers and, (e) a nonlinear modified 13-term Henderson filter. We evaluate their predictive performances calculating the RMSQ and MAD of the one-step ahead forecasting error.

Tourism

Chair: **António Costa** (Technical University of Lisbon - Portugal)

Forecasting Tourism to Japan: A comparison of Neural Networks and Time Series Models

Hubert P. Fernando — Victoria University of Technology; PO Box 14428; Melbourne City MC; Victoria 8000; Australia

Lindsay W. Turner — Victoria University of Technology; Australia

L. Reznik — Victoria University of Technology; Australia

This paper compares neural networks and time series models in forecasting tourist arrivals to Japan from the USA, UK and Australia. Univariate forecasts are made using both neural networks and time series models for total tourism to Japan from these countries and for the two disaggregated categories of tourist and business travel. Multivariate forecasts are made using the same data, combined with national indicators of the tourist's country of origin. The national indicators used are income, imports and exports.

Modelling and Forecasting Inbound International Tourism Demand to Portugal

Ana Cristina Marques Daniel — Instituto Politécnico da Guarda; Escola Superior de Tecnologia e Gestão; 6300 Guarda; Portugal

Francisco F. R. Ramos — Faculdade de Economia do Porto; Portugal

In this paper the Johansen cointegration analysis of time series is used to model and forecast the Portuguese inbound international tourism demand from five origin countries - France, Germany, Netherlands, Spain and United Kingdom. This approach examines the long-run relationships between the demand for holiday visits and the variables that affect holiday travel such as income, destination prices, travel costs (airfares and road costs) and prices of substitutes. Demand functions, for each origin country, are estimated using annual data on tourist flows from 1975 to 1997. The forecasting performance of the error correction models (ECM) are compared with a class of univariate time series models, which are used as benchmarks. In terms of forecasting accuracy the ECM's are very disappointing when compared to the benchmarks.

New approach in Forecasting International Visitor arrivals

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Quarterly visitor arrival time-series show a marked seasonal pattern. Due to increase in international tourism, seasonal variation in international arrival time-series also exhibits increasing (linear or non-linear) seasonal variation. Previous studies Osborn(1990), Bowerman, Koehler and pack(1990), Kulendran and King(1997) and Frances and Koehler(1998) indicated that seasonality requires careful handling in order to improve forecast accuracy. To improve the accuracy of tourism forecasts, this paper explores the available modelling options for modelling increasing seasonal variation in international visitor arrivals.

Trend, cycle, and seasonality in forecasting monthly international tourist flows

Jae H. Kim — School of Business; La Trobe University; Bundoora 3083; Australia

Imad Mooda — La Trobe University; Australia

International tourist flows time series exhibit strong trend and seasonality. Sound understanding of their statistical properties should be essential in building reliable forecasting models. This paper applies seasonal unit roots tests (HEGY and Caner tests) and Harvey's structural time series models to monthly international tourist arrivals to Australia. The primary objective is to examine statistical properties of trend, cycle and seasonality present in the data. Regression-based time series forecasting models and seasonal ARIMA models are constructed for international tourist arrivals, based on inferential outcomes of seasonal unit roots testing. Forecasting performances of these models are compared to that of Harvey's structural models.

Forecasting Turning Points in International Visitor Arrivals to Balearic Islands

Jaume Rossello — Edifici Mateu Orfila. Campus Universitari. Cra. Valldemossa. Km 7.5; 07071 Palma Mallorca; Balears; Spain

The aim of this paper is to forecast turning points in international visitor arrivals to Balearic Islands using leading indicator approach. This paper intended to prepare two indices, one for the UK and another for Germany using macro economic variables. The UK and Germany are the major tourist markets for Balearic Island and represent more than 80% of international visitor arrivals. Previous studies used econometric models and time-series models to forecast number of international visitor arrivals; however, there is uncertainty in the forecast of number of international visitor arrivals.

Keynote speech 2

Chair: Pedro de Lima (Johns Hopkins University, USA)

Macroeconomic Forecasting Using Many Predictors

Mark W. Watson

Princeton University, USA

Abstract: Macroeconomic forecasters can now access hundreds of potentially useful predictors each month. This raises the practical question of how information in these predictors should be efficiently used. Since standard statistical methods rely on a large number of time series observations relative to the number of predictors, these methods perform poorly when the number of predictors is large. This talk will discuss methods for forecasting when the number of predictors is of the same order or of larger order than the number of time series observations. Specifically, consider forecasting a single variable of interest (GDP, price inflation, interest rates, etc.) using k different predictors with a sample of size T , and suppose that $k=O(T^p)$, where $p \geq 1$. I consider two forecasting procedures. The first is motivated by an approximate factor model, in which the useful information in the predictors can be extracted by factor analytic methods. The second is motivated by Bayesian shrinkage or forecasting combining methods. Here the large number of predictors suggests that empirical Bayes methods are well suited for the problem. Theoretical results for these procedures will be outlined, and several pseudo-out-of-sample forecasting comparisons will be presented using U.S. and European macroeconomic data.

(Talk based on several research projects carried out jointly with Thomas Knox, Massimiliano Marcellino and James Stock.)

Mark W. Watson is a professor of economics and public affairs at Princeton University. He is a research associate at the National Bureau of Economic Research and a fellow of the Econometric Society. His work has been funded by the National Bureau of Economic Research and the National Science Foundation. His teaching credentials include posts at Northwestern University, the University of Chicago, and Harvard University. He holds a Ph.D. in Economics from the University of California, San Diego.

Short Term Forecasting in Electricity

Session Organizer and Chair: **L. M. de Menezes** (University of London - UK)

Using Weather Ensemble Forecasts to Switch Between Alternative Forecasts of Electricity Demand

James W. Taylor — Saïd Business School; University of Oxford; George Street; Oxford OX1 2BE; UK

Roberto Buizza — European Centre for Medium-range Weather Forecasts; UK

Weather forecasts are an important input to many short-term multivariate electricity demand forecasting models. Indeed, the accuracy of the weather forecasts has a strong influence on the accuracy of the demand forecasts. In view of this, there would seem to be some potential for switching between a multivariate and a univariate forecast of demand according to the uncertainty in the weather forecasts. Weather ensemble forecasts convey the degree of uncertainty in predictions of weather variables. Each ensemble consists of fifty-one different scenarios for the future value of a weather variable. In this paper, we consider the use of smooth transition combining models to enable a smooth form of switching between alternative demand forecasts. We use summary measures of weather ensemble forecasts as transition variables to govern the switching. We examine the usefulness of the approach for a range of different forecast lead times.

Evaluating the Effectiveness of Augmenting Linear Short-Term Electric Load Forecasting Models with Neural Networks

Henrique Steinherz Hippert — DEE-PUC, Rio; Brazil and Goldsmiths College, University of London; New Cross; London SE14 6NW; UK

Derek Bunn — London Business School; UK

Reinaldo Castro Souza — DEE, PUC RIO; Brazil

Forecasting of electricity demand has always been a valuable aspect of power system planning but, with the rise of competitive markets, improving accuracy has become even more important to help existing utilities and new players manage their business risks. Causal models that decompose the load are particularly attractive, since some physical interpretation may be attached to the model components, making it easier for system operators to understand their behaviour, and for traders to understand the drivers of volatility. Usually, there is a 'basic' component that reflects the normal behaviour of the load series, and a 'weather-dependent' component (usually modelled by regression), that models the effect on the load of unusual weather circumstances. In this paper, we propose using smoothing methods to model the 'basic' component of the load, and then we evaluate the effectiveness of neural networks, within the class of non-linear regression techniques, to model the 'weather dependent' component.

On Addressing Irregularities in Electricity Load Time-Series

L. M. de Menezes — Dept. of Mathematical & Computing Sciences; Goldsmiths College, University of London; New Cross; London SE14 6NW; UK

Hélio Francisco da Silva — PUC-RJ, Brazil and University of London; UK

As a result of the continuing privatization process within the energy sector, electricity load forecasting is a critical tool for decision-making in the Industry. Reliable forecasts are now needed not only for developing strategies for business planning and short term operational scheduling, but also to define the spot market electricity price. The forecasting process is data-intensive and interest has been driven to shorter and shorter intervals. Large investments are being made in modernizing and improving metering systems, so as to make more data available to the forecaster. However, the forecaster is still faced with irregular time-series.

Gaps, missing values, spurious information or repeated values in the time-series can result from transmission errors or small failures in the recording process. These so-called irregularities have led to research that focused on either iterative processes, like the Kalman filter and the E-M algorithm, or applications of the statistical literature on treatment of missing values and outliers. Nevertheless, these methods often result in large forecast errors when confronted with consecutive failures in the data. In this context, we propose an alternative to detect and replace values so as to improve the forecasting process and make use of other information in the time-series that relate to the variability and seasonality, which are commonly encountered in electricity load-forecasting data. We illustrate the method and address the problem as part of a wider project that aims at the development of an automatic system for short term load forecasting. The data were collected by ONS / ELETROBRAS – Brazil. We concentrate on 10 minutes data for the years 1997-1999 of Light Servicos de Eletricidade S.A. (Rio de Janeiro and its surroundings).

New Algorithms and Software for the Estimation of Econometric Models

Session Organizer and Chair: **Antonio García-Ferrer** (Universidad Autónoma de Madrid - Spain)

Computer Automation of General-to-Specific Model Selection Procedures

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David F Hendry — Nuffield College; UK

Over the last three decades, the LSE methodology (see Hendry, 1993, for an overview) has emerged as a leading approach for pursuing econometrics. One of its main tenets is the concept of general-to-specific modelling: Starting from a general dynamic statistical model, which captures the essential characteristics of the underlying data set, standard testing procedures are used to reduce its complexity by eliminating statistically insignificant variables, and to check the validity of the reductions in order to ensure the congruency of the model. As the reduction process is inherently iterative, many reduction paths can be considered, which may lead to different terminal specifications. Encompassing is then used to test between these, usually non-nested, specifications, and only models which survive the encompassing step are kept for further consideration. If more than one model survives the 'testimation' process, it becomes the new general model, and the specification process is re-applied to it. This paper proposes a computer automation of the general-to-specific model selection process which we call PcGets (GEneral-To-Specific). Written in Ox (see Doornik, 1998), it is a package designed for general-to-specific modelling of economic processes. In Monte Carlo experiments, the general-to-specific approach of PcGets recovers the specification of the DGP with a remarkable accuracy. The empirical size and power of the specification found by PcGets are investigated and found to be as one would expect if the DGP were known.

A MATLAB Toolbox for reliable time series modeling and forecasting in State-Space

Jaime Terceiro — Departamento de Fundamentos del Análisis Económico II; Universidad Complutense de Madrid; Campus de Somosaguas; 28223 Madrid; Spain

José Manuel Casals — Universidad Complutense de Madrid; Spain

Miguel Jerez — Universidad Complutense de Madrid; Spain

Gregorio R. Serrano — Universidad Complutense de Madrid; Spain

Sonia Sotoca — Universidad Complutense de Madrid; Spain

Software reliability is a wide issue, depending not only on the use of stable implementations of well-reputed algorithms, but also on software design aspects. This philosophy is implemented in E4, a MATLAB 4.x/5.x Toolbox which uses state-space methods to achieve both, flexibility and reliability. The Toolbox supports many standard formulations such as VARMAX, econometric models in structural form, transfer functions or general linear state space models. These models are estimated by exact maximum-likelihood, under standard conditions, or in an extended framework that allows for measurement errors, missing data, vector GARCH errors and constraints on the parameters. Ready-to-use functions are provided for model specification, preliminary estimation by subspace methods, analytic computation of the likelihood gradient and information matrix, simulation, forecasting and signal extraction. The core algorithms in E4 have been optimized for stability and numerical accuracy. In this aspect, the use of a computational platform such as MATLAB guarantees computational accuracy, portability and consistency between different platforms such as Windows 9x/NT, Macintosh and UNIX.

A new algorithm for identification, estimation and forecasting unobserved component models with time varying parameters

Marcos Bujosa-Brun — Departamento de Análisis Económico; Economía Cuantitativa; Universidad Autónoma de Madrid; Madrid; Spain

Antonio García-Ferrer — Universidad Autónoma de Madrid; Spain

Recently, Young et al. (1999) have proposed a complete algorithm for Dynamic Harmonic Regression (DHR) models of the Unobserved Components (UC) type based on a novel optimization method in the frequency domain. In this paper, we present an alternative algorithm for estimating the Noise Variance Ratios (NVR) hiperparameters that has some advantages: (1) linearity, (2) one stage estimation, (3) faster computing, (4) avoidance of some numerical problems. Empirical applications comparing both alternatives within Matlab (or Octave) are provided.

Judgemental Forecasting II

Chair: **Nigel Harvey** (University College London - UK)

Debiasing Forecasts: How Useful is the 'Unbiasedness' Test?

Paul Goodwin — Faculty of Computer Studies and Mathematics; University of the West of England; Frenchay; Bristol, BS16 1QY; UK

A number of studies have demonstrated the benefits of using the information on past errors to correct judgmental forecasts for possible systematic biases. Optimal linear correction, which involves regressing outcomes on to forecasts, has been found to be particularly effective. In order to assess whether a particular set of forecasts should be debiased, the 'unbiasedness' test, which is based on the F-distribution, can be applied to the parameters of the regression model. However, recent evidence suggests that this test has little value in predicting whether debiasing will improve judgmental forecasts in out-of-sample periods. This paper reports the results of a Monte-Carlo simulation experiment that was designed to investigate the accuracy of the guidance provided by test under different conditions, and to compare the effectiveness of the test with alternatives.

Problem representation and variation in the forecasts of 'political experts'

H.E. Purkitt — Dept. of Political Science; US Naval Academy; Annapolis, MD 21402; USA

Forecasts often involve judgements about "ill-structured" problems that lack a single optimal solution or agreement about boundary conditions. The paper reviews past research on how individual forecasters construct an initial representation of ill-structured problems and presents a method for summarizing the problem representation of individuals and groups of political forecasters. Examples of the method, based on the construction of free-hand causal diagrams, of novice and expert political forecasters are presented to illustrate how free-hand causal modeling can be used to understand the reasoning processes and performance accuracy of political experts from different backgrounds and experiences when forecasting about political problems.

Using judgment to make forecasts from time series affected by special events

Nigel Harvey — Department of Psychology,; University College London; Gower Street; London WC1E 6BT; UK

Fiona South — University College London; UK

Douglas West — Henley Management College; UK

Time series may be perturbed sporadically by exogenous influences. For example, sales of a consumer product may be affected by occasional promotional campaigns. Judgmental forecasters must take such factors into account. Goodwin and Fildes have suggested that they do so by adopting a pattern-matching strategy: forecasters search for the previous promotion expenditure that is most similar to the one for the forecast period and use the actual sales information for that period as a basis for their forecast. If this is what they do, the effects of a failure to find an exact match should depend on the shape of the function relating size of the promotion to the size of its effects. In our experiments, we varied both this function and the trend in the series. The pattern of errors in people's forecasts could be explained reasonably well by an elaborated version of the Goodwin and Fildes' model.

Neural Networks

Session Organizer and Chair: **Chris Chatfield** (University of Bath - UK)

Time Series Forecasting with Neural Networks

Chris Chatfield — Dept. of Mathematical Sciences; University of Bath; Bath BA2 7AY; UK

Neural networks (NNs) are increasingly applied to time-series forecasting, but with mixed results. Two case studies will be described (joint work with Julian Faraway, University of Michigan). Various NN models were tried and the resulting forecasts compared with those from seasonal ARIMA models and other methods. We found that NN modelling can easily go badly wrong and so it is unwise to fit NN models blindly in 'black-box' mode. The BIC or bias-corrected AIC should be used for comparing different NN models. NN forecasts were found to have rather disappointing accuracy in our examples. Moreover the out-of-sample forecast accuracy was much worse than within-sample fit as often happens in forecasting because of model uncertainty. Methods of examining the response surface implied by a NN model will be presented. More generally, a literature review of other NN forecasting results will be given, which suggest NNs seem best suited for forecasting long non-seasonal series.

A Statistical Model-Building Approach to Neural Networks

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This study presents a new nonlinear univariate forecasting technique that also provides a description of the data generating process. This new method incorporates the attractive features of neural networks, but has a statistical basis for model selection and interpretation. We assess predictability and forecasting accuracy using the Nelson-Plosser macroeconomic series.

Pattern-driven identification of radial basis function networks for nonstationary time series forecasting

António J. Rodrigues — Faculdade de Ciências; Universidade de Lisboa; Edifício C2; Campo Grande, 1749-016 Lisboa; Portugal

Radial basis function networks can be used as predictive models, both in nonlinear autoregressive and causal set-ups. Their identification can be heuristically based on the distributional properties of the training patterns; then, as models linear in the parameters, they allow a very efficient and robust estimation. In this paper, we propose a methodology for the design of Gaussian RBF models that heavily relies on the preprocessing of the training patterns through appropriate shape invariant transformations. The procedure induces stationarity in the sequence of patterns, exposes any outliers or structural changes, and ultimately enables a straightforward model design. We illustrate the application of the methodology with time series of very different characteristics, and produce some empirical results that reveal its merits when compared with alternative approaches.

Finance I

Chair: **Alberto Suárez** (RiskLab Madrid and Universidad Autónoma de Madrid - Spain)

Outliers and predictability in monthly Finnish stock market returns

Jussi Tolvi — Department of Economics; FIN-20014 University of Turku; Finland

The statistical properties and predictability of a monthly Finnish stock market index are considered, with special emphasis on possible outliers in the data. It is assumed that if true outliers are taken into account with an intervention model, the forecasts should become better compared to a model where all potential outliers are ignored. The series are modelled with a linear autoregressive model with GARCH errors. The results of the modelling change noticeably when detected outliers are taken into account in the analysis. Unexpectedly, however, the forecasting performance is not always improved by this. In some cases the outlier intervention model provides better forecasts than the model without outlier corrections, whereas in other cases the opposite takes place.

Using Simulated Currency Rainbow Options to Evaluate Covariance Matrix Forecasts

Hans NE Byström — Department of Economics; Lund University; P.O. Box 7082; S-220 07 Lund; Sweden

When choosing evaluation measures for variance and covariance forecasts one has to consider what the actual purpose of these forecasts is. In this paper we extend the results by Gibson and Boyer (1998) by looking at portfolios of rainbow currency options and how simulated trading of such options portfolios can be used as a preference free evaluation measure for the forecasted covariance matrix. The advantage of using portfolios instead of single options is the possibility it gives of relying on shorter return series. We apply the methodology to a system of four U.S. dollar exchange rates and compare the relative performance of different forecasting models. In doing this, we also apply and evaluate the fairly new Orthogonal GARCH technique to exchange rates, both with the option evaluation technique and with standard statistical measures.

Mixtures of autoregressive models for the analysis of financial time-series

Alberto Suárez — Computer Science Department - ETS de Informática; Universidad Autónoma de Madrid; Ctra. de Colmenar Viejo, Km. 15; E-28049 Madrid; Spain

The heteroscedastic structure of financial time series is analyzed by means of a novel class of non-linear models that involve probabilistic mixtures of autoregressive processes. In particular, the specification and implementation of MIXARCH and MIXGARCH processes is presented. The MIXARCH (MIXGARCH) model assumes that the time series is generated by one of a set of alternative ARCH (GARCH) models with a probability that depends on the recent history. The ultimate goal of the present investigation is to provide an adequate framework for the estimation of conditional risk measures, which can account for both the non-linearities in the heteroscedastic structure of financial time series and for the extreme events. These mixture models are sufficiently flexible to provide an adequate description for the extreme fluctuations occurring at the tails of the distribution, and whose likelihood is severely underestimated by the usual autoregressive models, which generally assume normal innovations.

Macroeconomics I

Chair: **Herman Stekler** (George Washington University - USA)

Are Hodrick-Prescott 'Forecasts' Rational?

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J.Z. Easaw — Middlesex University Business School; UK

S.M. Heravi — University of Wales; UK

D.J. Smyth — Middlesex University Business School; UK

We examine the proposal that inflationary expectations might be proxied using the Hodrick-Prescott (HP) filter - specifically that the HP filter might stand as an ex post proxy for corresponding ex ante rational expectations. We apply a battery of rationality tests to a long time series of filtered US inflation data. Our conclusion is that while the HP series are not fully rational in the sense of Muth (1981), they do meet the criterion of 'weak rationality' recently proposed by Grant and Thomas (1999). They are also rational predictors of direction for, following Merton (1981) agents, would not change their prior in the opposite direction to these 'forecasts'. These results are robust with respect to different values of the filter's smoothing parameter. Further, the accuracy of the HP series is comparable to that of authentic ex ante forecasts. The HP filter might therefore be of qualified use to model-builders requiring a time series of rational expectations for a period when no contemporaneous ex ante forecasts are extant.

Why can't we improve the Accuracy of Macroeconomic forecasts

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Robert Fildes — Lancaster University; UK

Macroeconomic forecasts are used extensively in industry and government. In earlier presentations, the historical accuracy of US and UK forecasts have been examined in comparison to their time series alternatives and the rationality of such forecasts. The conclusion drawn is that researchers have given too little attention to the issue of improving the forecasting accuracy record. In this discussion we pin-point areas where improvements might best be sought and consider the question of whether the search for 'accuracy' is a chimera and our attention would be better focused elsewhere.

The Value and Rationality of Economic Forecasts

Herman O. Stekler — Department of Economics ; George Washington University; Washington DC 20052; USA

G. Petrei — George Washington University; USA

There are several tests for determining whether economic forecasts are valuable to the users of these predictions. They are related to the test that Merton developed in evaluating the market timing ability of mutual fund managers. When these statistics are applied to economic forecasts they test whether the forecasts are superior to a no-change naive model in predicting the observed changes in an economic variable. Cumby and Modest suggested a different procedure for evaluating the value of investment forecasts. This test has not yet been applied to economic forecasts to determine whether the users would find them valuable. Moreover, this test is closely related to the procedures that are used to test whether economic forecasts are rational. This paper examines these statistical procedures and applies them to two different data sets.

Non- and Semiparametric Time Series Modelling and Forecasting

Session Organizer and Chair: **Jan Beran** (University of Konstanz - Germany)

Different aspects of Quantile estimation for transformations of Gaussian processes

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We consider stochastic processes Y , that are time dependent transformations of a stationary Gaussian process Z with long-range dependence. Ghosh, Beran and Innes (1997) obtained time dependent quantiles for such processes via kernel smoothing. It turns out that the optimal bandwidth for this estimation problem depends on the long memory parameter in the spectral density of the Gaussian process Z and the Hermite rank of an appropriately defined indicator function based on the observed time series. This paper addresses the data driven optimal bandwidth selection issue for this case. The general problem of forecasting is also looked into. Various algorithmic aspects are discussed. Simulations illustrate the results.

Nonparametric Quantile Smoothing and Autoregression of Financial Time Series

Klaus Abberger — FB Wirtschaftswissenschaften; University of Konstanz; 78457 Konstanz; Germany

Nonparametric approaches for conditional quantile estimation in time series are discussed. Therefore various nonparametric quantile regression estimators are presented. If the regressor is time index, then we arrive at quantile smoothing. If the regressor is composed of some past time series values, then the approach leads to quantile autoregression. Both aspects are applied to daily series of German stock returns. Application of quantile smoothing to stock return series reveals a pronounced asymmetric behaviour of upper and lower quantiles in course of time. Quantile autoregression leads to forecasts of conditional quantiles. A measure of goodness of fit for these quantile forecasts is being proposed and applications to stock market data show that past values contain some information about the tails of the conditional distribution, whereas in the central part the gain of taking past values into account is very close to zero.

Predicting increase or decrease for long-memory time series

Jan Beran — Department of Mathematics and Statistics; University of Konstanz; 78457 Konstanz; Germany

Dirk Ocker — The Swiss Union of Raiffeisen Banks; Switzerland

In practice, it is often of interest to have an approximate indication about the probability that there will be an increase (or decrease respectively) in the observed series over the next few hours, days or weeks. The Hurst parameter is often presented as an indicator of how long a time series may remain at the same or a higher level. In this paper, we investigate in how far this notion is correct. Also, methods are considered for estimating the probability of an increase over a certain future period. The role of the long-memory parameter in this context is elucidated.

Case Studies I

Chair: **António Costa** (Technical University of Lisbon - Portugal)

Modeling Climatic Time Series in Castilla-León (Spain): an application to climate prediction

Solange Mendonça — University of Trás-os-Montes e Alto Douro; Apartado 202; 5000 Vila Real; Portugal

Fernando de Pablo — University of Salamanca; Spain

Clemente Tomás — University of Salamanca; Spain

Autoregressive, integrated and moving averages (ARIMA) techniques as applied to temporal evaluations were used to analyze the time series of climatic variables at nine weather stations in the region of Castilla-León (Spain).

A previous analysis in order to evaluate the quality of the climatic data was made. A number of different techniques were used for this purpose. The network stability was also testified.

After brief discussion, the modelling method proposed by Box-Jenkins was used to study three climatic variables; namely, air temperature, relative humidity and monthly rainfall for the period between 1960 and 1989.

The results obtained show that the models used for the prediction of temperature and rainfall are mainly seasonal, with moving averages of the order of 1 [SMA(1)], while relative humidity can be explained in terms of a multiplicative model with one regular component and another first-order seasonal component [M.A.(1)xSMA(1)]. The models obtained were used to predict all three variables. Concordance with the real values measured was observed.

Forecasting Error Impact on Hospital Staffing Decision Making

Murray J. Côté — Department of Health Care Administration; Trinity University; 715 Stadium Drive; University San Antonio, TX 78212-7200; USA

Benito E. Flores — College of Business, Texas A&M; USA

One of the challenges in daily hospital operations is determining appropriate staffing for the given census. Census data exhibits a double periodicity in that the time series has a double (and different) seasonal pattern throughout the day and throughout the week. Building on the work of Lapierre et al. (1999), a forecasting model will be fitted to: 1) predict hourly census for a hospital care unit, 2) examine the extent of forecast bias and its practical implication on staffing, and 3) consider the cost of forecast errors in terms of staffing cost. Data is being collected to test the various models and cost data.

Forecasting the Construction Sector in Spain

Jose Parreno Fernandez — Universidad de Oviedo; ETSIIG. Campus De Viesques; 33204 Gijon; Spain

Alberto Gomez Gomez — Universidad de Oviedo; Spain

Javier Puente Garcia — Universidad de Oviedo; Spain

In this job, an approach to Box-Jenkins forecasting methodology and ARIMA models is made. For this job, we focused on the univariate and transfer function analysis. As an application, the construction sector in Spain is analyzed through the following time series: 1. Cement consumption, 2. Public bidding, and 3. Construction investment. First of all, a univariate model is achieved for every time series. In second place, data series are studied and compared by pairs in order to determining which series are caused by others, so that a transfer function model can be obtained. This transfer function model is expected to improve the forecasting skills of the univariate ones.

Electricity

Chair: **Reinaldo Souza** (Pontificia Universidade Catolica do Rio de Janeiro - Brazil)

Some remarks on the Radial Basis Function Network Approach to Short-Term Electrical Load Forecasting Problems

Zbigniew Gontar — University of Lodz; Rewolucji 1905r. Str, 39; 90-214 Lodz; Poland

We study the application of radial basis function networks to the Short-Term Load Forecasting (STLF) problems. In the paper, we present the results of developing the neural network based forecasting system for the short-term energy transaction planning for the one of the polish power distribution companies.

Developing of local energy markets in Poland, and introduction of the pool of the energy in the near future require support by the Short-Term Load Forecasting (STLF) systems in managing of the local market, energy transaction planning, and short-term Demand Side Management (DSM) activities. Point of particular interest is two-day ahead prognosis of energy demand. We have shown the modelling framework of application RBF in this STLF problems.

Short-Term Forecasting of the Electricity Market of Spain Using Neural Networks

Raúl Pino Diez — Dpto. Admon. de Empresas; Universidad de Oviedo; ETSII e II de Gijón; Campus de Viesques; 33204 GIJÓN - Asturias; Spain

David de la Fuente García — Universidad de Oviedo; Spain

Paolo Priore Moreno — Universidad de Oviedo; Spain

When short-term forecasting for large and strongly seasonal series are required (like a time series composed of hourly data through several years), one of the main problems concerning the use of neural networks is the required time for training the net. This is due to the size of the net (it can be large and containing a great amount of weights that have to be calculated), and to the size of the set of training patterns (could be tens of thousands patterns). In this job, a 'selective and continuous' training method is proposed. With this method, using an ART neural network, a selection of the most adequate patterns can be made in order to the later training of a Multilayer Perceptron, with forecasting aims. By using this method, a forecasted value for a given hour can be obtained in just a few minutes.

Composite Modeling for Medium-Term Hourly Load Forecasting

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Lúcio de Medeiros — Catholic University of Rio de Janeiro; Brazil

Francisco A. Pereira — Catholic University of Rio de Janeiro; Brazil

Reinaldo Castro Souza — Catholic University of Rio de Janeiro; Brazil

In a competitive market, the medium-term hourly load forecasting (several months to several years ahead) are used to provide information for strategic decisions on Load Management, Purchase and Sales Analysis and System Planning. It is the purpose of this paper to present an implementation of a model based upon a well-known decomposition method which consists in splitting the hourly load into coefficients, such as annual total load; weekly load consumption growth rates; daily and hourly weighting coefficients.

The model takes into account four types of days: Saturdays, Sundays, Mondays and weekdays. The influence of the weather on the load has not been considered here because the historical temperature hourly data were not available. Each model component has been treated by a specific type of algorithms. We use, for instance, Curve Estimation Models (Logistic); Exponention Smoothing; ARMA Models and Filtering Forecasts by Hanning Window.

Finally, to evaluate the performance of model a case study has been developed with load data from 1970 to 1999 of Light, one of the most important Brazilian Utility. The MAPE statistics (Mean Absolute Percentage Error) was calculated for the years of 1998 and 1999, resulting in the following values: 5,66% (in MWh) and 2,70% (in p.u. – per unit) for 1998 and 4,10% (MWh) e 2,17% (p.u.) for 1999.

A Neural Fuzzy Model to Forecast Very Short Term Load Series

Guilherme M. Rizzo — Catholic University of Rio de Janeiro (PUC-Rio); Rua Marquês de São Vicente 225; 22453-900; Rio de Janeiro – RJ; Brazil

Carlos E. Pedreira — Catholic University of Rio de Janeiro; Brazil

Reinaldo Castro Souza — Catholic University of Rio de Janeiro; Brazil

Plutarcho M. Lourenço — CEPEL / Eletrobrás; Brazil

Victor N. A. L. da Silva — CEPEL / Eletrobrás; Brazil

Guilherme Ferreira Ribeiro — CEPEL / Eletrobrás; Brazil

As a result of the recent privatisation process in the Brazilian Electrical System, the Utilities are now operating in a competitive environment. This new situation requires accurate forecasts of the load series in order to achieve good energy market operation.

The goal of this work is to combine a neural network based model and a fuzzy set based model to forecast the load series, discretized in half-hour intervals, corresponding to the period from 1997 to 1999 for Light, Rio de Janeiro, Brazil. The data were collected, in one minute intervals, by ONS / Eletrobrás, Brazil, and aggregated later to generate the half-hourly series.

The forecasts are produced daily (at 9 a.m. every day) for a lead time of 15 days, even though they are optimal only for the first 48 half-hours. The series is updated at midnight of the previous day.

Regime Switching

Chair: **David Dowey** (Universite d'Aix-Marseille II - France)

Dynamic Factor Models with Regime Switching in International GNP's

J.L. Cendejas — Dept. de Análisis Económico; Universidad Autónoma de Madrid; 28049 Madrid; Spain

J. del Hoyo — Universidad Autónoma de Madrid; Spain

J. Guillermo Llorente — Universidad Autónoma de Madrid; Spain

This paper studies the comovements and dynamic relations among GNP's for six economies (USA, UK, Germany, France, Italy, and Spain). The forecasting performance of the dynamic relations are also studied. The methodology used is a combination of the dynamic factor model (Stock and Watson, 1991), and the regime switching model (Hamilton, 1989). The common cyclical components for the six economies are calculated, and the recessions and expansions are dated using their calculated probabilities. We find two common cyclical factors, one for the USA and UK economies, and another one for Germany, France, Italy, and Spain. Based on these common factors we built dynamic models to study their influence on the Spanish domestic GNP. The forecasting performance of these models is compared with other alternative methodologies (UCM, ARIMA-type models, and VAR models).

Improving market-based forecasts of short-term interest rates: Time-varying stationarity and the predictive content of switching regime-expectations

Ralf Ahrens — Center for Financial Studies; Taunusanlage 6; D-60329 Frankfurt am Main; Germany

Modelling short-term interest rates as following regime-switching processes has become increasingly popular. Theoretically, regime-switching models are able to capture rational expectations of infrequently occurring discrete events. Technically, they allow for potential time-varying stationarity. After discussing both aspects with reference to the recent literature, this paper provides estimations of various univariate regime-switching specifications for the German three-month money market rate and bivariate specifications additionally including the term spread. However, the main contribution is a multi-step out-of-sample forecasting competition. It turns out that forecasts are improved substantially when allowing for state-dependence. Particularly, the informational content of the term spread for future short rate changes can be exploited optimally within a multivariate regime-switching framework.

Comparison of Regime Switching, Probit and Logit Models in Dating and Forecasting US Business Cycles

Allan P. Layton — School of Economics and Finance; Queensland University of Technology; GPO Box 2434; Brisbane, Queensland 4001; Australia

Masaki Katsuura — Meijo University; Japan

Three non-linear model specifications are tested for their efficacy in dating and forecasting US business cycles, viz a probit specification, a logit specification – both binomial and multinomial alternatives - and a markov, regime-switching specification. The models employ leading indicators compiled by the Economic Cycle Research Institute as putative explanators. They are tested within sample to determine their relative abilities to produce a business cycle chronology similar to the official NBER chronology. They are also tested in a post-sample context to test their relative abilities in anticipating future turning points with the result that the regime-switching model alternative performs the best.

Forecasting with Structural Change GARCH Models, A Comparison

David Dowey — GREQAM, Centre de la Vieille Charite; 2, rue de la Charite; 13002 Marseille; France

Ten years ago, Lamoureux and Lastrapes suggested the neglected structural change may account for 'paradox' of GARCH models; despite highly persistent conditional volatility estimates, their forecasting performance remains disappointingly poor. Nevertheless, the standard model, and numerous variations on it, have enjoyed widespread popularity for the analysis of financial series. In this paper, we compare three proposals for econometric modelling which provide for structural change in the underlying GARCH process; a simple switching regression; a smooth transition formulation, and the Markov-switching model. Our investigation is two-fold. In a Monte Carlo study we use simulated skedastic functions to reveal when and why each of the alternative modelling strategies performs best and we discuss the practical considerations for each as an empirical technique, with respect to estimation and testing. We then subject each method to a battery of stock return and exchange rate data, and in general we confirm reduced spurious persistence, improved forecast performance, and a more accurate matching of implied volatilities, and we highlight the relative strengths and weaknesses of each alternative.

Unobserved Components and Structural Models

Chair: **Victor M. Guerrero** (Instituto Tecnológico Autónomo de México - México)

Estimation of a General Encompassing Infrequent Permanent Shocks Trend Model, with an Application to Modeling the US Inflation Rates

Prasad V. Bidarkota — Department of Economics; 327 Waters Hall; Manhattan; KS 66506-4001; USA

We show how a general encompassing model of trends that includes deterministic trends, shifting trends, segmented trends, and random walk trends models as special cases can be estimated by maximum likelihood using a general recursive filtering algorithm for estimating non-Gaussian state space models. We estimate a shifting trend infrequent permanent shocks model and a random walk trend model for the monthly US inflation series using this algorithm, and compare the relative performance of the two along several dimensions. The two models fare about the same in terms of the mean squared and mean absolute forecast errors, as well as in terms of the commonly used likelihood based information criteria. Our findings suggest that, for the purposes of forecasting real data series, recognizing the difference between frequent small shocks and infrequent large shocks does not matter much.

Unobserved Components Models with Correlated Disturbances

Tommaso Proietti — Dipartimento di Scienze Statistiche; Università di Udine; Via Treppo 18, 33100 Udine; Italy

The paper deals with the decomposition of a time series process admitting an ARIMA representation into permanent and transitory components, with the aim of investigating whether the introduction of correlated disturbances provides meaningful extensions of the admissible parameter range. The main points are illustrated with reference to ARIMA(2,1,0) and IMA(2,2) models. It is argued that there is very little reason for such extensions, and that the restrictions implied by the assumption of uncorrelated components are sound. Models with a unique source of random disturbances, such as the Beveridge-Nelson decomposition, are dismissed on statistical grounds. Also, a doubt is cast on the generality of algorithms such as the partial fraction decomposition of the forecast function of an ARIMA model, and on the interpretability of the resulting components in terms of trends and cycles.

A Structural Modeling Approach to Assessing the Impact of Speed Limit Increases on Fatal Interstate Crashes

Sandy D. Balkin — Ernst & Young LLP; 1225 Connecticut Ave, NW; Washington, DC 20036; USA

J. Keith Ord — Georgetown University; USA

This study investigates the relationship between speed limit increases and increases in the number of fatal crashes on U.S. rural and urban interstates. Past studies use expected historical trends to support claims that 'speed kills.' Using structural modeling, we assess the change in series level after a known change in speed limit occurs. The results cast doubt on the blanket claim that higher speed limits and higher fatalities are directly related. After the initial speed limit increases in 1987, some increases in fatalities did occur, but there is also some evidence that either drivers tended to adapt to the higher speeds or safety measures have improved. The approach also allows for an interpretation regarding seasonal effects on the number of fatal crashes.

Joint Estimation of an Adjusted Time Series and its Linear Deterministic Effects

Victor M. Guerrero — Departamento de Estadística; Instituto Tecnológico Autónomo de México.; México 01000, D.F.; Mexico

A method is proposed for estimating an adjusted time series simultaneously with the parameters of some linear deterministic effects that are usually present in time series data. Such effects may be due to calendar variation, outlying observations or interventions in general. The method can be applied once a model that includes the effects has been built. Estimation of the adjusted series is then performed jointly with the deterministic effects, which amounts to re-estimating the parameters of the effects. Although the main goal when applying the method in practice might only be to estimate the adjusted series, an important by-product is that the deterministic effects get estimated with a substantial increase in efficiency. This fact justifies using the method with this sole purpose in mind. The methodology is applied on two real datasets.

Demand Forecasting with Supply Chain Applications

Session Organizer and Chair: **Hans Levenbach** (Delphus, Inc. - USA)

Forecasting for Inventory Control with Exponential Smoothing

Keith Ord — McDonough School of Business; Georgetown University; Washington, DC 20057; USA

Ralph D. Snyder — Monash University; Australia

Anne B. Koehler — Miami University of Ohio; USA

Exponential smoothing, often used for sales forecasting in inventory control, has always been rationalized in terms of statistical models that possess errors with constant variances. It is shown in this paper that exponential smoothing remains the appropriate approach under more general conditions where the variances are allowed to grow and contract with corresponding movements in the underlying level. The implications for estimation and prediction are explored. In particular, the problem of finding the prediction distribution of aggregate lead-time demand for use in inventory control calculations is considered. It is found that unless a drift term is added to simple exponential smoothing, the prediction distribution is largely unaffected by the variance assumption. A method for establishing order-up-to levels and reorder levels directly from the simulated prediction distributions is also proposed.

Developments in Forecasting Intermittent Demand

Aris. A. Syntetos — Buckinghamshire Business School; Buckinghamshire Chilterns University College; Newland Park, Chalfont St. Giles; Bucks HP8 4AD; UK

John E. Boylan — Buckinghamshire Chilterns University College; UK

John D. Croston — Independent Systems And Statistical Consultant; UK

Intermittent demand creates significant problems in the manufacturing and supply environment as far as forecasting and inventory control are concerned. Croston (1972) designed a method that deals specifically with intermittence. His method has been shown to provide a biased estimator of mean demand and three new unbiased intermittent demand estimation procedures have been developed (Syntetos and Boylan, 1999). In this paper we show that the importance of bias in forecasts increases with the supply lead time. The forecasting accuracy of Croston's method, EWMA, Moving Average and the three new forecasting methods is compared by means of simulation on a large sample of real intermittent demand data series. The selection of meaningful and appropriate accuracy measures is discussed in detail and the simulation exercise is extended to cover inventory control performance.

Accurate Store Level Forecasting

Bill Sichel — The Monet Group, Inc; 350 Fifth Avenue, NY; NY 10018; USA

Hans Levenbach — Delphus, Inc; USA

In order for retailers to maintain profitability, pressure on reducing inventory levels in stores continues to mount. Understanding the effectiveness of the forecast in maintaining appropriate inventory levels under stringent customer service levels is vital to the total forecasting process. Forecasting at the store level is characterized by high variability at the detailed item level, intermittent demand and a large number of Stock Keeping Units (SKUs). We will present an automated and visual method for monitoring the effectiveness of store level forecasting via: (1) creation of a Sold Out/Not in Stock Ratio (2) empirical estimation of lost sales utilizing cluster analysis and (3) trending in Inventory/Sales ratios.

Exploring Components of Variability in Weekly Point-of-Sale Data

Hans Levenbach — Delphus, Inc.; 152 Speedwell Avenue.; Morristown, NJ 07960; USA

To improve profitability, while reducing inventory levels and maintaining high customer service levels, retailers are increasingly turning to Point-of-Sale (POS) data in their forecasting activities. Weekly POS data at the store level is characterized by high variability at the detailed item level, intermittent demand and a large number of Stock Keeping Units (SKUs). We will present modeling strategy for effectively exposing the key components of variability in weekly POS data patterns.

Panel Session 2

Organizer: **J. Scott Armstrong** (The Wharton School, University of Pennsylvania, USA)

Chair: **Robert Fildes** (Lancaster University, UK)

Extrapolation

Panel members:

Don Miller — Virginia Commonwealth University, USA

Nigel Meade — Imperial College, UK

Vassilis Assimakopoulos — National Technical University of Athens, Greece

The panel will address three issues:

- 1. What principles (guidelines) produce the most effective extrapolations?
- 2. When is extrapolation most appropriate (versus other approaches)?
- 3. How can further research be encouraged to fill the gaps in knowledge?

J. Scott Armstrong will briefly present principles for how and when to extrapolate and will list some of the gaps. (A summary of principles is available on the web at <http://hops.wharton.upenn.edu/forecast/tofc.html>) The panel would then comment on whether there are additional principles that should be included on "what and when," and how to stimulate research on these topics.

Macroeconomics II

Chair: **Miguel A. Ariño** (Universidad de Navarra - Spain)

A New Coincident Economic Indicator for the Portuguese Economy

Alda Manso Rito — DGEP, Ministério das Finanças ; Rua da Alfândega, 5, 2º ; 1100-016 LISBOA; Portugal

Luis Catela Nunes — Nova University, Lisbon; Portugal

This paper intends to produce a new coincident economic indicator for the portuguese economic activity, using some modifications in the methodology in Stock and Watson (1989, 1991). Unlike other studies for the portuguese economy, we have decided to introduce the GDP y-o-y change rate in the model, since the evolution of this variable should be highly correlated with the state of the economy. This way, more stability and precision may be obtained when estimating the model. However, as GDP figures are revealed later, we had to modify the classic formulation of the Kalman filter, allowing for a prompt estimation of the coincident economic indicator using the available information at each point in time. The proposed methodology also allows for the estimation of the missing observations for the GDP behaviour. Results show that the approach followed is very satisfactory when compared with alternative models.

Business Fluctuations in Post-Transition China: Some Preliminary Findings

Philip A. Klein — Penn State University; USA

At The Economic Cycle Research Institute in New York City we have been negotiating for some time with officials of the Central Statistics Bureau of the Peoples' Republic of China to obtain data with which to examine the question 'Is there any evidence of business fluctuations since the beginning of the economic transition in the late 1970s.' We have now done some preliminary investigation and it appears that while they have not had any classical business cycles, there is evidence of some growth rate cycles. Moreover, our preliminary investigation suggests that a leading Index of such growth rate cycles can be constructed. How can the findings be explained? We shall examine this evidence carefully and draw whatever conclusions seem appropriate in an effort to answer a question which has been asked widely, 'Do formerly planned economies give evidence of Western-style cycles when they move toward the market and can these cycles be forecast and monitored with the tools that have performed successfully in market economies thus far analyzed?'

Ex post and ex ante Prediction of Unobservable Stochastic Processes: A Structural-model Based Approach

Fabio H. Nieto — Departamento de Matemáticas y Estadística; Universidad Nacional de Colombia; A.A. 72157 Bogotá; COLOMBIA

In this paper, a new optimal solution to the ex post and ex ante prediction problem of unobservable economic processes (also called disaggregation/benchmarking and extrapolation of time series) is presented. The approach is based on structural models and is more general, flexible, parsimonious and practical than previous procedures. The ex ante framework is used for developing statistical tests that permit to check the compatibility of pre-established economic goals for the near future, with past and current economic information. The ex ante methodology can also be used to obtain a coincident indicator of the dynamic behavior of an economy.

Impact of Economic Cycles on the Evolution of an Industry

Miguel A. Ariño — IESE; Universidad de Navarra; Av. Pearson 21; 08034 Barcelona; Spain

Maria Coello de Portugal — Universidad de Navarra; Spain

In this paper we present a very simple model to measure the impact of the global economic situation on the performance of an industry. This model can provide companies within the industry with information on their exposure to the fluctuations of the economy, as well as the intensity of this exposure. Different characteristics of the industry are discussed.

Prediction Intervals

Chair: **P. Geoffrey Allen** (University of Massachusetts - USA)

Bootstrap Prediction Intervals for Autoregressive Models with Lag Order

Jae H. Kim — School of Business; La Trobe University; Bundoora, Vic 3083; Australia

The use of prediction intervals based on the bootstrap-after bootstrap is proposed for autoregressive (AR) models. Monte Carlo simulations are conducted using a number of univariate and bivariate AR models of orders 1 and 2, which include stationary, non-stationary and cointegrated processes.

The major finding is that the bootstrap-after-bootstrap provides a superior small sample alternative to asymptotic and standard bootstrap prediction intervals. Asymptotic and standard bootstrap prediction intervals are often too narrow, substantially under-estimating future uncertainty especially when the model is non-stationary or near non-stationary.

Bootstrap-after-bootstrap intervals provide accurate and conservative assessment of future uncertainty under nearly all circumstances considered.

Bootstrap Prediction Intervals in ARIMA Processes

Lorenzo Pascual — Department of Statistics and Econometrics; Universidad Carlos III de Madrid; C/ Madrid 126; 28903 Getafe; Madrid; Spain

Juan Romo — Universidad Carlos III de Madrid; Spain

Esther Ruiz — Universidad Carlos III de Madrid; Spain

In this paper we propose a new bootstrap procedure to construct forecast intervals in autoregressive integrated moving average processes (ARIMA(p,d,q)). This procedure has the advantage over previously proposed methods of not requiring the backward representation of the model, so it could be easily extended to nonlinear models. The method is based on approximating the conditional predictive distribution. An extensive simulation study is presented to illustrate the good performance of the bootstrap prediction intervals. Finally, the behavior of the proposed procedure is illustrated with two empirical examples.

Prediction bounds for autoregressive processes.

Jose M. Corcuera — Departament d'Estadística; Facultat de Matemàtiques.; Universitat de Barcelona.; Gran Via de Les Corts Catalanes 585; Barcelona 08007; Spain

Laura Fiorot — Università degli Studi di Padova; Italy

How does the estimation of the unknown parameters, such as the mean, the variance, or the correlation coefficients, affect the prediction bounds or limits in autoregressive processes? Until now this problem has not been considered because the errors were of small order but mainly because we did not know how to correct it. In this work we give two predictive densities that correct the classical prediction limits (what we obtain by plugging in the estimates of the unknown parameters) in a way that, for relatively small samples, the prediction limits are practically correct.

Narrowness Of Prediction Intervals Revisited

Bernard J. Morzuch — Department of Resource Economics; University of Massachusetts; Amherst, MA 01003; USA
P. Geoffrey Allen — University of Massachusetts; USA

Prediction intervals are frequently too narrow. This problem, however, receives minimal attention in the forecasting literature. Probabilistic forecasts have a number of advantages over more common point forecasts, most notably the additional information conveyed. As forecasters we ought to pay more attention to their historically poor calibration in post-sample prediction periods. In the past, we have developed and presented strategies for promoting well-calibrated prediction intervals under a variety of model specifications and using different types of data series. These strategies employed parametric procedures. Their success has been limited at best but still better than other studies dealing with this problem. We attempt to improve our previous work by incorporating bootstrapping methods into our calibration procedures. Care in model specification, diagnostic testing, and judicious use of resampling procedures for generating key statistics needed for prediction intervals may promote better-calibrated prediction intervals.

Banking

Chair: **Manuela Magalhães Hill** (UNIDE, ISCTE – Portugal)

Bank Solvency Evaluation with a Markov Model

Juan-Carlos Reboredo — Department of Economics; Universidade Santiago de Compostela; 15704 Santiago de Compostela; Spain

This paper provides an empirical model for a probabilistic evaluation of bank solvency that includes heterogeneity and past solvency. Bank solvency positions are obtained from the value of a stochastic recursive profit function. Transition probabilities among bank solvency positions are determined by portfolio decisions, and draw the probabilistic evolution over time of bank solvency. Thus, the bank activity is characterized as a Markov decision process whose transition matrix is obtained from a Markov Chain model with a quadratic conditional variance. The empirical implementation for Spanish banks indicates that both heterogeneity and past solvency are important to evaluate bank solvency.

Determinants of Signaling: Evidence from Bank Loan Loss Provisions

Gerald J. Lobo — School of Management; Syracuse University; Syracuse, NY 13244; USA

Dong-Hoon Yang — Syracuse University; USA

This study examines bank managers' use of discretionary loan loss provisions to convey information about their banks' future earnings prospects. It also investigates bank-specific characteristics associated with the strength of signaling through loan loss provisions. The loan loss provision is the expense resulting from managers' estimates of the yearly net change in probable loan losses. Bank managers can use their superior information regarding default risks inherent in their loan portfolios to estimate the loan loss provision. In addition, they can exercise discretion over the timing of recognition of certain loan losses because the amounts of those losses are affected by managers' judgment.

The evidence suggests that bank managers use their discretion over loan loss provisions to signal their superior information. It indicates that the tendency to signal through loan loss provisions is associated with various bank-specific economic characteristics such as business risk, future investment opportunities, and degree of income smoothing, which affect the degree of information asymmetry. The study also provides evidence that bank managers signal simultaneously with discretionary loan loss provisions and dividend changes, suggesting that bank managers with incentives to mitigate information asymmetry use multiple signals to communicate their proprietary information.

Forecasting Liquidity in the ECCB Area

Garth Nicholls — Eastern Caribbean Central Bank; Box 89; Basseterre; St. Kitts

Tracy Polius — Eastern Caribbean Central Bank; St. Kitts

The paper looks at forecasting net foreign assets of the Eastern Caribbean Central Bank within the context of the Eastern Caribbean Currency Union. The methodology focuses on the growth and distribution of total monetary liabilities and the movement in real sector variables in identifying seasonal patterns. In forecasting net foreign assets, the institutional and operational framework of the central bank is taken into consideration. The exercise also seeks to determine the level of liquidity that the central bank needs to hold over certain months of the year and the variables that need to be monitored in order to determine liquidity.

Prediction of loan defaults using a credit card scoring model incorporating worthiness

Francisco Camões — Department of Economy; UNIDE, ISCTE; Lisboa; Portugal

Manuela Magalhães Hill — UNIDE, ISCTE – Portugal

The prediction of loan defaults has been the basis of a growing interest in the development of systems of credit scoring. Typically, discriminant analysis, probit, logit, or some other type of classificatory procedure has then been applied to develop a model for distinguishing between 'good' and 'bad' payers. However, some published studies have concluded that the use of models that seek to minimise misclassification errors do not necessarily lead to an increase in the credit concession profits.

In this paper two approaches for the inclusion of worthiness in credit card scoring models were investigated. In the first of these, worthiness was added to the usual credit scoring models, while in the second it formed the basis of a new methodology. Evidence was obtained that 'good payers' are not necessarily 'good customers' of credit card companies, and this is a major conclusion with clear implications for choosing the best model.

SESSIONS AND ABSTRACTS

— FRIDAY —

Keynote speech 3

Chair: **Keith Ord** (Georgetown University, USA)

Panels of Intercorrelated Time Series: Exploring Linear and Nonlinear Models

Dag Tjøstheim

Bergen University, Norway

Abstract: Panels of intercorrelated time series are studied. Both linear and nonlinear models are considered, and much of the emphasis is on the case where there are many time series and just a few observations for each series. In this situation it is demonstrated that Burg-type estimators for the autoregressive coefficients work much better than conditional maximum likelihood estimators. It is also shown that neglecting the intercorrelation generally leads to inconsistent estimates, and it is found that the choice of estimator may be made in terms of a break-even value for the strength of the intercorrelation. The Akaike order determination criteria are extended to the panel case, and it is shown that special care must be taken in their practical implementation. Finally, nonparametric estimators and their asymptotics are derived for the conditional mean and the conditional variance, and tests of linearity are discussed. The results are illustrated on real and simulated data.

Leading Indicators

Chair: **Maximo Camacho** (Universitat Autònoma de Barcelona (UAB) - Spain)

The Bottom-up Approach in Forecasting Inflation in Spain. Economic and Statistical Reasons and Policy Implications

Antoni Espasa — Inst. Flores de Lemus; Univ. Carlos III Madrid; Calle Madrid, 126 – 28903 Getafe; MADRID; Spain
Eva Senra — Univ. Carlos III Madrid; Spain

The paper analyses the methodology used in a systematic monthly forecast of Spanish inflation over the last fifteen years. The methodology employed is based on the disaggregation by large groups of markets, the use of specific leading indicators and the combination, in the case of each market price, of forecasts generated by models constructed with different information sets (multivariate or univariate) and with different specifications for the long-run behaviour (segmented or stochastic inflation equilibrium levels).

The paper also discusses the use of trace forecasts for breaking down observed data into two factors: (a) expectation (forecast) and (b) innovation. This signal extraction procedure has the advantages that it may be non-linear, the extractions from an aggregate and its components are consistent and, above all, its two factors have economic interest and are, therefore, both useful for policy. The bottom-up approach in forecasting inflation shows that innovations in different market groups have different long-term impact and different volatility. Both things should be taken into consideration in policy analysis.

Using Composite Indexes to Improve the Forecasting Performance of Vector Autoregressions

Don Harding — 7th Floor Economics and Commerce Building; The University of Melbourne ; Victoria 3010; Australia

Forecasters face a trade off between the need to combine information in a wide range of data series and the necessity of keeping models simple. They have long sought to achieve these ends by combining series into composite indexes. The NBER leading and composite indexes are one example of this approach. I show how composite indexes can be constructed within a VAR framework. The method of composite index construction is general and does not require parameter restrictions such as those involved in cointegration or the index VARS of Reinsel and Ahn (1983). However, cointegration and index VARS arise as special cases of the method.

Procedures for finding optimal composite indexes are derived. These procedures are then applied to construct optimal versions of the Conference Board's leading and coincident indexes and optimal versions of leading and coincident indexes for Australia. These indexes are used to generate forecasts of key macroeconomic variables within a VAR framework.

Vector Smooth Transition Regression Representation of the US GDP and the Composite Leading Index

Maximo Camacho — Departament d'Economia i d'Historia Economica; Edifici B; 08193 Belltarra (Barcelona); Spain

Much effort has been devoted to evaluate how well time series models represent real US output. In fact, it has probably been the most examined univariate time series in modern macroeconomics. Additionally, many authors have tried to improve the accuracy of univariate models by including certain variables that incorporate additional information about output features. In this paper, we are interested in models that use the Composite index of Leading Indicators (CLI) information about future output changes and turning points.

Until the 1990s, the emphasis of this literature have been on linear models. Univariate linear models have basically followed extensions of the seminal analysis of Box and Jenkins (1976). The most significant multivariate linear analysis for examining the accuracy of CLI at anticipating output features are the work of Auerbach (1982), Braun and Zarnowitz (1989), and Diebold and Rudebusch (1991).

However, during the current decade, several studies have found evidence in favor of nonlinear behavior in output. Hamilton (1989), Teräsvirta and Anderson (1992), Tiao and Tsay (1994), Potter (1995), Teräsvirta (1995), and Pesaran and Potter (1997) propose alternative univariate nonlinear approaches to US output. On the other hand, Granger, Teräsvirta and Anderson (1993), Estrella and Mishkin (1998), and Filardo (1992, 1999), examine with nonlinear multivariate models the predictive performance of CLI.

All of these studies suffer at least one of the following drawbacks. First, linear models implicitly impose strong symmetry properties. Second, univariate models loose the leading information that CLI may incorporate to the system. Third, non-vector autoregressive models fall to capture the dynamic interactions among the variables in the model. To our knowledge, only Hamilton and Perez-Quiros (1996) propose a nonlinear VAR model for analyzing the accuracy of those variables.

The contribution of this article to the previous literature is twofold. First, we propose a multiple equation extension of the STR model developed by Granger and Teräsvirta (1993). By analogy, we call it Vector Smooth Transition Regression (VSTR) model. The primary principle for estimation is maximum likelihood. This approach leads to simple linearity and model selection tests. The paper also analyzes the most recent model selection techniques in order to formally select one model from the family of VSTR. Thus, we focus the multiple equation STR models in an alternative view to Weise (1999).

Second, we contribute to the empirical literature of CLI in nonlinear models by applying the VSTR methodology to model the nonlinear features of GDP and CLI together. Our outstanding results are the following. First, Johansen tests do not find evidence in favor of CLI and GDP to be cointegrated. Second, a logistic-VSTR model is more accurate than any other nonlinear specification. Third, we have detected significant improvements at anticipating growth with the nonlinear model, even in real-time. Basically, this gains come from recessionary periods. Fourth, the nonlinear model is no better at replicating the US business-cycle phases than a simple linear univariate model.

Cointegration I

Chair: **Felipe M. Aparicio Acosta** (Universidad Carlos III de Madrid - Spain)

On Forecasting Cointegrated Seasonal Time Series

Mårten Lóf — Dept. of Economic Statistics; Stockholm School of Economics; P.O. Box 6501; S-113 83 Stockholm; Sweden
Philip Hans B.F. Franses — Erasmus University Rotterdam; USA

We analyze periodic and seasonal cointegration models for bivariate quarterly observed time series in an empirical forecasting study. We include both single equation and multiple equation methods. A VAR model in first differences with and without cointegration restrictions is also included in the analysis, where it serves as a benchmark. Our empirical results indicate that the VAR model in first differences without cointegration is best if one-step and four-step ahead forecasts are considered. For longer forecast horizons, however, the periodic and seasonal cointegration models are better. When comparing periodic versus seasonal cointegration models, we find that the seasonal cointegration models tend to yield better forecasts. Finally, there is no clear indication that multiple equation methods improve on single equation methods.

A Generalisation of the Concept of Cointegration to Harmonizable Processes

Roselyne Joyeux — School of Finance and Economics; Level 3, 645 Harris Street; UTS - Ultimo, Sydney, NSW; Australia

The theory of cointegration as introduced by Engle and Granger (1987) refers to the situation where multiple $I(d)$ series can be combined to produce an $I(k)$ series, where k can range from 0 to $d-1$. Although this approach has proved to be extremely fruitful in econometric modelling and forecasting, it has also frustrated researchers because of its limitations. In this paper we consider the generalisation of the concept of cointegration to other non stationary processes. The nonstationary processes considered here belong to the harmonizable class. The class of harmonizable processes includes slowly changing processes, periodic stationary sequences and certain non linear processes. The subclass of slowly changing processes, as introduced by Priestley (1965), is given particular consideration.

A Characterization of Cointegrating Relationships Using Induced-Order Statistics

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Processes which exhibit common trends or similar long waves in their sample paths are often called cointegrated. The concept of cointegration originated in macroeconomics and finance, where in some cases the theory suggests the presence of economic or social forces preventing two or more series to drift too far apart from each other. Take for example, those series as income and expenditure, the prices of a particular good in different markets, the interest rates in different parts of a country, etc. Cointegration relationships may also appear in other contexts, such as in the outputs of different sensing or processing devices having a limited storage capacity (or memory) and driven by a common persistent input flow. Although most studies on cointegration rest on the assumption of a linear relationship between the variables, the possibility that these variables depend on each other through a jointly nonlinear data generating process, and which standard cointegration tests may fail to capture, has open the way to new research trends. Since the concept of cointegration is inherently nonlinear, early attempts focussed on extending standard definitions, and on understanding how the standard tests were affected by the presence of neglected nonlinearity. In this paper we explore the advantages of using induced-order statistics in the characterization of cointegrating relationships. We propose some cointegration testing devices which are robust to monotonic nonlinearities and which do not require prior estimation of the cointegration parameter, and therefore lead to null distributions which are free from nuisance parameters.

Judgemental Forecasting III

Chair: **Ray D. Nelson** (Brigham Young University - USA)

Forecasting demand for discontinuous innovations: what do companies really want?

Marisa Maio Mackay — School of Marketing, University of South Australia; Elton Mayo Building City West Campus; GPO Box 2471; Adelaide SA 5001; Australia

David Corkindale — University of South Australia; Australia

This paper presents the results of an exploratory study that sought to examine the fundamental issues involved in estimating demand for discontinuous innovations. The results are based on a combination of in-depth interviews and a focus group of SME stakeholders. The results indicate that these stakeholders understand why forecasting is important in the new product development process. Little thought is given, however, to the choice of forecasting approach adopted by these companies. Although they acknowledged that there are limitations to the primarily qualitative techniques currently being used to forecast demand for discontinuous innovations. The stakeholders also identified features that should be incorporated in any 'new' forecasting approach for discontinuous innovations. There is clearly a need for researchers to work on formalising such a forecasting approach. A new approach needs to be comprehensive and structured in order to make devising, monitoring, evaluating and comparing forecasts more manageable and useful for practitioners.

Safe Harbor Protection for Forward-Looking Disclosures in Corporate Financial Reports

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The U.S. Congress enacted the 'Private Securities Litigation Reform Act' in 1995. The legislation revised and expanded the 'safe harbor' protection for publicly traded companies who voluntarily include forward-looking disclosures in both their annual shareholder reports and required Securities Exchange Commission (SEC) filings. The intent of the law is to increase the difficulty of plaintiffs in lawsuits to assert that specific forward-looking disclosures are not protected by the 'safe harbor' provision. This paper focuses on the extent to which a selected group of fifty NASDAQ firms meet the required disclosures necessary for protection under the revised 'safe harbor' rule.

The Characterization and Communication of Tax Revenue Forecast Uncertainty

Ray D. Nelson — Institute of Business Management; Marriott School of Management; Brigham Young University; Provo, Utah 84602; USA

Forecasts of different tax revenue sources play critical roles in state government budgeting in the United States. Public administrators often treat most planned expenditures equally. Augmenting point revenue forecasts with uncertainty measures can improve the budgeting process. Using probability distributions rather than point estimates allows division of expenditures into the base budget and conditional appropriations. The conditional expenditures category allows executive and legislative interaction and planning in order to maximize the benefits that accrue from less likely but favorable states of nature. A review of the rich literatures identifies statistical and judgmental characterizations of risk and uncertainty that provide the methodology needed to identify potential revenue usable in the base or conditional categories. Consideration of revenue uncertainty also allows incorporation of the covariance relationships among the portfolio of revenue sources rather than implicitly assuming statistical independent. Throughout the discussion, an example of the major tax revenue sources for the State of Utah illustrates the proposed methodology.

Forecasting of Nonlinear Time Series

Session Organizer and Chair: **Wai Keung Li** (The University of Hong Kong - Hong Kong)

A new approach to nonlinear and non-Gaussian state space modelling

Mike K P So — Hong Kong University of Science and Technology; Hong Kong

We propose a new approach for estimating nonlinear and non-Gaussian state space models. We adopt Markov chain Monte Carlo methods efficiently by constructing an approximated linear state space model based on extended Kalman filter. A posterior mode estimation method is developed for applying the extended Kalman filter. Prediction of the state variable can also be done. Examples in both count data and nonstationary growth models are given to illustrate our approach.

Forecasting with non-Gaussian time series models

Rob J. Hyndman — Department of Econometrics and Business Statistics; Monash University; Clayton VIC 3800; Australia

Non-Gaussian time series such as counts, proportions and highly skewed data arise frequently in practice, but there are few well developed techniques available for forecasting them. Three different approaches to forecasting non-Gaussian time series are compared: a state space model, a conditional linear AR model and a generalization of exponential smoothing methods. Point forecasts and forecast intervals shall be derived in each case. The types of data suitable for each approach shall also be investigated.

Outlier-Robust Nonlinear Analysis of Industrial Production

Dick van Dijk — Econometric Institute; Erasmus University; Rotterdam; The Netherlands

Jussi Tolvi — University of Turku

In recent years, a substantial amount of evidence for nonlinearity in macro-economic times series such as industrial production and unemployment has been produced. The evidence for nonlinearity is mainly based on linearity tests and superior in-sample fits of nonlinear models. By contrast, forecasts from nonlinear models often are found to be no superior to those obtained from linear models.

In this paper, we examine whether these findings might be due to the presence of aberrant observations. We apply linear, bilinear and threshold autoregressive models to industrial production series for a large number of OECD countries. We use standard and outlier-robust order selection criteria, linearity tests and estimation methods to specify and estimate these models and compare their forecasting performance.

Finance II

Chair: **Nigel Meade** (Imperial College Management School - UK)

Analysts' Forecasts in Asian Markets: The Relationship Between Accounting Systems and Accuracy

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Ervin L. Black — Department of Accounting; University of Arkansas; USA

In this study, we examine the accuracy and determinants of analysts' forecasts in the Asian-Pacific region in order to evaluate how accounting systems and cultural distinctions in this region affect earnings predictability. Since many investors rely on analysts' earnings forecasts instead of producing their own, the growth of international investment means forecasts in non-U.S. markets will become increasingly important to investors worldwide. We find that the analysts on average have an optimistic bias. We also examine individual countries (12) and groups (per Radebaugh and Gray 1997).

The largest forecast errors are in Thailand and the Philippines. We also test for differences in the forecast errors across countries and across groups and find evidence that Anglo-Saxon based accounting countries have smaller forecast errors. We also find evidence that firms with a larger difference between market value of equity and book value of equity have a larger optimistic bias in the analyst forecast.

FX Volatility Forecasts and the Informational Content of Market Data for Volatility

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Jason Laws — Liverpool Business School and CIBEF; UK

Stéphane Chauvin — ITC, Universidad Complutense

Measuring the risks associated with participating in financial markets has become the focus of interest since the beginning of the 1990s. Advances in time series modelling such as, amongst others, ARCH/GARCH and/or stochastic volatility models have made it possible to integrate the time-varying nature of volatility and correlation and thus to relax such embarrassing assumptions as constant volatilities (in the field of risk management) and constant correlations (in the field of portfolio diversification).

In this article, we first review the predictive power of several time series models of currency volatility (homoskedastic, ARMA, GARCH and stochastic volatility) using daily data from January 1991 through March 1999 for 6 major exchange rates. We carry on to check whether market implied volatility data can add value in terms of forecasting accuracy. Although this has been done in the past in the context of tests of market efficiency (see, for instance, Day and Lewis (1992) or Dunis and Keller (1995)) or in a forecasting context using a specific option pricing model to 'back out' ex post implied standard deviations (see Kroner, Kneafsey and Claessens (1995) for instance), this is the first time to our knowledge that such a forecasting exercise is conducted using data directly available from the marketplace in order to avoid the potential biases from the 'backing out' procedure. This original approach seems further warranted by current market practice whereby brokers and market makers in currency options deal in fact in volatility terms and no longer in option prices terms.

We compare the out-of-sample forecasting accuracy of our time series models with that of the 'mixed' models incorporating market data for currency volatility and conclude by combining these forecasts using a simple averaging procedure as a benchmark against the Granger-Ramanathan approach (1984) and the novel SOFI algorithm of data fusion by Chauvin et al. (1997, 1999). On the basis of the over 34000 out-of-sample forecasts produced, evidence tends to indicate that, although no single volatility model emerges as an overall winner in terms of forecasting accuracy, the 'mixed' models incorporating market data for currency volatility perform best most of the time.

A Comparison of the Accuracy of Short Term Foreign Exchange Forecasting Methods

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The hypothesis that foreign exchange rate behaviour is deterministic has been examined by several authors, others have proposed a non-linear stochastic framework. Here evidence for a deterministic generating process is evaluated by an analysis of the comparative accuracy of short-term forecasts of FX rates. Forecasts are generated by an AR-GARCH model (stochastic) and three nearest neighbour methods (deterministic). Three data frequencies are used: daily, hourly and half-hourly. For point forecasts, by any accuracy measure, no method considered was significantly better than a no-change forecast for daily and hourly data. For half-hourly data, most methods are significantly more accurate than a no-change forecast using the RMSE and PCB measures, but not using other measures such as MAE. There is significant evidence of directional forecasting accuracy for one period ahead for all methods on the half-hourly data sets. No evidence is found that the FX rate behaviour is better represented by a deterministic generating process than by a stochastic model.

Macroeconomics III

Chair: **Luis Delfim Santos** (Faculdade de Economia do Porto - Portugal)

An Empirical Study of Wagner's Law Applied to the Spanish Case

Manuel Jaén — University of Almería; Vicerrectorate of International Relations; Cañada de S/Urbano s/n, 04120; Almería; Spain

In this paper we carry out an empirical verification of Wagner's law for the Spanish case during the periods 1901-1992 and 1940-1992. We have used unitary roots and cointegration for our analysis. There is a structural break in the period 1936-1939, caused by the Spanish Civil War, so we will use Perron's (1989) contrast for unitary roots and Gregory and Hansen's (1996) contrast for cointegration. Concluding that Wagner's law doesn't explain the growth of Spanish public expenditure during the considered periods.

Estimating an Import Function for Turkey

Zelal Kotan — Central Bank of the Republic of Turkey; Turkey

Mesut Saygili — Central Bank of the Republic of Turkey and University of Washington; Turkey

This paper incorporates two different model specifications to estimate an import demand function for Turkey. The estimation performance of the two models is compared and contrasted for the period 1987Q1-1999Q1 by using quarterly data. The significance of variables that affect import demand is individually and jointly tested. Also, the short run elasticities of the two models are compared. The first model estimates imports using the Engle-Granger approach. In the long run, income level, nominal depreciation rate, inflation rate and international reserves significantly affect imports. International reserves have a significant effect on imports, however, the import function is estimated to be price and income inelastic. In the short run, on the other hand, inflation growth and growth of international reserves lose their significant impact on imports and income elasticity improves. In addition, the effect of depreciation rate increases. Export growth and a dummy that captures the crisis in the second half of 1998 and first quarter of 1999 are also found to have considerable influence on import growth in the short run. The second approach models import demand using the Bernanke-Sims structural VAR methodology. The findings indicate that anticipated changes in the real depreciation rate and unanticipated changes in the income growth and real depreciation rate have significant effects on import demand growth. Income growth is effective in both approaches. While, real depreciation rate fits better in the latter, better results are obtained in the former with the nominal depreciation rate. The forecast performance of the models for the year 1999 is discussed.

The Impact of Innovations in Monetary Policy in Portuguese Economy

Luis Delfim Santos — Faculdade de Economia do Porto; Rua Dr. Roberto Frias; 4200 Porto; Portugal

Fernando Teixeira dos Santos — Faculdade de Economia do Porto; Portugal

Using a VAR model we study the effect of innovations in the monetary policy on economic performance, analyzing its impact on variables such as the exchange rate, inflation and real growth. We also analyze the predictive capability of the model.

Technological Forecasting

Chair: **Peg Young** (Bureau of Transportation Statistics - USA)

A Forecast of Technology Foresight

Alan Porter — ISyE; Georgia Tech; Atlanta GA 30332-0205; USA

Helia Chaves Ramos — IBICT; Brazil

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Mahmud Farooque — George Mason University

Richard Klavans — CRP; USA

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Carl Pistorius — University of Pretoria; South Africa

We propose a normative forecast for 'tech foresight analyses,' including technology forecasting and technology assessment (TF/A for short), for the coming 20 years. This paper addresses the following:

- Does it make sense to associate technology assessment, forecasting, foresight, roadmapping, and competitive technological intelligence together?
- How will the changing nature of science & technology alter forecasting and assessment needs?
- How will powerful social drivers act to change TF/A, including pressure for sustainability and changes in science/technology policy/management interests?
- Who will be the customers for these analyses (and what do they want/need - e.g., threat/opportunity assessment)?
- What directions does the new generation technology assessment component being formed in Europe portend?
- How can new (and old) tools enrich TF/A? These include scenario management, information mining, and technological digital story telling.
- Can we point to exemplars of emerging TF/A forms?

15-Year Forecast of National High-Tech Competitiveness for 33 Nations

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J. David Roessner — Georgia Tech; USA

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Each three years Georgia Tech prepares 'High Technology Indicators' (HTI) on behalf of the U.S. National Science Foundation. The just-completed HTI-1999 includes four 'input' indicators that seek to predict national high-tech export competitiveness for some 15 years in the future. It also includes three 'output' indicators, reflecting current competitiveness. We report here on the input indicators and views of 303 experts comparing present and 15-year-out technological competitiveness for 33 highly industrialized and industrializing nations. The overall forecast is that national high tech competition is shifting from a steep slope (on which the U.S. and Japan outdistance the leading Western European countries, who outdistance others) toward a broad plateau.

The Use of Technological Growth Curves in Transportation

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This paper is concerned with the selection of appropriate technological growth models for transportation data. Included in the model selection process are the determination of the degree of symmetry of the growth curve, the type of error structure underlying the model, and the value of the upper limit to that growth. Actual time series data from transportation are employed to illustrate the applicability of the selection technique.

Multivariate Analysis

Chair: **John Haslett** (Trinity College Dublin - Ireland)

Multiple Discriminant Analysis of a Financial Ratio Analysis: Evidence from Panel Data in Portugal – EXAME®

Rute Maria Abreu — Instituto Politécnico da Guarda; Escola Superior de Tecnologia e Gestão ; Dep. Contabilidade e Auditoria; Av. Dr. Francisco Sá Carneiro, 50; 6300-356 Guarda; Portugal

Maria de Fátima David — Instituto Politécnico da Guarda; Portugal

In this paper, the potential of multivariate analysis is used as a tool for the analysis and evaluation of the results from a financial analysis. The financial economic ratio analysis is based in a panel data published in the Portuguese review Exame®.

The methodology is within the enterprises heterogeneity in the panel data performing the function of a standard of comparison, identifying new cases, testing multivariate differences among groups of enterprises and reflecting events occurring on an identical period with consequences in similar business.

The perspective of analysis is relies upon explanatory models of the financial analysis, that are proposed by many experts and which results from the treatment of a factorial analysis, without any information loss.

One develops a discriminant analysis to face the results of the factorial analysis with the cluster analysis, and then the hypotheses are empirically tested and compared to those held by the other remaining theories.

Comparing Export Sales Forecasting Practices Evidence from U.K. Exporters

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Adamantios Diamantopoulos — Loughborough University; UK

Although the practice of sales forecasting is a widely researched area, only recently have empirical studies differentiated between export and domestic forecasting. This is despite the fact that forecasting export sales is associated with unique problems not encountered in a domestic setting. This study contributes to the body of knowledge on export sales forecasting practices by (a) developing a firm typology based on contextual variables (namely organizational and environmental characteristics) and (b) using this typology to identify similarities and differences across different types of exporters in terms of forecasting activities (as reflected in forecast design, specification, and evaluation issues). The empirical data used is based on a survey of 180 UK exporters in the manufacturing sector which are subsequently clustered into three groups via application of cluster analysis and compared by analysis of variance tests. The findings provide insights into the practice of export sales forecasting in different organizational and environmental settings.

Exploratory Analysis of Time Trends in Multivariate Count Data: Application to variation in forest composition as reflected in pollen data

John Haslett — Dept of Statistics; Trinity College Dublin; Dublin 2; Ireland

Carl Sullivan — Trinity College Dublin; Ireland

The data are pollen counts, according to 21 different taxa, since 3700 years 'Before Present' at four sites in a forest in Ireland. They are available via the analysis of pollen spores found in cores from the forest floor; the relative abundance of the different taxa at different depths reflecting the composition of the forest at different times over the past millennia. Over time certain taxa become relatively more common, and others less common, as first one set of taxa dominates and is then overtaken by another, reflecting slowly changing ecological pressures. It is quite difficult to take in or measure the richness of the evolution of this multivariate record.

One perspective is to regard each record as providing information on the 'location' of (part of) the forest at that time in a 21 dimensional 'forest space'. The forest follows a 'trajectory' in that space. The observed data may be regarded as noisy measurements on these locations. One problem is to find a low dimensional representation which best captures a smooth trajectory.

The approach taken here involves (i) modelling each set of counts as a reflection of an underlying smoothly varying rate and (ii) seeking rotations (linear combinations) of these 21 rates which most clearly show the time evolution. This latter is approached via an application of canonical correlation.

Energy Forecasting: Scenarios and Planning

Session Organizer: **L. M. de Menezes** (University of London - UK)

Chair: **Erik R. Larsen** (City University Business School - UK)

Brazilian & Portuguese Load Profiles: a Comparative Study 500 years from the discovery

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Hélio Francisco da Silva — Pontificia Universidade Católica do Rio de Janeiro; Brazil

Luis Tadeu de Almeida — Instituto Superior Técnico; Portugal

The recent Brazilian Electrical System privatisation is now affecting market behaviour. In transforming public utilities into private, competitive corporations need to formulate new strategies and understand how to manage these new companies. The main research focus within this new reality is to provide practical re-structuring of major current problems, with which energy utilities are faced. Developing programmes in energy policy, modelling customer habits and load forecasting need therefore to be global.

An important aspect of comparative studies concerns facilitating the inclusion of the experience gained in the Industry, so as to create an international practical and academic knowledge interchange.

In celebrating of the 500 years of the discovery of the Vera Cruz Island, we present this Comparative Profiles Study of the hourly electrical load of Light Serviços de Eletricidade S.A. – Rio de Janeiro, Brasil and EDP Portugal.

Future, Which Future? Energy Scenarios for Colombia

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Angela Inés Cadena — Université de Genève; Switzerland

Felix Betancourt — Independent Consultant; Colombia

Juan Pablo Bonilla — Independent Consultant; Colombia

German Corredor — Independent Consultant; Colombia

Isaac Dyer — Universidad Nacional de Colombia; Colombia

Carlos Fonseca — (Independent Consultant); Colombia

Jorge Pinto — (Independent Consultant); Colombia

Daniel Vesga — UPME; Colombia

We report the outcome of a scenario project done for the Ministry of Energy and Mines in Colombia with a large group of stakeholders. The aim of the project was to provide a tool to help the planning department within the ministry to evaluate their long-term plans for the development of the energy sector in Colombia.

Based on the key drivers and a set of certainties and uncertainties four scenarios was developed each with their distinctive set of events and consequences for the energy sector in Colombia. We will describe the four scenarios and the underlying logic for each of them.

Finally, we will describe the use of these scenarios by the Ministry and try to evaluate how useful the project has been and will be in the future.

Valuing a Reservoir based hydro-energy plant

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Morten Ruud — University of Bergen; Norway

Valuing a reservoir based hydro-energy plant for the purpose of establishing a sales price or a take-over bid is a challenge as this value depends on the one hand on some highly unpredictable inputs (future water inflows) and on the other hand on some potentially controversial assessments (efficiency with which the reservoir system is managed). We offer an alternative, model based, negotiated approach. Starting from basic premises to which both parties can agree (e.g. physical structure of the system), a shared understanding of the system is build, based on explicit assumptions. This enables the derivation of a valuation acceptable to both parties, while avoiding tackling the most controversial aspects heads-on. A related issue is the determination the value of future water inflows.

Group Scenario Building: Emergent Consensus on Alternative Developments

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We report how a scenario group process was developed and used to involve a large group of diverse stakeholders in the scenario process. The aim of the project was to develop a set of scenarios for the Ministry of Energy and Mines in Colombia to be used in the evaluation of the long-term energy policy in Colombia.

We will not describe the final scenarios, but rather the process used to develop the scenarios. We used a mixture of interviews, carefully designed workshops, and expert input to form a view on the possible future developments of the energy sector within Colombia. Each workshop had its own goal and specific process, which was carefully designed to support the final consensus within the group.

Based on the work in the workshops and the consensus within the group, the final versions of the scenarios were developed by a core team of Colombian experts and international facilitators.

Exchange Rate

Chair: **Ana Pérez Espartero** (Universidad de Valladolid - Spain)

Equilibrium Exchange Rate and Misalignment Evidence from North Africa and Turkey

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The purpose of this paper is to estimate equilibrium real exchange rate (ERER) and derive a measure of misalignment for five currencies (Algerian Dinar, Moroccan Dirham, Egyptian Pound, Tunisian Dinar and Turkish Pound). Three alternative approaches are investigated. The first one is based on the long-run PPP, the second uses the parallel market premium data and the third approach relies on a structural model that captures the changes in economic fundamentals. A simple linear reduced form of this model is estimated using cointegration techniques over the period 1970-97. The long-run PPP based approach leads to a statistically significant and economically meaningful relationships between nominal exchange rate, domestic and foreign CPI indices. The parallel market premium based approach leads to measures of misalignment far more volatile than any likely deviations of actual exchange rate from its equilibrium level. The results of economic fundamentals based approach show that the estimated model explains a fair amount of variability in RER during the period. This model is then used for forecasting purposes.

Were The Peseta Exchange Rate Crises Forecastable During Target Zone Period?

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Zenón Jiménez-Ridruejo — University of Valladolid; Spain

During the decade of 1990's have taken place the collapse of a number of fixed or quasi-fixed exchange rate systems. The currency crises have happened in the most important countries along the world. So, it is necessary forecast and prevent them. However, financial market crises have shown extremely difficult to predict. Economic agents expectations are non-observable variables that we could not be ignored in our models. Besides, if we want to study the European case during the 1990's, the censured disposition of exchange rate neither could be ignored. We propose a discrete time target zones model, where we take into account these aspects, whose parameters will be estimated by the FIML method. The settled theoretical model is an extension of Dornbusch's (1976) model, applied in a two countries environment. It will be tested into a peseta/deutsche mark exchange rate frame, since June 1989 to December 1998. The estimation procedure of the model is based on the limited dependent rational expectation technique developed by Pesaran and Ruge-Murcia (1999). The results point out weightily differences between before and after the introduction of wide exchange rate bands in August 1993.

Exchange Rate Barometers

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Exchange rates are difficult to model and forecast. Following some successes in the seventies, the Meese-Rogoff papers suggested the exchange rate is unpredictable; fundamentals-based models fail to beat a random-walk rule in forecasting. Come the 1990s, however, a plethora of papers purported to show that this or that model actually beats the random-walk rule. However, setting this rule as the yardstick is wrong. In fact, a model, itself generating random-walk type forecasts, would be more profitable as long the predictions' standard error was smaller than that of the series. Moreover, even recent studies tend to test just one theory at a time without discriminating amongst competing theories. In truth, no single theory does a good job at explaining the exchange rate. A way forward is using co-integration techniques in a "theoretically agnostic" way. The equilibrium models thus obtained generate "forex barometers", i.e. indicators of overbought/oversold. These allow investors to identify major risks without generating detailed numerical forecasts.

Leading Indicators of Currency Crises in Emerging Economies

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V. Coudert — Banque de France; France

This study identifies common features of currency crises in 15 emerging countries over the period 1980-1998. By analyzing such features, we build an early-warning system aimed at predicting looming crises in probabilistic terms. This work departs from the existing literature in several ways. First, we use quarterly data, in contrast to other studies, which are based on monthly or annual data. This allows us to characterize crises more accurately and also to analyze the behavior of leading indicators as actual crises approach. Second, the overvaluation of currencies is assessed by using real effective exchange rates, instead of the usual bilateral rates. In addition, capital controls dummies are included in the set of explanatory variables and contagion indicators are constructed. Finally, we use the Fisher linear discriminant analysis technique. The model yields a relatively good - and unbiased - ratio of correct predictions: four out of five crises are predicted correctly and only one out of five non-crises is predicted as a crisis. These results compare favorably to those of other models. For early warning systems, there exists a fundamental trade-off based on the Bayes' formula in a context of rare events: to a certain extent, one has to choose between a high ratio of good classifications of crises and a low ratio of false alarms. Furthermore, using Bayes' formula allows us to calculate the posterior probability that a given emerging economy will be in a period of currency crisis within a one-year horizon.

Bayesian Methods

Chair: **Celal Aksu** (Koc University - Turkey)

Analysis of Two Forms of Empirical Bayes Estimation to Reduce Overestimation of Seasonal Variation in Classical Decomposition

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Don M. Miller — Virginia Commonwealth University; USA

It can be readily demonstrated that seasonality factors estimated through ratio-to-moving averages classical decomposition generally attribute part of the random variability of data to the seasonality factors, thus overestimating the magnitude of the seasonality factors. This consequence results, in part, from the small sample size for each specific seasonal factor, as a consequence of that factor's occurring only once during each seasonal cycle. This paper reports the results of a simulation study that emulated the characteristics of the seasonal, monthly members of the 111 series subset of the M-competition using two forms of empirical Bayes estimators to reduce the excessive variability of seasonal factors. The general result is that at least one of the empirical Bayes estimators consistently provided more accurate estimates of actual seasonality factors than classical decomposition, with the improvement sometimes being dramatic. Further analysis has focused on identifying an indicator that would predict which of the three techniques produces more accurate estimates of the generating process' actual seasonality factors under a given set of conditions.

Distribution of Economic Aggregates. A Bayesian viewpoint

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J. A. Sanz — University of Valladolid; Spain

This paper provides a method to distribute an economic aggregate among smaller areas, using indicators. It makes use of Bayesian tools, implemented by Gibbs sampling in order to obtain the estimates. The method, with minor changes, is applied to adjust predictions provided by individual (single country) econometric models, with the overall prediction arising from an aggregate model. Authors also explore the adequacy of their method in solving problems of time series interpolation or temporal disaggregation.

Bayesian Multivariate Regression for Predicting User Behaviour in a Software Agent Computer Security Environment

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Kostas Triantafyllopoulos — University of Warwick; UK

This paper examines the problem of intrusion in computer systems that causes major breaches or allows unauthorized information manipulation. We briefly review the unsatisfactory existing detection systems. A new intrusion detection system using Bayesian Multivariate Regression is proposed to predict such unauthorized invasions before they occur and take further action. We develop and use a Multivariate Dynamic Linear Model (DLM) based on a unique approach leaving the unknown observational variance matrix distribution unspecified. The result is simultaneous forecasting free of the Wishart limitations that is proved faster and more reliable. Our proposed system uses Software Agent Technology. The distributed Software Agent environment places a Software Agent in each of the computer system workstations. The Agent Environment creates a user profile for each user. Every user has his/hers profile monitored by the agent system and according to our statistical model prediction is possible. Implementation aspects are discussed using real data and an assessment of the model is provided.

A Hierarchical Bayes Model of International Interest and Inflation Rates

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Richard W. Andrews — University of Michigan Business School; USA

Peter J. Lenk — University of Michigan Business School; USA

The main purpose of this paper is to forecast the effects on inflation rates caused by changes in interest rates. Even though many governments use a monetary policy of changing interest rates to attempt to keep inflation in check there is no agreed upon relationship between the two measures. This relationship between interest and inflation rates has been studied extensively since Fisher's work in the 1930's. Most of the studies, however, concentrated on a single national economy and have not used recent data. In this paper we investigate this interest rate / inflation rate relationship in more than twenty countries and for periods ranging from 10 to 20 years. Using a hierarchical Bayes framework, for modeling and estimation, we are able to state conditions under which interest rate changes can be used to forecast inflation rate.

Forecasting with Neural Network and Other Nonlinear Models

Session Organizer and Chair: **Timo Teräsvirta** (Stockholm School of Economics - Sweden)

Modelling and forecasting economic time series with single hidden-layer feedforward autoregressive artificial neural network models

Gianluigi Rech — Stockholm School of Economics; P.O. Box 6501; SE-11383 Stockholm; Sweden

This paper considers modelling with artificial neural networks (ANN) from a statistical point of view, using statistical tools. The variables to the model are selected by applying model selection criteria to a linearized version of the model. The hidden units are selected sequentially using score or Lagrange multiplier type tests. The models obtained are evaluated using statistical tests and by comparing their performance with ANN model specified by pruning. Out-of-sample forecasting is also carried out to evaluate the performances of the ANN models built in this fashion.

Forecasting with artificial neural network models

Marcelo C. Medeiros — Stockholm School of Economics; P.O. Box 6501; SE-11383 Stockholm; Sweden

Gianluigi Rech — Stockholm School of Economics; Sweden

In this paper the forecasting performance of a number of artificial neural network (ANN) models is compared with that of linear models. The idea is to find out whether or not different techniques of specifying ANN models, such as pruning and statistical techniques, lead to vastly different models. If they do, then the next question is whether this matters from the forecasting point of view. Values of some 30 economic and other time series are predicted using models obtained by a number of different modelling techniques and the forecasts compared using a number of different criteria. It appears that, on the average, linear models do not perform worse than neural network models.

A Flexible Coefficient Smooth Transition Time Series Model

Marcelo C. Medeiros — Dept. of Electrical Engineering; Catholic University of Rio de Janeiro; Rio de Janeiro; Brasil

Alvaro Veiga — Catholic University of Rio de Janeiro; Brasil

This paper considers an additive smooth transition time series model with multiple regimes and transitions defined by hyperplanes in a multidimensional space. This proposal is a generalization of the STAR model with the major advantage of nesting several nonlinear models, such as, the Self-Exciting Threshold AutoRegressive (SETAR) model with multiple regimes, the AutoRegressive Artificial Neural Network (AR-ANN) model, and the Logistic STAR model. Furthermore, the proposed model can be also compared to the Functional Coefficient AutoRegressive (FAR) and the Single-Index Coefficient Regression models. A modelling cycle procedure, consisting of the stages of model specification, parameter estimation, and diagnostic checking is developed allowing the practitioner to choose among different model specifications during the modelling cycle. Encouraging results were found in both real and simulated data.

Forecasting with smooth transition autoregressive models

Timo Teräsvirta — Stockholm School of Economics; Box 6501; SE-113 83 Stockholm; Sweden

Stefan Lundbergh — Stockholm School of Economics; Sweden

This paper discusses the use of smooth transition autoregressive models for forecasting time series. First, techniques of modelling time series with these nonlinear models are discussed. Next, methods for obtaining multiperiod predictions are presented. The usefulness of forecast densities in the case of nonlinear models is considered and techniques of graphically displaying such densities demonstrated. Finally, an empirical application to two quarterly unemployment series is given.

Friday, 11:40-13:00 — Room: **Cristal B**

Panel Session 3

Organizer: **P. Geoffrey Allen** (University of Massachusetts, USA)

Chair: **Bernard J. Morzuch** (University of Massachusetts, USA)

Principles of Econometric Forecasting

Panel members:

P. Geoffrey Allen — University of Massachusetts, USA

Antonio Garcia-Ferrer — Universidad Autonoma de Madrid, Spain

Timo Teräsvirta — Stockholm School of Economics, Sweden

Robert Goodrich — Business Forecast Systems, Inc, USA

Principles of econometric forecasting, like principles for other kinds of analytic activities, can arise from several sources. They can codify the practices that are widely followed, or that are followed by respected members of the profession. They can result from experimentation to determine which techniques produce improved forecasts and under what conditions. They can be developed from meta-analysis, that is, from the formal analysis of published results. Few econometric forecasters view the concept of having principles to guide the profession as a negative development. To most it is either a good thing or a harmless diversion. But is it too soon to develop econometric forecasting principles? Will following some of the existing principles lead to better forecast performance, or are they unhelpful, misleading, or wrong? Are there important principles and practices that have been overlooked? Geoff Allen will present a summary of the 24 econometric principles developed as part of the Principles of Forecasting project. Other panelists will present their views on the above questions.

Friday, 11:40-13:00 — Room: Cristal A

Business Cycle Analysis

Session Organizer and Chair: **Kajal Lahiri** (University at Albany , SUNY - USA)

Synchronization of Cycles

Don Harding — Melbourne Institute; Faculty of Economics and Commerce; University of Melbourne; Victoria, 3010; Australia
Adrian Pagan — University of Melbourne; Australia

In this paper we suggest ways of measuring synchronization of cycles in a set of series and develop suitable measures of association and test statistics for such phenomena. In doing so we show that some existing methods are in error due to a failure to account for the time series properties of the data entering into their construction. A major advantage of the methods we propose is that they do not require data to be detrended and so one avoids what has often been a fruitless debate about the impact of detrending upon the location of turning points.

Measuring Uncertainty in US Business Cycle Forecasting

Kajal Lahiri — Department of Economics; University at Albany; SUNY, Albany; NY 12222; USA
Detelina Ivanova — University at Albany; USA

We use panel data on subjective probability distributions of multi-period inflation forecasts for based on ASA-NBER surveys over 1968-1998 to estimate the uncertainty in these forecasts, and to compare them with conventional ARCH-type estimates. The difference in these estimates is striking around business cycle turning points. Using the Lucas model we argue that forecaster discord is an important part of forecast uncertainty. The usefulness of these data in business cycle analysis is emphasized.

A Leading Index for the Indian Economy

Anirvan Banerji — Economic Cycle Research Institute; 420 Lexington Avenue, Suite 1645; New York, NY 10170; USA
Pami Dua — Delhi School of Economics; India

This paper adopts a classical leading indicator approach to yield a composite index of leading indicators for the Indian economy, designed to anticipate business cycle recessions and recoveries, as well as growth rate cycle upturns and downturns. Given the paucity of suitable data for the Indian economy, the construction of such a leading index constitutes a significant advance, and confirms that the durable sequences of leads and lags seen in typical market economies also hold up in the Indian case, permitting useful forecasts of cyclical turning points.

Cubic Splines Spectral Properties for Short-Term Trend-Cycle Estimation

Estela Bee Dagum — Faculty of Statistical Sciences; University of Bologna; Via delle Belle arti 41; (40126) Bologna; Italy
Antonella Capitanio — University of Bologna; Italy

Cubic splines have a long history as smoothers of noisy observations. Within the context of short-term trend estimation for current economic analysis we have compared the well known 13-term Henderson filter (H-13) with cubic smoothing splines (CSS) and found that for certain values of the smoothing parameter λ , CSS gives better results than H-13 from the viewpoint of (a) number of false turning points in the final estimate of the trend-cycle and (b) time lag to detect a true turning point.

The purpose of this study is to investigate the properties of CSS based on a transfer function approach. This enables us to find the values of λ for which the above (a) and (b) criteria can be optimized. We show that for values of λ near one, the gain functions of the CSS are close to that of H-13 filter but with a significant reduction in power at the 9 and 10 month frequencies, associated to false turning points. For all end points (except the last observation) the phase shifts are near zero at all frequency which implies a faster detection of a turning point.

Forecasting Crime

Session Organizer and Chair: **Wilpen L. Gorr** (Carnegie Mellon University - USA)

Modelling and Predicting Property Crime Trends in England and Wales

Sanjay Dhiri — Home Office; RDS Economics & Resource Analysis Unit, Room 263; 50 Queen Anne's Gate; London SW1H 9AT; United Kingdom

Sam Brand — Home Office; UK

Richard Harries — Home Office; UK

Richard Price — Home Office; UK

In 1998 the Home Office developed two models of property crime, based on long-run aggregate relationships between recorded crime and macroeconomic and demographic factors. These models were updated and revised last year and, for the first time, were used to make projections about the possible future direction of such crime in England and Wales. Although an understanding of possible future pressures on crime is vital for planning in the criminal justice system, very little work has been undertaken in this field. By publishing these projections, we hope to stimulate debate about the use and possible extension of such models.

Spatial-Temporal Point Process Models for Criminal Event Prediction

Donald E. Brown — Department of Systems Engineering; University of Virginia; Charlottesville, VA 22903; USA

Steven H. Kerchner — University of Virginia; USA

An important need in crime prevention is to predict the likelihood that criminal incidents occur at specified locations within a geographic region and a specified time range, based on historical incident records. A model for predicting the probability of occurrence of spatial-temporal random events was developed based on the theory of point patterns. This model views the available data as a realization of a marked space-time shock point process, and the prediction problem as the estimation of the space-time transition density of the process. In contrast to traditional space-time prediction models, this model incorporates richly informative observed event characteristics or features into space-time prediction. Our previous model assumes temporally homogeneous data and thus excludes all temporal features. We describe our extension to the model which incorporates temporal feature heterogeneity by changing the temporal transition density calculation. Test results comparing this model with traditional methods for predicting hot spots are described.

Modeling and Predicting Drug Market Locations Using Spatial Principles

Sanjoy Chakravorty — 309 Gladfelter Hall; Department of Geography and Urban Studies; Temple University; Philadelphia, PA 19122; USA

George F. Rengert — Temple University; USA

The locations of drug markets in U.S. cities are based on a number of spatial factors which are broadly grouped into 'susceptibility' (referring to the drug buying population), 'accessibility' (derived from the street network and interchange nodes), and 'opportunity' (arising from built environment features where buyers concentrate). Using arrest data over a ten year period from Wilmington, Delaware, census data, and geographic information on the street network and the built environment, we identify the specific factors that are most significantly related to drug sales related arrests. These factors are then combined into two models of drug market location prediction (using data from 1988-1995 to check the accuracy of the results for 1996-1997), where one model is census geography based and the other model is based on the geography created by the factor identification process. The robustness of the models suggest that this approach is replicable in other contexts.

Short-Term Forecasting of Crime Space and Time Series Data

Wilpen L. Gorr — H. John Heinz III School of Public Policy and Management; Carnegie Mellon University; Pittsburgh, PA 15213; USA

Andreas M. Olligschlaeger — Carnegie Mellon University; USA

Yvonne Thompson — Carnegie Mellon University; USA

For tactical deployment of resources, police need one-month ahead forecasts by crime type for small areas (precincts or patrol car beats). For Pittsburgh, Pennsylvania, we find the classical seasonal patterns of increased property crimes levels in Winter (due to economic pressures of cold weather and crime opportunities afforded by holidays) and increased aggression crimes in Summer (due to increased social interactions). It is difficult, however, to reliably estimate seasonality in small areas, thus we have attempted to pool data cross-sectionally to gain reliability and better forecast accuracy. We have completed an extensive set of forecast simulations comparing naive and various smoothing models and treatments of seasonal estimation. The results show common police practices to perform poorly and simple forecasting models to perform relatively well. Unlike other small data aggregations (e.g., products) which have variation dominated by pattern changes, variation in small-area crime counts seems to be dominated simply by randomness.

Telecommunications

Chair: **Masatsugu Tsuji** (Osaka University - Japan)

Performance Forecast of Codes on the Radio Telecommunications Systems Using Stochastic Model

Pedro. J. A. Sebastião — IST – Technical University of Lisbon; Torre Norte 11-09; Av. Rovisco Pais 1; 1096 Lisboa Codex; Portugal

Francisco A. B. Cercas — Instituto de Telecomunicações and IST; Portugal

Adolfo V. T. Cartaxo — Instituto de Telecomunicações and IST; Portugal

The objective of this paper is to present the method to forecast the performance of TCH codes family in a radio telecommunications system, where it was used the stochastic model. These codes were submitted to a channel where errors can occur independently and in burst. The radio telecommunications system was modelled by the 3 states Markov Model. To accelerate the performance simulation it was used the Interval Simulation Technique (IST). The 3 states Markov model is composed by state 1, where an errors occur independently; state 2 where there is no errors occurrence; state 3 where the errors occur in burst. In our system, the greater benefice of this method is this: We only need to process (coding and decoding) words for which the number of errors is greater than the error correcting capacity of the code. These methods can be applied to estimate the performance of other codes in a telecommunications system.

Forecasting the mobile phone penetration in Finland

Saku Mäkinen — Tampere University of Technology; Institute of Industrial Management; P.O.BOX 541; 33101 TAMPERE; FINLAND

Jarl-Thure Eriksson — Tampere University of Technology; Finland

Major drawbacks of traditional forecasting methods like diffusion models are that they are either analytically inaccurate or require too many presumptions about spreading dynamics in order to produce reliable forecasting results. In the past decade more sophisticated approaches like complexity theory or neural networks have emerged. These have provided new insights in the modelling of social penetration processes. In the framework of complexity theory percolation models appear to be very promising for forecasting the spread of innovations in a society. We approached the general spreading process in a society through the percolation theory and were able to construct a model that is not dependent on presumptions about the penetration. Further, the percolation model does not require assumptions for saturation level, inflection point or delay factor like diffusion models. The percolation model was applied to the spreading of mobile phones in Finland and our results appear to provide precise simulations and predictions for the penetration of new technology in a society.

A Forecasting of Local Competition in the Japanese Telecommunications Market

Masatsugu Tsuji — Osaka School of International Public Policy; Osaka University; 1-16 Machikaneyama, Toyonaka; Osaka 560-0043; Japan

Giant NTT was divided into four companies in 1999, and West NTT and East NTT, its new local call companies, are now being challenged by new competitors in the local call market such as local NCCs, and CATV, cellular phone, and mobile phone compnaies. Local NCCs include TNet, CTK, and OMP, which were mainly established by electric companies. Their current share of the market is however minimal, namely, 2%. Local NCCs are expanding their network not only to large users such as firms in metropolitan areas, but also to individual households. They may eventually become a real threat to NTT.

Based on the circumstances of the above local call market, we forecast the demand for local calls of West NTT and East NTT, and analyze how growing local competition affects local NTTs. We also focus on the strategies of local NTTs and new competitors to expand their market share. Local NCCs aim not only at promoting its telephone services, but also at starting a new business to provide Internet service at a fixed rate. Finally, policies to maintain fair and efficient competition will be presented.

Keynote speech 4

Chair: **Paulo Teles** (Faculdade de Economia, Univ. Porto, Portugal)

Some Results on Forecasting with Multivariate Time Series

Daniel Peña

Universidad Carlos III de Madrid, Spain

Abstract: Multivariate times series forecasts are expected to be more precise than univariate forecasts and the procedure to compute the expected increase in precision of the multivariate forecasts over the univariate forecasts is analyzed. The procedure is first presented in general terms and then it is applied to compare the predictions from VARMA and ARIMA time series models. It is shown that when most of the dependency among the components of a vector of time series is contemporaneous, the increase in precision of the multivariate forecasts over the univariate forecasts is expected to be small. Also, the increase in the number of parameters when estimating VARMA models with respect to the univariate ARIMA models has a negative effect on the forecasts precision. For series with strong contemporaneous dependency the Dynamic Factor Model (Peña and Poncela, 2000) provides a parsimonious way to build a multivariate model with better forecasting behavior. This is illustrated with real examples and Monte Carlo simulations. Taking into account some common deterministic effects on the vector of time series, as joint outliers and structural breaks can also lead to better forecasts and better assessment of the forecasting uncertainty.



Daniel Peña is Professor of Statistics in the Department of Statistics and Econometrics, Universidad Carlos III de Madrid and President of ECAS (European Courses in Advanced Statistics). He has been Professor at the Universidad Politecnica de Madrid, University of Wisconsin-Madison and The University of Chicago, President of the Spanish Statistical Association (SEIO) and Vicepresident of The Interamerican Statistical Institute. He has done research on Time Series, Robustness and Diagnostics, Multivariate analysis, Bayesian Statistics and Quality Methods. His papers have appeared in *Biometrika*, *The International Journal of Forecasting*, *JASA*, *JRSSB*, *JTSA*, *JBES*, *JCGS*, *CSDA*, *The Journal of Forecasting*, *The Journal of Econometrics*, *Statistica Sinica*, *SPL*, *Science and Technometrics*, among others. He is the author of a forthcoming book on time series (*A course in time series*, by D. Peña, C. G. Tiao and R.S. Tsay, Wiley). He is an ISI member and IMS fellow.

Forecasting with BVAR Models I

Session Organizer and Chair: **Luís C. Nunes** (Nova University of Lisbon - Portugal)

Bayesian Multivariate Time Series Models for Forecasting the Leading European Economies

Qiang Fu — Rm. 310, Informatics Centre; School of Computing, Engineering and Technology; University of Sunderland; St. Peter's Campus; Sunderland, SR6 0DD; UK

The primary concerns of this study are threefold. The first is to formalize a thorough, yet simple, methodological framework for empirical macroeconometric modelling in a Bayesian spirit. The second is to investigate whether improved forecast accuracy is feasible within a multicountry context. This is conducted with particular emphasis on the construction and implementation of Bayesian vector autoregressive (BVAR) models that incorporate both prior and cointegration restrictions. The third is to extend the approach and apply it to the joint-modelling of system-wide interactions amongst the leading European economies. The research undertaken consolidates existing empirical and theoretical knowledge of BVAR modelling. It provides a unified coverage of economic forecasting applications and develops an effective and progressive methodology for the economies. The empirical results reflect that in simulated 'out-of-sample' forecasting performances, the gains in accuracy from imposing prior and long-run constraints are statistically significant, especially for small sample sizes and long forecast horizons.

BVAR Models and Forecasting: a quarterly model for the EU-11 Area

Gianni Amisano — Institute of Economics,; LIUC University of Castellanza; Corso Matteotti 22; Castellanza (VA); Italy
Massimiliano Serati — LIUC University of Castellanza; Italy

This paper deals with the construction and evaluation of a quarterly forecasting BVAR model for the EMU-11 countries treated as a single country. We describe all the methodological and applied problems, with particular emphasis given to the prior specification, to the estimation of hyperparameters and to the construction of the dataset. In the current stage of the EMU completion, most variables are affected by turbulences and many macroeconomic relationships are characterized by structural instability. For this reason, the forecasting models used in this paper are time varying BVAR models. There are still some signs that the models we have estimated are affected by some paper we present an innovative approach in which we extend the BVAR time varying parameter methodology: the intensity of parameter variation is governed by a time varying variance/covariance matrix of the state equation error terms. This is achieved by slightly increasing the dimensionality of the hyperparameters space. We show some preliminary, encouraging evidence on how this proposal works, based on simulated data and on a restricted version of the EMU-11 model.

Bayesian VECM forecasting models for the EMU-11

Ricardo M. Félix — Research Department; Banco de Portugal; Lisboa; Portugal
Luís Catela Nunes — Universidade Nova de Lisboa; Portugal

BVAR models have been widely used as macroeconomic forecasting tools not only for its accuracy, but also for being easy to handle and to estimate.

This article presents a Bayesian VECM for the euro area. Macroeconomic variables were split into several groups (real variables, prices, monetary policy instrument and external variables). Cross-interactions between variables in different groups are controlled by hyperparameters to be calibrated. To avoid an excessive weight of factor loadings associated with cointegration relations, alternative informative priors are considered. Calibration of hyperparameters is made by optimising two alternative functions of 12 step ahead forecast errors.

The model provides a better treatment of long-run relationships and improves medium term forecasting relative to standard BVAR models in levels or first differences.

Seasonal

Chair: **F. Vitorino Martins** (University of Porto - Portugal)

Seasonal Adjustment of Consumer Price Indexes: A Non-Standard Bayesian Approach Via Dynamic Models and its Comparison with the X-12 and other Methods

Emanuel Pimentel Barbosa — Dep. Estatística; IMECC Unicamp, CP 6065; CEP 13.023-190; Campinas, SP; Brazil

Marc Witarso — IMECC; Brazil

Andreia Machado — IMECC; Brazil

The seasonal adjustment of economic time series and particularly consumer price indexes has been usually approached using methods based on moving average filters as the X11 and X12 ARIMA method, or even, model-based procedures as the TRAMO/SEATS and other methods. Although largely used in practice, all these methods, when applied to price indexes series, violate the basic consistency principle that the 12-months accumulated index should not change after the seasonal adjustment process.

It is presented in this paper an alternative method for seasonal adjustment of consumer price indexes based on a non-standard Bayesian implementation of multivariate dynamic linear models with common components. Our proposed method is then compared with the other competing methods considering the degree of consistency of their seasonal factors estimates as the main assessment measure, where real and simulated data are used.

Air travel demand forecasting in a highly seasonal environment

Basil Stephanis — Department of Transportation; Democritus University of Thrace; Greece

Dimitrios Dimitriou — Democritus University of Thrace; Greece

The Department of Transportation of the Democritus University of Thrace is currently involved in research regarding demand forecasting with emphasis on air transport demand with high seasonal features.

The paper which, me and my collaborator, are planning to present tackles the problem with many existing methods as well as innovative ones. The paper plans to review demand forecasting on air transport in regions with high seasonal fluctuations (tourist areas).

We will elaborate the data of air transport in two at least important tourist areas in Greece (islands), and we will make forecast with the methods Arima, Exponential Smoothing and S – Curve and Fuzzy regression. Finally we will refer to the results and will describe the pros and the cons of each forecasting method.

Forecasting seasonal series with correction by surveys data

F. Vitorino Martins — Faculdade de Economia; Universidade do Porto; R. Roberto Frias; 4200 Porto; Portugal

Ricardo Jorge Silva — Apiccaps e U.Lusiada; Portugal

We define a method that uses leading information of surveys to correct a first level forecasts of seasonal series made by a classic method (Holt-Winters or ARIMA models).

This correction is made by an estimated index constructed by a Logit multinomial model that uses lag distributed effects.

In the paper, the study of the nature of surveys opinions is presented, namely their relationship with growth rates of the analysed series and principal components synthesis.

A comparison with classical techniques is presented using ex-post forecasting and classical measures of forecasting efficacy.

Data used are monthly portuguese footwear exports (quantity) and several variables about opinions expressed by enterprises.

Judgemental Forecasting IV

Chair: **Dilek Önkal-Atay** (Bilkent University - Turkey)

A technique for improving calibration of probability forecasts

Oleksandr S. Chernyshenko — University of Illinois at Urbana-Champaign; 603 E. Daniel St., Psychology Department; Champaign, IL 61820; USA

Janet A. Sniezek — University of Illinois at Urbana-Champaign; USA

It is well known that subjective probability forecasts for individual events are poorly calibrated in a variety of settings. Specifically, they tend to be higher than is warranted by accuracy rates for the very uncertain events for which human judgment is so essential. However, global forecasts for the aggregation of these same events are much lower, often resulting in superior calibration (Sniezek & Buckley, 1991; Sniezek, Paese, & Switzer, 1990). A dual source explanation for this discrepancy in calibration proposes that different processes are involved in forecasts at the global and event levels. We present two studies of a priming technique developed from dual source theory. Results with college students and military intelligence experts show that priming judges for global forecasts prior to event forecasts improves calibration for the event forecasts of varying difficulty. Practical and theoretical implications are discussed.

Combining Probability Currency and Share Index Predictions

Andrew C. Pollock — Department of Mathematics; Glasgow Caledonian University; City Campus; Cowcaddens Road; Glasgow, G4 0BA; Scotland; UK

Alex Macaulay — Glasgow Caledonian University; UK

Dilek Önkal-Atay — Bilkent University; Turkey

Mary E Wilkie-Thomson — Glasgow Caledonian University; UK

A general framework is set out for the derivation of composite probability predictions for share index movements that incorporate currency movements using separate currency and share index probabilistic predictions. The framework is based on the assumption that changes in the logarithms of an exchange rate follow a Normal distribution with time varying parameters. In particular, it is shown that the means, standard deviations, cross correlations and probabilities calculated from previous periods can be used as a guide to the formation of predictions. It is also illustrated that predictive performance can be evaluated using the realised means, standard deviations and probabilities at the end of the forecast horizon. This integrated framework is applied in a practical context to 30-day ahead judgemental probability predictions for daily movements of the Swiss Franc against the US Dollar and for the US DJIA and the Swiss SMI share indices.

Provider-User Differences in Perceived Usefulness of Forecasting Formats

Dilek Önkal-Atay — Bilkent University; Faculty of Bus. Admin; Ankara 06533; Turkey

Fergus Bolger — Bilkent University; Turkey

This paper aims to examine potential differences in perceived usefulness of various forecasting formats from the perspectives of providers and users of predictions. In the first session of our experiment, participants are requested to make forecasts for financial series using point, interval, and directional probability forecasting formats. The participants are then asked to rank the usefulness of these formats, assuming the role of forecast providers. This is followed by a role switch exercise in which the participants are given new financial series along with predictions supplied by another forecaster. Participants are required to construct portfolios using the provided forecasts and then rank the usefulness of the formats, this time assuming the role of forecast users. In the second session, participants are given feedback and are asked to rank the usefulness in hindsight, both as providers and as users. Differences due to role are examined and future research directions are suggested.

Friday, 15:30-16:30 — Room: Douro

Forecasting Systems I

Chair: **J. Scott Armstrong** (Wharton School of the University of Pennsylvania - USA)

A framework for automatic forecasting using exponential smoothing

Rob J. Hyndman — Department of Econometrics and Business Statistics, Monash University, Clayton VIC 3800; Australia

Anne B. Koehler — Dept. of Decision Sciences and MIS, Miami University; USA

Ralph D. Snyder — Department of Econometrics and Business Statistics, Monash University; Australia

We provide a new approach to automatic business forecasting based on an extended range of exponential smoothing methods. Each method in our taxonomy of exponential smoothing methods can be shown to be equivalent to the forecasts obtained from a state space model. This allows (1) the easy calculation of the likelihood, the AIC and other model selection criteria; (2) the computation of prediction intervals for each method; and (3) random simulation from the underlying state space model. We demonstrate the methods by applying them to the data from the M3-IJF competition.

Increasing the use of forecasting software by greater user involvement

Michael Lawrence — University of New South Wales; Sydney 2052; Australia

Paul Goodwin — University of the West of England; UK

Robert Fildes — Lancaster University; UK

The paper reports a study of the impact on user satisfaction and forecast accuracy of user involvement in the design of a forecasting decision support system (FDSS). Two versions of a FDSS were tested via a laboratory study. Version 1, allowed the user control over all aspects of the system including the 'look' of various screen elements and, most importantly, the model to be used could be selected (and tested) from a number of alternative forecasting models provided within the FDSS. Version 2 allowed the user the same opportunity to modify the 'look' of the screen, but provided no opportunity for model selection; this feature was carried out optimally by the FDSS. The user was told the advantage of optimal model selection. Both versions finished by asking the user to either accept the forecast (displayed as a point on the time series graph) or to modify it via the mouse if unhappy with it. Results showed a much greater satisfaction with the forecasts provided by Version 1. However the accuracy of Version 1 was slightly inferior to Version 2. Further results will be presented and discussed.

Business Forecasting, Needs and Challenges

T. O. Oke — 600, Lanidex Plaza; Parsippany, NJ 07054; USA

David Reilly — Automatic Forecasting Systems; USA

As business activities become more integrated and complex, the use of automatic forecast has become a common tool in business decision making. Here we analyze how statistical forecasting methods are used for automatic forecasting in industries and numbers of companies. They are huge limitations in current automatic forecasting devices: firstly in terms of their lack of scientific approach and secondly in terms of their inflexibility to adapt to non-standard situations. More generally we discuss the 'model opportunity space' or 'model sample space' that is implied by different procedures.

Finance III

Chair: **Elma Suema Trevisan** (Pontifícia Universidade Católica do Rio de Janeiro - Brazil)

Neural Network, Decision Making and Stock Market

Petr Dostál — Raselinova 6, Box 40; 628 00 Brno; Czech Republic

The article is concerned with the prediction of time-series in the financial branch by means of neural network. There are some results of time-series quoted for different titles of American stock market. The precision of predictions (MAPE) is evaluated according to the type of neural network models and various periods of samplings. In conclusion, the process of decision making using fuzzy logic is described which enables you to evaluate the diversified and sometimes contradictory results of psychological, fundamental and technical analyses.

The Statistical Behavior of the Brazilian Stock Returns

T. K. N. Baidya — Departamento de Engenharia Industrial; Pontifícia Universidade Católica do Rio de Janeiro; Rua Marques de São Vicente 225; Gavea, Rio de Janeiro, CEP. 22453-900; Brasil

P. H. S. Costa — Pontifícia Universidade Católica do Rio de Janeiro; Brazil

The predictability of price changes has been a major theme of financial research. Many models have been built to do this job, but many of them assume that the financial time series are stationary, independent and normally distributed. The objective of our research is to test these hypotheses. We have selected six most negotiated Brazilian stocks, which represent about 60% of the total volume negotiated in São Paulo Stock Exchange. Our conclusion is that the series could be assumed to be stationary, but cannot be assumed to have a normal distribution and cannot be assumed to be independent.

Forecasting the São Paulo Stock Exchange Index: A Comparison of Models

Elma Suema Trevisan — Rua Rainha Guilhermina nº 66; Aptº 302 Leblon; 22441-120; Rio de Janeiro-RJ; Brasil

Katia Lorena Suez-Carrillo — Pontifícia Universidade Católica do Rio de Janeiro; Brazil

Mônica Barros — Pontifícia Universidade Católica do Rio de Janeiro; Brazil

The objective of this paper is to evaluate the performance of different econometric models in explaining the relationship between spot and future values for the São Paulo Stock Exchange Index (IBOVESPA index), that represents the largest stock exchange in Brazil. As a benchmark we use a martingale model and we study the performance of different competing models, such as VAR (Vector Autoregression), ECM (Error Correction Model) and the Fractionally Integrated Error Correction Model (FIECM) introduced by Lien and Tse, 1999. The FIECM model is then used to test the presence of long memory effects due to fractional co-integration. Moreover, due to the presence of heteroscedasticity, we add a GARCH structure to the errors in the models.

Turning Points

Chair: **Wildi Marc** (University of Fribourg, University of St-Gallen - Switzerland)

Dating the Business Cycle: An Indicators-based Approach

Beatriz Fariña Gómez — Dept. of Applied Economy (Statistics & Econometrics); University of Valladolid; Avda. Valle Esgueva, 6; 47011- VALLADOLID; Spain

José Luis Rojo García — University of Valladolid; Spain

This paper puts forward an statistical model in dating the business cycle. Turning points emerge after an evaluation of the (almost) overall economic and some socioeconomic indicators of the Spanish Economy.

In spite of other viewpoints that focus on a selection of a small package of indicators, this paper makes use of the joint cyclic behaviour in order to find the turning points, meaning by that, those points where a change in the 'feeling' of the spanish economy is guessed. The series which are obtained from each of the indicators hold their cyclic contents. These derived series play an essential role in our approach. For the present, our effort is focused on the analysis of the statistical patterns of this 'cyclical feeling' and on the cross empirical distributions of these feeling indicators. These patterns will be used later on in order to set up the model.

A Bayesian Method to predict turning points

H. Fernández-Abascal — Facultad de Ciencias Económicas y Empresariales; Avda. Valle Esgueva 6; 47011- VALLADOLID; Spain

L.J. Rojo — University of Valladolid; Spain

One of the most important goals of business cycles is the detection and forecast of turning points. In this paper we introduce a bayesian method to compute the probability that a future value of a serie goes beyond a threshold. Our method uses leading indicators.

The procedure is aplicated to forecast changes in the growth cycle of the Spanish economy. This cycle, with monthly data, is obtained from PIB (Gross Domestic Product) and IPI (Industrial Production Index) series. The composite index of leading indicators emerges from factorial analysis methods. The accuracy of the proposed procedure is assessed using the historic turning points. Furthermore we confront our predictions with the forecasts provided through other procedures.

Signal Estimation and Early Detection of Turning Points

Wildi Marc — Herrengasse 20; 2554 Meinisberg; Switzerland

Model based approaches are commonly used when estimating a signal overlapped by 'noisy' components : in order to avoid boundary problems due to the symmetry of the extraction filter one extends finite data sets on both ends by fore and backcasts generated from a model of the underlying process. Unfortunately, this procedure is not optimal if the selected and estimated model is not the 'true' one :optimization of the model parameters with respect to some forecasting criterion is generally not equivalent with the minimization of the resulting signal approximation error. In this article we present a signal estimation procedure which minimizes a consistent estimate of the variance of the signal approximation error. Moreover, as the proposed procedure enables control over the time delay of the approximating filter, we are able to detect turning points earlier than with traditional model based approaches.

Bootstrapping

Chair: **João Oliveira Soares** (CEG-IST, Instituto Superior Técnico - Portugal)

Structural Identification of Quasi White Noise Linear Models - Box & Jenkins Linear Models

Anselmo Chaves Neto — R. Ten. Cel. João A. Ramalho, 853; CEP 81530-500; Curitiba (PR); Brazil

Reinaldo Castro Souza — DEE/PUC,RIO; Brazil

The Box & Jenkins approach, proposed in 1970 as a general procedure to develop time series models for forecasting and control, consists of three stages, namely: structural identification, model parameter estimation and goodness of fitting tests. The structural identification is carried out via joint use of the autocorrelation function (ACF for short) and the partial autocorrelation function (PACF for short). However, in this particular stage of the procedure, there is a chance of the one assumes that the time series in study has been generated by a white noise type of stochastic process, when in fact, this assumption is not true. In other words the straight forward application of the identification procedure leads one to admit the series as being a white noise, yet, the model parameters are located in a particular region of the parametric space with properties not detected by the classical procedure. We define a time series with this property as "Quasi White Noise" series (QWN) from now on.

The bootstrap is a non-parametric computational intensive statistical procedure (CIS for short) which allows the evaluation of the variability of any statistics based on information of a single sample. It is recommended for situations where the standard procedures are not available or are difficult to be obtained in analytical terms. This technique can be used in problems characterised by both; finite sample or big sample size, as they produce better results in the former and as good result as the usual asymptotic in the latter. In this paper we formally propose the use of bootstrap as an additional technique to be used in the model identification stage of Box & Jenkins ARIMA structures. The remainder of the paper is organised as follows. In section 2 we address the problems associated with the identification of time series showing the QWN property, while in section 3 we propose the use of bootstrap for QWN series. In section 4 we describe a simulation study carried out and the main conclusions of the proposed procedure are drawn. The paper is concluded with an appendix containing the results and plots from the simulation study.

Bias evaluation and correction using bootstrap in ARFIMA parameters

Glaura C. Franco — Departamento de Estatística; ICEX/UFMG, C.P.702; MG, CEP:31270-010; Brazil

Valdério Anselmo Reisen — DEST/UFES, Vitória, ES; Brazil

Methods for estimating the fractional difference parameter d in ARFIMA(p,d,q) models include, nowadays, a wide variety of techniques, such as regression and maximum likelihood procedures. Some of these methods have a low bias and variance, but demand a great computational effort; while others are computationally attractive, but present a large bias.

The main interest of this work is to evaluate and correct the bias of the parameter d in the ARFIMA process using bootstrap, which has already been proved to perform satisfactorily on many estimation problems. In this context, the class of semi-parametric methods of estimating the long memory parameter is considered. The methodology is applied to the estimation, identification and forecasting procedures for the Nile river data.

Testing Moving Average Trade Rules Using GARCH Models and Bootstrap Methodology : An Empirical Study

João Simão — ISEGI/INE; Rua de Olivença, 41, 2º.dto; 1495-099 Algés; Portugal

João Oliveira Soares — CEG-IST, Instituto Superior Técnico; Portugal

This paper aims to evaluate the performance of technical analysis, and particularly moving average trade rules, when applied to Lisbon Stock Market data. We start by analyzing the main statistical characteristics of the series and also testing the significance of the results obtained with trade rules and buy-and-hold strategy. In a second phase, the time series of returns are modeled through ARMA-GARCH models, and the residuals are 'scrambled' by the bootstrap methodology. Moving average rules are then applied to 500 rebuilt series. Results reveal that some of these rules can outperform the market, questioning its efficiency.

Case Studies II

Chair: **Patrick Kent Watson** (University of the West Indies - Trinidad and Tobago)

Forecasting Scientists Career Trajectories: An Event History Analysis Approach

Barry Bozeman — School of Public Policy; Georgia Institute of Technology; GCATT Building; 250 14th St., N.W.; Georgia Tech; Atlanta, GA 30318-0490; USA

Juan Rogers — Georgia Institute of Technology; USA

Monica Gaughan — Oglethorpe University; USA

One rich source of data for understanding career trajectories of scientists and engineers remains largely unused, despite its relevance and near universal availability: the curriculum vita (CV). Having collected more than 1,000 CVs from participants and focal Department of Energy- and National Science Foundation-sponsored research projects, our aim is to determine the ways in which project participation, taken in conjunction with other 'marker' events, affect a variety of career trajectory issues including: (1) choice of work sector; (2) mobility, (3) productivity, (4) social capital and functioning within networks. We use Event History Analysis, an approach to dealing with longitudinal data, as a means of forecasting 'hazard rates' for various career trajectory variables.

Models in Strategy: Applications to Non-Profit

Chandra Aleong — University of Pennsylvania; PO Box 45; Lincoln University; Pa 19352; USA

The strategy literature focuses on for profit enterprises. There is little research done on strategy for non-profits and higher education organizations. This paper discusses the major models of strategy, the industry analysis approach or the Porter model; the resource based view or the RBV model and the more recent relationship view. An attempt will be made to find out whether any of these models influence the strategy of higher education institutions. The main objective of the paper is to uncover whether strategy leads to improvements in performance, which is defined as improvements in financial and enrollment data. To test whether the institution was paying more than lip service to strategy the paper will track the relationship between changes in strategy and the allocation of resources. This test will determine how dynamic the institution was in responding to the competitiveness of the market and changes in general market conditions. The research design is the case study method because it incorporates qualitative and quantitative data. The methods of analysis will be quantitative such as regression, trend and intervention analysis; content analysis; and factorial analysis. It should be possible to make inferences as to whether a change in strategy led to changes in performance. As market forces continue to buffet Higher Education institutions strategy seems to be assuming a greater role in the long run viability of these institutions. This research should add to the knowledge base in seeking to improve the well being of Higher Education.

Forecasting with BVAR Models II

Session Organizer and Chair: **Luís C. Nunes** (Nova University of Lisbon - Portugal)

Forecasting and Turning Points Prediction in a Bayesian Panel VAR Model

Matteo Ciccarelli — Fundamentos del Análisis Económico; Universitat d'Alacant; Ap. Correos 99, 03080; Alicante; Spain

Fabio Canova — Universitat Pompeu Fabra; Spain

We provide methods for forecasting variables and predicting turning points in panel Bayesian VARs. We specify a flexible model, which accounts for both interdependencies in the cross section and time variations in the parameters. Posterior distributions for the parameters are obtained for a particular type of diffuse, for Minnesota-type and for hierarchical priors. Formulas for multi-step, multiunit point and average forecasts are provided. An application to the problem of forecasting the growth rate of output and of predicting turning points in the G-7 illustrates the approach. A comparison with alternative forecasting methods is also provided.

Forecasting Australia's Economic Performance during the Asian Crisis

Peter Summers — Melbourne Institute; Faculty of Economics and Commerce; University of Melbourne; Victoria, 3010; Australia

During the Asian economic crisis of 1997-98, many forecasters predicted a sharp fall in Australia's GDP growth rate. These predictions were largely based on the fact that the countries most severely affected by the crisis represent over 60 per cent of Australia's export markets. During this period, published forecasts from a Bayesian vector autoregressive (BVAR) model consistently indicated that the crisis would have little or no effect on Australia's economic performance, despite the deterioration in the trade balance.

This paper argues that the more pessimistic forecasts attached too much weight to the links between Australia's external accounts and GDP growth.

In particular, I show that forecasts for the period September 1997 to December 1998, conditional on the actual path of the merchandise trade balance, predict higher inflation and interest rates than unconditional forecasts from a model without the trade balance. These latter forecasts were much closer to the actual outcomes.

Controlling Drift in Macroeconomic Forecasting Models

Ronald Bewley — School of Economics; The University of New South Wales; Sydney 2052; Australia

Macroeconomic VAR forecasting models commonly contain $I(1)$ variables both with and without drift. When the unit roots are imposed, long-run forecasts are dominated by deterministic linear time trends which have slopes that are typically insignificantly different from zero for the $I(1)$ variables without drift. This form of over-parameterisation is shown to be a major contributor to long-run forecast errors. A simple reparameterisation, based on a Bewley (1979) transformation, is shown to make the necessary restrictions, in both a classical and Bayesian framework, simple to impose with consequent gains in forecast accuracy.

Estimation and Prediction II

Chair: **Cristina Oliveira** (ISCAP/IPP - Portugal)

Improving AIC for optimal prediction

Pieter H.F.M. van Casteren — Department of Quantitative Economics; University of Amsterdam; Roetersstraat 11; 1018 WB Amsterdam; The Netherlands

AIC can be interpreted as a model selection criterion for optimal prediction. We propose an improvement in the derivation of AIC by using a shrinkage estimator for the so-called 'bias component'. This estimator emerges naturally from the usually realistic assumption that the competing models have small bias components. The result is a generalisation of AIC with a flexible penalty on model size. Asymptotic and simulation results show that AIC imposes an extremely small penalty on model size and that in general it is preferred to double the penalty. Moreover, it is explained how the penalty can be adjusted, using prior information about the competing models.

Autoregressive representation of the predictor with incomplete past of a stationary time series

Pascal Bondon — Laboratoire des Signaux et Systemes, ESE; Plateau de Moulon; 91192 Gif-sur-Yvette Cedex; France

The problem of predicting a stationary discrete-time series whose past is altered by some missing observations with arbitrary pattern is investigated. The autoregressive (AR) representation of the optimal linear mean-square predictor is obtained under the classical sufficient conditions of existence of such a representation for the predictor based on the complete past. These conditions hold for instance for any ARMA time series with no pole and zero on the unit circle. Explicit formulae for the prediction error variance and for the AR parameters of the predictor are obtained. These expressions allow us to characterize the processes for which the loss of observations in the past does not affect the prediction of a future value. This reveals the important role played by the AR parameters in forecasting. Then some properties of the AR parameters of the predictor based on the incomplete past for a finite order AR time series are established.

Generalized Extended Sample Autocorrelation Function: Contribution to the Identification of the Transfer Function Models

Cristina Oliveira — Instituto Superior de Economia e Gestão; Universidade Técnica de Lisboa; Rua do Quelhas 6; 1200 Lisbon; Portugal

Daniel Müller — ISEG, Universidade Técnica de Lisboa; Portugal

Commonly the identification of a transfer function model is done through the cross-correlation function analysis between the input and the output series. However, practice shows that this kind of procedure is generally not sufficient due the subjectivity associated to the identification of the polynomial orders r and s related to the output and input polynomials. On the basis of consistent iterated least squares estimates a generalization of the extended sample autocorrelation function is introduced and a method of model specification is proposed to the transfer function models. A practical example and a simulation study are presented to illustrate the procedure potentiality.

Friday, 17:00-18:00 — Room: Tejo B

Panel Session 4

Organizer and Chair: **Michael Lawrence** (University of New South Wales, Australia)

Improving Company Judgemental Forecasting

Panel members:

Marcus O'Connor — University of New South Wales, Australia

Paul Goodwin — University of West of England, UK

Nigel Harvey — University College London, UK

Nada Sanders — Wright State University, USA

Most company forecasts are prepared judgementally in a highly complex environment: not only are the underlying patterns of the time series difficult to de-code and extrapolate but environmental pressures and organisational expectations also play an important role. While forecast accuracy is an important goal many other goals are also present. A great deal of research activity has focussed on judgemental forecasting over the last decade, some laboratory based and some field based. This panel session draws on experts who have studied the judgemental forecasting and will seek to distill the lessons learnt from this body of work.

Exponential Smoothing

Chair: **Anne B. Koehler** (Miami University of Ohio - USA)

The Use of Unstable Parameter Values in Exponential Smoothing

Richard Lawton — Faculty of Computer Sciences and Mathematics; University of the West of England; Bristol; BS16 1QY; UK

It is well known that the monthly version of the Additive Holt-Winters method can have unstable parameter values within the normal range of values allowed for the parameters. (This was shown by Sweet in 1985.) This paper presents the results of a simulation study that was designed to investigate how often unstable values will be selected in practice, when the parameters are chosen to minimise the mean square error for the fitted data. The simulation also investigated how much effect selecting unstable values had on the quality of the forecasts obtained. The results of the study will be used to present advice on what to do when it is observed that minimising the MSE has resulted in unstable parameter values.

Smooth Transition Adaptive Exponential Smoothing

James W. Taylor — Said Business School; University of Oxford; George Street; Oxford OX1 2BE; UK

Adaptive exponential smoothing methods allow a smoothing parameter to change over time, in order to adapt to changes in the characteristics of the time series. However, these methods have tended to produce unstable forecasts and have performed poorly in empirical studies. This paper presents a new, flexible adaptive method, which enables a smoothing parameter to be modelled as a logistic function of a user specified variable. The approach is analogous to that used to model time-varying parameters in smooth transition models. An empirical study, using 1,020 real time series, gave encouraging results for the new adaptive method, applied to simple exponential smoothing. A second empirical study, involving financial time series, indicated that the method is a potentially useful alternative to the traditional GARCH and moving average volatility forecasting methods.

Normalization of Seasonal Factors in Winters' Procedure

Blyth C. Archibald — School of Business Administration; Dalhousie University; Nova Scotia - Canada B3H 1Z5; Canada
Anne B. Koehler — Miami University; USA

In Winters' seasonal exponential smoothing procedure, a time series is decomposed into: Level, Trend and Seasonal components, that change over time. The seasonal factors are initialized so that their average is 0 in the additive version or 1 in the multiplicative version. Usually, only one seasonal factor is updated each period, and the average of the seasonal factors is no longer 0 or 1; the "seasonal factors" no longer meet the usual meaning of seasonal factors. For both the additive and multiplicative Winters' methods, we develop a series of adjustment formulas that differ from previous approaches in that predictions from our renormalized smoothing values are the same as for the original smoothed values. These formulas can be applied every period, or when required. They renormalize the seasonal factors and additionally adjust the level and trend. We use the 406 monthly, seasonal series from the Makridakis competition to examine how the sum of the seasonal factors changes.

Finance IV

Chair: **Pilar Poncela** (Universidad Autónoma de Madrid - Spain)

Forecasting the Equity Premium: evidence from the Australian Market

D.E. Allen — Edith Cowan University, Joondalup Campus; School of Finance and Business Economics; JOONDALUP WA 6027; Australia

L.M. De Mello — Edith Cowan University; Australia

This paper provides a forecasting methodology for estimating the market risk premium in Australia. We employ an in-sample and out-of-sample forecast estimate using various dividend yield measures. The model uses forecasting evaluation statistics such as a RMSE, MAE and various other figures to calculate the degree of accuracy in forecasting. We find that the predictive power has declined somewhat in the late 90s, and this is due to the complexity involved in ever changing equity markets. We make a note that various other factors such as inflation and other macro economic factors could influence the movement in today's equity premia. We introduce a market-changing model where the equity premium forecast and the dividend yield model both have time-varying log coefficients. We show that good in-sample performance is no guarantee of out-of-sample performance in the equity premium prediction context. We show that a naive trader who just assumed that the equity premium was 'like it has been' would typically be worse off than a trader who employed a dividend yield-forecasting model.

The relation between asset returns and inflation at short and long horizons

Tom Engsted — Department of Finance; The Aarhus School of Business; Fuglesangs alle 4; DK-8210 Aarhus V.; Denmark

In analyzing the relationships between expected stock and bond returns and expected inflation at short and long horizons, we measure multi period expected returns and inflation from a vector-autoregressive (VAR) model involving only one-period variables. Thereby we circumvent the problems with the use of time-overlapping data. We apply the VAR approach on long term US and Danish stock and bond market data. The results in general point to large differences between the US and Denmark in the relationships between asset returns and inflation. In addition, our results for US stocks are in strong contrast to the results reported by Boudoukh and Richardson (1993). Our results indicate that for US stocks the Fisher model performs worse as the horizon increases.

Can we find globalization in financial stock markets?

Antonio García-Ferrer — Departamento de Análisis Económico; Economía Cuantitativa; Universidad Autónoma de Madrid; 28049 Campus de Cantoblanco; Madrid; Spain

Pilar Poncela — Universidad Autónoma de Madrid; Spain

In this paper we present a study of monthly stock market indexes of New-York, London, Paris, Rome, Tokyo, Madrid and Frankfurt. We search for signs of globalization in the stock markets and we are interested in the long-run behavior of the indexes analyzed. We found that the behavior of the Tokyo index is very different from the remaining ones, reflecting the deep Japanese crisis of the past years. The rest of the countries exhibit some common dynamic evolution. Therefore, we investigate if the common structure helps to improve forecasts of the indexes, over other alternatives. We use several univariate ARIMA and unobserved components models as a benchmark and build a multivariate model for the indexes incorporating all the common information among the variables. We use dynamic factor models to explicitly model the commonalities of several stock markets. Comparisons of the models are made in terms of the root mean square error (RMSE) for one step ahead forecasts.

Public Finance

Chair: **Adamantios Diamantopoulos** (Loughborough University - UK)

A Contribution to the Finance-Growth Debate

Jordan Shan — Department of Applied Economics (F063); Victoria University of Technology; MMC 14428, Melbourne, vic 8111; Australia

Alan Morris — Victoria University of Technology; Australia

Using a new Granger causality testing procedure, developed by Toda and Yamamoto (1995), this study contributes to the debate on the causality between financial development and economic growth. The study utilises time series data from 15 industrialised and developing countries in a VAR context. We find an evidence of bi-directional causality between financial development and economic growth as well as some evidence of reverse causation. The study therefore provides little support to the view that finance is a leading sector in economic development. Our research also indicate that causality patterns vary across different countries and hence caution must be taken in generalising an uniformed answer, specially in the case of the traditional cross-sectional approach, to the issue of causality between finance and economic growth.

Public expenditure, Deficit and Co-integration: An Empirical Analysis of Buchanan-Wagner's Hypothesis at the Spanish case

Manuel Jaén — University of Almeria; Vicerrectorado of International Relations; Cañada de S/Urbano s/n, 04120; Almeria; Spain

In this report it is tested for the Spanish case, the Buchanan-wagner hypothesis. It asserts that public deficits, by their own, increases the expenditure because they reduce the perceived tax price by the current tax payers of public services so then they increase the demand for these services. It is used the methodology of unit root and co-integration for the test. It is considered that dynamic structure of relation among deficit and the public expenditure increase. Using a joint scheme of co-integration and error adjustment it is identified the possibility of long run equilibrium joint to the dynamic at short terms inferred in the equilibrium path return. It is found just a vector of co-integration, which joins the agreed demand for the services of the government, the deficit, the rent, te relative price and the population.

Forecasting Public Finance Cash Data with Time Series Models

Peter Brandner — Austrian Institute of Economic Research; P.O. Box 91; A-1103 Vienna; Austria

Eva Hauth — Oesterreichische Nationalbank; Austria

Monitoring fiscal developments in EU member states of the euro zone is an important task under the provision of the Stability and Growth Pact. Since public finance data in national account terms are only available as annual figures, we analyze monthly cash data (four expenditure and four revenue components of the federal budget) to improve short term monitoring of budgetary positions in Austria. Unfortunately, monthly cash data are subject to various regular and irregular events. To deal with these mostly unexpected or uncontrolled events, we apply an outlier detection and adjustment procedure. The ARIMA model parameters and outliers are jointly estimated using data from 1989:1 through 1999:11. To minimize the scope for politically based manipulation, an automatic model selection procedure is utilized. Updated ex ante forecasts (one through 12 steps ahead up to 12 months, cumulated to an annual figure) for each of 1996, 1997, 1998 and 1999 are evaluated against the annual figures of the actual expenditures and revenues and against the annual figures of the official projections provided by the Ministry of Finance. For some components, the time series based forecasts point already after the first quarter to unexpected budgetary results. Interestingly, excessive outlier adjustment rather worsens the forecasting performance.

Methodological Issues

Chair: **Jon Vilasuso** (College of Business & Economics - USA)

Forecasting and Knowledge

Carlos Alberto Mallmann — Grupo de Investigación de la 'Dinámica Social'; Centro de Estudios Avanzados; Universidad de Buenos Aires; Argentina

In this paper we:

- I) Suggest a response to the question ¿which should be the Characteristics of the conceptual frameworks, and/or theories, and/or Paradigms with which one studies the future of the societies?;
- II) Contribute with a conceptual framework which has some of the Required characteristics;
- III) Present some empirical evidence, which confirms it, and make some Forecasting's.

Nonnormality in long Memory Models

M. R. Sena-Jr — Departamento de Estatística, CCE; Universidade Federal do Espírito Santo; Av. Fernando Ferrari, S/N, Vitória, E.S.; 29070-900 Brazil

S. Lopes — DE, IM, UFRGS, Porto Alegre; Brazil

Valdério Anselmo Reisen — DEST, CCE/Programa de Mestrado em Engenharia Ambiental, CT, UFES Vitória, ES; Brazil

An usual assumption made for ARFIMA models parameter estimation is the normality of the errors. This, however, may not be a reasonable assumption in some case. This paper uses Monte Carlo simulation methods to evaluate the robustness of different estimators to misspecification of the error distribution. In particular, we consider misspecification against fat-tailed, skewed and bimodal distributions.

Forecasting Heavy-Tailed Random Variables: A Monte Carlo Assessment of Robust Estimation Methods

Jon Vilasuso — Department of Economics; College of Business & Economics; West Virginia University; P.O. Box 6025; Morgantown, WV 26506-6025; USA

This study conducts Monte Carlo simulations to assess the reliability of autoregressive parameter estimates using least squares and robust estimation methods when the disturbance term is heavy-tailed. Heavy-tailed distributions examined include mixture of normals, student-t, infinite-variance stable distributions, and an autoregressive conditional heteroskedastic process. Overall, robust parameter estimation displays less bias than least squares, however there are important differences between robust estimation methods. For each heavy-tailed distribution and random process, least median of squares estimation results in the least bias. Out-of-sample forecasts of changes in the U.S. federal funds interest rate serve as an illustrative example where gains in forecast accuracy are achieved using least median of squares estimation.

Business

Chair: **Michael J. Leonard** (SAS/ETS, SAS Institute, Inc - USA)

Does Adoption of Just-in-Time Inventory Practices Lead to More Accurate Forecasts of Earnings?

Thomas A. Carnes — Department of Accounting; Sam M. Walton College of Business Administration; University of Arkansas; BADM 401; Fayetteville, AR 72701; USA

Jefferson P. Jones — Auburn University; USA

Timothy B. Biggart — University of North Carolina at Greensboro; USA

Katherine J. Barker — University of Texas at Brownsville; USA

We examine the effect of successful JIT adoption upon earnings predictability. Inventory levels can affect earnings levels in several ways, both by creating noise or timing problems that make earnings less predictable and by being manipulated in order to produce fraudulent financial statements. In Biggart, Carnes and Jones (1999), we find that firms that successfully adopt JIT inventory practices have a higher earnings response coefficient, indicating that capital markets value successful JIT adoption. JIT practices reduce inventory levels, thereby decreasing the differences in cash flows and reported earnings by reducing timing differences due to varying cost flow assumptions and the capitalization of fixed overhead. Adoption of JIT practices also reduces inventory holding costs, including shrinkage and obsolescence costs, and reduces the opportunity for earnings management through manipulation of inventory levels. If JIT reduces the earnings uncertainty related to inventory, firms that adopt JIT should have less uncertain (more predictable) earnings.

Estimating the demand for discontinuous innovations: the forecasting dilemma

Marisa Maio Mackay — School of Marketing; University of South Australia; Level 2-25, Elton Mayo Building; City West Campus.; GPO Box 2471; Adelaide SA 5001; Australia

This paper consolidates research that has been carried out in the area of forecasting demand for discontinuous innovations in the concept stage of development. Discontinuous products help to secure the ongoing survival of many organisations. To improve the success rate of such product introductions, practitioners must be able to better forecast the demand for these products. This review paper has shown that there has been very limited research (in particular empirical research) that has been carried out in this area. Most of this research has been qualitative and/or focused on testing or discussing the application of existing approaches that have typically been used to estimate demand for continuous innovations. Researchers need to recognise this area as a separate research stream, which warrants serious attention. Only then can progress begin to be made in an area where practitioners have been largely left to fend for themselves.

Promotional Analysis and Forecasting for Demand Planning: A Practical Time Series Approach

Michael J. Leonard — SAS Institute, Inc.; SAS Campus Drive; Cary NC 27513; USA

Many businesses use sales promotions to increase the demand for or visibility of a product or service. These promotions often involve increased expenditures (such as advertising) or loss of revenue (such as discounts), and/or additional costs (such as increased production). Business leaders need to determine the value of previous or proposed promotions. One way to evaluate promotions is to analyze the historical data using time series analysis techniques. In particular, intervention analysis can be used to model the historical data taking into account a past promotion. This type of promotional analysis can help determine how past promotions affected the historical data and can also help predict how proposed promotions may affect the future based on similar, past promotions. This paper briefly describes intervention analysis, provides practical advice for promotional analysis and forecasting using intervention analysis, and demonstrates these practices using SAS/ETS[®] Software.

SESSIONS AND ABSTRACTS
— SATURDAY —

Keynote speech 5

Chair: **Robert Fildes** (Lancaster University, UK)

Bayesian Modeling of Economies and Data Requirements

Arnold Zellner

University of Chicago, USA

Abstract: In previous work, we have used Bayesian methods in the analysis of various models to explain past variation and forecast future values of the rates of growth of real GDP for 18 industrialized countries. Using these models, point and turning point forecasts were calculated and found to be reasonably accurate compared to those of benchmark and other models' forecasts. In this paper, Marshallian demand, supply and entry models are employed for major sectors of an economy that can be combined with factor market models for money, labor, capital and bonds to provide a Marshallian macroeconomic model (MMM). Herein, the sectoral models are used to produce sectoral output forecasts which are summed to provide forecasts of annual growth rates of U.S. real gross domestic product (GDP). These disaggregative forecasts are compared to forecasts derived from models implemented with aggregate data. The empirical evidence indicates that it pays to disaggregate, particularly when employing Bayesian shrinkage forecasting procedures. Further, some considerations bearing on alternative model-building strategies will be presented using the MMM as an example and describing its general properties. Last, data requirements for implementing MMMs are discussed.

(Talk based on joint work with Bin Chen — University of Chicago, USA.)



Arnold Zellner is H.G.B. Alexander Distinguished Service Professor Emeritus of Economics and Statistics at the Graduate School of Business of the University of Chicago. Professor Zellner received his Ph.D. from the University of California, Berkeley, in 1957, and has honorary doctorates from Universidad Autonoma de Madrid, University of Kiel, and Technical University of Lisbon. He is author and co-author of more than a dozen books and about two hundred papers. His work has deeply influenced econometrics and statistics, in particular modern time series analysis and forecasting.

Panel Session 5

Organizer and Chair: **Robert Fildes** (President, IIF, and Lancaster University, UK)

Certification and Professional Training in Forecasting

Panel members:

Clive Mason — BT, USA

Hans Levenbach — Delphus Inc., USA

Peg Young — US Department of Transportation / Bureau of Transportation Statistics, USA

Robert Fildes — President, International Institute of Forecasters, and Lancaster University, UK

This panel will examine the need to improve the training of organisational forecasters. Bridging the gap between academic study in forecasting and professional practice has always been a goal of the Institute and the Journal. At the New York Symposium in 1991 a number of sessions examined the problem and how it might be overcome. This panel discussion will consider two important aspects of the problem: the merits and difficulties of developing a certification program and second, the question of an appropriate syllabus for such a certificate. The final issue is how the target market might best be reached.

Cointegration II

Chair: **Alain Hecq** (Maastricht University - The Netherlands)

Forecasting in a Small and Unstable Regional Economy Using Regime Shifting Models: the Case of Extremadura

Miguel Ángel Márquez Paniagua — Departamento de Economía Aplicada; Facultad de Ciencias Económicas y Empresariales; Universidad de Extremadura; Avda de Elvas, s/n; 06071-Badajoz; Spain

Julian Ramajo — Universidad de Extremadura; Spain

We consider forecasting in a small and unstable regional economy subject to structural breaks. In this context, we work with two types of regime shifting data-based models. The econometric framework is cointegration theory. So, the objective of the present work is to analyze the out-of-sample forecasting performance of the two approaches used to construct a short-term regional econometric model: stochastic and deterministic time varying parameters models. The forecasting experiments will be illustrated by specifying and estimating an econometric model for a small and unstable region in SW Spain: Extremadura.

Long-Run Causality in Vector Autoregressions. A Predictive Approach

A. Aznar — Departamento de Análisis Económico; Facultad de CC.EE. y EE.; c/ Gran Vía, 2; 50005 ZARAGOZA; SPAIN

M. C. Domingo — Facultad de CC.EE. y EE.; Spain

Inmaculada Villanua — Facultad de CC.EE. y EE.; Spain

This paper is dedicated to defining long-run causality in partially non-stationary models and to deriving sufficient conditions to be satisfied by the parameters of the model in order for that type of long-run causality to exist.

We show that a variable causes another variable in the long-run when both variables are cointegrated. Furthermore, we find that sufficient conditions for long-run causality depend on whether the number of cointegrating relations is equal to or more than the number of caused variables.

Bootstrapping Cointegration Tests: Robust Extended ECM Test under Structural Cobreaks.

Miguel A. Arranz — Dpt. of Statistics and Econometrics; Universidad Carlos III de Madrid; Madrid; Spain

Alvaro Escribano Sáez — Universidad Carlos III de Madrid; Spain

The aim of the paper is the analysis of ECM cointegration tests under structural breaks. It is well known that the behavior of the test depends on some nuisance parameters, which is an undesirable feature in empirical applications. We show that the bootstrap extended ECM test has good size and power properties in the case of different cobreaking schemes, being robust to misspecifications.

Nonlinear Error Correction and Forecasting : An empirical Examination

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Following the seminal work by Engle and Granger (1987), the concepts of cointegration and error correction model have been widely used in much empirical work. In fact, given that use of econometric model in generating forecasts has its tremendous practical importance, many researchers have presented evidence that imposing correct number of cointegrating relations improves forecasts. In this paper, we show that forecasting performance can further be enhanced by applying nonlinear error correction models. That is, we can improve our forecasts by using more information on the strength of an attraction, which can be different depending on the direction as well as the size of equilibrium errors.

In doing so, we first propose simple estimation and testing procedures to measure the strength of an attraction. These procedures are then applied to a few economic data sets, and evidence is presented for the nonlinearity and asymmetry of the adjustment process. The forecasting performance of two alternative models (linear vis-a-vis nonlinear models) are compared, and it is found that the nonlinear models which incorporate additional information on the strength of an attraction outperform the linear specifications of the error-correcting mechanism.

Assessing Forecast Performance of Common Cyclical Features Restrictions in Cointegrated Systems

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Gianluca Cubadda — Universita del Molise; Italy

Several papers have assessed the forecasting gains of imposing long-run constraints in VAR. Monte Carlo studies reveal that these cointegrating restrictions help only for long-term and sometimes medium-term forecasts. However, policy makers and business cycle analysts are more interested in time horizons less than one year. The main goal of this paper is to examine whether short-term forecast accuracy is improved by also considering common cyclical features restrictions. In particular, we consider three forms of common cyclical features: the serial correlation common feature (Engle and Kozicki, 1993; Vahid and Engle, 1993), non-synchronous common cycles (Vahid and Engle, 1997), and the weak form reduced rank structure (Hecq, Palm and Urbain, 1998). Two 'real-world' examples lead our investigation. The first one is concerned with predicting the quarterly US real GDP using various information sets. Our second example concerns forecasting the seasonally unadjusted European industrial production indexes. Indeed, Cubadda (1999) and Hecq (1998) argue that seasonal filtering alters the properties of common feature test statistics. We analyze one-step up to sixteen-steps-ahead forecasts using both the TMSFE and the Clements and Hendry (1995)'s GFESM criterion.

Survey Data

Chair: **Roy L. Pearson** (College of William and Mary - USA)

Predicting monthly indicators: A closer look at consensus estimates

Mathias Moersch — DG Bank AG; 60265 Frankfurt am Main; Germany

This paper analyses the quality of consensus forecasts for a number of macroeconomic data announcements. The data covered are the consumer price index, producer price index, non-farm payrolls, unemployment rate, retail sales, industrial production and durable goods orders, in other words all important monthly market movers in the United States. Since these consensus forecasts are taken as a proxy for the part of the announcement that is already known by the markets in event studies, the quality of these estimates is of particular relevance. This paper therefore compares the consensus forecasts to naive prediction models and it tests for their unbiasedness and efficiency.

Inflation Forecast Uncertainty

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Paul Söderlind — Stockholm School of Economics; Sweden

Economic theory suggests that in general the results of decisions involving expectations depend not only on the point forecast but also on higher moments. This paper explores the appropriateness of different methods of extracting a measure of aggregate uncertainty from survey data. It also proposes a new method that allows the decomposition of aggregate uncertainty into an average individual uncertainty and a measure of disagreement. Two theoretical models show that the appropriate measure of aggregate uncertainty depends on its intended use. An empirical part analyses the joint behaviour of different measures of inflation uncertainty. All measures are highly correlated with the forecasted level of inflation. Some suggestions for forecasting and policy modelling are offered.

Properties of Macroeconomic Forecast Errors

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Paul Newbold — University of Nottingham; UK

This paper investigates the distributional properties of individual and consensus time series macroeconomic forecast errors, using data from the Survey of Professional Forecasters. The degree of autocorrelation and the presence of ARCH in the consensus errors is also determined. We find strong evidence of leptokurtic forecast errors and some evidence of skewness, suggesting that an assumption of error normality is inappropriate; many of the forecast error series are found to have non-zero mean, and we find sporadic evidence of consensus error ARCH. Properties of the distribution of cross-sectional forecast errors are also examined.

An Evaluation of Consensus Forecasts of Real GDP Growth

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This paper presents evidence on how well the private sector forecasts real GDP growth. The evaluation is based on forecasts for 63 countries over the 1990s. The main questions addressed are: (1) How large are forecast errors and how do they differ between industrialized countries and developing countries? (2) Are the forecast errors unbiased and efficient? (3) How does private sector performance compare with that of official agencies, in particular IMF, World Bank and OECD? (4) Is there a link between the standard deviation of forecasts (across analysts) and forecast accuracy? (5) Is there a set of analysts whose performance is consistently better than that of the consensus? Is the forecasting performance of 'locals' (institutions based in the country) better than that of the rest? (6) How is the consensus formed? In particular, how is an individual analyst's forecast influenced by the past consensus (mean) forecasts and by past official forecasts?

The Accuracy of Recent Short-Term Employment Forecasts Obtained by Employer Surveys: The State of Illinois Experience

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George W. Putnam — Illinois Department of Employment Security; USA

Waleed K. Almousa — Illinois Department of Employment Security; USA

The U. S. Workforce Investment Act of 1998 and generation-low U.S. unemployment rates have increased the desire for accurate short-term forecasts of future regional employment needs. One potential forecasting approach is forecasts derived from employer surveys. A necessary condition for survey-based forecasting to be efficient is employers can predict their future employment with reasonable accuracy. This paper assesses the accuracy of three-month-ahead employment forecasts by samples of State of Illinois establishments obtained quarterly since 1995. The total sample is approximately 10,000 ex ante forecasts, plus data on the establishment's industry sector, current employment, business outlook, and use of temporary workers. Responses by firm are matched with the actual establishment employment for the forecasted month. Forecast accuracy is analyzed by industry sector and establishment size, with tests of such factors as seasonality, use of temporary workers, and business outlook. Various benchmarks show the relative accuracy of the employer forecasts.

Forecasting Systems II

Chair: **Michele Hibon** (INSEAD - France)

Intelligent Forecasting Agent

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Robert Gay — Nanyang Technological Univ.; Singapore

Yuan Miao — Nanyang Technological Univ.; Singapore

Agent technology is regarded as one of the most promising technologies to be used in the new millennium. Agents that are autonomous, goal-oriented, pro-active and intelligent, represent a new way for designing forecasting system. In this paper, we propose a dynamic predictive data mining (DPD) model for constructing a new type of agent, intelligent forecasting agent (IFA) to assist human beings to do forecasting. The theoretical foundation of the DPD and IFA includes Dynamic Cognitive Network (DCN), data mining and agent technology. Unlike traditional forecasting system, the IFA has the ability to select and prepare the data to mine on behalf of human beings. By representing the DPD as its knowledge, the IFA can further refine the DPD autonomously using the historical data prepared. Finally, the IFA is able to do the inference with the refined model by numeric calculations and assist people to predict the unknown. The methods described in this paper provide a relative practical way for constructing of intelligent forecasting agents and can be applied to various forecasting applications.

A forecasting and decision support system to purchasing operations

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We present a software that is a simple but reliable tool to forecast demand for a company's products integrated in a system to generate a purchasing planning. There are two main routines in this software: the first one, the forecasting module, suggests a forecasting model (if possible) for each product based on a time series approach, and generates forecasts for the planning horizon; the second one, takes into account those forecasts, as well as actual customer orders, actual inventory, transit stock, safety stock and economical order quantity, to suggest how much and when the product must be bought. The projected inventory for each period is also available. Those procedures are interactive: the number of future periods for which plans are made, the length of each period and the values of the forecasting models parameters are variables controlled by the forecaster. It is also possible to simulate various scenarios taking as the inputs other values for forecasted quantities and/or the quantity to order.

Forecasting Tools and Methods In the Cyclical Chemical Industry

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Emese Molnár — University of Miskolc; Hungary

This paper is about a cyclical industry. World prices for naphtha and gasoil fluctuate like the supply and demand change as well as the crude oil prices. The polyolefin prices are also cyclical in nature and sensitive to changes in the supply-demand balance. This paper emphasizes the most important problems in the chemical price forecasting.

First we define these problems. E.g. which characteristics are for the polyolefin prices, how to get reliable information of the prices, how to supply the managers with the required information about these areas and the future changes.

Secondly we show the possible methods and the results of the forecasts in different timehorizonts (annual, quarterly and monthly data).

(OTKA F20270 - F20272 projects)

Expert Systems for Forecasting--Empirical Experience

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J. Scott Armstrong — Wharton School of the University of Pennsylvania; USA

Expert systems use rules to represent an expert's reasoning in solving problems. The rules are based on knowledge about methods and the problem domain. We surveyed the literature for applications of expert systems to forecasting problems and found 14 comparative studies containing empirical results. Expert systems were more accurate than unaided judgment. There was little evidence with which to make comparisons with judgmental bootstrapping or with econometric models, two reasonable alternatives. In this session we discuss the conditions under which you can expect expert systems to be useful and principles to guide their application.

M3- Competition, Further Results

Michele Hibon — INSEAD; Boulevard de Constance; 77305-Fontainebleau; France

Spyros Makridakis — INSEAD; France

The results of the M3-competition, so far, were given by categories, corresponding to different types of series: micro, industry, finance, demographic and other data; and different time intervals between successive observations: yearly, quarterly, monthly and other.

In this paper we try to extend the study by identifying other types of categories. To do this, we determine the autocorrelations among successive values of the time-series and distinguish such series by the type of the pattern which characterizes them. Then, we check if the accuracy of the forecasting methods is different and if they are doing better depending upon the new categories being identified.

Finance V

Chair: **M. Loretan** (Federal Reserve Board - USA)

Cross Sectional Aggregation and Persistence in Variance

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Z. Psaradakis — University of London; UK

M. Sola — University of London; UK

This paper explores the interactions between cross-sectional aggregation and persistence of volatility shocks. We derive the ARMA-GARCH representation that linear aggregates of ARMA processes with GARCH errors admit, and establish conditions under which persistence in volatility of the aggregate series is higher than persistence in the volatility of the individual series. The practical implications of the results are illustrated empirically in the context of an option exercise.

Forecasting Emerging Stock Market Volatility: Evidence from Turkey

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We employ a random walk model, a historical mean model and moving average (MA) models, an exponential smoothing model, exponentially weighted moving average (EWMA) models, regression (REG) models, and symmetric and asymmetric conditional heteroscedasticity (CH) models (ARCH, GARCH, GJR-GARCH and EGARCH) to forecast out-of-sample monthly stock market volatility in Turkey for the first time. The performance of these models is evaluated using symmetric and asymmetric error statistics. The symmetric criteria favour the EGARCH, REG1, MA3 and GARCH models whereas the EWMA models and the GJR-GARCH model are poor alternatives. All CH models are superior if the underpredictions of volatility is undesired. Otherwise, short term MA models seem better. We find that five models (REG1, ARCH, GARCH, GJR-GARCH and EGARCH) are efficient forecasters. The incremental information tests indicate that the ARCH model is superior. We find a significantly negative relationship between the mean index returns and expected volatility. However, unexpected volatility does not play any role on the market returns. We also report that the volatility forecasts of the CH models are more reliable in daily risk management if a Value-at-Risk methodology is followed.

The effects of exchange-rate exposures on equity assets

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Robert M. Kunst — Institute for Advanced Studies and University of Vienna; Austria

The traditional approach to currency management for investors with international portfolios has been either to ignore the foreign exchange risk, assuming that the benefits from asset diversification in international markets cannot be enhanced by hedging the exchange risk, or to hedge all assets completely. However, the need for diversification has been supported by the impacts on asset prices of the recent currency crises. The second option can also be very costly, as the cost of hedging certain currency risk exposures can outweigh the gain in yield.

Based on these insights, we provide empirical evidence on the dynamic effects of the dollar exchange rate volatility on several stock indexes traded on the corresponding stock exchanges. Relying on model-based predictions of several cost functions, we then recommend optimal hedging strategies against currency exposures on these exchanges. The policy implication here is that improved volatility forecasts should result in more accurate asset prices.

Comparing GARCH Specifications with White's Reality Check

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Leonardo Souza — Pontifícia Universidade Católica do Rio de Janeiro; Brazil

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In many practical applications in time series, the main goal is to find a model that outperforms a given benchmark. However, as the number of tested models grows, there is a chance of finding a better model just as a result of (bad) luck. The purpose of White's RealityCheck[®] is to test for the significance of the best improvement over the benchmark obtained after a number of tentative models.

In this work, RealityCheck is put into proof through a Monte Carlo experiment in the context of GARCH models. The volatility predictions are compared using the out-of-sample likelihood and the RMSE of the squared observations. We present the empirical size and power of the test in several situations. We conclude that the Reality Check power increases quickly as the sample size grows, which is most useful in practice, but is highly sensitive to the choice of the statistic of comparison.

Evaluating 'Correlation Breakdowns' During Periods of Market Volatility

Mico Loretan — Federal Reserve Board; 20th & C Streets, NW; Washington, DC 20551; USA

William B. English —

Financial market observers have noted that during periods of high market volatility, correlations between asset prices can differ substantially from those seen in quieter markets. For example, correlations among yield spreads were substantially higher during the fall of 1998 than in earlier or later periods. Such differences in correlations have been attributed either to structural breaks in the underlying distribution of returns or to 'contagion' across markets that occurs only during periods of market turbulence. However, we argue that the differences may reflect nothing more than time-varying sampling volatility. As noted by Boyer, Gibson, and

Loretan (1999), increases in the volatility of returns are generally accompanied by an increase in sampling correlations even when the true correlations are constant. We show that this result is not just of theoretical interest: When we consider quarterly measures of volatility and correlation for three pairs of asset returns, we find that the theoretical relationship can explain much of the movement in correlations over time. We then examine the implications of this link between measures of volatility and correlation for risk management, bank supervision, and monetary policy making.

Long-Memory Forecasting II

Session Organizer: **Nuno Crato** (NJIT and ISEG - Portugal)

Chair: **Esther Ruiz** (Universidad Carlos III de Madrid - Spain)

Forecasting Performance of Long Memory and Markov Switching Modelling using the Portuguese Inflation Rate

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Gabriel, Vasco, J. — ISCTE; Portugal

Time Series researchers are becoming aware of the importance that structural changes and long memory may have on econometric models. Indeed, failure to detect and account for parameter changes and persistence properties may lead to erroneous inference and forecasting ability (see Clements and Hendry (1999)). This paper investigates and compares the performance of long memory and Markov switching modelling using the Portuguese inflation rate.

Recent econometrics is being increasingly dominated by non-linear models, namely the Markov switching-type introduced by Hamilton (1989), where shifts in the series are the result of a change between regimes, which is modelled as the outcome of an unobservable discrete Markov process with stationary transition probabilities. On the other hand, long memory and fractional integration models have a flexible representation considering processes with a non integer order of integration and persistence properties (see Baillie (1996) for a "survey"). More recently, there has been some work that studies an effective relation between these two concepts (see Granger and Terasvirta (1999), Diebold and Inoue (1999) and Hidalgo and Robinson (1996).

We use monthly and quarterly inflation rates constructed from the CPI, covering the period 1968-1996. For this time span, some major events led to changes in economic policy and substantial fluctuations of the PIR: the two oil shocks, the democratic Revolution with the subsequent loss of its colonies, the two agreements with the IMF, the entry in the EC.

Forecasting inflation by long memory regression models

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Charles Bos — Erasmus University Rotterdam; The Netherlands

Marius Ooms — Erasmus University Rotterdam; The Netherlands

We study recursive out-of-sample forecasting of monthly postwar U.S. inflation rates and log price levels. We use the autoregressive fractionally integrated moving average model with explanatory variables (ARFIMAX). For forecasting horizons up to a year we find significant explanatory power of variables associated with the Phillips curve, like unemployment rates and other indicators of macroeconomic activity. Even correcting for the effect of explanatory variables there is conclusive evidence of both fractional integration and structural breaks in the mean and variance of inflation in the 1970s and 1980s and we incorporate these breaks in the forecasting model for the 1980s and 1990s.

We use maximum likelihood, modified profile likelihood and least squares methods to generate dynamic forecasts and forecast intervals. We compare the results of the fractionally integrated model with those for ARIMA(p,d,q) models with fixed order of $d=0$ and $d=1$ for inflation. Comparing mean squared forecast errors, we find that the ARIMA(p,1,q) model performs worse than the other models in the last part of the 1990s.

Robust trend estimation and forecasting for long-memory processes

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Yuanhua Feng — University of Konstanz; Germany

Sucharita Ghosh — WSL; Switzerland

Philipp Sibbertsen — University of Dortmund; Germany

Forecasts for time series with long memory in a semiparametric framework are investigated. The forecasts are based on an extrapolation of the nonparametric trend and optimal forecasts of the stochastic component. The influence of outliers in the observed data is reduced by using robust nonparametric estimators for the trend function. Forecasts are optimized by using boundary corrected estimates of the trend function. Results on forecasting in Beran and Ocker (1999) are generalized to robust trend estimates. Data examples illustrate the usefulness of the method.

The estimate of the forecast error variance in the ARFIMA process for parameter uncertainty: A simulation study and an application.

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Bovas Abraham — University of Waterloo; Canada

Ela Mercedes Toscano — Universidade Federal de Minas Gerais; Brazil

In this paper we consider forecasts from long memory time series using the ARFIMA(p,d,q) model with $d \in (0.0, 0.5)$. We also investigate through simulations, the bias in the estimator of the variance of the k-step ahead forecast errors. To estimate the parameters of the process we consider estimators obtained from parametric and semi-parametric approaches. The methodology presented here is applied to a well known set of data: the Nile River minima.

Finite Sample Properties of a QML Estimator of Stochastic Volatility Models with Long Memory

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Esther Ruiz — Universidad Carlos III de Madrid; Spain

We analyse the finite sample properties of a Quasi-Maximum Likelihood (QML) estimator of Long Memory Stochastic Volatility models based on the Whittle approximation of the Gaussian likelihood in the frequency domain. We extend previous studies by including in our Monte Carlo design all the parameters in the model and a bigger range of parameter values that includes some more realistic and nonstationary cases. We show that for the parameter values usually encountered in practice, the properties of this estimator are such that inference is not reliable unless the sample size is extremely large. We also discuss a problem of non-identification in the Autoregressive Long Memory Stochastic Volatility model when the volatility has a unit root and we show up its effect on the properties of the QML estimators. An empirical analysis of a series of daily observations of the IBEX-35 index of the Madrid Stock Exchange illustrates our findings.

Inflation

Chair: **Stephen J. Huxley** (University of San Francisco - USA)

TIPS and The Term Structure of Inflation Forecasts

Albert E. DePrince, Jr. — Director, Business and Economic Research Center; Professor of Economics and Finance; Middle Tennessee State University; Box 102; Murfreesboro, TN 37132; USA

Inflation forecasts are an integral part of Federal Reserve policy deliberations, and a new information source has recently been noted by officials—the spread between the Treasury inflation protected securities (TIPS) and conventional Treasury securities. As such, the spreads reflect expected inflation; however, some question the spreads' forecast content. This paper addresses that issue. It treats the spreads as a 'market-wide' inflation forecast and compares the term structure of inflation expectations based on the spreads with the term structure of other 'market-wide' inflation forecasts (surveys). On the assumption that the TIPS spread reflects expected inflation, the paper next breaks the term premium in conventional Treasury securities into two parts: the term structure of expected inflation and the maturity risk premium. The paper ends with an assessment of the time series characteristics of the maturity risk premium derived from the TIPS yield curve.

Inflation, Unemployment and Monetary Policy in Brazil

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Regina C. Madalozzo — Federal University of Rio Grande do Sul; Brazil

Ronald O. Hillbrecht — Federal University of Rio Grande do Sul; Brazil

In this article we analyse the role of the Non-Accelerating Inflation Rate of Unemployment (NAIRU) in an inflation targeting model and also present some estimates of the NAIRU using Brazilian Data. We present a monetary policy model where the NAIRU gap plays a key role for inflation targeting, not because monetary authorities should close the gap every period, but because it helps predict future inflation. For the estimation of the NAIRU two different models are used. One is based on a transfer function estimation of a traditional Phillips curve approach. The second one is a signal extraction method where the NAIRU is the unobservable stochastic trend of the unemployment data. The NAIRU is estimated using both the IBGE and DIEESE data. The results show a linear Phillips curve for Brazil, and allow good estimates of the NAIRU. The estimations performed using quarterly data produced a time varying NAIRU. Our results are in line with the acceleration of inflation during the eighties and the desacceleration of inflation that follow the Real Plan.

Medium-Term Forecasts of Potential GDP and Inflation Using Age Structure Information

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Economic behavior as well as economic resources of individuals vary with age. Swedish time series show that the age structure of the population contains information correlated to medium-term trends in growth, inflation and other macroeconomic data. GDP gaps estimated by age structure regressions are closely related to conventional measures using filters, time series methods, and structural models. Reliable estimates of potential GDP and other macroeconomic series often become available after (at least) a one-year lag. Monetary policy is believed to affect inflation with a lag of one or two years. Projections of the population's age structure are comparatively reliable several years ahead and provide additional information to improve on 3-5 years-ahead forecasts of potential GDP and inflation.

Forecasting the inflation rate in Trinidad & Tobago: an application of the Koreisha-Pukkila two-step method to monthly data

Patrick Kent Watson — Department of Economics; University of the West Indies; Trinidad and Tobago

Trinidad & Tobago is a small primary exporting economy. The inflation rate in such an environment is of crucial importance to the smooth functioning of the economy. On it depends the general well being of the population and the overall stability of the economic system. Neighbouring Caribbean and Latin American countries (Jamaica, Guyana and Venezuela to name only three) have suffered tremendously as a consequence of runaway inflation rates, resulting in never ending wage demands, rising interest rates and general economic instability. Useful forecasts of the inflation rate are an important step in initiating control measures.

In this paper an attempt is made to model the retail price index of Trinidad & Tobago (from which the inflation rate is derived) using the recent procedure outlined by Koreisha and Pukkila (1998). The results obtained are compared with some naive forecasts which many believe provide more accurate forecasts than those obtained from more complex models.

A Data Mining Approach to Forecasting Inflation

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A data mining methodology related to forecasting inflation in the United States used a simple linear regression $Y = a + bX$ where X = annual inflation rate over the past X years, Y = annual inflation rate over the following Y years. X ranged from 1 to 20 years, Y from 1 to 30 years (600 cases) for 1947-97. The overall mean R Square was only about 25 percent, but it had a non-random pattern, and reached above 90 percent in several cases, 99 percent in one case. Possible explanations for the good fits and non-random pattern are explored in the paper, along with the methodology used in the data mining exercise.

State Space Models

Chair: **Siem Jan Koopman** (Free University - The Netherlands)

Alternative Seasonal Models for the Analysis of Non-Stationary Time Series

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Peter C. Young — Lancaster University; UK

Problems such as modelling the business cycle, forecasting turning points, extracting seasonal components and seasonal adjustment, amongst other topics, have received a great deal of attention in the literature on time series analysis. Many different methodological approaches have been developed to cope with these problems, but Unobserved Components (UC) models seem to provide the most natural, recursive estimation framework for signal extraction and forecasting, particularly in relation to non-stationary time series. In this paper, we present a UC approach that is formulated within the normal stochastic state space (or structural model) setting, but with a number of quite novel aspects. These include the specification of a multiplicative 'seasonal' component based on a new method of estimation that allows for the modulation of one seasonal cycle by another of a different period. The practical utility of this new approach, which further exploits the exceptional spectral properties of the Dynamic Harmonic Regression (DHR) model, is illustrated by an example concerned with the analysis and forecasting of four-hourly electricity demand data.

Use of Functions B-Spline to Derive State-Space Models

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Mariano J. Valderrama — University of Granada; Spain

The main objective of this paper is to derive a state-space model for a real time-continuous stochastic process by means of an approximate expansion in terms of a basis of B-splines functions and a set of uncorrelated random variables with known variances. Then we apply the Kalman filter equations to estimate the process from different available noisy observations. In fact, several state-space models are obtained and their properties are analysed. Furthermore, a computer simulation is performed for studying the procedure efficiency in order to estimate a process from measures disturbed by noise.

Understanding the Kalman Filter: An Algebraic Approach

Ralph D. Snyder — Monash University; Clayton, Victoria 3185; Australia

Catherine Forbes — Department of Econometrics and Business Statistics; Monash University; Australia

The basic ideas underlying the Kalman filter are outlined in this paper without recourse to the complex formulae for revising and updating the means and variances of system components found in traditional expositions of the subject. The key to the exposition is an algebraic system based on the first two moments of the multivariate normal distribution. A spin-off is a new approach to seeding the Kalman filter for non-stationary time series. The exposition is inherently simpler than traditional presentations. It also provides an ideal framework for the implementation of the Kalman filter in an object oriented computing language.

Time Series Count Data Models Based on the State Space Form : A Comparison

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Cristiano Fernandes — Laboratório de Estatística Computacional; Brazil

In this article we compare two different models used to estimate time series models for count data. Both models are based on the structural approach, where the time series is decomposed in components which have a direct interpretation such as trend, seasonal, cycle and irregular. The main difference between these two models is the way the components and the likelihood are evaluated. While the first and most recent of the models, associated with Durbin and Koopman, makes use of computer intensive techniques to solve these problems, the other approach, associated with Harvey and Fernandes, is analytical by construction. We compare the models using real time series.

Fitting exponential family time series models and forecasting

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A treatment is discussed for the analysis of time series state space models for discrete observations. It employs the Kalman filter and smoother algorithms and efficient importance sampling based on Gaussian approximations to the non-Gaussian model. Methods for maximum likelihood estimation of the parameters is given. The emphasis of this paper is on how to forecast discrete data generated by exponential family time series models.

Labor Market

Chair: **Karen S. Hamrick** (United States Department of Agriculture - USA)

Forecasting Australian Unemployment Rate Series

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Cyclical asymmetry has been recognized as a nonlinear phenomenon in recent studies examining unemployment rate time series. The probabilistic structure of such time series is different during economic upswings and downswings. So, with forecasting unemployment rates in mind, it seems intuitive that models should reflect this change in structure by incorporating nonlinearities to allow for the switching in optimizing behavior between different phases of the business cycle. Accordingly, this paper evaluates the point forecasts from models of the various monthly, raw Australian unemployment rate series; these models being drawn from both the linear and nonlinear classes. The nonlinear models are based on a standard logistic smooth transition autoregressive (LSTAR) model of unemployment which includes a lagged level term and a seasonal, rather than first-difference transition variable. Forecasts from this model are evaluated against the best-fitting linear autoregressive (AR) alternative. Dynamic point forecasts from models of unemployment rates from the three largest states and Australia as a whole, suggest that the LSTAR forecasts are superior over a longer forecast horizon from eight months to two years. Over the shorter time horizon of up to eight months, while forecasts from the linear model outperform those from the nonlinear variety, both models perform creditably.

Forecasting Regional Employment with the ENTROP Method

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Blien Uwe — (Unknown)

Forecasting methods require the identification of causal processes and stable trends. Here a combination of top down and bottom up methods is used to estimate the development of employment in all 327 (western) German districts for a time span of two years.

In a first step, employment is forecasted independently according to several dimensions (type of region, industry and federal state), which are selected according to theoretical considerations. The results are used to generate a forecast additionally based on autonomous trends of the respective regions and on experts' judgements about singular developments. The different sources of information are combined using the ENTROP method.

ENTROP is an entropy optimizing procedure, a generalization of common RAS-techniques, newly developed for the estimation of matrices from heterogeneous information. In a defined sense the estimated matrix is the most probable one. The method chosen uses any available information extensively. Therefore, the estimates are reliable, as is shown in an ex-post forecast.

There is a double purpose for the forecast of employment: first, it helps to gain insights in the causal processes generating regional developments and regional disparities on labour markets. Second, it is useful for the budgetary planning of the Federal Employment Services. Then, the assignment of money to the local units of this administration can be done according to current and future labour market developments.

Forecasting Asymmetric Unemployment Rate; A comparison Among Standard Linear and Non-linear Time Series and Artificial Neural Network Model

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Asymmetry has been well documented in the business cycle literature. The asymmetric business cycle suggests that the major macroeconomic series, such as unemployment rate, are non-linear and, therefore, the use of linear models to explain their behavior and forecast their future values may not be appropriate. Many researchers have focused on providing evidence for the non-linearity in the unemployment series. Only recently have there been some development in applying non-linear models to estimate and forecast unemployment rate. A major concern of non-linear modeling is the model specification problem; it is very difficult to test all possible non-linear specifications, and to select the most appropriate specification. Artificial Neural Network (ANN) models provide a solution to the difficulty of forecasting unemployment over the asymmetric business cycle. ANN models are non-linear, free from the classical regression assumptions and are able to learn the structure of all kinds of patterns in a data set with a desired accuracy and to forecast future values. In this paper, we apply three ANN models, i.e., back-propagation model, recurrent model, and probabilistic model, to estimate, classify, and forecast postwar aggregate unemployment rates in US and Canada. We compare the out-of-sample forecast results obtained by the ANN models with those obtained by the standard linear and leading non-linear times series models currently used in the literature. It is shown that the artificial neural networks models are able to forecast the unemployment series as well as, and sometimes better than, all other econometrics time series models.

An Analysis of the Employment Trends in the U.S.A.

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In this paper exponential smoothing, and Box-Jenkin's ARIMA models will be used to forecast future employment and output levels in manufacturing and service sector of the U.S. A. economy. The U.S. Department of Labor forecasts manufacturing employment to decline slightly (-0.7 percent) from 1994 to 2005. However, this forecast can be disputed. There are several statistical issues concerning the underestimation of growth industries and overestimation of declining industries. Further, many firms may be incorrectly classified by the U. S . Department of Labor in setting up Standard Industrial Classifications (SIC's) for manufacturing. For example, video production facilities are classified as 'services'. When a large number of industries (tobacco industry and steel industry) experienced a decline in employment, there is till some number of industries that experienced a rapid growth in employment (medical instrument production and pharmaceutical firms). Forecasts are developed for each sector separately and also for the aggregate data.

The Impact of Welfare to Work on the Labor Market: Supply, Demand, and Wages for Low-skilled Occupations

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The goal of 1996 U.S. welfare program reform was to reduce welfare dependency by increasing work incentives. Welfare programs have indeed experienced a large drop in participation as recipients became employed, mostly in low-wage/low-skilled jobs. The impact that this increase in labor supply has on the labor market depends on labor market and macroeconomic conditions. The Economic Research Service computable general equilibrium (CGE) model of the United States provides a simulation laboratory for assessing the labor market impacts of the labor supply changes resulting from welfare reform under alternative macroeconomic scenarios. Presented here is an overview of the model and results from various macroeconomic and policy scenarios.

Interest Rates

Chair: **M. Dolores Robles** (Universidad Europea-CEES - Spain)

The Short-Term Interest Rate and its Uncertainty

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This paper investigates the relationship between short-term interest rate and its uncertainty in UK, Switzerland, Germany and Spain from 1975-1999. Under the discrete-time specification of the LEVELS model and using GMM we choose the model that provides the best forecast of the volatility among 9 possible structures in order to generate a measure of interest rate uncertainty. The selected models are the specification by Cox, Ingersoll and Ross (1980) in Switzerland, Cox and Ross (1976) in Spain and Germany and the general LEVELS model in UK. We always introduce the series in first differences in the mean equation since the unit root is more evident in our data than when the models were applied to USA series. Finally, we show while in Germany interest rate uncertainty does not Granger-cause the interest rate, in Spain increased uncertainty significantly lowers interest rates. Evidence of causality is also found in UK and Switzerland.

A forecasting Model for the US term structure of interest rate

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In this paper, we built a chain forecasting model for the US term structure of interest rate. Empirical studies have shown that interest rates are cointegrated and the cointegration relationship contains useful information for the future movement of the term structure. The chain forecasting model is built from the short end of the yield curve to the long end with the US discount rate or the federal fund rate as one main factor. We define the cointegration regression residual from the yields of two different maturities as conditional yield spread. We found that 1) the conditional yield spread is a more powerful predictor than the popularly used yield spread for future interest rate movement, and 2) short-term interest rates contain useful information for Federal Reserve Bank's possible future decision and a large part of the discount rate movement is expected by the financial market.

Interest Rates, Capital Accumulation, Saving and Economic Growth: A Time Series Analysis

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Sam AmirKhalkhali — Saint Mary's University; Canada

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Often, the differences in views regarding the interrelationships among important macroeconomic variables can be traced to the assumptions underlying the theoretical models used. In turn some of the critical differences in assumptions relate to assumptions about the degree of capital mobility, the time frame of the analysis, and the direction of causality. For an empirical policy-oriented study, it is important to specify a framework that encompasses both short run dynamics as well as long run responses, and one that is able to sort out the causality issue, since that is ultimately an empirical question. Our purpose is to use time series models that accommodate those differences in a general way. Using Canadian quarterly data, we examine the interrelationships between short and long-term interest rates, private saving, public saving, domestic investment, and the rate of growth of real GDP in Canada within the framework of vector autoregression and error-correction models. Our preliminary results, indicate a significant role for short term interest rates with major implications for policy formulation.

Structural Breaks and Interest Rates Forecast: A Sequential Approach

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M. Dolores Robles Fernandez — Universidad Europea, CEES; Spain

The analysis of the future behaviour of economic variables can be biased if structural breaks are not considered. As Clemens and Hendry (1998) have pointed out, when these structural breaks are present, the in-sample fit of a model give us a poor guide to ex-ante forecast performance. This problem arises both in univariate and multivariate analysis and can be extremely important when cointegration relationships are analysed. The main goal of this paper consists in to analyse the impact of structural breaks on forecast accuracy evaluation. We are concerned in forecasting several spanish interbank money market interest rates. In order to make the analysis, we perform two forecast excises: (1) without structural breaks and (2) when structural breaks are explicitly considered. We use the sequential mehodology proposed by Fernández and Peruga (1998) in order to estimate possible structural breaks in a endogenous way. After that, we compare the out-of-sample forecast ability of these models for several horizons.

The Predictive Ability of Several Models of Interest Rates Volatility

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This paper analyses several volatility models that are the most frequently used in finance. Among others, there are included sample measures, like historical volatility, and the GARCH family. The aim of the paper is to select the best volatility model by comparing its ability to forecast interest rates and term premia into the Term Structure of Interest Rates. Term premia are estimated in a VARMA context using weekly data of continuously compounded yield to maturity of the Spanish Interbank Money Market. In order to determine the best forecasting model, a new criterion is proposed and compared with the standard ones, which are based on forecast error size measures (i.e. root mean squared error, RMSE). This new criterion minimizes the Mean Opportunity Cost (MOC) associated to a investment decisions based on forecast made with the competing models. Although there was some variation across terms, the results show that the most simple volatility measures allows the best interest rates forecast. However, conclusions change according we use RECM or MOC.

Case Studies III

Chair: **Philip Hans Franses** (Erasmus University Rotterdam - The Netherlands)

Beta Estimation and Forecasting with Panel Data Methods

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Anthony W. Hughes —

In this paper, panel estimation techniques are applied to the (conditional) CAPM as a basis for forecasting beta in the presence of statistical characteristics such as time-varying and random beta. We evaluate the performance of these forecasts across different models of CAPM and different methods of estimating beta. Traditionally, researchers have considered either the cross-sectional or the time series behaviour of returns while ignoring the inherent panel nature of the data. Different approaches to the analysis of expected excess returns have enabled researchers to study different problems. For example, time series methods are used to estimate beta and for testing whether betas are time invariant or random. Further, in order to test the appropriateness of the CAPM, the standard approach (eg. Fama and MacBeth (1973) and Ferson and Harvey (1999)) is to first estimate the betas in the time series domain and then use these estimates to determine whether or not beta solely or jointly explains the cross-section of excess returns. In this paper, we take advantage of the panel nature of the data to improve many aspects of the analysis. The panel method simultaneously allows: testing for time-varying and random betas; estimation of beta with greater precision than the standard time series approach; greater power in testing the CAPM or conditional CAPM; and allows the assumption of homogeneous parameters to be empirically tested. Although this approach is similar in spirit to Gibbons (1982), we are able to improve upon his method by including time-varying and random betas, and homogeneous effects on conditioning variables. We then compare the out-of-sample forecasting performance (as measured by mean forecast error, mean absolute forecast error and mean squared forecast error) of the panel approach to different CAPM model-specifications with the conventional CAPM and Conditional CAPM estimation procedures. We compare these evaluation criteria for different standard ways of forecasting beta, and we find evidence that using the panel estimation approach decreases forecasting error.

An econometric demand-supply model for private house prices and stock in Sweden (1970 - 1998)

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A housing market model for Sweden has been estimated by explicitly modelling both the demand and the supply sides. The equations are specified as error correction models. On the demand side house prices in the short-run adjust to the changes in the real after tax long interest rate, financial wealth, the employment rate, rents on houses and finally, the change in the population. There is a long run relationship between house prices and the following ratios: debt to income, debt to financial wealth, the private housing stock to income, the stock of rental housing (flats) to the private housing stock, along with the level of the after tax real long interest rate. The supply side is based on Tobin's q model. This model addresses stocks and flows that are important determinant of the changes in stock. The results indicate that even in a turbulent period, Swedish house prices and housing investment are tracked quite well by this specification. We also discuss the Swedish housing market and the controversy over the causes of the recession (1991 - 1993), in the context of the 1991 Tax reform. The importance of policy simulations and their usefulness to Swedish policy makers is discussed. According to our model, many factors were instrumental in producing the house price boom of the late-1980s. Initial debt levels were low as were real house prices, giving scope for rises in both, as were income-growth expectations and these became more important as a result of financial liberalization, though partly offset by bigger real interest rate effects. Tests of model adequacy indicate that the housing price and Tobin's q housing investment models are stable robust and satisfy the underlying theoretical assumptions. Using the respective models simultaneously forecasts for the year 1999 - 2000 are 8.4% and 8.5%

Optimal deliverance of newspapers

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Around 200,000 copies of the Norwegian newspaper Dagbladet are sold daily at more than 11,000 salespoints. It is difficult in advance to determine the exact number of newspapers that will be sold at each salespoint. Each salespoint is therefore supplied with a few more copies than it is expected to sell. This can lead to surplus copies at the end of the day, yielding large costs for handling the returns. On the other hand at some of the salespoints Dagbladet will be sold out, leading to lost potential sales.

At each salespoint the sale at a certain day are assumed to come from a distribution with time dependent expectation and variance. The optimal deliverance is given as a certain percentile of this distribution, such that the cost of returns and the loss of potential sales are balanced.

The expectation and variance of the sale distribution are modelled as separate functions of day of the week, time of the year, holidays (Christmas, Easter, etc.) together with a trend over time. These functions are specific for each salespoint, but with a latent structure allowing for borrowing strength from other salespoints in the estimation. Central statistical techniques are reduced-rank regression and additive Poisson regression.

Some Issues About Classical Forecasting Methods Applied to Energy Markets

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Forecasting is a very important task for people involved in the management of energy markets, even when there is a stable economic setting. The energy organizations urgently demand automated and accurate forecasts so they can anticipate future demand, prices and other market variables. This paper reviews some characteristics of an efficient forecasting system for an energy market based on classical statistical models for time series forecasting. Some issues addressed concerns to the easiness of automation and understanding, adequacy and accuracy. Finally, the expert systems approach to forecasting is analyzed and considered its potential usefulness in these markets.

Impulse-Response Analysis of the Market Share Attraction Model

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The market share attraction model (or MCI model) is often used to correlate market shares with explanatory variables. The model has the important feature that it implies that market shares sum to unity and that they lie within the (0,1) interval. The model is usually written in a reduced form specification in which the logs of the ratios of market shares to a benchmark are correlated with explanatory variables. It is often difficult to precisely understand how the model actually correlates the original levels of market shares with (changes in) explanatory variables and in innovations. In this paper we propose to use impulse-response analysis to help to understand the structure of an MCI model. The impulse-response functions for the market shares cannot be obtained from a transformation of the impulse-response function of the reduced form variables and hence we have to rely on a simulation-based method to calculate impulse-response functions.

Nonlinear Modelling

Chair: **Nicholas Sarantis** (London Guildhall University - UK)

Genetic Programming Forecasting of Sunspot Numbers

M. A. Kaboudan — Penn State University; USA

In this paper genetic programming paradigm is used to evolve time series models that predict Wolfer's sunspot numbers. Genetic programming is a random search technique that assembles equations when given user-selected explanatory variables and operators. It is used here to evolve time series models. First, the method's ability to predict chaotic data is demonstrated. Two maps, the Henon and Logistic map, are selected and models are genetically evolved for them. Given that sunspot numbers have been well-predicted using nonlinear stochastic models (subset bilinear and SETAR, for example), the series seems to be a natural candidate to predict and forecast using genetically evolved models (GEMs). While it is possible to obtain impressive one-step-ahead forecasts for the period 1921-1999, the method does not seem to produce multi-step-ahead forecasts with the same quality. Prediction-statistics as well as multi-step-ahead forecast-statistics are presented. Results GEMs produced are statistically compared with others reported in the time-series and statistical literature.

A Combinatorial Approach to Multiple Regime Time Series Models

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Threshold AR models (TAR) have found a large number of successful applications in econometrics and time series. The central idea behind this specification is to switch the parameters of a linear model according to the value of an observable threshold variable. When this variable is a lagged value of the time series, it is called a self-exciting threshold autoregressive (SETAR) model. The estimation of those models has only been considered in the case of only one threshold variable. In this paper, we propose a heuristic to estimate a more general SETAR model with multivariate thresholds. We formulated the task of finding multivariate thresholds as a combinatorial optimization problem and developed an algorithm based on a Greedy Randomized Adaptive Search Procedure (GRASP). The proposed algorithm was tested over a number of simulated and real problems and has performed very well.

A Hybrid Neuro-Fuzzy/Genetic Model for Time Series Forecasting

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Neuro-Fuzzy Systems (NFS) match the learning capacity and the fault tolerance of Artificial Neural Networks (ANN) with the linguistic interpretation ability of Fuzzy Systems.

The Hierarchical Neuro-Fuzzy BSP (Binary Space Partitioning) models form a new class of recursive NFSs with a dynamic structure which evolves to increase accuracy. The Hierarchical Neuro-Fuzzy BSP model has the capability of self-creating the structure in order to obtain the necessary accuracy in Time Series Forecasting applications. In this type of partitioning, the space is successively divided in two regions, in a recursive way. This partitioning can be represented by a binary tree that illustrates the successive n-dimensional space sub-divisions in two convex subspaces. A characteristic of this models is the high number of parameters (~20) to be set. To deal with that, a Hybrid Neuro-Fuzzy/Genetic Model was specially developed. The Genetic Algorithm is able to find quickly the best set of parameters for any specific time series, allowing the hybrid model to be used as a plug in a decision support tool. Such a tool has been developed and successively tested with different time series: commercial, finance and electric load.

The Employment of Neural Networks in the Coffee Price Forecast

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The readiness of accurate, reliable and quickly available information is crucial to the process of decision making along the productive chain in the agribusiness, mainly in the case of the coffee, characterized by the natural instability of the market as well as by the strongly speculative character on the part of the economic agents. In that sense, the general objective of this work is to develop and to implement an informational system for the forecast of coffee prices. In this case, the methodology is based on neural networks. A series of dry cherry coffee prices is used at the Brazilian producer level. The results indicate that the method presents a large employment potential in the forecast of agricultural prices. Besides to be efficient in the recognition of patterns and regularities, the neural networks present larger flexibility than the statistical techniques. This flexibility allows for the incorporation of hardly formalized elements starting from a specialist's intuitive knowledge until informations generated by formal statistical models.

On Some Mixture Type Time Series Models

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C S Wong — The University of Hong Kong; Hong Kong

Recently mixture type time series models have been proposed and studied to some extent in the literature (e.g. Wong & Li 2000).

This paper gives a summary of the relevant works. One advantage of this type of models over other nonlinear time series models is that it has a fuller range of shape changing predictive distributions. Estimation is easily done via the EM algorithm. The models are applied to some real data.

Nonlinearities and Business Cycles in Stock Markets: International Evidence

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In this paper we employ the STAR (Smooth Transition Autoregressive) model to investigate nonlinear business cycles in the stock markets of seven major industrial countries (the G-7). Tests reject linearity for all stock markets. The estimated nonlinear models suggest that stock prices are characterised by asymmetric cycles in most countries, with the speed of transition between the expansion and contraction regimes being relatively slow for all countries. We also use a nonlinear, STAR-based, Granger noncausality test to investigate the international transmission of cyclical movements. The results indicate that there is only a small number of interactions between the stock markets. We also compare the forecasting performance of STAR and linear models.

Finance VI

Chair: **Spyros Skouras** (University of Cambridge and EUI - UK)

A Note on the Distribution of Stock Index Returns: Evidence from Fifteen Countries

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The distribution of asset returns is of great importance to asset and option pricing models, international portfolio diversification and currency hedging decisions, and internal risk management models such as value-at-risk applications. This paper primarily aims at investigating the statistical distribution of the stock index returns in stock markets of fifteen developed and developing countries for the period 1987 to 1997. We closely follow the 1968 Fama-Roll methodology to describe the symmetric stable Paretian distributions. The paper employs five different holding periods from one day to one month. Empirical results show that higher frequency returns deviate significantly from normality whereas lower frequency returns exemplify better a normal distribution. We discuss the implications of our results for asset pricing, international portfolio diversification and risk management.

Risk Forecasting Under Non Standard Conditions

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Forecasting the Value at Risk (VaR) of a portfolio of financial assets, has become the benchmark of financial risk management. It amounts to estimating the maximum expected loss with a given probability of a given portfolio. This involves the estimation of the probability density function (p.d.f.) of the portfolio. When the portfolio is made up of a linear combination of jointly Normally – or, Gaussian - distributed assets, the implied portfolio p.d.f. is easily shown to be Gaussian, as well. These two assumptions – Gaussianity and linearity -, are customary in financial practice. They present, however, two major shortcomings: a) there are financial positions specially relevant in risk control, which are related in a non linear fashion to the underlying assets, notably financial options; b) financial assets are known to be very volatile, with large departures from their mean values occurring frequently – i.e., outliers -. The first point has been tackled in practice through simulations, or else largely eschewed. A recent paper has proposed an analytic approximation under normality – Britten-Jones and Schaefer (1999) -. The second point has been addressed in the applied financial literature, fitting a variety of densities with thicker tails than the Gaussian density – notably, the Student t -. Among them, one relatively new is the Edgeworth-Sargan (ES), family of p.d.f.'s. This type of density has been shown to fit the data adequately, both in the univariate and the multivariate context – Mauleón (1997, 1999 and 2000) -. Besides, it is easier to work with than its competitors. The purpose of this paper is precisely to propose a joint solution to both problems. The paper provides a solution to the problem of forecasting the VaR of a financial position, that depends non linearly on a non normally distributed asset. The p.d.f. of this asset is assumed to follow a general ES specification, and a general approximate analytic solution is obtained. The accuracy of this solution is assessed by means of simulations in realistic contexts.

GARCH Estimation and Discrete Stock Prices

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The continuous-state GARCH model can be only approximatively correct if applied to returns calculated from discrete price series. This paper proposes a modification of the above model to handle such cases by modeling the dependent variable as an unobserved stochastic variable. Using Swedish stock price data we compare the parameter estimates and asymptotic standard errors from the approximative model and our extended model. We find small deviations between the two models for longer time series, but larger differences for the shorter series, mainly in the variance parameters. None of the models provide us with continuous residuals. By constructing generalized residuals (Gourieroux et al. (1987)) we show how valid residual diagnostic and specification tests can be performed.

Combining Heterogenous Classifiers for Stock Selection

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George T. Albanis — City University Business School; UK

This paper assesses the benefits of selecting outperforming shares by combining forecasts produced by linear and nonlinear statistical classification methods. These include probabilistic neural network, vector quantization and recursive partitioning algorithms. The paper has a direct application to active portfolio management. It also addresses an interesting theoretical issue. Combining unbiased forecasts of continuous variables is known to reduce the error variance below that of the median individual forecast. However, this does not necessarily hold for forecasts of discrete variables (buy/sell recommendations), nor where the costs of errors (lost trading profits) are not directly related to the error variance. We find that combining by simple 'Majority Voting' improves accuracy and profitability only marginally. Much greater gains come from applying the 'Unanimity Principle', whereby a share is not selected as potentially high-performing unless all classifiers agree.

Forecasting Value at Risk in Emerging Arab Stock Markets

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Cherif Guermat — University of Exeter; UK

The economic and political uncertainties of most of the Arab countries may lead to the assumption that many features of Arab stock markets are harder to predict than stock markets in developed countries. Value at Risk (VaR) is an important measure of risk exposure and it is becoming the most used tool for risk management. In this paper extreme value theory with volatility updating is used to forecast Value at Risk in three emerging Arab stock markets and the US stock market. The US stock market is used here as a benchmark. Several forecast accuracy criteria are used to compare forecast performance in the four stock markets. An asymmetric forecast criterion is also suggested.

Risk Neutral Forecasting

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Any mapping that has the same sign as the conditional mean of returns is a risk neutral investor's best predictor so it may be difficult to estimate the conditional mean yet easy to estimate a 'risk neutral best predictor'. An asymptotically consistent estimator for risk neutral best predictors is proposed and is characterised both analytically and using simulations. Our results suggest that there are broad circumstances in which an investor should prefer forecasts based on this estimator to those generated by maximum likelihood estimation of the conditional mean. To facilitate the estimator's computation, a tailor-made algorithm is proposed and its properties are investigated.

The decision problem we choose to focus on leads to the development of statistical and computational methods which can be applied to the estimation of 'investment rules' and of 'economically valuable' forecasting models.

Computational Intelligence and Financial Econometrics

Session Organizer and Chair: **Shu-Heng Chen** (National Chengchi University - Taiwan)

On Optimizing GP Financial Econometrics

M. A. Kaboudan — Penn State University; Lehigh Valley; USA

This paper presents new methods aimed at producing fitter models using genetic programming (GP). There are many studies now that document GP's success in evolving reasonable models that replicate the dynamics of real world time series. However, there are none that attempt to optimize GP's performance by merging what the econometrics and time series literature offer into GP methodology. This is our aim here. The combined methodology seems to produce better models than previously possible using either GP, econometric, or time series alone. We apply the methods to stock prices and test the null hypothesis that forecasts produced by GP and econometric or time series methods are equally acceptable. To test the hypothesis, a new a-statistic is used. The statistic is a ratio of two MSEs. In the numerator, MSE belongs to a genetically evolved model (GEM). An econometric or time series model produces the MSE in the denominator.

VAR-VECM vs. Neural Nets with Divisia in Taiwan

Jane Binner — AI-ECON Research Group; Department of Economics; National Chengchi University; Taipei; Taiwan 11623; R.O.C.

Bin-Tzong Chie — National Chengchi University; Taiwan

Alicia Gazely — National Chengchi University; Taiwan

Shu-Heng Chen — National Chengchi University; Taiwan

This paper compares the forecasting performance of VAR-VECM (Vector Autoregression-Vecot Error Correction Model) and Nerual Nets in forecasting inflation rate in Taiwan. VAR-VECM models are built from referring the quantity theory of money as the long-run equilibrium, whereas neural nets do not rely on this restriction and are simply nonlinear functions of money supply. Early study shows that Divisia was not performing well in the Var/VECM's, and Neural Nets can outperform the VAR-VECM model no matter whetehr it is the simple sum or Divisia used. However, this result has been criticized as not incorporating the dual price index as the rate of interest in the Divisia models, which is the ideal rate of interest to use with Divisia and mirrors the quantity of money index.

In this paper, we produce this 'Divisia interest rate' variable, and re-run the Divisia models to see whether Divisia will now work better than simple sum.

The Dual Price Index is produced from from 1970m1 - 1998m9. To construct the quarterly version, it is a question of taking every third month, i.e m3/m6/m9/m12.

A Tutorial Guide to Agent-Based Computational Modeling of Artificial Stock Markets: With Specific Reference to the Software AIE-ASM Version 3

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Chia-Hsuan Yeh — I-Shou University; Taiwan

This brief tutorial will introduce a new area currently known as 'agent-based computational finance' (ABCE). To do so, we also introduce the implementation of ABCE with the software AIE-ASM developed by the AI-ECON Research Group at Natioanl Chengchi University in Taipei. The software can be freely downloaded from the AI-ECON website. This tutorial shall show the installment and several key operation procedure to run it. We then indicate what can be expected from a single run of a typical simulation, and highlight the analysis of the simulation results with financial econometrics.

Would Wavelets Help in Neural-Nets Based Forecasting of Stock Price?: Evidences from 11 Stock Market Indices

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While some earlier studies have shown that wavelets can be used to enhance the forecasting performance of neural nets, little study has actually confirmed whether this property generally holds. In this paper, we propose a forecasting competition among neural nets, "neural nets plus wavelets" and random walks over 11 stock market indices, including Taiwan(TAIEX), U.S(S&P500), U.S(Dow Jones Industry Average), Japan(NK 225), H.K(HengSeng), South Korea(COMPOSITE), Singapore(STRAITS), Australia (ALL ORDS.), France (SBF 250), U.K,London(FTSE-100), German(DAX). The performance criteria are MSE, MAE and MAPE. Each tournament is composed of 300 random draws from the time series of those 11 indices with a prespecified sample size and a size ratio of training sample to testing sample. For the first six tournaments, the size ratio is fixed to 7 to 1, and the sample size is changed from 2000, 1000, 500, 100, 50 to 20. For the next tournament, we fix the sample to 2000, but increase the size ratio from 49, 199, 399, 599, 999, to 1999 to 1. These experimental designs allow us to evaluate the forecasting performance of the models on question by taking into account several influential factors, including small vs. large sample and short-term vs. long-term forecasting.

Price Discovery in Agent-Based Computational Modeling of Artificial Stock Markets: What Make it Work and What Don't?

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Based on the agent-based computational modeling of artificial stock markets, this paper studies the determinants on price discovery in the stock market. Based on AIE-ASM Version 2 (Chen and Yeh, JEDC, 2000), we simulate the artificial stock markets based on different settings on dividend processes, interest rates, units of stock issued, and traders' risk attitudes. For each scenario, we calculate the risk-adjusted intrinsic value of the stock, and then examine how well the stock price generated endogenously can follow these intrinsic values. Based on the simulation results, we then answer the question what could make it difficult or easy for markets to reflect the intrinsic value.

Statistical Analysis of Genetic Algorithms in Market Timing

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In this paper, the performance of canonical GA-based trading strategies are evaluated under several well-known nonlinear time series in finance, namely, the ARMA process, the Bilinear processes, the GARCH process, the stochastic volatility processes, the chaotic processes and the TAR processes. Unlike many existing applications of computational intelligence in financial engineering, for each performance criterion, we provide a few rigorous asymptotic statistical tests based on Monte Carlo simulation.

As a result, this study provides us with a thorough understanding about the effectiveness of canonical GAs for evolving trading strategies under the different underlying stochastic processes. We then test extend this statistical analysis to real high-frequency financial time series.

Population

Chair: **Luisa Canto e Castro** (University of Lisbon - Portugal)

An Evaluation of Demographic Forecasting and the Consequences

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In this paper evaluations of the performance of forecasts provided by the United Nations, since 1950 are made for a variety of countries. From this it is revealed that there are some serious inadequacies of relying on the component method. An alternative 'Top Down' approach is forwarded as a means of producing more bounded forecasts. The consequences of forecast errors are explored in the context of public policy making and expenditure. Scenarios are developed for the education sector in Scotland to illustrate the potential costs of forecast error.

Forecasting Mortality and Morbidity Indicators of AIDS in Portugal

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The study of mortality and morbidity indicators of AIDS (Acquired Immunodeficiency Syndrome) in Portugal has a great importance for a possible control and prevention of the disease. These indicators allow decision makers on Health to know the phenomenon better and offer useful information for the definition of policies to face this disease. In this work we intend to make projections of morbidity and mortality indicators of AIDS for a period of several years. For the accomplishment of this projection we propose the parallel use of occult periodicity methodology and of Bayesian modelling.

Examining Structural Shifts in Mortality Forecasts Using the Lee Carter Method

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We present an extension of the Lee-Carter method of forecasting mortality to examine structural shifts in forecast trajectories of this event. Austrian data consisting of fifty years of single-age mortality rates, $M(x,t)$, are subdivided into twenty-eight 24-year submatrices each. Using SVD, the submatrices are decomposed into three component submatrices: 1) $K(t)$, the multiple realizations of the index of mortality to which each respective age specific death rate is linearly related; $A(x)$, the average shape across age of the log of mortality schedules; $B(x)$, the sensitivity of the log of mortality at age x to variations in the elements of $K(t)$. From the most stable of the $B(x)$ trajectories, the best of the $K(t)$ trajectories is targeted. This targeted $k(t)$ is forecasted as an interrupted time series to ultimately yield the best-fit life expectancy trajectory.

The effect of excessive heat on mortality

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Portugal is a country known by its nice weather and soft temperatures. Extreme hot and cold periods are very rare and are directly responsible for the occasional high peaks in the series of the daily number of deaths. These series were studied and dynamic regression models with the temperature as a covariate have been adjusted for several regions in Portugal.

Food and Agriculture

Chair: **Annette L. Clauson** (U. S. Department of Agriculture - USA)

The Use of Neural Network Model for Forecasting Agricultural Prices

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The neural network models are structures based on the study of the human brain. These models are good flexible function approximators to any data-generating process and a powerful tool for forecasting purposes, especially when the data-generating processes are unknown.

The design of the network's architecture and the learning rules are crucial for obtaining satisfactory results.

This research work discusses the scope and limitations of neural network model for forecasting problems and provides an example of a neural network model for forecasting agricultural prices.

Finally, this study presents a comparison between a neural network model and a ARIMA model for forecasting wheat prices. Results show the neural network model to be more accurate to forecast wheat prices than the ARIMA model.

Forecasting coffee futures prices using Neural Networks and ARIMA models. Trading simulation

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Coffee futures prices forecasts are an important issue in the economic development of an exporting country such as Colombia. In this paper Neural Networks' performance is evaluated as a mechanism of forecasting coffee futures prices. Forecasts of ARIMA models and Neural Networks are compared in ex post forecasting under the same conditions in the time horizon. Using the price of the futures contract as a measure of performance, ARIMA is slightly better. When the forecasted prices are used to simulate trading, Neural Networks give higher economical returns, predicting more accurate positions (long and short) in the market than ARIMA.

A Primer on Forecasting with an Application to Commodity Prices

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John Baffes — The World Bank; USA

Donald Mitchell — The World Bank; USA

The paper outlines a procedure for selecting a forecasting model and applies the method to forecasting annual commodity prices. The modeling framework consists in the following. First, we determine the stationarity properties of the series. Second, we examine whether a univariate or multivariate model is the appropriate specification. In the univariate case, we determine which of the following families of models fits the data: (i) ARIMA; (ii) Exponential Smoothing; (iii) Spectral Analysis; and (iv) Non-linear models. In the multivariate case we examine the following cases: (i) VARMA, (ii) VAR, and (iii) ARX models. Third, we proceed to the model selection process by: (i) estimating the model up to observation s ; (ii) examining the forecasting performance between observations s and T , where T is the last observation; (iii) minimizing the forecast errors by specifying a loss function; (iv) combine forecasts when more than one model performs well. We use annual prices for a number of primary commodities.

Using Estimated Demand Equations to Forecast Retail Meat Prices

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Significant changes in the production and delivery of meats to consumers in the U.S. has made modeling of demand and consumption, and forecasting retail prices difficult. Current demand models based on income and prices indicate that consumers should favor beef or pork, but changes in U.S. consumption patterns in the past ten years have indicated otherwise. In industrialized countries, the demand for food is generally price inelastic. However, price elasticities for food items such as beef and pork differ across stores, weeks, and months. While the own-price elasticities of demand for beef and pork are inelastic at the aggregate level, it is not necessarily true at the point of sale level for the individual meat products. The objective of this study is to use estimated demand equations for individual meat products to forecast individual cut retail prices that consumers are willing to pay. The demand equations will be generated from observed 1999 monthly price and quantity data for selected meat cuts. Aggregate and individual cut retail meat price forecasts using the estimated demand equations for the individual meat products and an ARIMA model of estimated retail meat price changes will be evaluated.

Back Forecasting of U.S. Retail Food Prices: An Exploratory Analysis

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Along with energy prices, food prices are the most volatile consumer price category that the U.S. government tracks. The only government entity that systematically examines food prices and provides food price forecasts is the Economic Research Service (ERS), an agency of the U.S. Department of Agriculture (USDA). Many of the traditional models (ARIMA, Time Series, Inverse Demand) available for forecasting retail food prices assume that past cycles, seasonality, and trends repeat themselves. When changes in industry structure occur over time and consumer tastes and preferences which influence demand are not statistically measurable, some of the traditional models fail to accurately forecast each of the 15 food categories that comprise the All Food Consumer Price Index (CPI). An ARMA model will be used to back forecast or run the historical data through the model backwards for each of the 15 food categories. This will create a new historical index base which can then be used to forecast retail price indexes forward. Forecasts using ARIMA, Inverse Demand, Time Series, and Back Forecasting will be compared.

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