

The 29th International Symposium on Forecasting

June 21-24, 2009



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Note: The star symbol (*) in this book denotes the presenter for an abstract with multiple authors

Keynote Speakers

**Professor Stephen F. Witt**

The Hong Kong Polytechnic University, Hong Kong SAR, China

Time Varying Parameter Structural Time Series Models: An Application to Tourism Demand

Monday, June 22, 2009, 8:45am-9:30am

Venue: Grand Ballroom

**Professor Rob Hyndman**

Monash University, Australia

Extreme Forecasting

Tuesday, June 23, 2009, 8:30am-9:30am

Venue: Grand Ballroom

**Professor Scott Armstrong**

Wharton School of Business, University of Pennsylvania, USA

**Evidence-based Methods to Forecast Elections:
The PollyVote Project**

Wednesday, June 24, 2009, 8:30am-9:30am

Venue: Grand Ballroom

Featured Speakers



Professor James Taylor

Saïd Business School, University of Oxford, UK

Exponentially Weighted Methods for Forecasting Intraday Time Series with Multiple Seasonal Cycles (IJF Editor's Invited Paper)

Monday, June 22, 2009, 11:10am-12:10pm

Venue: Ballroom C



Professor Lindsay W. Turner

Victoria University, Australia

Forecasting Regional International Tourist Arrivals

Tuesday, June 23, 2009, 11:10am-12:10pm

Venue: Ballroom C



Professor Robert Fildes

Lancaster University, Management School, UK

Forecasting Support Systems and the Combination of Soft and Hard Information

Wednesday, June 24, 2009, 11:10am-12:10pm

Venue: Ballroom BC



Professor Paul Goodwin

University of Bath, UK

Forecasting Support Systems and the Combination of Soft and Hard Information

Wednesday, June 24, 2009, 11:10am-12:10pm

Venue: Ballroom BC

Keynote Speech [K1]**Plenary Session:**

Monday, June 22, 8:45am-9:30am

Room: Grand Ballroom

[Time Varying Parameter Structural Time Series Models: An Application to Tourism Demand](#)**Stephen F. Witt**The Hong Kong Polytechnic University, Hong Kong SAR, China
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Empirical evidence has shown that seasonal patterns of tourism demand and the effects of various influencing factors on this demand tend to change over time. To forecast future tourism demand accurately requires appropriate modeling of these changes. Structural time series models (STSMs), which specify the trend, seasonal and cycle components of a variable as stochastic, and time varying parameter (TVP) models, which relax the restriction on the constancy of demand parameters over time, have been introduced into tourism demand studies and shown superior forecasting performance compared to deterministic models. This study further develops the causal STSM by introducing TVP estimation of the explanatory variable coefficients, and therefore combines the merits of both the STSM and TVP model. This new model, the TVP-STSM, is employed to model and forecast quarterly demand for Hong Kong tourism by tourists from four key source markets. The empirical results show that the TVP-STSM outperforms all seven competitors, including the basic and causal STSMs and the TVP model, for one, two and three quarters ahead, but the relative forecasting accuracy declines with more distant (four and eight quarters ahead) forecasting horizons.

Financial Time Series Forecasting - Financial Time Series [OS1]

Organized Session:

Monday, June 22, 10:00am-11:00am

Room: Ballroom B

Stochastic Volatility Models with Leverage using Different Marginal t Distributions**Boris Choy**

University of Sydney, Australia

Stochastic Volatility (SV) models have become a common tool in modeling the volatility of the prices or returns of different financial products. However, the volatility always reacts asymmetrically to the sign and magnitude of the prices changes or returns. In stock markets, stock prices and returns are more volatile to a plunge than a rally. To capture this asymmetric effect, leverage effect is introduced to the SV models and the correlation between the error distributions in the returns and the volatility is measured. In a SV model with leverage effect, a bivariate normal distribution is a standard choice to model the return and the log-volatility. The bivariate t distribution becomes more popular as financial data always exhibits fat tails. However, the bivariate t distribution forces the marginal distributions of the return and log-volatility to have t distributions with same degrees of freedom which is unrealistic. This paper proposes a modified bivariate t distribution that gives marginal t distributions with different degrees of freedom. We show that this distribution provides better results than the bivariate t distribution in empirical studies. The modified bivariate t distribution can be easily extended to multivariate cases that can be used in multivariate SV models.

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Least Absolute Deviation Estimation for Unit Root Processes with GARCH Errors**Wai-Keung Li ***

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This paper considers a local least absolute deviation estimation for unit root processes with GARCH errors, and derives its asymptotic properties under only finite second order moment for both errors and innovations. When the innovations are symmetrically distributed, the asymptotic distribution of the estimated unit root is shown to be a functional of a bivariate Brownian motion and then two unit root tests are derived. The simulation results demonstrate that the tests outperform those based on the Gaussian quasi maximum likelihood estimators with heavy-tailed innovations and those based on the simple least absolute deviation estimators.

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Modeling and Predicting Volatility and its Risk Premium: A Bayesian Non-Gaussian State Space Approach

Gael M Martin *

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Catherine S Forbes

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Monash University, Australia

The object of this paper is to model and forecast both objective volatility and its associated risk premium using a non-Gaussian state space approach. Option and spot market information on the unobserved volatility process is captured via non-parametric, 'model-free' measures of option-implied and spot price-based volatility, with the two measures used to define a bivariate observation equation in the state space model. The risk premium parameter is specified as a conditionally deterministic dynamic process, driven by past 'observations' on the volatility risk premium. The inferential approach adopted is Bayesian, implemented via a Markov chain Monte Carlo (MCMC) algorithm that caters for the non-linearities in the model and for the multi-move sampling of the latent volatilities. The simulation output is used to estimate predictive distributions for objective volatility, the instantaneous risk premium and the aggregate risk premium associated with a one month option maturity. Linking the volatility risk premium parameter to the risk aversion parameter in a representative agent model, we also produce forecasts of the relative risk aversion of a representative investor.

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Finance I [FIN1]

Contributed Session:

Monday, June 22, 10:00am-11:00am

Room: Ballroom C

In-sample and Out-of-sample Bias in Large Scale Testing of Trading Rule Performance**Qingwei Wang**

Center for European Economic Research, Germany

Pei Kuang *

Goethe University Frankfurt, Germany

Michael Schroeder

Center for European Economic Research, Germany

This paper considers the in-sample and out-of-sample data snooping bias in large scale testing of trading rules performance in emerging foreign exchange rate markets. The bias occurs when the same data is used repeatedly by one or many researchers and practitioners in searching for optimal trading rules. Out-of-sample tests are often proposed as an effective way of reducing the bias. But as long as the in-sample data snooping bias is not controlled such that a large number of seemingly satisfactory results are found, a new sample is used repeatedly for out-of-sample tests. Therefore, the out-of-sample data snooping bias can also occur. We show that the bias can be substantial in both in-sample and out-of-sample in the context of testing the predictive ability of trading rules. The results are based on two stepwise bootstrap tests which formally account for the data snooping bias. These tests are more powerful and enable us to show how many satisfactory results are genuine and how many are spurious. Studying 25988 trading strategies for emerging foreign exchange markets, we report rare evidence against market efficiency. This result contrasts with previous findings of significant net profits in developed countries (Qi & Wu, 2006) even after they adjust for data mining bias. Using standard tests we find hundreds to thousands of seemingly significant profitable strategies (best rules can sometimes generate an annually mean excess return of more than 30%). Almost all these profits become insignificant once the data snooping bias is taken into account. These findings are robust to the inclusion of transaction costs, sub-sample analysis and smaller universes of trading rules.

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Integrating Phase Space Reconstruction, ICA and Random Forest for Financial Time Series Forecasting**Han-Chou Lin ***

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Financial time series forecasting are essential to the success of many businesses and financial institutions. Numerous financial time series models have provided investors with more precise forecasts. Recently, random forest (RF) has gained popularity and is regarded as a state-of-the-art technique for regression and classification applications. It is a global model and able to provide a good generalization. However, while these well-established techniques are applied to financial time series forecasting and applications, major problems arise.

Firstly, chaos theory points out that the complicated things which are originally believed unpredictable have predictability. Secondly, for chaotic time series, the techniques of prediction based on phase space reconstruction (PSR) which is an embedding that maps a signal into a sufficiently high dimension, but high embedding dimensional data in the phase space may contain much more noise. The major innovation of this study is to integrate PSR, independent component analysis (ICA) and RF model (PSR+ICA+RF) in an attempt to increase the accuracy for the financial time series forecasting. ICA is a novel statistical signal processing technique that was originally proposed

to find the latent source signals from observed mixture signals. The proposed approach first uses PSR and ICA to the forecasting variables for generating the independent components (ICs). After identifying and removing the ICs containing the noise, the rest of the ICs are then used to reconstruct the forecasting variables which contain less noise and served as the input variables of the RF forecasting model. The effectiveness of the methodology was verified by experiments comparing the PSR+SVR approach for NASDAQ Index. The results show that the proposed PSR+ICA+SVR approach has a better performance of financial time series forecasting and assist the development of financial decision support systems.

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[An Evaluation of Financial Markets Ability to Anticipate Growth Fluctuations](#)

Laurent Ferrara *
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Christophe Bellego
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Recent macroeconomic evolutions have pointed out the impact of financial markets on economic activity. For few years, the literature has focused on the role of financial variables in forecasting macroeconomic growth fluctuations. On one hand, many papers have used financial series to forecast GDP growth rate in a quantitative setting. On the other hand, others studies have underlined the leading ability of some market variables, such as interest rates and stock indexes, to predict large fluctuations such as recessions. In this paper, we propose to evaluate the ability of a large set of financial variables to detect in advance business cycle turning points in the Euro area, by using recent approaches to non-linear time series modeling.

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Neural Network Models I [NNM1]

Contributed Session:

Monday, June 22, 10:00am-11:00am

Room: Ching

[Residual Analysis and Combination of Embedding Theorem and Artificial Intelligence in Chaotic Time Series Prediction](#)

Muhammad Ardalani-Farsa *
Ryerson University, Canada

Saeed Zolfaghari
Ryerson University, Canada

A combination of Embedding Theorem and Artificial Intelligence along with residual analysis is used to analyze and predict chaotic time series. Based on embedding theorem, the embedding parameters are determined and the time series is reconstructed into proper phase space points. The embedded phase space points are fed into a Feed Forward Neural Network and trained using Back-Propagation method. Genetic Algorithm is employed to improve the weights and biases of the neural network determined during training. The improved weights and biases are kept to predict the future value of phase space points and eventually chaotic time series. The residual of predicted time series is analyzed and observed that the residuals demonstrate chaotic behavior. The residuals are considered as a new chaotic time series and reconstructed according to embedding theorem. A new neural network is trained to predict the future value of residual time series. The residual analysis is repeated several times. Finally, a neural network is trained using predicted value of original time series and residuals as input and original time series as output. The last neural network is used to capture the relationship among the predicted value of original time series and residuals and original time series. Similarly, the weights and biases of neural network are improved using Genetic Algorithm and kept to predict the future value of time series. The method is applied to the Mackey-Glass and the Lorenz equations which produce chaotic time series to evaluate the validity of the proposed technique. Numerical experimental results confirm that the proposed method can predict the chaotic time series more effectively and accurately compared to the existing methods.

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Bankruptcy Prediction of U.S. Restaurant Firms

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In the U.S., the operating environment for the restaurant industry has worsened over the past several years due to the high rate of leverage buyout and recapitalization activities. Faced with costs of raw products rising at alarming rates, the restaurant industry is about to face the most challenging operating environment ever. Current toughening economic and market conditions may lead to more restaurant firm bankruptcies. The number of failing firms is an important indicator for the health of the economy because failures not only threatens the existence of an individual firm but also costs the society and the nation's economy in terms of lost revenue, taxes, and jobs. As a result, the development of reliable failure prediction models has become imperative to enable the parties concerned to take preventive actions.

Based on financial data of sample restaurant firms, this study developed a bankruptcy prediction model employing artificial neural networks (ANN) technique. Ten financial ratios, measuring liquidity, leverage, solvency, profitability and efficiency aspects of an operation were selected as potential predicting variables. Removing firms with incomplete financial information, this study identified 28 restaurant firms that went bankrupt between 1996 and 2008. To match the bankrupt firms, non-bankrupt restaurant companies, during the same periods, were searched. These firms were then matched to the original sample by the reference year and size. Financial information for the three years immediately preceding bankruptcy is obtained for each firm to develop the model. Most reliable failure

prediction studies utilize various types of hold-out samples to increase the developed model's validity. This study obtained a hold-out of 58 firms, 3 bankrupt and 55 non-bankrupt, for model testing. The study attempts to provide empirical insight into the competency of ANN model in predicting U.S. restaurant firm failures.

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[The NN3 Forecasting Competition: Evaluation and Statistical Tests of the Results](#)

Michele Hibon

INSEAD, France

The NN3 forecasting competition is an empirical evaluation of artificial neural networks (ANN) and other methods of computational intelligence (CI) in time series prediction. This forecasting competition was conducted by Sven Crone and Kostas Nikolopoulos. The accuracy measures used to evaluate the results include Symmetric Mean Absolute Percentage Errors, Median Absolute Errors, Average Ranking, and Mean Absolute Scaled Errors. The interpretation of non-parametric statistics are aided by Analysis of the Mean (ANOM) and the method of Multiple Comparisons with the Best (MCB) which uses average rankings as criteria to compare each method with the best one and the mean.

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Forecasting Techniques I [FT1]

Contributed Session:

Monday, June 22, 10:00am-11:00am

Room: Ballroom A

[Measuring Forecasting Ability in Asymmetric Stochastic Volatility models](#)

Georgios Tsiotas

University of Crete, Greece

Stochastic volatility (SV) models have been considered as a real alternative to conditional variance models, assuming that volatility follows a process different from the observed one. Existing SV models have treated normality violations such as skewness-asymmetry in the form of the leverage effect. This paper introduces generalized SV specifications that count for both skewness and kurtosis using the noncentral-t, the skewed-normal, and the skewed-t distributions. In this framework, a fully Bayesian Markov Chain Monte Carlo approach is used for parametric and log-volatility estimation. These models are then investigated for their performance in within sample estimation, in comparison with other SV specifications using synthetic, and real financial data series. The results show that there is much to gain from the introduction of the noncentral-t SV model. Also, forecasting evaluation experiments, based on regression, predictive ability tests, and model averaging strategies show relatively good performance for the newly defined SV models.

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[A Survey of Techniques for Identifying and Handling Outliers and Missing Values in Time Series Data](#)

Anthony Waclawski *

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Andrew Fisher

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It is an unfortunate truism that the source data used to build and generate statistical forecasting models are not well-behaved. Both statistical outliers and missing values are classic examples of aberrant data. In many of our business situations we have observed numerous instances where the prevailing analytic strategy either ignores high frequency counts of unusual data values or deliberately deletes them using automated preprocessing routines. Neither of these scenarios are good solutions. If one's analytical approach is to do nothing about the presence of outliers and/or missing values, the resulting forecasting models will essentially describe none of the data neither the bulk of the data nor the outliers. Moreover, even though these values might be perfectly legitimate, if they lie outside the range of most of the data, they can cause potential computational and inference issues.

In the statistical vernacular, outliers are defined as observations that lie an abnormal distance from the majority of values in a data set. Before abnormal observations can be identified, it is necessary to characterize normal observations. From an operational perspective, it is customarily left up to the analyst and/or a consensual process to determine what is considered abnormal.

Missing values describe those instances where no data value is stored for a variable in a given observation. Unfortunately, missing values occur in all types of data irrespective of the business environment, subject matter, and/or data base used. Salient causes of missing data include data collection problems (i.e. miscodes), corrupted raw data fields, and human error.

This paper describes our experience relative to dealing with these analytically unpleasant scenarios and shares methodological approaches relative to identifying missing values, statistical normality and outliers within data distributions. We also offer some suggestions for keeping one's data and conclusions appropriate to the problem being addressed.

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Comparing Different Grouping Mechanisms for Subaggregate Seasonal Demand Forecasting

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Previous research has shown that forecasting accuracy for seasonal demand at the SKU level can be improved if seasonality is estimated from a group of seasonally homogeneous group. The question of how to form these groups has been widely recognized as being important but difficult, and has not been properly addressed. In this paper we present a theoretically derived grouping mechanism. This mechanism is compared with the clustering method using the average linkage between groups as used by Bunn and Vassilopoulos (1993). Preliminary simulation results will show how well these two methods perform and the key differences between them in forming seasonally homogeneous and distinct groups.

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Econometrics I [ECO1]
Contributed Session:

Monday, June 22, 10:00am-11:00am

Room: Tang II

Modeling Monthly Electricity Demand: Interaction between Monthly Econometric and Daily Time Series Models**Antoni Espasa ***

Universidad Carlos III de Madrid, Spain

Jose Ramon Cancelo

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An issue of interest in forecasting electricity demand is to understand how it reacts to changes in explanatory variables like income, number of households and relative prices. Data on these variables are only available on a monthly basis, and monthly models are the natural tool for estimating the relevant elasticities and forecasting the load for horizons from one month to two years ahead. The demand for electricity, however, is also dependent on weather conditions and the number and type of special days, weekends, holidays and vacation periods within a month. The standard practice to account for their contribution is to include monthly aggregates of weather and special days' indicators in the right hand side of the equation. No attention is usually paid to the nonlinear and switching-regime effects of those variables on daily demand and on the income and price elasticities. We propose a two-step procedure that combines a daily model and a monthly model to take into account the different speed of reaction of the demand to the changes in its determinants. In the first step a daily model is constructed to derive efficient estimates of the effects of weather conditions and special days, and to compute a daily series of demand adjusted for those effects (AD) and series of demand due to temperature effects (TD) and to special days (SD). Secondly, monthly models for AD and SD are specified, income and price elasticities are estimated, and medium-term forecasts for them are obtained, while TD is forecasted as a function of temperature. Final forecasts for the observed load are obtained by summing the forecasts of the different demands. We illustrate our proposal by applying it to the electricity demand in mainland Spain.

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Model Selection When There are Multiple Breaks**Jennifer Castle ***

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Jurgen A. Doornik

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David F. Hendry

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We consider selecting an econometric model when there is uncertainty over both the choice of variables and the occurrence and timing of multiple location shifts. The theory of general-to-simple (Gets) selection is outlined and its efficacy demonstrated in a new set of simulation experiments first for a constant model in orthogonal variables, where only one decision is required to select irrespective of the number of regressors (less than the sample size). That generalizes to including an impulse indicator for every observation in the set of candidate regressors (impulse saturation). Monte Carlo experiments show its capability of detecting up to 20 shifts in 100 observations. The forecast performance of models selected using the selection algorithm Autometrics is assessed. We find that model selection based on Autometrics using relatively tight significance levels and bias correction is a successful approach, and allows multiple breaks to be tackled. Even though the approach requires both expanding and contracting searches—as there are more regressors than observations—impulse and level saturation allow many breaks to be detected and 'modeled' by dummies. The proposed approach yields improved forecast performance when there are multiple breaks affecting the model.

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Multivariate Semi-Nonparametric Distributions with Dynamic Conditional Correlations

Trino-Manuel Niguez

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Javier Perote *

Rey Juan Carlos University, Spain

Esther Del Brio

University of Salamanca, Spain

This paper generalizes the Dynamic Conditional Correlation (DCC) model of Engle (2002) to incorporate a flexible non-Gaussian distribution based on Gram-Charlier expansions. The resulting semi-nonparametric (SNP)-DCC model formally admits a separate estimation of, in a first stage, the individual conditional variances under a Gaussian distribution and, in the second stage, the conditional correlations and the rest of the density parameters, thus overcoming the known “dimensionality curse” of the multivariate GARCH models. Furthermore, the proposed SNP-DCC solves the negativity problem inherent to truncated SNP densities providing a general parametric structure that may accurately approximate a target heavy-tailed distribution. We test the performance of a (positive) SNP-DCC model with respect to the (Gaussian)-DCC model through an empirical application of density forecasting for portfolio asset returns data. Our results show that the proposed multivariate model is more flexible and provides a better fit and forecast of the portfolio returns distribution tails, being thus useful for financial risk forecasting and evaluation.

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Intermittent Demand Forecasting [ITD]

Contributed Session:

Monday, June 22, 10:00am-11:00am

Room: Ming I

[ADIDA: An Aggregate - Disaggregate Intermittent Demand Approach to Forecast](#)

Kostas Nikolopoulos

University of Manchester, United Kingdom

Aris Syntetos

University of Salford, United Kingdom

John E. Boylan

Buckinghamshire New University, United Kingdom

Fotios Petropoulos *

National Technical University of Athens, Greece

Vassilis Assimakopoulos

Ministry of Economy and Finance, Greece

Intermittent demand patterns are characterized by infrequent demand arrivals coupled with variable demand sizes, when demand occurs. Such patterns prevail in many industrial applications, the IT, automotive, aerospace and military being perhaps the most characteristic ones. An intuitively appealing strategy to deal with such patterns from a forecasting perspective is to aggregate demand in lower-frequency 'time buckets' thereby reducing the presence of zero observations at the expense though of losing important information. In this paper we explore the trade-off under concern by means of investigation on 5,000 SKUs from the Royal Air Force (RAF, UK). We are also concerned with the empirical determination of the optimum aggregation level as well as the effects of aggregating demand in 'buckets' that equal the lead time length (plus review period). This part of the analysis is of direct relevance to a (periodic) inventory management setting where cumulative demand estimates over that time horizon are required. Our study allows insights to be gained into the value of aggregation in an intermittent demand context. The paper concludes with an agenda for further research in this area.

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Forecasting (Intermittent) Demand

Andrey Kostenko

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Several methods have recently been proposed for demand forecasting for inventory control. Some attempts have been made to separate intermittent demand forecasting into a stand-alone forecasting research area, with its own methods, theories and literature. Nevertheless, the original idea of Croston (1972) differs diametrically; his main proposal being a simple extension of Muth's (1960) local level model so that two different aspects of demand (magnitude and occurrence) can be modeled separately. Croston (1972) concluded that it had the considerable advantage that the same forecasting system could be used with demands that occur every unit-time period and otherwise.

The models of Croston and Muth, however, are inapplicable when demands (when they occur) are represented by small positive integers, and modifying the models accordingly appears to be the most obvious and least straightforward challenge in statistical forecasting for inventory control. Another important issue is that Croston's approach to forecasting intermittent demand (involving sequences of positive sizes and intervals) may well have better alternatives based on time series models for non-negative counts representing the number of unit-size demands occurred in a typical unit-time period. In the last 30 years, a large range of stochastic models has been developed for forecasting low counts, and even the simplest models/distributions may often do well. It is therefore argued that (intermittent) demand forecasting should be considered in the context of more established areas of time series research, such as forecasting of counts or forecasting with exponential smoothing.

This talk will review some of the main contributions in this area, and propose some future directions.

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[Forecasting Intermittent Demand for Slow-Moving Items](#)

Keith Ord *

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Ralph Snyder

Monash University, Australia

Since Croston's original work in 1972 various forecasting methods for intermittent demand have appeared in the literature, most assuming a normal or lognormal distribution for the size of the demand in a given period. In this paper we examine alternative models for the intermittent demand of slow-moving items; such items may be of low value on an individual basis but often make up a large percentage of the number of SKUs in an inventory system. We use such models to generate point forecasts using the mode of the prediction distribution and also examine prediction intervals.

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Time Series Models/Methods I [TSM1]

Contributed Session:

Monday, June 22, 10:00am-11:00am

Room: Tang I

Computing and Using Residuals in Time Series Models**Jose Alberto Mauricio**

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The most often used approaches to obtaining and using residuals in applied work with time series models are unified and documented with both partially-known and new features. Specifically, three different types of residuals, namely “conditional residuals”, “unconditional residuals” and “innovations”, are considered with regard to (i) their precise definitions, (ii) their computation in practice after model estimation, (iii) their approximate distributional properties in finite samples, and (iv) potential applications of their properties in model diagnostic checking. The focus is on both conditional and unconditional residuals, which properties have received very limited attention in the literature. However, innovations are also briefly considered in order to provide a comprehensive description of the various classes of residuals a time series analyst might find in applied work. Theoretical discussion is accompanied by practical examples, illustrating (a) that routine application of standard model-building procedures may lead to inaccurate models in cases of practical interest which are easy to come across, and (b) that such inaccuracies can be avoided by using some of the new results of conditional and unconditional residuals developed with regard to points (iii) and (iv) above. For ease and clarity of exposition, only stationary univariate autoregressive moving average models are considered in detail, although extensions to the multivariate case are briefly discussed as well.

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Multiplicative Seasonal Vector ARIMA Models**Jose Gallego**

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Matrix multiplication is non-commutative in general. Hence, the order in which the matrix polynomials are placed in multiplicative seasonal vector ARIMA models is important. The differences due to the rotation of these polynomials are examined using real economic data and by conducting a Monte Carlo investigation. A multiplatform software package has been developed to build multivariate transfer function models, which also provides capabilities to forecast and seasonally adjust multiple time series.

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Forecasting Linear Dynamical Systems using Subspace Methods

Alfredo Garcia-Hiernaux

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Since the seminal work of Ho and Kalman (1966) system identification has concentrated in modeling a data set using a state-space representation with no a priori restrictions. From the 90s, system identification has been led by new techniques known as subspace methods. These algorithms have a wide use in fields like engineering and physics and have been recently adapted to the particular characteristics of the economic and financial data, for instance, in Bauer (2005) or García-Hiernaux et al. (2009). However, despite the extensive literature about the statistic properties of these procedures and its increasing use with different purposes, the matter of forecasting with subspace methods still remains quite unexplored. The scarce references just use the state-space model estimated with these techniques to extrapolate, but do not exploit the subspace properties in order to improve the forecasts. This paper explores the forecasting in-and out-of-sample properties of these methods and suggests a procedure based on combining multiple forecasts, obtained from setting a range of values for a specific parameter that is typically fixed by the user in the subspace methods literature. The proposal is compared against alternatives and evaluated by forecasting the German gross domestic product, finding good results in one-step-ahead and mid-term out-of-sample forecasts.

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Featured Speech [FS1]

Featured Session:

Monday, June 22, 11:10am-12:10pm

Room: Ballroom C

Exponentially Weighted Methods for Forecasting Intraday Time Series with Multiple Seasonal Cycles (IJF Editor's Invited Paper)**James W. Taylor**

Saïd Business School, University of Oxford, United Kingdom
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This paper considers the prediction of intraday time series that consist of both intraweek and intraday seasonal cycles. Applications of relevance include forecasting volumes of call center arrivals, transportation, e-mail traffic and electricity load. After reviewing previously proposed forecasting approaches, new candidate methods are introduced. A new parsimonious exponential smoothing formulation is presented that can be viewed as a generalization of two previously proposed methods. A second new exponential smoothing method is developed by adapting a procedure previously used for daily sales data that involves smoothing the total weekly volume and its split across the periods of the week. The paper also introduces several methods based on exponentially weighted least squares. These include the use of discounted recursive least squares with either trigonometric terms or regression splines. A somewhat different approach involving regression splines has previously been proposed in the literature, and this is revisited here using the parsimonious exponential smoothing method to model a time-varying spline. Although the emphasis is on point forecasting, we also consider the potential for density forecasting from the various methods. Application of the methods is illustrated using a series of arrival volumes at NHS Direct, the 24 hour telephone helpline provided by the National Health Service in England and Wales.

Financial Time Series Forecasting-Risk Management [OS2]

Organized Session:

Monday, June 22, 11:10am-12:10pm

Room: Ballroom B

Stress Testing Correlation Matrices in Risk Management**Mike So**

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Evaluating portfolio risk typically requires correlation estimates of security returns. Historical financial events evidently show that correlations can jump up quickly, causing significant increase in the portfolio risk. As such, in doing stress testing for portfolios, it is important to consider the impact of tremendous increase in selected correlations. Standard stress testing mechanism leads us to change the selected correlations to designated values. However, the correlation matrix may become non-positive definite after changing some of its entries. This paper proposes a method to convert an existing correlation matrix to incorporate the change while keeping the matrix positive definite. Simulations show that our method is efficient and is able to work well in a dimension of 1000.

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Bayesian Forecasting for Financial Risk Management**Cathy WS Chen ***

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Richard Gerlach

University of Sydney, Australia

Wayne Lee

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Edward M. H. Lin

Feng Chia University, Taiwan

We consider a computational Bayesian framework for forecasting Value-at-Risk (VaR) in an empirical study. We employ a range of parametric models, including standard, threshold nonlinear and Markov switching GARCH specifications, together with four probability distributions for the error component: the Gaussian, Student-t, generalized error and skewed Student-t. Adaptive Markov chain Monte Carlo methods are employed to estimate the 1-period predictive asset return distribution. For the empirical study, an asset portfolio of four major Asia-Pacific stock markets is considered. To compare competing models the violation rate, absolute deviation given violation and market risk charge are employed. Results reveal that (i) asymmetric models were favoured at 1 and 10 day forecast horizons; for 2 day horizons non-stationary models were favoured; (ii) for 1 and 2 step ahead forecasting skewed errors were strongly favoured; while for 10 day forecasting normal errors were preferred; and (iii) the popular RiskMetrics approach ranked last all cases.

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Bayesian Time-varying Quantile Forecasting in Financial Markets**Richard Gerlach ***

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Cathy WS Chen

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Nancy Chan

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Recently, Bayesian solutions to the quantile regression problem, via the likelihood of a Skewed-Laplace distribution, have been proposed. These approaches are extended and applied to a family of dynamic conditional autoregressive quantile models. Popular models, used for risk measurement and management in finance, are extended to this fully nonlinear family. An adaptive Markov chain Monte Carlo scheme is designed for estimation and inference. Simulation studies illustrate favorable performance, compared to the standard numerical optimization of the usual non-parametric quantile criterion function. An empirical study employing ten major financial stock indices and Value at Risk forecasting finds significant nonlinearity in dynamic quantiles and evidence favouring the proposed model family, for lower level quantiles, compared to standard parametric volatility and risk models in the literature. Simpler and more standard models are favoured at less extreme quantiles.

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Finance II [FIN2]

Contributed Session:

Monday, June 22, 11:10am-12:10pm

Room: Ching

Volatility Model Averaging and Option Pricing**Georgia Papadaki ***

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Paolo Zaffaroni

Imperial College London, United Kingdom

The focal point of this paper is model uncertainty in volatility modeling and its implications when option pricing is under consideration. We examine some of the most popular methods used in volatility averaging including Bayesian Model averaging, Bayesian Approximation and Thick Modeling. An empirical analysis based on the S&P 500 index is performed to test whether these methods can provide more accurate volatility forecasts compared to individual models. The different averaging volatility schemes are afterwards used for pricing options on the same index, addressing an important gap in the literature; the unsubstantiated assumption that a particular volatility model drives the dynamics of the underlying asset. In the context of discrete volatility option pricing, two further innovations are suggested and contrasted. The first introduces pricing by averaging the individual option prices under different volatility models. The second proposition refers to a pricing method where first the alternative volatilities driving the dynamics of the underlying asset are averaged and afterwards this averaged volatility scheme is used for pricing. Both proposals are compared against single alternatives. The empirical analysis indicates a greater accuracy of averaging methods for both volatility forecasting and option pricing.

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Volatility Forecasting Model Selection with Exponentially Weighted Information Criteria**Wei Chong Choo**

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In this paper, we consider a recently proposed information criteria (IC) for selecting among forecasting models. This IC involves the use of exponential weighting within the measure of fit in the standard IC, such as the Akaike's IC or Schwarz's Bayesian IC. The effect of this is that greater weight is placed on more recent observations in order to reflect more recent accuracy. This new exponentially weighted IC has previously been used to select among models for point forecasting. In this paper, we consider its use for selecting between a variety of volatility forecasting models, including GARCH, exponential smoothing, and smooth transition exponential smoothing. In the likelihood functions for all the models, we allow conditionally non-Gaussian distributed errors in order to capture more fully the leptokurtosis in financial returns data. We demonstrate the use of model selection based on the new IC using stock indices data obtained from four major stock markets.

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Forecasting Methods for Interval Time Series: Some Financial Applications

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An interval time series (ITS) is a time series where each period of time is described by an interval. In finance, ITS can describe the temporal evolution of the high and low prices of an asset throughout time, where they are related to the concept of volatility and are worth considering in order to place buy or sell orders. This work reviews several approaches to forecast ITS, such as exponential smoothing methods, the k-NN algorithm and the multilayer perceptron. Another approach that is considered consists of forecasting the time series of the minimum and the maximum (or, alternatively, of the center and the radius) of the intervals using univariate or multivariate forecasting methods. Regarding the multivariate models, the possible cointegrating relation between the high and low values is analyzed, and the equivalence of the VAR models for the minimum and the maximum and for the center and radius is proved. The performance of the aforementioned approaches is compared in two financial ITS and some interesting conclusions are drawn from the comparison.

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Judgmental Forecasting I [JF1]

Contributed Session:

Monday, June 22, 11:10am-12:10pm

Room: Ballroom A

[Forecasting the Effectiveness of Policy Implementation Strategies through Structured Analogies](#)

Nicolas Savio *

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Primarily, policies are intended to address economic, social or environmental problems that might exist. When implementing a policy, any government will be faced with the decision as to what strategy to adopt in order to meet the objectives set out by the policy in the most cost effective way. Several such policy implementation strategies (PIS) may be available, making such a decision not always so straightforward. With limited funds available, such a decision has particular importance for budgeting purposes. This paper suggests forecasts of PIS effectiveness as a decision support tool for this task. The nature of structured analogies (and its track record in situations of low quantitative data availability) is considered suitable for generating such forecasts and is hence proposed.

A pilot study is carried out for an initial assessment on performance. University students were presented with three disguised cases and then asked to produce individual forecasts using either structured analogies or unaided judgment (depending on their allocated group). The students were then grouped and the process was repeated. The results of this experiment are presented here. It was found that in the hands of non-experts, the structured analogies approach improves forecast accuracy when compared with unaided judgment. Accuracy improves further when forecasts are produced in groups.

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[Judgmental Forecasting of the Impact of Digital Planning Policies](#)

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Konstantinos Nikolopoulos

Manchester Business School, Greece

Vassilis Assimakopoulos

National Technical University of Athens, Greece

This study describes an experiment on forecasting the impact of Digital Planning Policies in Greece. The experiment included cases of policies run by the General Secretariat for Research and Technology in Greece. A panel of selected experts was asked to produce judgmental forecasts for the success of these policies. The panel comprised expertise in the areas of information society, forecasting and information technology. The form of communication with the experts was e-mail. The experiment was conducted by employing structured analogies and unaided judgment. Each method was also followed by a two-round Delphi process. This study presents the preliminary results of the experiment and compares them with the results of previous experiments with a group of non-experts.

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Decision Making using Forecasts: Comparing the Use of Judgemental and Statistical Forecasts

Marcus O'Connor *

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Willam Remus

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Kai Lim

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Forecasts are generally produced to aid decision making in some way. The better the forecasts, the better the decisions will be. The literature on the link between forecasting and decision making is, however, rather scarce. In the study reported in this presentation the task of forecasting and decision making was given to the same group of people. Using a production planning scenario, we examine the quality of the forecasts and decisions in two situations—when the decision makers used their own forecasts and when they used statistically generated forecasts. Results indicate that, although there were no differences in the judgemental forecasts of the two groups, there were vast differences in the accuracy of the decisions—with, as expected, the statistical forecast group making better decisions (because the statistical forecasts were better). However, even though the forecasting task was deliberately made less difficult than the decision task, people were much more accurate in forecasting than in decision making. In addition, unlike many other studies where judgemental inaccuracy is often due to inconsistency, this study found no major differences in consistency between the groups. Most of the differences seemed to arise from a lack of understanding of the functional form of the task that required the utilization of information on demand, inventory and workforce capacity. Furthermore, feedback did not seem to have any effect on the forecasting or decision accuracy.

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Technology and Innovation Forecasting I [TIF1]

Contributed Session:

Monday, June 22, 11:10am-12:10pm

Room: Tang II

[The Beltline Moulding Contours Forecasting With ARIMA Model](#)**Abdul Talib Bon ***

Universiti Tun Hussein Onn, Malaysia

The ARIMA model offers a good technique for predicting the magnitude of any variable. Its strength lies in the fact that the method is suitable for any time series with any pattern of change and it does not require the forecaster to choose a priori the value of any parameter. Its limitations include its requirement of a long time series. Often it is called a Box-Jenkins model. Like any other method, this technique also does not guarantee perfect forecasts. Nevertheless, it can be successfully used to forecast long time series data. In our study the developed model for cross section on beltline moulding production was found to be classified for each contours the best ARIMA models where is for Contour 2 with ARIMA (3,1,1); Contour 3 with ARIMA (1,1,1); Contour 4 with ARIMA (1,1,1); and Contour 5 with ARIMA (1,1,1) also. From the forecast generated by the developed model, it can be seen that forecasted dimension of cross section beltline moulding for best ARIMA models for four contours are towards the mean range compared with the actual values. The forecast values are more stable and in consistent condition.

Another important result obtained in this study is that we have generated a SAS programming for an ARIMA identification program. The program has been applied to time series data from the real data from a manufacturer and shows very good results. On the other hand, the validity of the forecasted values can be checked when the data for the lead periods become available. This program will be useful in determining which model can be used by researchers to forecast cross section on beltline moulding in manufacturing. However, it should be updated with current data from time to time.

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[Pre-launch Forecasting of New Product Diffusions](#)**Evren Ozkaya ***

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Pinar Keskinocak

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In global economy, growing demand combined with increasing rates of innovation in both product and process technologies drive shorter product life cycles. Forecasting product life cycle behavior with the limited information available prior to the product launch remains one of the most important and difficult challenges faced by many businesses as they introduce new products. Diffusion models are good candidates for providing comparisons of potential market penetration scenarios using historical product adoption patterns.

In this paper, we present a practical framework for the analysis of historical product diffusion patterns and propose several methodologies for algebraically estimating new product diffusion parameters. We introduce user-friendly versions of the classic Bass Diffusion Model with new sets of parameters that are more intuitive and have natural interpretations in terms of more easily estimated market characteristics. We test our models on real-world data sets from the high-tech industry and report significant forecast improvement opportunities.

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International Diffusion of Renewable Energy Technologies for Electricity Generation**Nigel Meade ***

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Towhidul Islam

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We will model and forecast the diffusion of renewable energy technologies (RETs) as a means of electricity generation. The RETs we consider are wind turbines, solar cells and biomass. In contrast to most industrial technological innovations there is not a straightforward economic advantage flowing from the new technology. Generation of electricity by a renewable energy technology is generally more expensive and less convenient than the current technology. The advantages of RETs are reduced carbon emissions and reduced usage of fossil fuels. This means that the diffusion of the technology is linked with the pricing of the environmental benefits of RETs via incentive schemes. The diffusion of RETs in electricity generation will be modeled using a multi-country Bass type framework, where the dependent variable is electricity generated by each renewable technology. The effect of covariates including incentives schemes, investment costs and fossil fuel costs will be examined by parameterising the Bass model coefficients. The model is developed using EU and US data.

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Bayesian Method [BYM]

Contributed Session:

Monday, June 22, 11:10am-12:10pm

Room: Tang I

New Insights in Inflation Forecasting Using Bayesian Model Averaging**José S. Morales ***

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Forecasting an inflation is a key issue for organizations, companies and individuals. Bayesian Model Averaging (BMA) is a useful tool for obtaining accurate forecasts of different price indices and has been applied to basic regression approaches which include a shrinkage parameter. In the last year some papers on this subject proposed to analyze the effect of this parameter in the forecasting but failed to search the best one. Using a computer program to calculate the BMA forecasts for all the possible values of this parameter brings new ideas for selecting the best one. Forecasts obtained under a shrinkage parameter have high accuracy when using BMA with autoregressive models. This paper provides preliminary evidence from inflation forecasting examples which cover both positive and negative inflation situations.

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Bayesian Analysis of Asymmetric Smooth Transition Dynamic Range Models**Edward M. H. Lin ***

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Cathy WS Chen

Graduate Institute of Applied Statistics, Feng Chia University, Taiwan

Richard Gerlach

Discipline of Operations Management and Econometrics, Australia

In this article, Bayesian estimation, volatility forecasting and model comparison for an asymmetric nonlinear smooth transition conditional autoregressive range (CARR) model are derived. An adaptive Markov chain Monte Carlo scheme is developed for these purposes. The logistic transition function is considered and its main properties are investigated and its characteristics discussed in detail. We suggest a proper prior distribution, thus ensuring the posterior is proper, for the smoothing parameter via a suitable, weakly informative prior. The proposed models can capture aspects such as sign asymmetry and heteroskedasticity, which are commonly observed in financial markets. An innovation of this paper is that it presents a mixture proposal distribution to improve the acceptance rate problems that often occur in Bayesian inference. The methods are illustrated using simulated data. Finally, an empirical study is provided to illustrate a rational explanation for asymmetric volatility in financial markets and deviance information criterion (DIC) is employed to compare the proposed model with its limiting class, the threshold CARR models.

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[Bayesian Density Forecasting of Intraday Electricity Prices](#)

Michael Smith *

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Anastasios Panagiotelis

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Electricity spot prices exhibit strong time series properties, including substantial periodicity, both inter-day and intraday serial correlation, heavy tails and skewness. In this paper we capture these characteristics using a first order vector autoregressive model with exogenous effects and a skew t distributed disturbance. The vector is longitudinal, in that it comprises observations on the spot price at intervals during a day. A band two inverse scale matrix is employed for the disturbance, as well as a sparse autoregressive coefficient matrix. This corresponds to a parsimonious dependency structure that directly relates an observation to the two immediately prior, and the observation at the same time the previous day. We estimate the model using Markov Chain Monte Carlo, which allows for the evaluation of the complete predictive distribution of future spot prices. We apply the model to hourly Australian electricity spot prices observed over a three year period, with four different nested multivariate error distributions: skew t, symmetric t, skew normal and symmetric normal. The forecasting performance is judged over a 30 day forecast trial using the continuous ranked probability score, which accounts for both predictive bias and sharpness.

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Dating and Forecasting Turning Point [OS3]

Organized Session:

Monday, June 22, 01:30pm-02:30pm

Room: Ballroom C

[An Econometric Analysis of Some Models for Constructed Binary Time Series](#)

Don Harding *

LaTrobe University, Australia

Adrian Pagan

UNSW, Australia

Constructed binary random variables commonly featured in macroeconomic and finance literatures are shown to have a DGP that can be approximated by a Markov process (MP). The methods of construction endow these binary variables with additional properties including a lower bound on the MP's order and restrictions on its parameters. It is shown that in standard dynamic discrete choice models these restrictions make certain parameters infinite and the log likelihood undefined. It is shown how to allow for these special features in estimation procedures. These procedures are applied to investigate the relation between the business cycle and the yield spread.

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[Obtaining Early Signals About US-recessions: An Application of A New and Efficient Multivariate Real-time Filter Design](#)

Marc Wildi

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This paper proposes a new approach to the detection of US recessions that seeks to replicate the recession dates declared by the Business-Cycle Dating Committee (BCDC) of the National Bureau of Economic Research (NBER). Releases of recession dates by the BCDC are typically delayed by 6 to 18 months. We propose a Multivariate Direct Filter Approach (MDFA) and apply it to a 'standard' small set of economic variables. The MDFA inherits an optimality property originally derived for the univariate DFA (Direct Filter Approach). More precisely, it can be shown that the filter minimizes the (unobservable) mean-square filter error up to a smallest possible error term. Besides this desirable theoretical efficiency property the new multivariate filter extends the scope of the (univariate) DFA by accounting efficiently for cointegration, for lead-lag relations among time series and by accounting for practically relevant questions about 'direct' vs. 'indirect' filtering. We then compare its real-time performance in recession dating to that of indicators proposed by Chauvet and Piger (2008), by Chauvet (1998) and Chauvet and Hamilton (2005), to the CFNAI (Chicago Fed National Activity Index) and to the ADS-index (Aruoba-Diebold-Scotti (2008)). Our new filter is both fast and reliable. It anticipates the last seven recessions from 1969 to 2009 by an average of 3.5 months after including data publication lags and the last recession is signalled with only a two month delay in February 2008. Revisions in the filter due to data-updating are small because the filter assigns most of the weight to data that is either unrevised (total civilian employment) or that is only slightly revised (manufacturing and trade sales, employment on non-agricultural payroll) whereas industrial production or income series receive little weight.

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[Alternative Specification of Business Cycle and Growth Cycle Coincident Indicators](#)

Gian Luigi Mazzi *

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Jacques Anas

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The ability of promptly and correctly detecting turning points, especially in periods of high uncertainty or recession, is of primary importance for policy makers and analysts. Moreover, detecting systems have to avoid returning false signals which could negatively affect the effectiveness of monetary policies as well as the future plans of economic agents. In this paper, we present univariate and multivariate Markov Switching based alternative specifications of two euro area coincident indicators, for business and growth cycle respectively, aiming to promptly detect turning points. We simulate in real time their performances by using the Eurostat real time database. Results of the simulations are assessed against the turning points identified in the euro area reference chronology, which simultaneously dates business and growth cycle turning points by means of a non parametric algorithm. We also analyze in detail the behavior over the period 2006-2008. Particular attention is also paid to the number of false signals or missing cycles characterizing each indicator. In the simulation we have adopted the classical 0.5 threshold; in order to reduce the risk of false signals we have investigated an alternative rule by which no decision is taken when the filtered probabilities lie between 0.4 and 0.6 without observing any significant result. By using the QPS and the Concordance Index, we are able to rank the alternative specifications and to identify the two outperforming specifications for growth and business cycle respectively. Main findings of the paper are that the selected indicators are not characterized by relevant false signals or missing cycles; they appear nevertheless slightly lagging with respect to the reference chronology. Furthermore, we observe that the growth cycle indicator appears more robust than the business cycle one which is, partially, explained by the very few numbers of business cycles fluctuations characterizing our economy in the recent period.

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Finance III [FIN3]

Contributed Session:

Monday, June 22, 01:30pm-02:30pm

Room: Ching

The Role of Trading Volume in Volatility Forecasting**Van Le ***

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Ralf Zurbrugg

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Current models of volatility generally either use historical returns or option implied volatility to generate forecasts. Motivated by recent findings in the strand of literature focusing on volume-return (price) volatility relationships, this paper proposes the introduction of trading volume into various ARCH frameworks to improve forecasts. In addition to the informational enrichment and the improvement in model fit, ex-ante evidence indicates that the incorporation of both option implied volatility and trading volume into an EGARCH model leads to its outperformance over numerous other alternate forecast approaches. Noticeably, abnormal returns obtained from trading simulations underscores the improvement in forecast accuracy to be economically significant. These results remain robust to different measures of volatility and volume and offers scope for investors to more accurately predict volatility in the future.

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[‘Real Time’ Early Warning Indicators for Costly Asset Price Boom/Bust Cycles: A Role for Global Liquidity](#)**Lucia Alessi ***

European Central Bank, Germany

Carsten Detken

European Central Bank, Germany

There is some skepticism in the academic and central banking community whether asset price bubbles can be identified in real time in order to allow policy makers to possibly ‘lean against the wind’. Indeed, reliable and timely warning signals are a necessary requirement for any policy aiming at tightening the screws during pre-boom and early boom periods. This paper provides new evidence that such early warning indicators exist which signal costly asset price developments in ‘real time’ and with sufficient lead to react. We test the performance of a host of real and financial variables as early warning indicators for costly aggregate asset price boom/bust cycles, using data for 18 OECD countries between 1970 and 2007. A signaling approach is used to predict asset price booms which have relatively serious real economy consequences. We use a loss function to rank the tested indicators given policy makers’ relative preferences with respect to missed crises and false alarms. The paper analyzes the suitability of various indicators as well as the relative performance of financial versus real, global versus domestic and money versus credit based liquidity indicators. We find that over the average of all countries and for a wide range of preference parameters the ‘global’ private credit gap and the ‘global’ M1 gap are the best early warning indicators. The forecast performance is such that the approach should provide value added to policy makers contemplating leaning against growing financial imbalances—either by means of monetary or macro-prudential policies—as long as their preferences are relatively balanced between missed crises and false alarms. With respect to the latest boom wave around 2005-2007, the global private credit gap has been sending persistent warning signals while the global money (M1) gap has not.

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Forecasting Volatility in the Presence of Model Instability**Jonathan Reeves** *

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John Maheu

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Xuan Xie

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Recent advances in financial econometrics have allowed for the construction of efficient ex post measures of daily volatility. This paper investigates the importance of instability in models of realized volatility and their corresponding forecasts. Testing for model instability is conducted with a subsampling method. We show that removing structurally unstable data of a short duration results in a negligible impact on the accuracy of conditional mean forecasts of volatility. In contrast, it does provide a substantial improvement in a model's forecast density of volatility. In addition, the forecasting performance improves when we evaluate models on structurally stable data, often dramatically.

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Energy Sales and Markets I [ESM1]

Contributed Session:

Monday, June 22, 01:30pm-02:30pm

Room: Ballroom B

Natural Gas Consumption Maxima Modeling**Ondrej Konar ***

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Natural gas consumption modeling can be very useful for natural gas distribution companies since they do not measure consumption for all their customers on a daily basis. One of the interesting issues is to model extreme events (e.g. maximum consumption of a given group of customers). This would be very useful for e.g. managing the transportation or gas storage capacity. We have a set of about 1000 customers (randomly selected within the scope of synthetic load profiles creation project) with consumption measured on a hourly basis for four years. Based on these data and the extreme values theory we try to answer the question: What is the probability of exceeding a given consumption limit? This requires finding an appropriate distribution function and fitting its parameters to available data. The work is supported by the Grant Agency of the AS CR, grant No. 1ET400300513.

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[Forecasting Electricity Spot Prices Accounting for Wind Power Predictions](#)**Tryggvi Jonsson ***

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The complexity of forecasting electricity prices originates from the presence of nonlinear and nonstationary dynamics potentially induced by stochastic external forces. A modeling framework suitable for nonlinear time-varying processes with a few external factors is proposed. It permits issuing both point and probabilistic forecasts in a nonparametric fashion, thus avoiding the commonly employed Gaussian assumption. The first layer takes the form of a nonparametric transfer function derived using local polynomial regression, and accounts for the nonlinear impact of external forces on the process. This transfer function is then passed on as an external signal to a dynamic regression model which addresses the relation to recent observations and forecasting errors. Exponential forgetting and recursive parameter estimation are employed in order to accommodate time-varying characteristics of such dynamics. Finally, time-adaptive quantile regression is used for modeling forecast error densities conditional to some external signal. The introduced framework is applied to the forecasting of electricity spot prices in Western Denmark during a 22-month period in 2006 and 2007. The known impact of wind power forecasts on prices is handled via the transfer function model, along with intra-day variations and day-type effects. The market dynamics are modeled with an ARMAX (AutoRegressive Moving Average with exogenous terms) model, where the external signal originates for the transfer function model. Density forecasts are finally derived conditional upon both the spot price forecast and the forecasted wind power penetration in the area. Forecast evaluation results demonstrate the quality of the proposed point and density forecast methodology. Due to a foreseeable increased penetration of inexpensive renewable generation in electricity markets, its influence on market prices and dynamics should be further

considered in the future. Also, the flexibility of the methodology can make it of great value for the prediction of other nonlinear processes significantly influenced by a few external factors.

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Wind Power Density Forecasting Using Conditional Kernel Density Estimation

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James W. Taylor

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Of the various renewable resources, wind power is widely recognized as one of the most promising. Although most attention has focused on point forecasting, the management of wind farms and electricity systems can benefit greatly from the availability of estimates of the uncertainty in the power generated from each wind farm. This paper aims to contribute to this area by developing an approach to producing forecasts of the probability distribution of wind power. There are two key uncertainties when modeling wind power in terms of wind speed. The first is the inherent uncertainty in wind speed. The second is the uncertainty in the relationship between wind speed and wind power. In this paper, we use conditional kernel density estimation. Application of the technique to this area is not straightforward because it only captures the second of the two uncertainties in wind power described above. The usefulness of the approach is evaluated using wind power, wind speed and wind direction datasets for wind farms in Scotland and Spain.

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Econometrics II [ECO2]

Contributed Session:

Monday, June 22, 01:30pm-02:30pm

Room: Ballroom A

Identifying a Simplified VAR Model with Reduced Rank and Leading Index**Yu-Pin Hu**

National Chi Nan University, Taiwan

This paper proposes a simplified vector autoregressive (VAR) model which is a general form of the index model and the reduced-rank model. This model can provide more information when extracting the leading index and white noise series simultaneously, and also gives a smaller prediction error. Theoretical results includes: representing the model by a transformation, deriving the maximum likelihood estimations, analysis of the covariance of the prediction error, and proposing a correlation-form statistic to test the model. Simulation studies show the validity of the proposed statistics for nonlinear and nonstationary processes. Finally, the theoretical results are applied to analyze two economic data sets.

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A New Procedure for Multiple One-sided Hypothesis Testing**Muhammad Akram ***

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Hypothesis testing plays a significant role in diagnostic checking of econometrics models. In terms of testing based on multiple test statistics, King, Zhang and Akram (2008) presented a new procedure, which involves estimating the joint density of the vector of test statistics under the null hypothesis through bootstrapping and approximating the p value using this estimated density through Monte Carlo simulations. They found that when the component tests are invariant to the nuisance parameters, this testing procedure had the potential to produce higher powers than the conventional tests. Akram, Zhang and King (2008) investigated the application of this testing procedure to the information matrix (IM) test, which is an example of the situation where the component tests are only asymptotically invariant to nuisance parameters. They found that this testing procedure has higher powers than the IM test based on the asymptotic critical values.

In this paper we apply this new procedure of multiple testing to test the null hypothesis that allows for at least one of the component tests being one-sided. We compare this new testing procedure with the F-test and the joint one-sided test proposed by King and Smith's (1986) in the context of testing linear regression coefficients. We find that all tests have approximately correct sizes, while, the power of this new testing procedure is higher than that of the other two tests most of the time.

Key words: bootstrapping, kernel density estimation, Markov chain Monte Carlo, posterior density.

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Military Manpower Modeling and Forecasting

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For effective defence manpower planning, the Ministry of Defence, UK requires reliable medium/long term forecasts of military manpower strengths. A single service econometric forecasting model of the Royal Navy Total Manpower (Jaffry & Capon, 2005) has been in operation with the Ministry of Defence, UK for many years. The model has been shown to be resilient and stable with time. The Naval Manning Agency, UK uses the outturns as a major input to their manpower planning. This paper presents competing single service models for the Royal Navy, Army and Royal Air Force, as well as tri-service econometric trained manpower strength forecasting models. A number of econometric approaches including Seemingly Unrelated Regression (SUR), Vector Autoregressive Regression (VAR) and Vector Error Correction Mechanism (VECM) have been used to produce the tri-service manpower trained strength models. The in-sample forecasts show that the VECM methodology outperforms all the competing models. The out-of-sample forecasts for the next 20 years are produced using the selected models. In order to assess the policy implications of various options for MoD, a scenario analysis has also been performed.

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Judgmental Forecasting II [JF2]

Contributed Session:

Monday, June 22, 01:30pm-02:30pm

Room: Tang II

Judgmental Forecasting from Autocorrelated Time Series**Nigel Harvey ***

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Many real-world time series show autocorrelation: the value of an observation at time t is correlated with that at time $t-1$. We used two experiments to examine the extent to which participants could detect autocorrelation in graphically-displayed time series data. Both experiments were run online, using participants recruited through the ipoints.co.uk reward scheme. In both experiments participants saw a time series comprising 50 noisy observations, and had to make forecasts for the next two observations. The task was framed as a sales forecasting exercise, and participants could earn a bonus for being in the most accurate 10%. Experiment 1 ($n = 840$) used a within-subjects design, with two variables: autocorrelation (0, 0.4, 0.8) and noise (low, high). Participants saw two trials for each of the 6 possible autocorrelation-noise combinations, a total of 12 forecasts. Results indicated that participants' predictions showed an implicit assumption of autocorrelation even when there was none present. In other words, participants' estimates were drawn towards the ($t-1$) data point even when there was no autocorrelation in the series. Conversely, estimates in the 0.8 autocorrelation condition showed insufficient correlation with the ($t-1$) data point. Overall, participants were weakly, although significantly, sensitive to the autocorrelation of the series, showing higher autocorrelation in their predictions for the 0.8 series relative to the 0.4 and 0 series. One potential explanation of these results is that participants are drawn towards the central tendency of the autocorrelation across all the trials they have already experienced, a phenomenon we have observed in within-subjects time series forecasting before. In Experiment 2 ($n = 621$) we replicated Experiment 1 using a between-subjects design in which participants made predictions for a single time series. Results were very similar to Experiment 1: Participants were weakly sensitive to autocorrelation, but underestimated high autocorrelations and overestimated low autocorrelations.

Email: n.harvey@ucl.ac.uk**Enhancing Forecasting Support Systems for Supply Chain Forecasters****Paul Goodwin ***

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While many forecasting systems provide users with sophisticated statistical facilities there is generally an absence of support for judgmental interventions, despite findings that up to 90% of system forecasts are adjusted in some companies. In particular, there appears to be a need for facilities that allow forecasters to make effective use of the diverse range of information and advice that they receive during the forecasting process. This paper reports on ongoing work that is investigating the design of such facilities using a prototypical forecasting system. Alternative designs containing novel features are being evaluated with the aim of establishing enhanced human-computer interaction so that forecasters and their collaborators can combine information and advice more efficiently.

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Damage Assessment: Predicting What would have Happened, a Case Study**Geoffrey Allen ***

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A natural catastrophe or human accident can lead to partial or total loss of production. Measuring the amount of loss, a key component in an insurance claim, can be difficult for some production processes. For example, the yield of an agricultural crop is influenced by many weather and cultural factors. The case concerns the inadvertent application by a contractor of a damaging pesticide to a cranberry grower's entire farm, resulting in at least one year of lost production and, because cranberries are perennial, of potentially more. Even with consistent cultural practices, yield varies substantially from year to year, from farm to farm, and from variety to variety. Lack of long data series and difficulty in obtaining comparable data from other growers complicated the problem, leading to a relatively simple time-series analysis. In addition, judgmental forecasts based on biological characteristics gave substantially different yield estimates. In the end we rejected combining the forecasts in favor of estimates from a time-series approach

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Environmental and Climate Applications I [ECA1]

Contributed Session:

Monday, June 22, 01:30pm-02:30pm

Room: Tang I

[Spectral Estimation of a Structural Spatial Model: An Application to the Interpolation and Smoothing](#)**Javier Fernandez-Macho**

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Massive large-scale environmental datasets with global coverage have become quite common in recent years. Examples include global emissions source databases on greenhouse gases and ozone-depleting compounds. One important use is the estimation of actual levels for such atmospheric pollutants on a world grid basis, and is useful to climate modelers, global warming analysts as well as policy-makers. Likewise, similar treatment can be applied to a wide range of areas ranging from economics to geophysics.

Obtaining direct measurements on a global basis is not a feasible solution, not only because the number of individual locations may be extremely high (a large-scale world grid can have millions of points) but also because of the difficult physical accessibility of many of them. The observed emissions can then be taken as a proxy of the underlying unobservable levels which are thought to be governed by a smoothing mechanism due to atmospheric dispersion. However, as is usually the case, these spatial data may be contaminated with noise or even missing at many locations and a problem that thus arises is how to extract and/or interpolate the underlying smooth signal or trend.

This paper sets out a nonstationary structural spatial model that assumes data to evolve across a spherical grid constrained by second-order smoothing restrictions. We then use a frequency-domain approach to estimate the spatial model via maximum likelihood. As a result, the computational burden associated with estimation of two-dimensional models is dramatically reduced and analytic expressions for the asymptotic variance of the smoothing parameters with which to construct confidence intervals can be obtained.

An application to the estimation of CO₂ global levels using data from emissions from all anthropogenic sources for the year 1995 illustrates the proposed technique.

Keywords: Discrete Fourier Transform, frequency domain, interpolation, missing observations, nonstationary spatial data, spatial statistics, spectral likelihood, state space, signal extraction.

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Analysis and Forecasting of Central England Temperature: An application of the Linear Dynamic Harmon

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Although the exact future pace and extent of global warming are highly uncertain, many claim that the world has embarked on a major series of geophysical changes that are unprecedented in the past few thousand years. Many of the central questions posed by economic approach to climate change are based on Ramsey's (1928) optimal growth theory where the real return of capital (r) depends on the time discount rate (ρ), the consumption elasticity (ϵ) and the average consumption growth (g). If values imposed on these variables differ greatly from actual market data then the central questions about warming policy—how much, how fast, and how costly—remain open, as recent contrasting examples, the Stern Review (2007) and the DICE Model (2008), have shown. Using one of the longest time series available, the Central England Temperature, we investigate if sensible forecasts (based on existing forecasting scientific literature) can shed some light into this policy bone of contention.

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Past, Present and Future of Computational Intelligence Applied to Forecast Time Series I [OS4]

Organized Session:

Monday, June 22, 02:40pm-03:40pm

Room: Ballroom C

[Modeling and Prediction of Exotic Phenomena Using Information Theoretic Approaches, Spectral Analysis and Neurofuzzy Modeling: A Tutorial](#)

Masoud Mirmomeni *
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Caro Lucas
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Behzad Moshiri
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Babak Nadjar Araabi
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Nowadays, modern societies are mostly dependent upon several technologies, and natural threats to these technologies can be seen as threats to human life. In other words, modern societies have become a risk society in the sense that it is increasingly occupied with debating, preventing and managing risks that it itself has produced. Therefore, creating an alarm system to provide human beings and technologies protection from such hazards seems to be a pressing concern. It is obvious that predicting such anomalies plays an important role in the alarm system. Many of these anomalies are very difficult to predict because they show chaotic behaviors. Neural and neuro-fuzzy models have performed well in the prediction of nonlinear and chaotic time series. Although these approaches show great performance in short-term prediction, when the number of observations for training is limited, they can neither reconstruct the dynamics nor learn the shape of the attractor. They may present the most accurate one step ahead predictions, but in larger prediction horizon their performance dramatically falls down. On the other hand, one of the most important parts in modeling and system identification is input selection. By proper input variables selection with more generalization capability, a better perception of the system is provided. In this article, first of all, a decomposition method based on Singular Spectrum Analysis (SSA) is used to make an intuitive nonlinear black box modeling technique applicable to long term prediction of natural time series. Then, a methodology based on Mutual Information (MI) for input variables selection is used to choose the most informative lags of each PCA produced by SSA. At the end, a combination of SSA and locally linear neuro-fuzzy modeling technique is proposed to make accurate long term prediction of natural chaotic phenomena.

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Disaggregation & Aggregation of Time Series Components: A Hybrid Forecasting Method using Generalized Regression Neural Networks and Holt's Method

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In the current paper, a new hybrid forecasting methodology is proposed which leverages from statistical and Artificial Intelligence techniques to perform multi-step ahead forecasting. The new methodology is based on the disaggregation of time series components, the prediction of each component individually and the reassembling of the extrapolations to obtain an estimation for the global data. The STL decomposition procedure from the literature (Cleveland et al., 1990) is implemented to obtain the seasonal, trend and irregular components of the time series, while Generalized Regression Neural Networks (Specht, 1991) are used to perform out-of-sample extrapolations of the seasonal and residual components. Holt's exponential smoothing method (Holt, 1957) is employed for the estimation of the directional component. The application of the Generalized Regression Neural Networks is based on the dynamic calibration of the training process for each of the seasonal and irregular components individually. The proposed hybrid method is applied on 60 time series from the NN3 competition to obtain 18 out-of-sample predictions. The results from the application indicate that the new methodology can significantly outperform standard statistical techniques in the literature, with an average of 27% improvement in prediction accuracy. One of the main contributions of the current research lies in the investigation of the strengths and weaknesses of the GRNN in predicting structural components in time series.

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[ADANN: Automatic Design of Artificial Neural Networks to Forecast Time Series](#)

Juan Peralta Donate *

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In this work an initial approach to design Artificial Neural Networks to forecast time series is tackled. The approach is an automatic method to design Artificial Neural Networks and is carried out by a Genetic Algorithm (as a search algorithm). A key issue for these kinds of approaches is what information is included in the chromosome that represents an Artificial Neural Network. There are two principal ideas about this question: first, the chromosome contains information about parameters of the topology, architecture, learning parameters, etc. of the Artificial Neural Network, i.e. Direct Encoding Scheme; second, the chromosome contains the necessary information so that a constructive method gives rise to an Artificial Neural Network topology (or architecture), i.e. Indirect Encoding Scheme. The results of a Direct Encoding Scheme (in order to compare with Indirect Encoding Schemes developed in future works) to design Artificial Neural Networks for NN3 Forecasting Time Series Competition are shown. In addition, an extension of the system, in order to include the weight values set into the chromosome, is described and evaluated.

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Travel and Tourism Forecasting I [TTF1]

Contributed Session:

Monday, June 22, 02:40pm-03:40pm

Room: Tang II

Conceptualizing a Hybrid Decision-support System for Tourism Destinations

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Forecasting tourism demand is a field of vital research activities around the globe. In particular, long-term and mid-range forecasting methods are prevalent in the tourism domain (Song & Li, 2008; Song & Witt, 2005). Short-term forecasting is limited to proprietary applications in the industry, e.g. airlines or hotel groups or chains. Various stakeholders at a tourism destination, though, may benefit from these more fine-grained approaches revealing arrival and occupancy forecasts on a monthly, weekly and even daily basis.

This paper will outline the concept, structure and functionality of a new web-based decision-support system which centers around improved and hybrid forecasting tools, improved by pooling know-how, quantitative data and experiences and sharing the common insights. One intriguing example for such a combination of econometric forecasting and judgmental contribution of experts is the recently developed web-based tourism demand forecasting system for Hong Kong (Song, Witt, & Zhang, 2008).

The hybrid approach propagated for this research project follows a slightly different direction. 1. It will be based upon past booking and current reservation data of a sample (15 to 20%) of the hotel companies at a daily level. 2. Forecasts, then, will be setup on an amalgam of conventional time-series analyses and weighted extrapolation. 3. Benchmarks for the individual hotel against a flexible group of competitors will enable additional insights. 4. In a strictly separated approach, additional external impacts on future demand will be incorporated applying monthly time-series analysis for the entire destination (Smeral & Wueger, 2005). 5. Structured expert opinions can be collected through the system and either impact different parameters in the forecasting models or directly reveal estimates for a time-series. 6. Finally, an automated web mining tool called webLyzard will be used to observe tourism specific media coverage which results can be fed back into the routines of forecasting.

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Predicting Turns in Hotel Occupancy Growth Rate using Composite Leading Indicator

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Hong Kong hotel industry contributes significantly to foreign exchange earnings, employment, and economic growth. In 2006, Hotels and tourist guesthouses generated 0.8% of GDP, around HK\$11.4 billion in Hong Kong. There were 24600 employed in Hotels and tourist guesthouses, or 0.7% of total employment. Although the total visitor arrivals keep on increasing in the last few years, it may not directly affect the total receipt in Hotel industry. This is the reason why the Hoteliers would prefer to use the Hotel Occupancy rate to assess the achievement of the property rather than using the other index.

However the highly volatiles of hotel occupancy create a difficult situation for the hotel management to manage their resources. During positive growth period resources are in relatively high demand while in contraction periods resources are less demand. For the purpose of capital investment, strategic planning and resources allocation, in order to minimize risk due to the changes in the hotel occupancy growth rates, the hotel management needs an early prediction of turning points such as peaks and troughs.

Due to the importance of accurate turning-point forecasts, combined with the lack of research in predicting turning points in Hong Kong hotel occupancy volatility pattern, the purpose of this empirical research is to predict the turns of the Hong Kong Hotel Occupancy growth rate by using the composite leading indicator.

This study seeks to identify the turning points in monthly hotel occupancy growth rate by extracting the smooth growth rates using the trend derivative (slope) approach. The trend derivative of unobserved trend component can be get by two approaches, namely is the statistical modelling and the (HP) filter approach. The statistical modelling method was also named as Basic Structural Model (BSM) (Harvey, 1989). Garcia-Ferrer and Bujosa-Burn (2000) was successfully used the BSM to extract the trend derivative in their study.

Hodrick-Prescott (HP) Filter approach is commonly used by the macroeconomists to get a smooth estimate of the long-term trend component of the series (EView 4.0, p.190). Simply, the trend derivative is gained by the extraction of the trend component by using the HP filter approach. In this project, both approaches will be used to identify the potential turning points in the monthly Hong Kong Occupancy growth rate.

The definition of the down turn (DT) and upturn (UT) was shown as below:

DT at t is equal to: $\{ (Y_{t-3} , Y_{t-2} , Y_{t-1} < Y_t > Y_{t+1} , Y_{t+2} , Y_{t+3}) \}$

DT at t is equal to: $\{ (Y_{t-3} , Y_{t-2} , Y_{t-1} > Y_t < Y_{t+1} , Y_{t+2} , Y_{t+3}) \}$

Note: Y_{t-3} , Y_{t-2} and Y_{t-1} are the past values of the growth rate and Y_{t+1} , Y_{t+2} and Y_{t+3} are the future values of the growth rate.

After the identification of these turning points, the project will construct a composite leading indicator that will be used to predict the turns of the Hong Kong Hotel Occupancy growth rate. In order to develop the composite leading indicator, the basic economy variables, such as GDP, Exchange rate and Stock market index of the main source markets of visitor arrivals to Hong Kong will be considered. Then the constructed composite leading indicator will be assessed by the available composite leading indicators, such as the OECD CLI and business survey index.

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Forecasting Tourism Arrivals to Australian and New Zealand

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George Athanasopoulos

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In this paper we propose a new set of multivariate stochastic models that capture time varying seasonality within the vector innovations structural time series (VISTS) framework. These models encapsulate exponential smoothing methods in a multivariate setting. The models considered are the local level, local trend and damped trend VISTS models with an additive multivariate seasonal component. We use these models to forecast international tourist arrivals to Australia and New Zealand. We evaluate their forecasting performance against the univariate counterparts of these models.

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Demographic and Social Applications I [DSC1]

Contributed Session:

Monday, June 22, 02:40pm-03:40pm

Room: Tang I

[The Prediction of Hospital Competitive Environment](#)

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Kratochvíl Oldřich

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This article deals with the prediction method for of hospital competitive environment. The two dimensional partial differential equations of second order are used. The theory is presented first. the next part is dedicated to the building of a model and is followed by a case study concerning the health sector.

Hospitals have influence on each other in the competitive environment because they all have qualified doctors to deliver high quality and specialized health services, equipped with advanced medical devices, implemented with effective management systems and enjoy a good reputation. The hospital competitive environment is also influenced by public transportation availability, development of new routes, parking places, tram and bus routes, new buildings and housing estates and so on. These also have influence on patients' attitude to hospitals.

The suggested program enables the search for hospital competitive environment, which is of paramount importance, and the results can be used for decision making processes. The methodology includes the dynamic phenomena which is a very flexible computer program for the set up of conditions, restrictions and obstacles. The two and three dimensional graphs together with polar graphs are used for evaluation. The calculation can improve the decision making process. The designed method for the prediction of competitive environment can be applied to other fields such as the market, finance, and business sectors.

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[Identification of Trends in the Accident Rate at the Spanish Interurban Roads](#)

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In this work we illustrate how to identify trends or patterns in the average (Spain) and specific (regional) segments of interurban roads from annual observed accident frequency, and to derive the predictive density function for future observations. For an assumed Poisson distribution on the number of accidents, a gamma prior and an appropriate hyperprior, a full hiercharchical bayes formulation is used to estimate the accidente rate for 77 segments (aprox. 850 km) of a typical Spanish corridor during the period 2001-2007. Subsequently, the prior and posterior distributions are smoothed over time using exponentially weighted moving average. Further we derive the predictive density function of a future observation, which can be applied in a multiple regresion model to analyze the effect of traffic conditions and road types on accident frequency.

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Monitoring and Forecasting Public Performance in Scotland

Robert Raeside

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Since 2007 the 32 Local Authorities in Scotland have been bound by a concordat which requests that they collect data to report progress toward outcomes as part of a single outcome agreement. At the national level there are some 60 measures to be reported upon of which 5 are strategic outcomes and 15 are national outcomes and 45 are used as indicators. At the local authority level data is collected and forwarded to be aggregated into national measures and formed into high level indicators of performance. It is intended that these indicators be used to monitor progress to nationally agreed targets and local level targets. In addition, it is hoped that from forecasting trends in these indicators that the forecasts can be used in allocating resources in a better way to allow targets to be obtained. This study involved detailed case study work with four local authorities. The aim of these case studies is to investigate the feasibility of using trends in outcome indicators to make forecasts from which resources can be allocated. A further aim is to investigate the benefit of using these forecasts over conventional approaches currently conducted in local authorities. In this the time series are very short so historical data will be used to construct longer data series to facilitate the investigation. This work will be reported in this paper and in addition results from an investigation in how to detect departures from trends in the indicators will be presented.

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Energy Sales and Markets II [ESM2]

Contributed Session:

Monday, June 22, 02:40pm-03:40pm

Room: Ballroom A

[Pricing Pacific-rim Temperature-based Weather Indices](#)

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A number of papers have been devoted to pricing temperature-based weather indices that are readily traded on United States and European cities at the Chicago Mercantile Exchange. These indices are based on the deviation of the daily maximum temperature from a specific threshold accumulated over a particular horizon. In contrast, the newly established Pacific-Rim index traded on Japanese cities is based on the average of daily temperatures that are the accumulation of the average of hourly temperatures over a 24-hour period. It is anticipated that Pacific-Rim contracts will be expanded into other climatic regions, as increased accumulation frequency creates more path dependency in temperature evolutions and therefore offers more flexibility in hedging various forms of temperature-related risks. From a pricing perspective, where prices are related to expectations of future index levels, the recent expansion of weather derivatives into other regions accumulated at different frequencies has merely resulted in the adaptation of existing Fourier series pricing models fitted with additional data.

This paper investigates whether the Pacific-Rim temperature-based weather index can be more accurately estimated by an alternative model. More specifically, it proposes a unique exponential profiling model, and compares it to the traditional Fourier transformation model. Both models are evaluated in the Australian context using temperatures measured in Sydney, as Australian cities are likely contenders for an exchange-traded weather derivative market.

The results suggest that the exponential model reduces the intraday temperature tracking error providing a superior Pacific-Rim index forecast in all out-of-sample periods. Improvements in index forecasting accuracy will result in a more accurate pricing model and, as a result, are likely to increase the liquidity associated in trading these contracts.

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[On the Reliability Assessment of Density Forecasts of Continuous Variables with Reliability Diagrams](#)

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Probabilistic forecasts in the form of densities are becoming more and more common forecasting products in meteorology, economics and finance, or as input to general decision-making problems in management sciences. Reliability (in other words, probabilistic calibration) is seen as a primary requirement when verifying such probabilistic forecasts since a lack of reliability would introduce bias in subsequent decision-making. Reliability diagrams comprise popular and practical diagnostic tools for the reliability evaluation of density forecasts of continuous variables. They relate to the assessment of the unconditional calibration of probabilistic forecasts, taking the form of a quantile-quantile plots. A reason for their appeal is that deviations from perfect reliability can be visually assessed based on deviations from the diagonal. Such deviations from the diagonal may however be caused by sampling effects, as well as induced by serial correlation in the forecast-verification pairs. We build on a previous proposal consisting of associating reliability diagrams with consistency bars that would reflect the deviations from the diagonal potentially observable even if density forecasts were perfectly reliable. Our consistency bars however

reflect potential deviations originating from the combined effects of limited counting statistics and of serial correlation in the forecast-verification pairs. They are generated based on an original surrogate consistency resampling method. This method relies on identification of the spectral structure present in the sequence of probability integral transforms, then used for generating surrogate time-series of probability integral transforms reflecting the observed correlation pattern. The ability of this method to provide consistency bars with a significantly better coverage against the i.i.d. resampling alternative is shown from simulations. A practical example of the reliability assessment of density forecasts of short-term wind power generation is finally given.

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Toward Valid Forecast Intervals for Electricity Consumption Models

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University of Lille, France

The aim of our work is to provide validated forecast intervals for French electricity consumption. The first part of this paper was presented at ISF 2008. We assume that, up to an additive unobserved white noise, electricity consumption at date t is determined by the consumption at dates $t-1, \dots, t-p$ and by the observed values of an exogenous climatic phenomenon such as the temperature observed at times $t, t-1, \dots, t-q$. In order to avoid the negative effect of large dimensions, we assume the additive effect of these two items defined by a function f which depends on consumption and a function g who depends on the temperature. The most popular methods for estimating the functions f and g are kernel and spline methods. In this paper, we concentrate on kernel methods. We consider various configurations for the functions (they can be linear or non-linear) and various dependence structures for the exogenous sequence (which can be a random stationary sequence with or without dependence, a random non stationary sequence or a deterministic one). We investigate methods using projection of f and/or g on convenient spaces as well as recursive methods of backfitting type. We find that in all situations, the distribution of the forecasting error does converge as the number of observations increases. At horizon h , the distribution converges towards the noise one. We propose methods to estimate this distribution and to obtain forecasting intervals having (at least for large samples) a specified level. The non asymptotic situation is investigated through extensive simulation. In the finite distance case, the forecast interval is determined by the noise and by the estimation error. The relative importance of these two parts is studied, and its dependence on the sample size revealed. We show practical results on French electricity consumption.

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Forecasting Practice I [FP1]

Contributed Session:

Monday, June 22, 02:40pm-03:40pm

Room: Ching

Diffusion and Forecasting Models for TV Programs

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Television audience measurement (TAM) is an important area of television audience research. One of the important topics in TAM is the first time reach (diffusion) of television programs. Though there has been much research on modeling the diffusion of new products in marketing, this paper is the first attempt to develop diffusion models for TV programs. This paper proposes statistical models based on the hazard rate function and uses the maximum likelihood estimation method to develop the diffusion models. Using a comprehensive database of the People Meter data supplied by a television station in Hong Kong, which contains minute-to-minute detailed television viewing behavior of Hong Kong residents, we are able to demonstrate that the proposed models provide very good fit to the empirical data and they outperform existing models. An extension of the proposed model using proportional hazard analysis has also been investigated. This extension allows us to evaluate the effects of viewers' characteristics on their likelihood of watching a drama. Also, due to the fact that not all individuals in the population would watch a particular television program, proportional hazards mixed models (called the cure models in survival analysis) have been used to develop diffusion models that are suitable for all people in the population. To forecast the cumulative adoption at an earlier stage of a drama, this paper discusses how to forecast the parameters in the proposed models and use Bayesian formulae to update the distribution of these parameters after each episode is broadcasted. Finally, implications of the models for the marketing of TV programs and future research directions are discussed.

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[Improving Movie Gross Prediction through News Analysis](#)

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Traditional movie gross predictions are based on numerical and categorical movie data. But since the 1990s, text sources such as news have been proven to carry extra and meaningful information beyond traditional quantitative finance data, and thus can be used as predictive indicators in finance. In this paper, we use the quantitative news data generated by Lydia, our system for large-scale news analysis, to help us to predict movie grosses. By analyzing two different models (regression and k-nearest neighbor models), we find models using only news data can achieve similar performance to those use numerical and categorical data from The Internet Movie Database (IMDB). Moreover, we can achieve better performance by using the combination of IMDB data and news data. Further, the improvement is statistically significant. In this study, our particular contributions are: 1) We provide a comprehensive way to evaluate news data and linguistic sentiment indexes as well as give a detailed analysis for movie news data; 2) We build k-nearest neighbor models for movie gross predictions, which have not been studied in previous movie prediction literatures; 3) Through large scale analysis, we prove that news data is capable of helping people to build models with better performance. We do not use any post-release data in our experiments, and all the predictions are out-of-sample predictions. In practice, our approach provides a feasible and more accurate estimation regarding the investment worthiness for some pre-release investors and almost all the post-release investors.

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[Competing for New Hospital Locations: A Simulation Modeling Approach](#)

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Hospitals compete with each other for patients and medical service offerings. Not all patients go to the hospital nearest to their homes. Some patient migrations occur among hospitals because of doctor referrals and needs for special services. Competition among hospitals can be viewed positively or negatively. The negative manner means real competition, but the positive manner means the 'partnership' of hospitals to take advantage of size, expertise, medical specialties and so on. Some hospitals do not wish to compete with each other, but rather cooperate by forming hospital partnerships. The special situation can be mentioned in case when these 'partnership' hospitals want to establish a new hospital in their territory that will draw patients from nearby competing hospitals. This new hospital must minimize the draw away patients from the two friendly hospitals while to maximizing patients draw from competitors. In practice there are some deterrents for patients to cross even though the hospital is nearby. There can be breakdown by service such as medical, surgical, psychiatry, and maternity, breakdown by product such as cardiac, liver, lung, and bones. It means to 'increase' the distance by some offers, regulations or restrictions.

There are about 126 of such combinations in our application.

We constructed a simple simulation model for use by hospital planners. The model simulates the dynamic phenomena and is very flexible for the set up of conditions, restrictions and obstacles that we have encountered. The suggested program enables the simulation of described problems and the results are expected to improve the decision-making process.

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Forecasting for Climate Policy: CO₂, Global Temperatures, and Alarms [OS12]

Organized Session:

Monday, June 22, 02:40pm-03:40pm

Room: Ballroom B

Forecasting for Climate Policy: CO₂, Global Temperatures, and Alarms

Kesten Green

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Scott Armstrong *

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Some scientists have proposed manmade CO₂ as a cause of dangerous global warming. We examine the predictive validity of using CO₂ as a policy variable. In doing this, we look at other possible relationships with global mean temperatures, including spurious predictors. We have previously shown that forecasts from a no-change benchmark model — which predicts global mean temperatures will be the same as last year's temperature for the next 100-years — are quite accurate. Do prediction markets agree? We address this question and discuss whether prediction market forecasts of global mean temperatures are useful. Finally, we describe our use of structured analogies to forecast the outcome of the social phenomenon of alarm over dangerous manmade global warming.

Keywords: decision making, expert judgment, public policy, scares, spurious correlation

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Past, Present and Future of Computational Intelligence Applied to Forecast Time Series II [OS5]

Organized Session:

Monday, June 22, 04:00pm-05:00pm

Room: Ballroom C

[Novel Fuzzy Approach to Time Series Analysis and Prediction](#)

Martin Stepnicka *

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Antonin Dvorak

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A new methodology for analysis and forecasting of time series is proposed in this paper. It directly employs two techniques: the fuzzy transform and the perception-based logical deduction. Due to their use and the approach consisting in a construction of several independent models, the methodology is successfully applicable for robust long time predictions.

There are two standard approaches to forecast a time series. The Box-Jenkins methodology uses autoregressive and moving averages models. This approach (no matter how useful and successful) provides us with a non-interpretable analysis. Therefore, it is not appropriate for an extension by means of the fuzzy sets theory, where the interpretability and transparency play a crucial role. Therefore, our methodology stems from the second approach—the decomposition.

The traditional approach to the trend analysis assumes the trend to be an a priori given function for whole domain, which is too restrictive. To overcome this problem we propose the F-transform method for the trend description. The F-transform does not fix any shape of the curve, but it possesses powerful approximation, noise reduction and computational properties.

For the trend forecast we employ the perception-based logical deduction with automatically generated fuzzy rules. As antecedent variables, we consider distinct first and second order differences of the F-transform components of the given time series. Generated fuzzy rules may describe logical dependencies of the trend changes which is highly desirable in comparison with the standard prolongation of the trend. The advantage of the transparently interpretable form of the rules using fragments of natural language is doubtless.

In cases of long time predictions, there is a danger of the error propagation due to “forecasting from forecasted”. We propose a construction of several independent models. Each model forecasts a distinct number of steps into the future. The suggested approach fully avoids the problem of error accumulation.

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Estimation of the Bifurcation Sets of Catastrophic Phenomena using a Line Clustering Approach for Alarming and Prediction of Hazardous Phenomena

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Nowadays human beings face several threats from different sources. Some of them are natural threats such as environmental catastrophes and some of them arise from technology, in which human beings play the most important role. In addition, modern life is mostly dependent upon several technologies such as satellites and computers, and is vulnerable to their potential malfunction. Therefore, natural threats to these technologies can be seen as threats to modern life. Modern society has become a risk society in the sense that it is increasingly occupied with debating, preventing and managing risks that it itself has produced. Therefore, it is important to develop alarm systems to avoid such disasters. Unfortunately, many of these tragic events in the past years made it very difficult to predict because such phenomena show chaotic behaviors such as sudden changes and catastrophic jumps. On the other hand, catastrophe theory is a mathematical method for describing the evolution of forms in nature. This theory was created by René Thom who wrote the revolutionary book *Structural Stability and Morphogenesis* in 1972. Catastrophe theory is particularly applicable when gradually changing forces produce sudden effects. Therefore, it seems that this theory is a good approach for modeling hazardous phenomena. In this paper, we tried to estimate the bifurcation set of the catastrophic phenomena as their critical points which can be used as an alarm system for the occurrence of catastrophic hazards. The method which is used in this paper is based on the line clustering method as a data driven approach. By estimating the bifurcation set, it is possible to make long-term prediction and as a result, catastrophic jumps can be detected and disasters can be avoided. Simulation results show the power of the proposed method in estimation of the bifurcation set among empirical data.

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Macro and Microeconomic Applications I [MMA1]

Contributed Session:

Monday, June 22, 04:00pm-05:00pm

Room: Ballroom B

Forecasting the Economic Impact of Digital Planning Strategy at National and Regional Level**Eleni Petra ***

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Forecasting the impact of new digital planning policy implementations is of crucial importance for those involved in making such decisions, e.g. the government. Through a set of such policies, the government forms a national digital Planning Strategy affecting all aspects of everyday life and the business sector. The economic impact becomes apparent within a few years via a series of macroeconomic variables, such as unemployment rates and competitiveness of small and medium enterprises. This study describes the state of the digital planning policy in Greece and provides a forecasting framework for key macroeconomic variables at regional and national level.

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[A Comparative Analysis of the Synchronization of Business Cycles for Developed and Developing Economies with the World Business Cycle](#)**Ilse Botha**

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Globalization brought about worldwide changes, such as economic and financial integration between countries. This integration implied, in business cycle theory, the emergence of a common business cycle. Most developed economies seem to follow the world business cycle most of the time. There is little evidence of the co-movement between emerging markets, such as South Africa, and the common cycle.

Factor models, using principle component analysis, were constructed for developed and developing countries with output, consumption and investment data. These factors were compared to the world business cycle. Co-movement was found between some countries and the world factor. The results suggest that there are country-specific and worldwide sources of economic shocks, which play different roles at different times in different countries. This has implications for forecasting the business cycle, especially in times of economic turmoil.

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Group Forecasts and Judgmental Adjustments

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While most of the behavioral research on forecasting has been examined by the individual forecaster forecasting at the organizational level normally tends to rely on a group of forecasters to arrive at 'consensus' on forecasting results with each group member exercising a different responsibility, generally with competing and non-coherent objectives. The current study aims to examine members of forecasting groups who play the roles of marketing, production, and forecasting directors. Based on previous research results, comparisons are made between the forecasting performance of the modified consensus group process and that of the staticised group. Additionally, we investigate the group members' tendencies to 'adjust when adjustment is not needed', as opposed to 'not adjusting when adjustment is needed'. Finally, we discuss the implications for group forecasting processes in organizations.

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Demographic and Social Applications II [DSC2]

Contributed Session:

Monday, June 22, 04:00pm-05:00pm

Room: Tang I

A New Perspective on Population Aging

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Warren Sanderson

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In Sanderson and Scherbov (2005) we introduced a concept of Prospective Age—a new forward-looking definition of age and argued that its use, along with the traditional backward-looking concept of age, provides a more informative basis upon which to discuss population aging. Age is a measure of how many years a person has already lived. In contrast, our new approach to measuring age is concerned about the future and takes into account the increase in life expectancy. In this presentation, we show that supplementing the traditional measure of age with a new forward-looking measure leads to a very different picture of future aging in the world and its regions.

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[To the Prognosis of the Tertiary Education Trends in OECD Countries from the Demographic Point of View](#)

Savina Finardi *

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The level of educational attainment is different among OECD countries. This level increases mainly in some European countries (due to the so-called Lisbon strategy). It could be influenced by some analyses which confirm the hypotheses about the relation between the level of educational attainment and some other social-economic indicators (economic growth, labour productivity, total factor productivity, unemployment, life expectancy, level of wealth and so on).

The comparison of the level of educational attainment is a quite complicated issue because educational systems are different across countries. The first possibility is to use some aggregated indicator, which takes into account the length of individual stages of education. In our preceding research, we verified this methodology and compared it with some other approaches. The second approach is to use just the share of tertiary-educated people, which is advantageous due to the better comparability of tertiary education across countries.

In the last year, we can see the catching-up process of some OECD countries, where the share of tertiary-educated people rises. However, it is caused by the quick increase of the participation level of the young population on tertiary education, in contrary to demographic trends (number of entrances is roughly constant, but the size of the young population is smaller).

The aim of the paper is to forecast the share of graduates in tertiary education to the size of the related population in selected OECD countries using the forecasts of trends in tertiary education and the demographic forecasting models.

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Evaluating Short-run Forecasting Properties of the KOF Employment Barometer

Boriss Siliverstovs

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This study investigates the usefulness of the business tendency surveys collected at the KOF institute for short-term forecasting of employment in Switzerland aggregated in the KOF Employment Barometer. We use the real time dataset in order to simulate the actual predictive process using only the information that was available at the time when predictions were made. Using real-time data vintages, we evaluate the presence of predictive content of the KOF Employment Barometer both for nowcasts that are published two months before the first official release and for one-quarter ahead forecasts published five months before the first official release. We employ the Bayesian Model Averaging approach which allows us to incorporate the following three sources of uncertainty into our forecasts: error term uncertainty, parameter uncertainty, and model selection uncertainty. We find that inclusion of the KOF Employment Barometer leads to substantial improvement both in in-sample as well as, more importantly, in out-of-sample prediction accuracy. This conclusion holds both for nowcasts and one-quarter ahead forecasts.

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Travel and Tourism Forecasting II [TTF2]

Contributed Session:

Monday, June 22, 04:00pm-05:00pm

Room: Tang II

Econometric Analysis of Tourism Demand Systems: A Time-varying Perspective**Doris C. Wu ***

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The time varying parameter (TVP) technique is superior to its fixed parameter counterparts in that it relaxes the restriction on the constant effects of the independent variables on the dependent variable. Therefore, specifying a demand model in the TVP form is more appropriate in terms of reflecting the dynamics of consumer behavior. This study incorporates the TVP technique into the tourism demand modeling process and aims to examine tourists' consumption behavior using a advanced methodology.

In the previous two decades, different advanced econometric models have been employed for tourism demand modeling and forecasting. Among them, most are single equation models, each of which examines the demand for one tourism product only. Hence, the demand for different tourism goods and services and their interactions cannot be explored at the same time. The almost ideal demand system (AIDS) model, however, can overcome this limitation by including more than one equation in a system and estimating these equations simultaneously. Based on the AIDS model, the cross-price elasticities between two related tourism products can be calculated to reflect the interdependence relationship between each other.

Given the advantages of the TVP approach as well as the AIDS model, this research presents the first attempt to employ the TVP error correction AIDS model in analysing tourists' consumption of a bundle of tourism goods and services (i.e., shopping, hotel accommodation, meals outside hotels and others) aiming at maximizing their utility given budget constraints. Particularly, eight demand systems are established referring to eight major source markets of inbound tourism in Hong Kong. Based on the estimation of these complete systems, the interactions among the demands for these tourism product categories and the impacts of price changes on the demand are investigated from a time-varying perspective. The expenditure and price elasticities are also generated on a time-varying basis. The empirical results will shed new insights into tourists' consumption behaviors, and this information will assist the relevant stakeholders in both public and private sectors with regard to their strategic decision making on tourism planning and development.

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Comparison of Forecasting Accuracy among Tourist Destinations by using Trend Analysis Method

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The majority of the previous studies of the tourist demand forecasting have been focused on forecasting accuracy on only a single type of tourist destinations, evaluating many forecasting methods in order to find appropriate ones for them. The purpose of this research is to expand the previous research and ultimately find out the appropriate tourist demand forecasting methods among different types of tourist destinations by examining their predictive abilities. Various forecasting models were compared to identify the degree of accuracy among three types of tourist destinations: natural, recreational, and cultural/historical tourist destinations, and the accuracy of those models was evaluated by measuring the errors between the actual and forecasted time series data in the period of model estimation and approval. The models considered here include nine trend analysis methods in total. The evaluating criteria for checking the accuracy of the estimations are MAPE (Mean Absolute Percentage Error) and RMSE (Root Mean Square Error).

The results of the analysis can be summarized as follows:

First, it was confirmed that Gompertz showed superiority over other models in the forecasting accuracy of Sokri Mt. and Manjanggul Cave as the natural tourist destinations since it reflects the steps of growth and decline describing the normal distribution. Second, in the case of recreational tourist destinations, the results of the estimated methods for Everland and Seoul Grand Park were inconsistent; however, it was verified that Cubic and Gompertz Curve showed better forecasting results for attraction and experience-centered recreational tourist destinations such as Everland, while Exponential and Modified Exponential Curve have attained superiority over others in ecological or sightseeing-centered recreational tourist destinations such as Seoul Grand Park. Third, Cubic and Modified Exponential Curve seemed more accurate in forecasting of cultural and historical tourist destinations such as Bulguk temple and Hyunchung temple.

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The Law of One Price for Hotel Rooms: Does it Hold in Greater China and is it Useful for Forecasting?

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The Hong Kong Polytechnic University, Hong Kong SAR, China

Vera Shanshan Lin

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This paper tests for the presence of a law of one price for hotel accommodations between three cities in Greater China (Hong Kong, Singapore and Taipei) with monthly data over a ten-year period. Based on the work on price discovery in the microstructure literature (Gonzalo & Granger, 1995), we examine cointegration and weak exogeneity between room rates in different locations as a metric to assess the location which is driving price discovery. The leading role of Hong Kong vis à vis the two other Greater China cities is a major finding. In a second step, we draw on the approach of Grammig, Melvin and Shlag (2005) to examine the symmetric versus asymmetric response of room rates in each location to (exogenous) exchange rate shocks. Ignoring the exchange rate may lead to false conclusions about price discovery. Room rates in a given location may be wrongly classified as an informational satellite from the point of view of price discovery when room rates in this location only adjust to exchange rate changes. On the basis of the empirical results, we are able to propose a new approach to forecasting hotel room rates, making use of the adjustment towards long run relationships with room rates in foreign locations and past exchange rate movements.

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Forecasting Practice II [FP2]

Contributed Session:

Monday, June 22, 04:00pm-05:00pm

Room: Ballroom A

Investigating Management's Ability and Willingness to Revise Forecasts

Robert Stoumbos *

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Lloyd Tanlu

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This study investigates the determinants of management forecast revisions. The extant literature on earnings forecasts present several reasons why managers choose to provide earnings guidance and revise their initial forecasts, including managerial incentives (Matsumoto, 2002; Rogers & Stocken, 2005), litigation concerns (Kasznik, 1999; Skinner, 1994), and the behavior of analysts and investors (Anilowski, Feng, & Skinner, 2007). An implicit assumption in these studies is that managers can easily obtain and incorporate news into their forecasts, and are able to, contingent on their incentives, decide whether or not to disclose this information and revise their forecasts. However, it is unclear whether managers actually are able to obtain the necessary information to be able to make credible forecast revisions. Studies in forecasting (Bolger & Wright, 1994; Lawrence & O'Connor, 1996) suggest that characteristics of the object being forecasted—in this case, earnings—play a large role in determining how and why forecasts are revised. Furthermore, the management accounting literature (Bruns & Waterhouse, 1975; Simons, 1987) indicate that organizational characteristics and control systems in place (such as budgets) may affect a manager's ability to collect information and make credible forecast revisions.

We hypothesize, and find empirical evidence, that organizational complexity, cost structure, and environmental uncertainty are significant determinants of whether or not, and how often, managers revise their forecasts. Additionally, complexity and cost structure can magnify or dampen the effect of incentives as determinants of (a) whether or not firms revise their forecasts, (b) the number of times forecasts are revised, and (c) the resulting forecast errors after actual earnings are realized. We contribute to the literature by demonstrating that forecasting capability and environmental uncertainty are important determinants and moderating factors that affect management's willingness in revising earnings guidance.

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Macroeconomic Planning in the Problems of Regional Growth

Danila Karbaev

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Forecasting, analyzing and planning of regional socioeconomic growth issues may have influence over many macroeconomic indices. The paradigm of economic planning processes can be presented in terms of indices, targets and constraints. First of all, target indices need to be defined to address the regional growth issues. Secondly, a set of rules will be formed from the system of constraints for the problem solving process. Optimization problems for this system are then formulated. In the last five years new systems of classification were introduced in Russia. These classifiers are based on the international standard of classification systems. Thus, a series of new problems arise from a large number of indices and a small amount of historical data. In this paper, the planning and data analysis techniques are based on spreadsheet solving methods to estimate the dynamics of regional macroeconomic indices. These models are presented according to Russian Classifier of economic activities (Russian equivalent of NACE, SIC and NAICS). The concept is illustrated using scenarios of modeling socioeconomic growth in one of the leading regions of Russia.

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Can We Predict University Rankings Published by US News & World Reports

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The validity of university rankings is often debated among academic researchers and even university presidents. However, for ordinary families university rankings can assist their decision-making process. Therefore, it is in universities' interests to predict and analyze their rankings. First, our study is to show how the ranking, published by US News & World Report, can be predicted. Our study also shows how to relate our predicting models to some practical applications for university managements and boards.

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Keynote Speech [K2]

Plenary Session:

Tuesday, June 23, 8:30am-9:30am

Room: Grand Ballroom

[Extreme Forecasting](#)

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Extremely bad data, extremely bad methods and extremely difficult problems will be used as the basis of some extremely useful lessons. I will describe three cases from my consulting experience and draw some general lessons that are widely applicable.

The first case involved forecasting passenger traffic on an Australian airline. The data showed variations due to school holidays, major sporting events, competitor activity, industrial disputes, changes in fare structures, and other factors. I will discuss the types of models that can be used to successfully forecast such data.

The Australian government subsidizes some pharmaceutical products, and requires forecasts of the likely expenditure on such products. After two consecutive years in which the expenditure was under-estimated by half a billion dollars, I was asked to review their forecasting procedures and recommend how to do it better. I will describe the results.

My third example involves forecasting the maximum electricity demand in any half hour period up to ten years in advance using only ten years of historical data. This seemingly impossible task was resolved so successfully, that the methods developed are now used as the basis of official forecasts for three states of Australia.

These three diverse examples will be used to draw some general conclusions about model complexity, structural change and forecast uncertainty.

Rob Hyndman is Professor of Statistics and Director of the Business and Economic Forecasting Unit at Monash University, Australia. He is Editor-in-Chief of the *International Journal of Forecasting*, author of over 100 research papers in statistical science, and he received the 2007 Moran medal from the Australian Academy of Science for his contributions to statistical research. He is co-author of the best-selling textbook *Forecasting: Methods and Applications* with Makridakis and Wheelwright (Wiley, 1998), and has also recently co-authored *Forecasting with Exponential Smoothing: The State Space Approach* (Springer, 2008). Rob has consulted to hundreds of companies and organizations on forecasting problems for over 20 years.

Telecommunications I [OS6]

Organized Session:

Tuesday, June 23, 10:00am-11:00am

Room: Ballroom B

Diffusion of Cell Phones: Micro and Macro Level Diffusion Parameters**Vinay Kanetkar**

University of Guelph, Canada

Over the last 20 years researchers have been studying diffusion of cell phones. Using aggregate data estimated model suggest that diffusion process is not different from many other durable products. Because cell phone requires continual service support, service providers earn revenue from existing as well as new customers. Using aggregate data for Canada, we demonstrate estimation of diffusion model for total number of subscribers as well as new addition of subscribers.

We provide validation to above model using household durable ownership data for the Canada. We formulate extended Bass model to incorporate socio-economic as well as demographic variables specific diffusion parameters. Using information about 100,000 households over 11 years, we estimate socio-demographic segment level parameters of Bass model. Our estimate indicate that household with higher socio-economic status households have very high penetration rates than lower socio-economic status household. Our models also indicate that overall diffusion parameters were very similar to the macro data estimates.

Our work indicates that using three or more cross-sections, it is possible to estimate parameters for Bass model at the segment level and understand segment specific innovation and diffusion parameters. Such insight would be useful to position to the first time buyers as opposed to replacement buyers.

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The Impact of Market and Technology Related Factors on Innovation Diffusion in an International and Multi-generational Context—The Case of Cellular Mobile Phones**Towhidul Islam ***

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Nigel Meade

Imperial College London, United Kingdom

To discover why technology diffuses differently in different countries, we propose a multi-country, multi-generation (MCMG) model. Using the cellular telephone market, we analyze comprehensive socio-economic and telecommunications data covering seventy geographically and economically diverse countries. We find substantive effects of increasing price sensitivity of analog phones once second generation digital phones is launched, strong positive impact of competition on analog phones while weak impact on digital phones, negative impact of competing standards during earlier generations but no subsequent impact. We find significantly different coefficient innovation and imitation of switching adopters compared to new adopters of second generation of technology. We also found volatility in adoptions of cellular phones is far greater than implied in the basic Bass model. We have also demonstrated the predictive validity of our proposed model.

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Finance IV [FIN4]

Contributed Session:

Tuesday, June 23, 10:00am-11:00am

Room: Ching

Intra-day Covariance and Correlation in Hong Kong Stock Market**Yu Yang ***

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Mike So

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Covariance and correlation measures based on multivariate high frequency data inherit massive intra-day market information. To see their ability in capturing local market speculation, we make use of the intra-day data of the Hong Kong constituent stocks in 2008 to construct nonparametric covariance and correlation estimators with volume information incorporated. Empirical study on their statistical properties is given. Additionally, we investigate their performance in estimating portfolio risk and dynamic portfolio choice in short-term trading mechanism.

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Stock Market Decision-making Model**Karel Rais ***

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Petr Dostál

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This article aims to establish a stock market decision-making model that can improve prediction accuracy. Approaches such as fundamental analysis, psychological analysis, technical analysis, and simulation are used to build the model.

The fundamental analysis is performed with the use of judgemental forecasting and Delphi method. The psychological analysis is represented by Elliott waves and the technical analysis by regression evaluation, prediction based on dynamic models, fuzzy logic, neural networks, genetic algorithms, and hybrid models. The chaos analysis is used for the test of randomness of time series.

The designed methodology is used for the processing of the data to generate buy and sale signals on stock prices, currency ratio and commodities in the world market. An case study is given regarding the evaluation of inputs that provides market signals for decision-making processes.

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Regime Switching Models of Hedge Fund Returns

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In this paper we estimate and compare the forecasting performance of several dynamic regime-switching models of hedge fund returns. In particular, the conditional mean of return is an ARMA process while its conditional volatility is modeled according to the GARCH specification. We also incorporate a Markov switching structure of the model parameters to capture large jumps experienced by the majority of hedge fund strategies during the periods of financial turmoil. Finally, we compare the one-step-ahead recursive out-of-sample forecast performance of different models. Our results obtained for several hedge fund strategies in the Hedge Fund Research (HFR) Inc. database during the period of 1990-2008 reveal that this approach may be quite useful for forecasting performance of hedge funds following non-directional strategies such as Convertible Arbitrage, Relative Value Arbitrage, Fixed Income Arbitrage and Distressed Securities.

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Time Series Models/Methods II [TSM2]

Contributed Session:

Tuesday, June 23, 10:00am-11:00am

Room: Ballroom C

Bootstrap Prediction in Unobserved Component Models**Esther Ruiz** *

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Alejandro Rodríguez

Universidad Carlos III de Madrid, Spain

Unobserved component models have proven to be very useful for the description of the dynamic evolution of financial and economic time series. One of the main advantages of these models is that they allow to obtain estimates of the underlying components which often are of interest in themselves. Furthermore, one may want to obtain prediction intervals not only for future observations but also for latent underlying components with a particular interpretation as, for example, the underlying trend of the series. These intervals can be constructed by expressing the corresponding unobserved component model as a state space model and using the prediction equations of the Kalman filter with the true parameters substituted by consistent estimates and assuming Gaussian innovations. This approach has two limitations. First, it does not incorporate the uncertainty due to parameter estimation. Second, the Gaussianity of future innovations assumption may be inaccurate. To overcome these drawbacks, Wall and Stoffer (2002) propose a bootstrap procedure to evaluating conditional forecast errors of future observations that requires the backward representation of the model. Obtaining this representation increases the complexity of the procedure and limits its implementation to models for which it exists. Recently, Rodríguez and Ruiz (2009) proposed a bootstrap procedure for constructing prediction intervals for future observations, which does not need the backward representation of the model. Consequently, this second procedure is much simpler, without losing the good behavior of bootstrap prediction intervals. When comparing the finite sample properties of Wall and Stoffer (2002) and Rodríguez and Ruiz (2009) for the Local Level Model, it can be concluded that the backward representation is not needed. However, the procedures proposed by Wall and Stoffer (2002) and Rodríguez and Ruiz (2009) are designed to obtain bootstrap densities of future observations but not of the latent components. Recently, Pfefferman and Tiller (2005) proposed a bootstrap procedure to obtain the Mean Square Error (MSE) of the one-step-ahead predictions of the unobserved states that incorporates the parameter uncertainty. However, in order to obtain a prediction interval for the state, it is necessary to assume a particular distribution for the state-prediction errors. In this paper, we extend the bootstrap procedure proposed by Rodríguez and Ruiz (2009) to obtain prediction intervals for the underlying unobserved components. We propose a new procedure and analyse its finite sample properties in the context of the local level models. The performance of the new proposed procedure is compared with those of alternative procedures. Finally, the results are illustrate by obtaining prediction intervals the underlying trends of several real time series. Our procedure can also be implemented to obtain prediction intervals for the underlying volatilities in the context of stochastic volatility models.

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Bootstrapping Expos Methods

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Manuela Neves

Technical University of Lisbon, Portugal

The bootstrap methodology, initially proposed in independent situations, has revealed its inefficiency when dealing with dependent data. The estimation of population characteristics is more complex. The same applies to the forecast of time series. A time series is a set of observations usually ordered in equally spaced intervals and one of the main goals of time series analysis is to forecast future values. Exponential smoothing (EXPOS) refers to a set of forecasting methods that can be used to model and to obtain forecasts. We intend to present a method that combines EXPOS and bootstrap methodology in forecasting: Boot.EXPOS. Given a time series, it begins with the selection of the best EXPOS method for fitting the data by using the AIC criterion. After adjusting the appropriate EXPOS model the focus of our attention is on the residual part. The bootstrap resampling scheme is used after an autoregressive adjustment selected by AIC criterion. The time series is then reconstructed, adding the initial characteristics to the bootstrapped residuals. Point forecasts and prediction intervals are finally obtained using the selected EXPOS model. The forecasting performance is evaluated using some accuracy measures. Comparisons with other EXPOS methods are also made. All the computational work was performed using the R 2.8.1 software.

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Macroeconomic Fundamentals and Stock Return Predictability

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James Morley

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Does the real economy possess predictive power for stock returns? While a sizable literature exists on this question, the evidence is mixed and continues to draw debate. In this paper, we examine the issue of stock return predictability over a range of time horizons using business condition measures and a Bayesian time-varying parameter model for the United States. Not only does this model allow for testing of stock predictability, the time-varying coefficients allow for investigation of how this predictability has changed over time. Our findings indicate both discrete structural breaks as well as gradual changes in the predictive ability of a number of the variables. We also find more evidence of predictability over fixed coefficient prediction models. Importantly, these results reinforce the need to consider time variation in forecasting relationships.

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Energy Sales and Markets III [ESM3]

Contributed Session:

Tuesday, June 23, 10:00am-11:00am

Room: Tang II

Challenges of Automated Forecasting in Retail

Roland Martin *

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Stephan Kolassa

SAF AG - Simulation, Analysis and Forecasting, Switzerland

Forecasts in retail are used to ensure an optimal goods supply. Since there are often thousands of forecasts that are to be computed the user cannot check each forecast manually. Therefore, rather the robustness of the forecasting methods are in the focus than finding an optimal forecasting model. Computational time is also an issue especially when several hundred stores in different time zones are involved and the forecasts are computed in the competence center of the customers. A further challenge is that often customers have a different view on the business and use different KPIs to measure the performance of a forecasting system. This talk gives an insight to the customer's view of forecasting and challenges that forecasters are confronted with examining issues like automatization, mass forecasts beyond manual inspection, computational time and space constraints and customer KPIs.

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Forecasting Passenger Cars Stock in Europe in 2020

Emilie Bertout *

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Frederic Lantz

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In this paper, Passenger Cars models are developed in order to estimate future fuel consumption in Europe in 2020. Thus, we focus on car modeling and especially on car characteristics and their impacts on new car sales. Because of the maturity of European car market, stock turnover is becoming a key parameter which influences new car sales. For this modeling purpose, a two-step approach is developed.

First, we estimate the survival function of cars over the last decade in the main European markets. For each year, the car composition per vintage is analyzed to determine the parameters of log normal distribution.

Secondly, the estimated parameters are introduced in the car sales regression model which is based on macroeconomic variables (activity, credit indicators).

Two problems arise when building prediction intervals for the car sales:

- Small samples are used;
- Previously estimated figures are used in the car sales model.

Consequently, the use of bootstrap techniques strongly improves prediction intervals by reflecting the original distribution of the data.

Main European markets (Germany, France, the UK, Italy, Spain) are used as examples to illustrate the application of such techniques.

Finally, we carry out forecasts up to 2020 and test several scenarios (stock turnover rate, engine technology). From a set of assumptions (fuel economy, annual vehicle travel), we deduce energy consumption.

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Extracting Fuzzy Rules for Electrical Load Pattern Identification and Forecasting

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In this paper a new method for load pattern identification that takes into account autocorrelations and exogenous variables effects, inherent features of electric load profiles, is presented. The load patterns are evaluated as a linear combination of load profiles and selected from the observed data series, where weights are obtained as a nonlinear function of temperature. These load profiles are extracted from the data by the subtractive clustering method while a fuzzy inference system, using the daily average temperature, implements the nonlinear function. The method was applied to a real hourly load series, pattern identification and short-term load forecast, and its performance is presented in terms of the mean absolute percentual error (mape).

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Transportation Forecasting [TPT]

Contributed Session:

Tuesday, June 23, 10:00am-11:00am

Room: Ming I

[Comparative Analysis of Fuzzy Time Series and Judgmental Forecasting: An Empirical Study of Forecasting Dry Bulk Shipping Index](#)

Okan Duru *

Graduate School of Maritime Sciences, Kobe University, Japan

Shigeru Yoshida

Department of Maritime Logistics, Kobe University, Japan

This paper investigates the accuracy of fuzzy time series and judgmental forecasting for maritime transportation costs. Considerable research efforts have been undertaken to forecast freight rates, i.e., the price of overseas transportation. Critical problems exist due to the uncertainty of markets and highly volatile situations. Judgmental forecasting and fuzzy time series are applied to dry bulk shipping freights, and the results are compared with some statistical benchmark methods such as X12 ARIMA and exponential smoothing. Judgmental forecasting improved its superiority among the quantitative methods. Moreover, fuzzy time-series methodology has better accuracy than the statistical extrapolation method.

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[Cancellations Forecasting: A Temporal Case-based Predicting Procedure](#)

Tsung-Hsien Tsai

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Utilizing service capacity properly is one of essential elements to enhance profits; capacity will not be spoiled or reserved customers will not be denied at the day of service. Forecasting cancellations accurately helps revenue management operators adopt appropriate overbooking policies so that booking limits of various products can be dynamically monitored and adjusted. This paper proposes a case-based predicting model to forecast cancellations by using railway data.

The fundamental idea is that similar cancellation patterns during the booking period may indicate the trend of final cancellations in the day of service. The conventional framework of case-based reasoning is applied. First of all, similarity between cancellation curves is computed and used as the base for the following steps. Then highly similar samples are selected as potential solutions. Integrating these potential solutions to project the final cancellations in future service dates is the goal in the last stage. Important temporal features such as trend, day-of-week, and level shift were examined, and influential features were incorporated into the proposed model. In addition, the whole procedure can update cancellation information when it becomes available over the booking period (2 weeks in this study). The model is intrinsically dynamic and does multi-step ahead forecast from the first day of the booking period.

We compared the proposed model with traditional methods such as Regression, Pick Up, and their variants and found that the case-based model has potential to handle nonlinear situations. In practice, many industries have similar cancellation information in their point-of-sales databank such as restaurants, hotels, airlines, and car rentals. The proposed model can also be extended to these fields with necessary modifications.

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[Does Mode Make a Difference? Forecasting Transportation Data](#)

Peg Young

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The transportation forecasting competition, run by Michele Hibon, employed 368 transportation-related data sets, which encompassed yearly, quarterly, monthly, daily and hourly series. The results of the competition, when comparing and contrasting the results across the transportation modes, showed that different transportation modes did better with different forecast techniques. This presentation is a follow-up study, using comparable modal data over the same time period and experiencing the same interventions and economic conditions, to determine if the previous modal preferences of forecast model persist.

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Forecasting Practice III [FP3]

Contributed Session:

Tuesday, June 23, 10:00am-11:00am

Room: Tang I

Career Concerns and the Dynamics of Macroeconomic Forecast Revisions

Bruno Deschamps *

University of Bath, United Kingdom

Christos Loannidis

University of Bath, United Kingdom

Using forecasts from Consensus Economics Inc., we analyze macroeconomic forecasts inefficiencies for the G7 countries. Following a large empirical literature on the predictability of forecast revisions, we first find that revisions are on average positively auto-correlated. Our analysis is novel because the multi-dimensional nature of our data (24 monthly forecasts for each event, 17 years, 7 countries, numerous forecasters) allows us to investigate comprehensively the dynamics of forecast revisions.

The main result is that the dynamics of forecast revisions change with the forecast horizon. We find that, in most cases, forecast revisions are modest and are positively auto-correlated for short horizons, while they are of substantial magnitude and exhibit negative auto-correlation for long horizons.

We then show that this pattern of forecast revisions can be explained by the existence of career concerns among forecasters. Based on the model of managerial decision of Prendergast and Stole (1996), we develop a model in which forecasters wish to appear well-informed at the time they release their forecasts. Hence, it is optimal at shorter horizons to smooth their forecasts, with small gradual revisions, in order signal that the previous forecasts were accurate. To signal the information content of their private information, forecasters have an incentive to make large revisions at long horizons.

In this study we have found that the autocorrelation of forecast revisions is initially positive but becomes negative as forecast horizons become more distant. We have shown that this pattern is consistent with the career concerns hypothesis and the theory of strategic forecasting.

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[Real Time Common Factor Markov Switching Models](#)

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Markov switching models are used to make inferences about the state of the economy. Nevertheless, the use of univariate models might limit the usefulness of this type of models in an out-of-sample forecasting exercise. A key question is how to apply these models in real time forecasting. The use of Markov switching common factor models might overcome this difficulty. We would like to show the gains of moving to the multivariate set up, specially for real time forecasting. To this end, we integrate monthly and quarterly indicators in the same model in order to update the outcome of the model more frequently due to the availability of higher frequency information. Also, since we use the information as soon as it is available, we need to account for ragged ends. We will illustrate this with a real data example.

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System Economics: Overcoming the Pitfalls of Forecasting Models via a Multidisciplinary Approach

Patrick McSharry *

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In areas from medicine to climate change to economics, we are faced with huge challenges and a need for accurate forecasts, yet our ability to predict the future has been found wanting. The basic problem is that complex systems such as the atmosphere or the economy cannot be reduced to simple mathematical laws and modeled accordingly. The equations in numerical models are therefore only approximations to reality, and are often highly sensitive to external influences and small changes in parameterization—they can be made to fit past data, but are less good at prediction. Since decisions are usually based on our best models of the future, how can we proceed? This paper draws a comparison between two apparently different fields: biology and economics. In biology, drug development is a highly inefficient and expensive process, which in the past has relied heavily on trial and error. Institutions such as pharmaceutical companies and universities are now radically changing their approach and adopting techniques from the new field of systems biology to integrate information from disparate sources and improve the development process. A similar revolution is required in economics if models are to reflect the nature of human economic activity and provide useful tools for policy makers. We outline the main foundations for a theory of systems economics.

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Exponential Smoothing [EXS]

Contributed Session:

Tuesday, June 23, 10:00am-11:00am

Room: Ballroom A

Forecasting with Different Types of Outliers in Exponential Smoothing

Anne Koehler *

Miami University, United States

Ralph Snyder

Monash University, Australia

Adrian Beaumont

Monash University, Australia

Outliers in time series have the potential to affect the estimation of parameters and forecasting when exponential smoothing methods are used. Different types of outliers that have been defined in the context of ARIMA models are presented, including additive outliers, innovative outliers, level shifts, and ramp shifts. Then, these types of outliers are incorporated into the linear innovations state space model for the exponential smoothing methods. Special cases of the innovations state space models that correspond to simple exponential smoothing and Holt's trend corrected exponential smoothing are examined. A method for identifying outliers using innovations state space models is proposed. This method is investigated both by simulation and application to the M3 time series. Forecasts from outlier models and basic non-outlier models are compared.

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On the Stability of the Double Seasonal Holt-Winters Method

Richard Lawton

University of the West of England, United Kingdom

This method was proposed by Taylor (2003) for data which has two different sources of seasonality. He originally applied it to electricity data where the demand for electricity is recorded every half hour of the day. This data exhibits both a cycle over the length of the day and also over the week, reflecting the way we organize our lives. The method is an adaptation of the Holt-Winters Method to estimate both sources of seasonality. It was shown by Archibald (1990) that, for certain seasonal lengths, and certain parameter values, the Holt Winters Method is not always stable, or to use other terminology for the same phenomenon, invertible (in particular this is the case for the commonly used monthly version). This means that differences in the effects of initial values used to start the process off will grow over time rather than dying out. This is contrary to the more simple forms of exponential smoothing where effects of different initial values do die out over time. This paper seeks to apply the matrix based approach used by Lawton (1998) to explore the invertibility or stability of the Double Seasonal Holt-Winters Method.

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[Exponential Smoothing and the Akaike Information Criterion](#)

Ralph Snyder

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Using an innovations state space approach, it has been found that the Akaike information criterion (AIC) works slightly better, on average, than prediction validation on withheld data, for choosing between the various common methods of exponential smoothing for forecasting. There is, however, a puzzle. Should the count of the seed states be incorporated into the penalty term in the AIC formula? We examine arguments for and against this practice in an attempt to find an acceptable resolution of this question.

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Featured Speech [FS2]

Featured Session:

Tuesday, June 23, 11:10am-12:10pm

Room: Ballroom C

Forecasting Regional International Tourist Arrivals

Lindsay W. Turner

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The forecasting of tourist arrivals has a long and rich history of research dating back some thirty years, although the modern efforts really started in the late 1980's. This research is focused upon national tourist arrival databases, and forecast arrivals to specific countries. The processes used have reached a degree of sophistication and the industry based forecasts are accurate to the degree that they are commercially viable. More recently, data has started to become available at a sub-national level for what might be described as regional data. The regions may be states (provinces), cities or city states, or specific tourist zones. The need to forecast at this intra national level has become more pressing due to the impact of tourism on regional economies-different regions within countries now compete to gain larger shares of the international trade in tourism.

Forecasting at the regional level has numerous difficulties and new challenges for the forecaster that opens a significant new area of research. These challenges are being undertaken through current research by the author and co-authors, with some industry forecasts currently established in the market. This presentation will discuss this work with the focus upon the potential for wider research and the problems that need to be overcome.

In particular, the current work forecasting international arrivals within Canada, China, Mexico, Thailand and the USA are discussed, and this discussion is used to develop several research issues that will hopefully lead to wider research developments in this field.

Lindsay W. Turner is an applied econometrician specialising in forecasting and has published over one hundred journal articles and 12 books in the field of economic forecasting, applied international trade, financial trade and tourism economics. In the past fifteen years his focus has been on international tourism, the forecasting of international tourist arrivals and related issues of cultural divergence and impact. In particular, he specialises in European and Asian cultures and the East West divide. Starting in 2001 Professor Turner has undertaken an extensive modeling development to generate detailed arrivals forecasts for the entire Asia Pacific region, including North America each year. In 2008 the forecasts also include sub-national regional forecasts for the states of the United States, provinces of Canada, city based regions of Thailand and the regions of Mexico. These forecasts are published by the Pacific Asia Travel Association based in Bangkok (English) and the China National Travel Agency based in Beijing (Chinese). Professor Turner is joint editor of the journal *Tourism, Culture and Communication* and on several other editorial boards including the *Journal of Travel Research* based in the USA, *Tourism Economics*, based in the UK and the *Journal of China Tourism Research* based in Hong Kong. He is a member of several tourism organizations including the Travel and Research Association (USA), the International Association of Scientific Experts in Tourism (Europe), the International Symposium for Forecasting (USA) and he is an elected member of the International Academy for the Study of Tourism.

Telecommunications II [OS7]

Organized Session:

Tuesday, June 23, 11:10am-12:10pm

Room: Ballroom B

Broadband Subscription Forecasts: A mixture of Linear and Non-Linear Models

Qmars Safikhani *

Informa, United Kingdom

Sizing the broadband subscription trend for each country and analyzing the technology migration is the major task in the telecoms forecasting area. That analysis includes how a country broadband market evolves and flowing from starting saturation, the time required getting to maximum capacity (MC) and finally the migration trend from one technology to another.

This presentation describes the use of linear multiple regression and nonlinear model to evaluate various part forecasting and level setting access technologies for broadband, and the impact that migration from a technology to another could have on overall broadband penetration levels.

In the first stage we deploy a linear multiple regression to find out the maximum capacity (MC) of a country for a specific technology and a nonlinear model for fitting a curve between the last actual data point and MC.

Forecast Methodology

The methodology underpinning the forecast for broadband subscribers is a 2 step process:

1. Sizing the Market Capacity (MC).
2. Technology Migration.

Sizing the Market Capacity (MC).

In order to get the Market Capacity (MC), the first stage would be “Data collation” against nine key variables:

1. GDP per head.
2. PC penetration per households.
3. Level of urbanization.
4. PSTN coverage.
5. Teledensity.
6. TV household penetration.
7. Cable TV household penetration.
8. Cable TV homes passed.
9. Number of competing operators.

The second stage is “Weighting of variables”. Each variable for which data can be collated is weighted according to one of four categories, determined by the median value of each variable and skewedness thereof.

The final stage is “Summing the weighted variables” for each market. This will provide a tailored market capacity (MC) for each country based on the percentage of homes passed, likely to have a fixed broadband subscription.

Technology Migration

In order to measure the trend of technology migration at country level we deploy Normalized Gompertz model with four parameters.

The model implies to depict for each technology:

1. The starting point in terms of market share for the technology.
2. Growth rate and time length to reach the MC of the technology.
3. The length of the time and the final point in terms of minimum market share for the technology.

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An Integrated Forecasting Model for Telecoms Services: Fixed Telephony, Mobile, Data and Internet Services

Mohsen Hamoudia *

France Telecom Group, France

Following our work on the business market (presented at ISF2008), this paper proposes an integrated model which considers the whole core of telecoms in terms of services—including fixed telephony, mobile services, data and internet services, and in terms of markets—residential and business.

The main feature of this model is that the multiple linkages between these various services, the existing and potential substitutions effects and the markets are integrated within the same system of simultaneous multiple regression equations. Estimation is performed using 2SLS and 3SLS.

The proposed methodology is illustrated using both simulated and actual data for countries such as France, Germany, UK, Spain, Italy, Sweden, Netherlands, and USA. Forecasts generated by country and by services will be compared and benchmarked to forecasts built on other models and methodologies.

Keywords: business market, residential market, mobile services, broadband Internet services, fixed telephony, data services, multi-equation models, FMC (Fixed Mobile Convergence)

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Finance V [FIN5]

Contributed Session:

Tuesday, June 23, 11:10am-12:10pm

Room: Tang I

Optimal Investment Strategies for Funds of Hedge Funds Using Independent Component Analysis**Fotios Amaxopoulos**

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This paper focuses on the implementation of an efficient Signal Processing technique called Independent Component Analysis in order to try to identify the driving mechanisms of hedge fund returns. We propose a new algorithm to interpret economically the independent components derived by the data using a wide dataset of financial linear and non-linear factors and we use the alpha classification given by the independent component factor models to form optimal portfolios of hedge funds, based on their predictive power. Furthermore, we identify the risk sources and replicate the hedge fund returns in a month to month basis. The results show that our approach outperforms the classic factor models for hedge funds in terms of explanatory power and statistical significance, in- and out-of-sample. Additionally, the ICA model seems to outperform the other models in asset allocation and portfolio construction problems, showing strong predictive evidence of ICA alphas.

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[Analysis of Long-run Benefits from International Portfolio Diversification: Evidence from BRICS](#)**Ye Bai ***

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Paul Alagidede

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The world financial system has become increasingly integrated over the turn of the twentieth century. With increasing economic restructuring, improvements in communications and information technology, barriers to flow resources across markets have become much easier now than previous decades. Emerging market economies continue to play a significant role in this development. In this paper we examine the integration and portfolio diversification benefits within and between the largest emerging markets (Brazil, Russia, India, China and South Africa (BRICS)) and major OECD countries that would significantly change the dynamics of the global economy in the next 50 years.

The results show that when the small sample issue is considered, there is no cointegration found between BRICS and four major OECD countries. BRICS pair-wise cointegration tests have consistent results (with/without) controlling small sample. We can reject the null that China and Russia has no cointegration. The maximum eigenvalue statistics tests show that there are cointegration between US-Brazil, US-China, US-India and US-South Africa. These results have important implications to international investors' portfolio diversification strategies.

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The Analysis of Intraday Market Behavior before Takeover Announcements

Maxwell Stevenson *

The University of Sydney, Australia

Bruno Dore Rodrigues

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Reinaldo Souza

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The objective of this study was to observe the differences in the intraday market microstructure behavior before a takeover announcement was made on a sample of target companies and their bidders, as well as a control group of companies. Under the hypothesis of agents with asymmetric information, the specific aim was to analyze the joint impact of time, liquidity, volume and bid-ask spread on market volatility before a takeover announcement for the targets, and to compare the results with the market behavior of the bidding companies. The use of economic or transaction time, as measured by duration in the Autoregressive Conditional Duration (ACD) model, was the basis for the analysis of the equity volatility of the sample of stocks. These stocks were traded on the Australian Stock Exchange (ASX), with the targets and bidders sourced from companies that had been identified according to previous research. The control group of companies was selected on the basis that they were trading in the same period as the targets and the bidders, and that they exhibited similar characteristics of size and industry.

The analysis was conducted on tick-by-tick data over a period of six months and then three months before an announcement date. In the case of those companies where there was no announcement, the corresponding period was a predetermined date that marked the termination of the study. It revealed that the intraday trading behavior of a takeover target was affected by private information that was revealed to the market at least in the three month period before the official announcement of the takeover offer. The bidder's trading behavior, like that of the targets, was also observed to be in contrast to that of the control companies.

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Energy Sales and Markets IV [ESM4]

Contributed Session:

Tuesday, June 23, 11:10am-12:10pm

Room: Ching

[Forecasting Hourly Electricity Loads in Korea: Innovations State-space Modeling Approach with Multiple Seasonality](#)

Moonyoung Baek

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(1) Refined versions of the existing innovations state-space models and (2) Construction of prediction interval for the point forecasts made by Taylor's double seasonal Holt-Winters method through the innovations state-space model for Taylor's method.

The present study discusses an improvement of forecasting by considering double seasonality in hourly time series observations. The existing forecasting approaches are capable of dealing with a single seasonal pattern only. Therefore, we attempt to figure out a theoretical relationship between method-based forecasting approaches (exponential smoothing methods) and a model-based forecasting approach (innovations state-space modeling). We examine the forecasting performance of models with single seasonality and another model specification with double seasonality in the framework of the innovations state-space forecasting approach. Finally, we analytically derive forecast variance and then construct prediction intervals based on the innovations state-space models.

Using the electricity loads series of South Korea that contains two typical seasonal (daily and weekly) patterns, we empirically show that the innovations state-space model for Taylor's double seasonal exponential smoothing method outperforms the models for the standard Holt-Winters exponential smoothing method with single seasonality. In addition, we also construct prediction intervals, from post-sample, based on the relevant innovations state-space models specified in this study, and compare the ranges of those prediction intervals. The (relatively) narrowest range observed from the model with double seasonality implies consistency in forecasting performance.

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[Forecast Model of Heat Demand](#)

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Petr Dostál

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Jaroslav Baláče

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This paper deals with the utilization of time series prediction for the control of technological process in real time. An improvement of technological process control level can be achieved by time series analysis in order to predict their future behavior. We can also find an application of this prediction by the control of the Centralized Heat Supply System (CHSS), especially the control of hot water piping heat output.

Due to the large operational costs involved, efficient operation control of the production sources and production units in a district heating system is desirable.

Knowledge of heat demand is the base for input data for operation preparation of CHSS. The term "heat demand" is instantaneous required heat output or instantaneous consumed heat output by consumers. The course of heat demand can be demonstrated by means of heat demand diagrams. Of particular importance is the daily diagram of heat demand (DDHD), which demonstrates the course of requisite heat output during the day.

This diagram is most important for technical and economic consideration. Therefore, the forecast of this diagram course is significant for short-term and long-term planning of heat production.

In this paper we propose the forecast model of DDHD based on the Box-Jenkins methodology. The model is based on the assumption that the course of DDHD can be sufficiently described as a function of the outdoor temperature and the weather independent component (social components). Time of day affects the social components. The time dependence of the load reflects the existence of a daily heat demand pattern, which may vary for different week days and seasons. Forecast of social component is realized by means of Box-Jenkins methodology. The complete forecast algorithm with inclusion of outdoor temperature is described. Finally, this paper presents some computational results and conclusions.

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Gas Consumption and Temperature—A Detailed Analysis and Strategies of Statistical Modeling

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Ondrej Konar

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Marek Maly

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Emil Pelikan

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This paper presents the results of our detailed investigation of the relationship between natural gas consumption and ambient air temperature as a part of a modeling work on several large scale gas utility projects concentrating on domestic and small commercial customers. This report includes both parametric and nonparametric approaches to statistical modeling of the temperature influence. We discuss several aspects of the inherent nonlinearity that are of particular interest from a practical point of view. In particular, we focus on: i) asymmetry of the response's derivative with respect to temperature (as well as on the possibility of its reasonably simple but realistic statistical modeling in this context), and ii) lags between the temperature and consumption. We study the lag structure as a nonlinear filter with relatively fast decaying coefficients. This is not as simple and straightforward as it might seem on the surface, however. The complications arise because there are relatively strong interactions between the form of the filter and calendar effects on several time scales. We will present our modeling approach and discuss practical implications of the difficulties mentioned above. This report concludes with demonstration of our model's performance on real data. Model checking is easy and standard for the training data itself but it is more demanding, less straightforward and nonstandard in a real large scale gas industry setting. Complications arise mainly when the overall model directly involves unobservable process states, for which the inference goes through certain observable functionals (as is the case when certain aggregated consumptions are disaggregated). The work is supported by the Grant Agency of the AS CR, grant No. 1ET400300513.

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Travel and Tourism Forecasting III [TTF3]

Contributed Session:

Tuesday, June 23, 11:10am-12:10pm

Room: Tang II

[Modeling Australian Domestic and International Inbound Travel: A Spatial-Temporal Approach](#)

Minfeng Deng *

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George Athanasopoulos

Monash University, Australia

In this paper Australian domestic and outbound travel is modeled by an origin-destination (OD) travel flow model, augmented by time series components. Spatial OD models have traditionally been applied in a single cross-sectional context, where the spatial structure is assumed to have reached its long run equilibrium, and as a result the temporal dynamics are not explicitly considered. On the other hand, spatial effects are rarely accounted for in traditional tourism demand modeling and forecasting, even though evidence from multivariate ARIMA models indicate possible existence of significant correlations between a number of time series. We attempt to address this dichotomy between spatial modeling and time series modeling in tourism forecasting by using a spatial-temporal model. In particular, tourism behavior is modeled as travel flows between regions. Spatial interactions are explicitly accounted for at both the origin and the destination, while temporal dependencies are accounted for via the inclusion of ARIMA components. A significant spatial effect at the origin might indicate potential Australian tourism marketing targets, as an increase in tourists from one market could lead to potential increases in other markets from the same region. On the other hand, a significant spatial effect at the destination might indicate potential Australian tourism “hotspots”, where tourists exhibit convergent behavior and more tourism infrastructure is needed. Moreover, we allow the strength of spatial autocorrelation to vary over time, while the strength of temporal autocorrelation to vary over space. We evaluate the forecasting performance of this spatial-temporal approach against pure time series alternatives.

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[Comparison between Linear and Nonlinear Combination Methods on Tourism Demand Forecasts](#)

Shuang Cang

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It has demonstrated in the tourism literature that the combination of individual tourism forecasting models can provide better performance in most cases, and the linear combination of individual tourism forecasting models is adopted in the tourism literature review. However, the linear combination can utilize only the outputs from individual forecasting models that have a linear correlation to the actual tourism demand value. This paper proposes a number of nonlinear combination methods using neural networks context, instead of the linear combination, to cope with the nonlinear relationship between the inputs and the actual outputs.

The UK quarterly inbound tourism arrival data at different purpose of visits are used in this study. The comparisons between linear and nonlinear combination methods on tourism demand forecasts are also carried out. The empirical results and statistical tests demonstrate that the proposed nonlinear combination forecasting models are robust, powerful, and outperform the recently proposed linear combination models in the tourism literature in most cases.

Keywords: tourism demand forecasting, neural networks, autoregressive integrated moving average, multiplicative exponential smoothing, combination forecasts

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A Parametric and Non Parametric Approach to Detect Significant Turning Points in Tourism Demand

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Due to the dynamic nature of world economies together with other random effects, tourism demand has become highly volatile and as a result, tourism demand growth turns from expansion period to slow growth period (down turn) and slow growth period to expansion period (up turn). Governments and the tourism industry need an early prediction of turning points, such as expansion and slow growth period and the duration of these periods for their planning and investment. In order to do that, identifying the significant turning points in tourism demand is a prerequisite. The objective of this study is to identify the significant turning points in the Australian inbound tourism demand. In macroeconomics this is called the “dating” process or the process of constructing a reference turning point chronology. Establishing a cycle turning point chronology is important to find links between the cycles (arrival growth cycle) and diverse economic aggregates. It is clear that dating is an ex post exercise, but accuracy of the dating method is important in order to use different economic series or models to forecast turning points. Importantly established arrival growth cycle reference chronology (dating) can be used in empirical studies to classify economic series according to their advance (leading, coincident or lagging) or to validate another forecasting method.

There have been few non parametric approaches to establish turning point dates including the graphical inspection in the tourism literature. Presently, there is no generally accepted dating method in the tourism industry. The objective of this paper is to investigate different parametric and non-parametric dating methods to identify the significant turning points in Australian tourism demand since 1975 to 2007 from USA, UK, New Zealand, and Japan.

Key words: Tourism cycles, turning points, chronology, tourism forecasting, non parametric approach

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Macro and Microeconomic Applications II [MMA2]

Contributed Session:

Tuesday, June 23, 11:10am-12:10pm

Room: Ming I

Constructing GDP Early Estimates for the Euro Area**Gaetana Montana ***
Eurostat, Luxembourg**Mazzi Gian Luigi**
Eurostat, Luxembourg**James Mitchell**
Niesr, United Kingdom

The availability of early information on the macroeconomic evolution of a specific country or economic area plays a strategic role in the implementation of monetary policies and business cycle analysis. The GDP is a macroeconomic indicator which is able to give a synthetic picture of the economy. The main limitation of the use of GDP is often represented by its lack of timeliness, which reduces its usefulness for decision makers and analysts.

This paper investigates the possibility of constructing early estimates of the euro area period on period growth rate of GDP by using selected forecasting models: standard regression model, factor model, bridge equation models and airline as benchmark. We carried out an in-depth investigation of available quarterly and monthly information at different time lags and concentrated our efforts on constructing estimates at t+15 and t+30 from the end of the reference quarter. We performed a real time simulation of our models for the two alternative delays using the Eurostat vintage database against the official Eurostat flash estimates of GDP available at t+45. The simulation exercise shows that the incomplete information lowers the accuracy of both estimates, which nevertheless remain reliable enough.

Moreover, the simulation shows that multivariate methods with indicators usually perform better than the airline model. Finally, we show that our models have a quite small RMSE and a very high sign with Eurostat flash estimates. The simulation results are particularly relevant because they belong to a period characterized by a high degree of uncertainty.

In the last part of the paper we investigate further improvements such as the use of combining forecasting techniques and the use of indirect approach to construct early estimates of euro area GDP. The preliminary findings of such exercise appear very encouraging for further researches.

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Do Forecasters Inform or Reassure? Evaluation of the German Real-time Data**Konstantin Kholodilin ***
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The paper evaluates the quality of the German national accounting data (GDP and its use-side components) as measured by the magnitude, dispersion, and entropy of the forecast/revision errors. It is demonstrated that government consumption series are the least reliable, whereas real GDP and real private consumption data are the most reliable. In addition, early forecasts of GDP, private consumption, and investment growth rates are shown to be systematically upward biased. Finally, early forecasts of all the variables seem to be no more accurate than naive forecasts based on the historical mean of the final data.

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An Intelligent Fuzzy Forecaster for FOREX Using Adaptive Neuro-Fuzzy Inference System

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Time series forecasting by Artificial Neural Networks (ANNs) is known as intelligent forecasting. The advantages of intelligent forecasting are: robustness, better fitting and simplicity of use. ANNs and their extensions have been widely used in forecasting research and applications. One of the fascinating applications is financial forecasting, including the popular FOREX, that has inherent complexity and depends on several unknown chaotic and human based parameters. While the complexity and popularity of FOREX increased, new heuristic methods of forecasting must be deployed. Most current approaches involve the use of rule-based intelligent system to forecast trends in FOREX.

In this paper we present results of the proposed method to forecast FOREX rates which have several trends. The main idea is based on an intelligent procedure that uses Adaptive Neuro-Fuzzy Inference System (ANFIS) which is a well-known system in modeling of sophisticated functions with many applications in classification and recognition. We introduce the proposed method in terms of its architecture and learning procedure and present the experimental results. The system automatically tunes the own parameters using hybrid learning method with the combination of Gradient Descent (GD) and Least Squares (LS) algorithms to update all parameters. Due to the fuzzy interpolation and adaptability, and the neural networks abilities, this method, providing smoothness, is a tradeoff between ANNs and fuzzy systems. We trained the whole system on up to 10-year FOREX data containing trends. Furthermore, system training is done offline with hybrid learning method on long term and is exploited to short term forecasting of FOREX in an experimental state. Due to the high computational complexity in the learning method, its demand for resources is considerable. The experimental results show the proposed method has high adaptability to future trends in FOREX.

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Methodological and Theoretical Advances in Neural Network [OS8]

Organized Session:

Tuesday, June 23, 01:30pm-02:30pm

Room: Ballroom C

Evaluation of Input Variable Selection Methodologies for Multilayer Perceptrons for High Frequency Time Series**Nikolaos Kourentzes ***

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Sven Crone

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Neural networks (NNN) have been successfully applied in several time series forecasting applications. Past forecasting competitions, like the NN3, NN5 and the MH competitions, have shown that as the data frequency increases, the relative accuracy of NN against benchmarks increases, too, providing evidence of promising NN performance on high frequency forecasting problems. However, most of the published modeling methodologies for NN have been developed for low frequency data, like monthly time series. Literature suggests that the modeling tools of low frequency data do not readily apply for high frequency problems, which exhibit different properties of multiple overlying seasonalities, large amount of data, persisting outliers, etc. Therefore, a number of modeling challenges arise as the time series frequency increases. Furthermore, the selection of the input variables for NN, which is the most important determinant of NN accuracy, is usually based on tools developed for low frequency problems, like the ACF and PACF analysis, which become problematical as the frequency increases. This leaves an open question on how to model the input vector of NN for high frequency data and whether the methodologies that have been developed in the past are still applicable.

This analysis evaluates how several ACF and PACF, regression and heuristic based approaches, which are widely used to model NN, perform when applied to high frequency data, discusses the challenges that arise in modeling high frequency data and provides evidence which of these methodologies are still useful for high frequency problems. A large set of daily time series is used to evaluate the competing input variable selection methodologies, using the established standards of valid empirical evaluation, i.e. using a homogeneous set of time series, rolling origin evaluation, robust error measures and statistical tests to determine how these methodologies compare to each other and against a set of established benchmarks.

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Forecasting Heterogeneous Assortments with Artificial Neural Networks—Modeling Challenges of Trend-seasonal, Discrete and Intermittent Demand of Fast-moving Consumer Goods

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Demand planning in the consumer goods industries faces the challenge of forecasting heterogeneous assortments, consisted of thousands of products with time series of different sales volumes, levels of randomness, time series length, seasonal and/or trend patterns and structural breaks (see e.g. Crone & Trammitzke, 2008). Consequently, individual model selection is required to select a suitable forecasting models developed for a particular time series pattern (Fildes, 1989), followed by parameter estimation for the selected model. In contrast, Neural Networks (NN) promise a semi-parametric, universal approximation and robust generalization of any arbitrary linear or nonlinear data generating process to any desired degree of accuracy (Hornik et al., 1998). This implies that a single (suitably chosen) NN architecture could learn both the correct model structure and optimal parameters for all archetypical patterns of the Pegels-Gardner taxonomy directly from the time series, eliminating the challenge of model selection (Crone, 2007) and simplifying the application of forecasting methods on large, heterogeneous assortments.

While the comparative accuracy of NN has been assessed, their evaluation normally assumes certainty of the true underlying model form, e.g. regarding the ability of NN to model seasonal time series of a particular type (e.g. Zhang & Qi, 2005). In practice, however, model selection routines are imperfect and often struggle to identify the correct model for short and noisy empirical time series. As a consequence, the ability to circumvent model selection in itself may be a desirable property to minimize overall errors beyond optimal parameterization. This research analyzes the issues of (a) the general ability of NN to learn and generalize arbitrary time series patterns, and (b) the impact of misspecification errors from model selection in order to derive a method's sensitivity to universal prediction and generalization.

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Time Series Models/Methods III [TSM3]

Contributed Session:

Tuesday, June 23, 01:30pm-02:30pm

Room: Ching

OPEC News Announcements and Oil Price Volatility**Harald Schmidbauer ***

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Several times a year, the OPEC schedules a conference among its members in order to agree on further oil production policies. The cartel's decision usually takes the form of an announcement, setting a supply level for world oil production. Prior to OPEC conferences, there is usually rampant speculation about which decision on production levels (no change, increase, or cut) the cartel members would agree on. The purpose of our investigation is to assess the impact of an OPEC announcement on oil price volatility.

Our analysis is based on daily price changes of WTI crude oil. A dummy variable indicates the days on which an OPEC announcement is made. This variable is then suitably modified to reflect a certain pattern of impact of news announcement on price volatility. We then use a GARCH specification which contains the modified dummy variable. Our analysis can thus differentiate between pre- and post-announcement effects on volatility, and distinguish between three kinds of OPEC decisions concerning the future crude oil production levels.

We find that the oil price volatility increases significantly after an OPEC announcement has been made, the strength of this effect depending on the kind of decision. This phenomenon can be explained entirely in terms of anticipation effects, that is, with a model based on dummy variables acting on volatility only prior to the official announcement.

Our models also reveal the decision-specific patterns in which the anticipation of an OPEC announcement affects the oil-price volatility.

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Forecasting Large Datasets with Conditionally Heteroskedastic Dynamic Common Factors**Lucia Alessi ***

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Utrecht University, The Netherlands

Many financial issues involve the prediction of large covariance matrices, e.g. the construction of optimal portfolios and the pricing of options based on many underlying returns. In macroeconomics, modeling the conditional volatility of inflation helps to predict its level: knowing the covariance structure of inflation and many other economic quantities may improve the forecast even further. Moreover, assessing inflation uncertainty becomes very important now that the era of the 'Great Moderation' might have come to an end. For these and many other purposes we need to estimate the covariance of large datasets. Therefore, we propose a new method for multivariate forecasting, which combines Dynamic Factor and multivariate GARCH models. We call it Dynamic Factor GARCH, as the information contained in large macroeconomic or financial datasets is captured by a few dynamic common factors, which we assume being conditionally heteroskedastic.

The paper is mainly empirical. After describing the estimation of the model, we present simulation results and carry out two empirical applications. In the first application, we consider one-step-ahead predictions of daily asset returns volatilities and co-volatilities: we find that the DF-GARCH always outperforms the benchmark. In the second application, we employ the DF-GARCH for inflation multi-step-ahead predictions (up to one year) with monthly data. In this second case, we model not only the conditional mean, but also the conditional variance and covariance

of our macroeconomic data as this not only may improve the forecast of the level of inflation, but it is also interesting per se. Indeed, we find that the DF-GARCH predicts inflation level and volatility at least as well as the considered benchmarks. Moreover, as an important side-product, our model allows to detect and predict conditional correlations between inflation and other macroeconomic variables, which is useful when planning monetary policies.

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The Method of Prediction of Weighty Event Arising Moments. By the Example of the DJIA Stock-exchange Index and Crimes Number Time Series

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Igor Kuznetsov

International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences, Russian Federation

In the present work we present the substantial event prediction method with applied examples based on universal behavior rules of complex nonlinear hierarchical systems, which are assumed as a basis for prediction algorithms for events such as when DJIA (Dow Jones Industrial Average) stock-exchange index falls and homicides and serious crimes escalate. These situations are named in general as objects. The study of times series shows characteristics peculiar to the behavior of complex systems with precursor activation effects before the objects. This is shown as “germination” of less substantial events to more substantial ones, which leads to especial changes in the object distribution form or recurrence graph, the main aspect in the creation of predictor function declaring alarm which is a time interval where objects might appear. The developed algorithms for weekly crimes time series predicted about 80% of serious crimes and 70% of homicides. They produce similar results for different towns and show small variations in prediction results as small variations of algorithm parameters take place. Another algorithm was developed to predict stock-exchange index downward movements. There are 10 objects for DJIA daily time series in the last 11 years, such as “black Tuesday” in 1997, crisis in August 1998 and the slump after the 9/11 incident in 2001. The developed algorithm predicted all the 8 retrospective objects and was verified by the last two DJIA plunges in July and October 2008. It also predicted future positive trends in DJIA.

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Economics and Business Cycles I [EBC1]

Contributed Session:

Tuesday, June 23, 01:30pm-02:30pm

Room: Ballroom A

Simple Forecasting Methods for US GNP

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Numerous time series models exist for forecasting economic output. Autoregressive models were initially applied to US GNP and have been recently extended to nonlinear structures such as threshold autoregressive and Markov-switching models. Since post-war GNP time series is limited to a small number of quarterly observations, it is difficult to distinguish between competing approaches from out-of-sample performance results. Motivated by Occam's razor, we seek parsimonious models which are based on simple assumptions and require few parameters to estimate. We compare point forecasts of complicated time series models with a hierarchy of benchmarks for forecast horizons ranging from one to sixteen quarters ahead. Simple benchmarks include the unconditional forecast based on the average of all previous observations and persistence. We find that simple methods such as the unconditional forecast are competitive and outperform complicated time series models.

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Using Survey Data to Predict Cyclical Turns in U.S. Non-Manufacturing Job Growth

Anirvan Banerji

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The service sector constitutes a dominant part of the U.S. economy, with the non-manufacturing sector accounting for 90% of U.S. jobs. The fact that non-manufacturing employment has already in 2007-09 experienced by far the largest plunge in any post-World War II recession underscores the importance of predicting the timing of recessionary downturns in U.S. non-manufacturing employment growth.

Over three decades of data on employment diffusion indexes for all industries, as well as for manufacturing industries, have long been available from government sources. From this data, we derived an employment diffusion index for non-manufacturing industries (EDI-NM). Using the Bry-Boschan procedure, we determined that cyclical turning points in the EDI-NM had a statistically significant lead over U.S. non-manufacturing employment growth in 1977-2009. OLS regressions also showed the EDI-NM to have a statistically significant leading relationship over non-manufacturing employment growth over this time period.

New purchasing managers' survey data for the non-manufacturing sector began to be published in 1997, thus we now have more than a decade's worth of monthly data to be tested for predictive ability. Specifically, we used the employment diffusion index within this purchasing managers' survey (PMI-NME). Using the Bry-Boschan procedure, we found that cyclical turning points in the PMI-NME did not have a statistically significant lead over U.S. non-manufacturing employment growth in 1997-2009. OLS regressions also showed that the highest variance in non-manufacturing employment growth explained by the PMI-NME was at a lead time of zero months.

An analogous analysis over the same time period (1997-2009), this time using the EDI-NM—which was a good predictor over the 1977-2009 time frame—produced similarly disappointing results, suggesting that although neither the EDI-NM nor the PMI-NME was able to predict turning points in non-manufacturing job growth in this shorter period, these negative results might represent anomalies over a longer time frame.

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Did We Really Miss the Onset of the Recent Recession? Follow the Leaders.**Antonio García-Ferrer ***

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The forming of a recession requires one or more components of spending to plummet rapidly and the GDP growth rate to drop about a full percentage point. This situation will have to continue and affect other segments of the economy. Although not all global recessions began in the same way, history has shown that in most business cycles the first expenditure component that falls prior to the recession is usually consumer durables such as homes, and only when the recession is in full swing does business spending on equipment and software weaken. Although leading indicators from these sectors have been quite successful in sending early signals of recession in the economy, no one has a crystal ball. The real value here then is to see if a combination of two or more of these measures are behaving in a collective manner. When applied to monthly Spanish economic indicators, empirical results show that early signals of recession appeared as early as March 2006, while confirmation of the recession came between the second and third quarters of 2007.

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Supply Chain Forecasting I [SCH1]

Contributed Session:

Tuesday, June 23, 01:30pm-02:30pm

Room: Tang I

[A Family of Demand Forecasting Distributions for Inventory Planning](#)

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With the availability of Point-of-Sale (POS) data in consumer goods manufacturing applications, consumer demand is rapidly replacing the need for using shipment data as a proxy for forecasting 'end-user' demand. Shipment data or customer demand, on the other hand, is still vital to forecasting demand for inventory uses. Differences in the distributions between consumer and customer demand are often overlooked and can result in wrongly interpreting the demand forecast for inventory replenishment planning in a supply chain environment (e.g. 'hockey-stick effect', returns, lead times, etc.). In this presentation we describe a new approach for determining stochastic safety stock levels without relying on the normal distribution or a deterministic order policy, like DRP. Improved demand planning by generating more robust and reliable safety stock during a standardized, periodic demand cycle leads to an improved forecasting process and synchronizes replenishment plans with demand signals. The methodology is illustrated in a real-world example of a manufacturer of confectionary goods.

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[Analysis of Judgmental Adjustments Based on State Dependent Parameter Estimation Techniques](#)

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Robert Fildes

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Andrey Davydenko

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Companies which are based on supply chains use demand forecasts to drive purchasing and supply chain management. For most of these companies, a particular type of a Decision Support System, known as a Forecasting Support System (FSS), is employed to prepare the forecasts. These FSS integrate a statistical forecast approach with a manager's judgment.

The manager's judgment is an important part within the forecasting business. In fact, managers may add some information to the final forecast which is difficult to include in a statistical model like a future product promotion.

Despite the importance of judgment, the literature devoted to the study of its effect on forecasting accuracy is scarce. However, some previous research has modeled the appropriate weight that statistical forecasting and judgmental forecasting should have delivered 'optimal' forecasts. Generally speaking, it was found that negative adjustments were more precise than positive ones. This discontinuity between positive and negative adjustments may suggest the necessity of nonlinear models to describe the judgmental process.

The present work reports the nonlinear effect of adjustments on the final forecasting accuracy. Concretely, a state dependent parameter (SDP) estimation approach is used to study the non-linearities involved in the manager's adjustment. SDP technique uses recursive methods like Fixed Interval Smoothing combined with special data re-ordering and 'backfitting' procedures which shows in a non-parametric way, i.e. through a graph, the state dependency between the parameter under study and an associated state variable.

Real data sampled monthly from a manufacturing company is used to illustrate the usefulness of the proposed methodology. In fact, the results suggest a non-linear model between the weight of the adjustments in the forecast accuracy and the size of the adjustments that can be exploited to modify the adjustments influence and produce better forecasts.

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Tourism Supply Chain Forecasting: A Collaborative Approach

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Estimates of the future demand for tourism constitute a very important element in all tourism planning activities. As a result, tourism demand forecasting has attracted much attention from both academia and practitioners. Most attention has been directed to the development of advanced quantitative forecasting methods. Such methods undoubtedly can facilitate the production of accurate forecasts. However, this traditional stand-alone forecasting approach can be improved through collaboration in practice. Tourism products are often configured from a variety of service providers such as accommodation, transportation and attractions, which form tourism supply chains (TSCs). The fragmented nature of the tourism industry implies that individual firms often rely on cooperating with other private or public organizations, which creates a need for collaboration in tourism demand forecasting. This research aims at applying the concept of collaborative forecasting to the forecasting function of a TSC. Unlike traditional forecasting methods, collaborative forecasting is an approach that breaks down the units of analysis and involves reliance on supply chain partners to provide specific and timely information. It is based on cooperation and information sharing between the links in the chain. Accordingly, collaborative forecasting for a TSC requires a variety of people from various echelons of the chain to work together. This paper first examines the current situation of tourism demand forecasting and then discusses the potential benefits as well as challenges of collaborative forecasting for the tourism industry. After that, practical solutions for setting up collaborative forecasting in TSCs are put forward. The forecasting methodology and the design of a collaborative TSC forecasting system are described in detail. Built upon ASP.NET and Web services technologies, the system proposed in this paper, which takes advantage of advanced tourism demand forecasting methods, can provide advanced information sharing and communication among TSC members and allow the development of more accurate forecasts.

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Travel and Tourism Forecasting IV [TTF4]

Contributed Session:

Tuesday, June 23, 01:30pm-02:30pm

Room: Tang II

Global Financial Crisis and Hong Kong Tourism Demand Forecast**Vera Shanshan Lin ***

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Alina Xinyan Zhang

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Bastian Zixuan Gao

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The paper examines the impact of the global financial crisis on the demand for Hong Kong tourism by residents from the main source markets for the period 2009-2012. To capture the influences of the economic turmoil, the autoregressive distributed lag model (ADLM) is used to calculate the tourism demand elasticity, and four scenarios (ranging from the most pessimistic to the most optimistic) are created to examine the possible impacts of the changes in the income levels of the major source markets and the price of Hong Kong tourism on the demand by tourists from these markets. The demand elasticities reveal that the economic condition in the source markets is the most significant determinant of the demand for Hong Kong tourism. In the most pessimistic scenario, the total number of tourist arrivals to Hong Kong is projected to reach 23.1 million in 2010 and 23.8 million in 2012, while in the most optimistic scenario, the numbers are 24.7 million in 2010 and 27 million in 2012, respectively. Under the four scenarios, tourist arrivals from the USA will decline the most during the period 2007-2010. The forecasts show that the market shares of the source markets will change slightly over the forecasting period. Mainland China, Taiwan and Japan will still dominant the Hong Kong tourism market.

Key words: ADLM model, Tourism demand elasticity, Financial crisis, Scenario forecasts

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Why Discounting does Work (and When)**Kelly J. Semrad ***

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The purpose of this study is to examine the relationship between hotel financial performance and discounting of room rates. Hotel managers have toiled over a course of action that would help them preserve hotel revenue during diminished demand seasons. They have responded to this challenge by discounting hotel room rates to sustain revenue and the means by which they can determine how discounting can increase hotel financial performance. That revenue would otherwise be lost when supply of rooms exceeds the demand. Most of the current studies are prescriptive and normative in scope rather than focusing on providing explanation of the behavioral pricing of hotel managers. This paper departs from previous studies in that it aims at providing an explanation of the discounting behavior and claims that discounting is more effective in the short-term than the use of moving averages to set room rates.

This study provides a theoretical framework that investigates the fundamentals of discounting and empirically assesses the efficacy of the discounting process in the hotel industry. By applying the rational expectations theory, the dynamics of seasonality are recognized as integral variables in the discounting strategy process. This differs from previous research studies that imply the hotel industry functions as a static entity, and thus fail to take into account the substantial price variability of the hotel industry. The study contributes to the considerable literature denoting

explanation and comprehension of the rationality of discounting on hotel financial performance. The results of the study reveal that the discounting of room rates increases financial performance in the short-run, but that moving averages of room rates is a more appropriate pricing strategy in the long-run. A co-integration analysis and an error-correction model were principal to the determination of these results.

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[Forecasting Tourism in Post-Soviet Georgia](#)

Edward Raupp

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When the Soviet Union collapsed in 1991, 15 separate nations began a process of opening their borders to foreign visitors and actively seeking tourists from around the world. Forecasting tourist activity in these nations presents unusual problems with respect to historical data and political instability. In none of the 15 nations are these problems more evident than in Georgia, a small Eurasian country on the “Old Silk Road,” long kept behind a veil of secrecy and struggling to maintain its independence against a resurgent Russia, and yet a country where tradition holds that “a guest is a gift from God.” This study briefly examines the historical periods affecting tourism in Georgia, offers a model of the “trauma trough,” and applies both statistical and judgmental methods to forecast tourism in Georgia over the next five years.

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Tourism Forecasting I [OS9]

Organized Session:

Tuesday, June 23, 02:40pm-03:40pm

Room: Ballroom B

Combination Forecasts of UK Outbound Tourism Demand**Shujie Shen**

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Haiyan Song

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This paper aims to provide a comprehensive investigation to the performance of combination forecasts. The empirical study focuses on the demand for outbound leisure tourism by UK residents to seven destination countries. Five modern econometric models and two time series models are employed to generate individual forecasts before a variety of combinations are exercised. Six combination methods are used and their forecasting performances are evaluated and compared. These combination methods include the simple average combination method, the variance-covariance combination method, the discounted mean square forecast error (MSFE) method, the Granger-Ramanathan Regression method, the Shrinkage method and the time varying parameter (TVP) forecast combination method. The empirical results suggest that the combination forecasts are superior to the best of the individual forecasts overall. In addition, more sophisticated combination forecasts, which take the historical performance of the individual forecasts into consideration, perform better than the simple average combination technique. The discounted MSFE method turns out to be the best combination method.

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[The Tourism Forecasting Competition](#)**George Athanasopoulos ***

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Rob Hyndman

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We evaluate the performance of various methods for forecasting tourism demand. The data used include 366 monthly series, 427 quarterly series and 518 yearly series, all supplied to us by tourism bodies or by academics from previous tourism forecasting studies. The forecasting methods implemented in the competition are univariate and multivariate time series approaches, and also econometric models. This forecasting competition differs from previous competitions in several ways: (i) we concentrate only on tourism demand data; (ii) we include econometric approaches; (iii) we evaluate forecast interval coverage as well as point forecast accuracy; (iv) we observe the effect of temporal aggregation on forecasting accuracy; and (v) we consider the mean absolute scaled error as an alternative forecasting accuracy measure.

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Finance VI [FIN6]

Contributed Session:

Tuesday, June 23, 02:40pm-03:40pm

Room: Ching

[Analysts Earnings Forecasts Distribution Normality: An Empirical Investigation](#)**Henry Leung**

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The employment of IBES analyst earnings estimates consensus in extant capital markets research literature presupposes normality in per period, per firm analyst earnings estimate distribution on the basis that: (i) the central limit theorem holds true because analyst estimates are independently and identically distributed (iid); and (ii) the unweighted consensus mean and/or median are the best estimator(s) of a normal distribution. On the contrary, contemporaneous monthly forecast distributions for Australian stocks from 11 months through actual reported earnings between 1988 through 2002 were generally found to be significantly non-normal, with this result coming across four different forecast bias deflator types. Furthermore, respective distribution skewness and kurtosis were significantly positive from zero. These findings suggest the possibility of a more accurate surrogate consensus than the IBES mean and median. This will have major implications on stakeholders of capital markets who consume them.

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The Direction Forecasting of Stock Price in SET50 with Grey Forecasting Model**Noppanon Homsud**

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The objective of this research is to forecast the direction of daily closing stock prices, which are in SET50, using the Grey Forecasting Model. SET50 is an index which is calculated from the stock prices of 50 listed companies in terms of large market capitalization and high liquidity. The data of 255 days of 46 daily closing stock prices from 2nd January, 2008 to 30th December, 2008 are used. The method for testing is determined by using 4 to 10 datasets. Then, the Grey Forecasting Model is applied to forecast the direction of daily closing stock prices. It is found that the most accurate forecasting occurred when using 6 datasets because it can forecast the direction of closing which exactly equals 64.21%. Moreover, more than a half, 35 out of 46, of the listed companies are forecasted correctly.

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Economics and Business Cycles II [EBC2]

Contributed Session:

Tuesday, June 23, 02:40pm-03:40pm

Room: Ballroom A

[The Effect of Oil Price Changes on the Technological Fluctuations in an Oil Exporting Country: A DSGE Approach](#)**Hossein Kavand ***

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Asghar Shahmoradi

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This paper estimates a DSGE model to investigate how oil price changes can affect technological fluctuations in an oil exporting country. By focusing on Iran as an example of a resource intensive emerging economy, this paper uses Blanchard-Kohn approach and Kalman filter method to estimate unobservable technological deviations from its steady state. Besides this, estimated models can nicely simulate the stylized facts of comovement, standard deviation and persistent of the cyclical components of the macroeconomic variables. Based on the results, there is a positive correlation between the oil price changes and the estimated technological fluctuations. In addition, this positive relationship is stronger in the period of accumulated positive oil price shocks such as 2004 to 2008 period. The results show that oil price changes can be used as an indicator for predicting technological fluctuations in this economy.

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Forecasting Interval Valued Inflation Rates**Carlos Maté**

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Monetary policy at central banks requires the production of accurate forecasts of inflation rates. In recent years different approaches to incorporating uncertainty into the forecasts have been proposed, providing more complex forecasts than point forecasts. In addition, methodologies like Bayesian model averaging have improved the accuracy of forecasting methods. The last twelve months have shown a sharp increase, followed by an abrupt decrease, in inflation rates, deflation now being a real possibility in this year. Symbolic data incorporates uncertainty into the data itself. It has recently been successfully applied in forecasting especially in the use of intervals and histograms. This paper shows how some interval methods can be applied in the forecasting of inflation rates, and evaluates the advantages and disadvantages of this approach. Some proposals for further research are suggested.

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How the Capital Services Implementation Could Influence GDP and Business Cycle?

Jakub Fischer *

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Capital services are the very often discussed concept in relation to national accounts and the gross domestic product estimates. This concept, which is considered as a possible future widening of the system of national accounts, used as a cost of capital not only consumption of fixed capital, but also an estimate of the return to capital.

It is important for estimates of GDP because the GDP in non-market sectors is estimated by the cost method as a sum of intermediate consumption, compensations of employees and the consumption of fixed capital. After the implementation of capital services, the gross value added in non-market sectors will be higher of the return to capital.

The aim of this paper is to present the first experimental results of capital services in the Czech Republic and the estimates of its impact on the gross value added and GDP. There are two main questions: how the capital services implementation influences the business cycle (whether the capital services are cyclical or not) and how it influences the productivity measurement and forecasting (after replacement of capital stocks by capital services in the production function).

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Environmental and Climate Applications II [ECA2]

Contributed Session:

Tuesday, June 23, 02:40pm-03:40pm

Room: Tang II

[Forecasting the Incidence of Moorland Wild Fires Given Realistic Climate Change Scenarios](#)**Kevin Albertson ***

Manchester Metropolitan University, United Kingdom

Jonathan Ayles

The University of Manchester, United Kingdom

Gina Cavan

The University of Manchester, United Kingdom

Julia McMorrow

The University of Manchester, United Kingdom

Hotter, drier weather brought by climate change increases the probability of wildfires. Changing climate is likely to make fire outbreaks more severe and extend their incidence across the seasons. Fighting wildfires is difficult and costly as they can be extensive and are in remote locations. Wildfires in peat threaten severe carbon loss.

Models of fire incidence are used to forecast the chance of wildfires in the Peak District of northern England. The temporal distribution of fires is modeled using probit and poisson techniques. These models are assessed by both backcasting and forecasting actual fire occurrence outside the sample period used for estimation. The probit model is the more accurate at predicting out-of-sample fire outbreaks during a drought year.

A data set has been generated by the BETWIXT project which simulates and forecasts the likely impact of climate change in England. The probit model is applied to this simulated weather data to assess the likelihood of wildfires under future climate conditions. As part of the process, we comment on the time-series properties of climate forecasts.

Keywords: climate change, climate simulations, wildfires, probit analysis, poisson analysis, general to specific, seasonality, risk assessment, backcast, tourism, time-series, plant phenology, national parks, BETWIXT

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Validation of Global Circulation Models: The Role of Benchmark Time Series**Robert Fildes** *

Lancaster Center for Forecasting, United Kingdom

Peter C. Young

Lancaster Center for Forecasting, United Kingdom

Nikolaos Kourentzes

Lancaster Center for Forecasting, United Kingdom

This paper first considers the validation of long term climate global circulation models as used by the IPCC in their forecasts of global warming. Within the forecasting community, benchmark forecasts of annual average temperature have an important role. This paper presents an appraisal of various extrapolative time series benchmarks forecasts of annual average temperature, both global and local. Methods include non-linear unobserved component models, neural nets and benchmark smoothing models. Nonlinear models relating carbon emissions to globally averaged atmospheric carbon dioxide are also considered. The presentation concludes with a comparison of the time series forecasts with forecasts produced from global circulation models and a discussion of the implications for climate modeling research. The role of benchmark statistical models in the validation of global circulation models is also considered.

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Supply Chain Forecasting II [SCH2]

Contributed Session:

Tuesday, June 23, 02:40pm-03:40pm

Room: Tang I

Anti Bullwhip Effect in Supply Chains: Is the Sharing of Forecasts Still Valuable?**John E. Boylan ***

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Mohammad M. Ali

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The Bullwhip Effect is a demand amplification phenomenon and occurs when demand variability increases as one moves up the supply chain. Many papers in the literature show that, if supply chain members forecast using the less variable downstream member's demand, this amplification can be reduced, leading to reductions in inventory cost. Forecast Information Sharing is thus recommended in the literature as a major strategy to counter the Bullwhip Effect.

Some recent papers have mathematically shown the existence of an Anti-Bullwhip Effect, a phenomenon opposite to the Bullwhip Effect. The papers have analytically shown that, for certain ranges of demand parameters, there is a decrease in variability as demand moves upstream in supply chains. Boundary conditions have been derived for simple ARMA processes. Some papers have questioned the value of Demand Information Sharing in such cases.

This research explores Forecast Information Sharing (FIS) in Supply Chains in the case of the Anti-Bullwhip Effect, i.e. when demand variability decreases in supply chains. We consider the Anti-Bullwhip Effect regions of some ARMA demand processes. The value of Forecast Information Sharing is then explored both with the help of simulation and on a two year, weekly sales data of a European Grocery Store. The value of Forecast Information Sharing is quantified in our research on the basis of percentage decrease in inventory cost using FIS. This research shows that, even in the case of the Anti-Bullwhip Effect, there is value of Forecast Information Sharing for certain ranges of demand parameters.

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The Effects of Integrating Management Judgement into Statistical Demand Forecasts

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Konstantinos Nikolopoulos

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A number of research projects have demonstrated that the efficiency of stock control systems does not relate directly to demand forecasting performance, as measured by standard forecasting accuracy measures. When a forecasting method is used as an input to a stock control system it should therefore always be evaluated with respect to its implications for stock control (through accuracy implications metrics), in addition to its performance on these accuracy measures. In this work we address the issue of judgementally adjusting statistical forecasts for 'fast' demand items and the implications of such interventions both in terms of forecast accuracy and stock control, the latter being measured through inventory volumes and service levels achieved. In order to do so we use a large empirical dataset from the pharmaceutical industry. The study allows insights to be gained into the combined forecasting and inventory performance of judgemental estimates. It also aims to advance the practice of forecasting competitions by arguing for the consideration of additional (stock control metrics) when such exercises take place in an inventory context.

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Tourism Forecasting II [OS10]

Organized Session:

Tuesday, June 23, 04:00pm-05:00pm

Room: Ballroom B

Beyond Point Forecasting: Evaluation of Alternative Prediction Intervals for Tourist Arrivals**Haiyan Song ***

The Hong Kong Polytechnic University, Hong Kong SAR, China

Jae Kim

La Trobe University, Australia

Kevin Wong

The Hong Kong Polytechnic University, Hong Kong SAR, China

George Athanasopoulos

Monash University, Australia

Shen Liu

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This paper evaluates the performance of prediction intervals generated from alternative time series models, in the context of tourism forecasting. The forecasting methods considered include the autoregressive (AR) model, the AR model using the bias-corrected bootstrap, seasonal ARIMA models, innovations state-space models for exponential smoothing, and Harvey's structural time series models. We use thirteen monthly time series for the number of tourist arrivals to Hong Kong and to Australia. The mean coverage rate and length of alternative prediction intervals are evaluated in an empirical setting. It is found that the prediction intervals from all models show satisfactory performance, except for those from the autoregressive model. In particular, those based on the bias-corrected bootstrap in general perform best, providing tight intervals with accurate coverage rates, especially when the forecast horizon is long.

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Predicting Turns in Hong Kong Inbound Tourism Demand Growth Rate with Determinants

Nada Kulendran *

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Tourism demand undergoes a period of high growth rate and slow growth rate due to changes in the tourist's origin country and destination country's economic, social, political situations and unexpected crises. Turning points in tourism demand occur when growth rate moves from expansion period to contraction period or contraction period to expansion period. During the expansion period resources are in high demand, while in the contraction period resources are in low demand. Such a change in demand for resources requires development of an appropriate risk management strategy at the tourism destinations. To minimize risks, an accurate forecasting of turning points in travel demand is needed. For the purpose of making the correct investment and planning for further expansion in the tourism industry, the government and various sectors of the tourism industry often like to have prior knowledge of the beginning and/or end of turning points in their countries' tourism demand growth. In this context, a tourism forecaster is expected to make predictions with greater degree of accuracy on the take-off tourism demand growth rate for the following quarter. Given the importance of obtaining accurate turning-point forecasts, coupled with the lack of research in predicting turning points, it is evident that more research is needed to develop an appropriate method to forecast turning points in quarterly tourism demand growth rates. To predict turning points in quarterly smooth inbound Kong Hong tourism demand this project consider a logistic regression model with the tourism demand determinants such as income, price, price of substitute, oil price and special events. Regimes such as expansion and contraction are examined as binary variables. Finally the prediction performance of the logistic regression models is assessed with the use of composite leading indicators and time-series models such as ARIMA and BSM.

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Macro and Microeconomic Applications III [MMA3]

Contributed Session:

Tuesday, June 23, 04:00pm-05:00pm

Room: Tang II

Forecasting of Czech External Trade Time Series**Lubos Marek ***

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Michal Vrabec

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We analyze time series of external trade of the Czech Republic and Czech crown exchange rate in this article. We show that relationship between these two time series exists by using the cross-correlation function. Forecasting is then conducted based on this relationship. The data of the external trade series are published by Czech Statistical Office on a monthly basis. However, data for the current month are released 2–3 months later. On the other hand, the values of the series are known immediately after realization and they are quite precise (such as the series of Czech crown exchange rate vs. USD or EURO). Therefore, when we describe the dependency between these series using the appropriate model, we can use this dependence for forecasting.

We will employ stochastic models and transfer function models. We find that the SARIMA model is appropriate for the forecast of the export and import series. Then we compute the cross-correlation function between external trade series and Czech crown exchange rate series. The results show significant linear dependence between the two series in current time point t and past time points $t-1, t-2, \dots$. We build a transfer function model with input series X (Rate), output series Y (Export or Import) and noise series N . Then we use the LTF method for identification of appropriate transfer function model (TFM). In addition, we use constructed TFM for forecasting of future export and import values. The forecasts are based on the real values of input series, not on the input series forecasts. We compare the forecasting performance of the SARIMA model and TFM model at the end of our analysis. We show that the TFM model outperforms the SARIMA model.

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The Incorporation of GDP News in Other Macroeconomic Variables Forecasts**Bruno Deschamps**

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We use data from Consensus Economics to analyze the efficiency of forecasts for ten macroeconomic variables (GDP, CPI, unemployment, etc) of the G7 countries. The aim of the paper is to identify the sources of the inefficiencies and the time it takes for economic news to be incorporated into forecasts. Following a large empirical literature, we first find that forecast revisions are inefficient and positively auto-correlated. We then use the multi-dimensional nature of our data (24 monthly forecasts for each event, 10 variables, 17 years, 7 countries) to investigate in some detail the dynamics of forecast revisions. The novelty of the paper is to investigate the relationship between the forecast revisions of the different variables. We estimate for each country a VAR model using the forecast revisions for the ten variables. The impulse response functions provide evidence of the linkages between the forecasts of the different variables. We find that the diagonal elements are significant, implying that forecasters attempt to 'smooth' their revisions. The main result is that the off-diagonal elements are often significant, meaning that the forecast revisions of one variable can impact the future forecast revisions of the other variables. We find that GDP forecast revisions 'drive' revisions for all the other variables, except inflation. This indicates that forecasters could improve forecast accuracy for such variables by incorporating GDP news as soon as possible, thus improving efficiency and reducing the persistence of forecast revisions.

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Nowcasting the US Economy on a Daily Basis

Klaus Wohlrabe

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We evaluate the predictive power of two mixed-frequency approaches for US output growth for the current quarter. Using real-time data, we compare a state-space VARMA approach and MIDAS regressions which allows us to combine multiple individual leading indicators in a parsimonious way and to directly exploit the information content of the monthly series to predict quarterly output growth. When we use real-time-vintage data, the indicators are found to have significant predictive ability, and this is further enhanced by the use of monthly data on the quarter at the time the forecast is made. In a second step we include dynamic factors extracted from more than 200 daily time series. In a daily recursive forecasting exercise we demonstrate that the combination of daily and monthly information leads to a higher forecasting accuracy than using only monthly data.

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Energy Sales and Markets V [ESM5]

Contributed Session:

Tuesday, June 23, 04:00pm-05:00pm

Room: Tang I

[Modeling and Forecasting of Wind Power Fluctuations Using Markov Switching AR-GARCH Models](#)**Pierre-Julien Trombe** *

Informatics and Mathematical Modeling, Denmark Technical University, Denmark

Pierre Pinson

DTU-IMM, Denmark

Wind power time series (at a few minutes temporal resolution) exhibit successive periods with different behaviors in terms of fluctuations. In a general manner, one can then consider there may be a switching between regimes with different dynamics of the conditional mean and variance, while the regime-switching mechanism is governed by some unknown mechanism. Recent developments in wind power modeling and forecasting based on Markov-Switching AutoRegressive (MS-AR) models proved to be highly suitable both in capturing some of those non linearities and generating one-step ahead forecasts. However, none of these existing models account for time-varying variability in each regime which is of main concern when analyzing wind power fluctuations of large offshore wind farms. Application of such models may allow for thorough analysis of those power fluctuations, for one-step ahead point forecasting of wind power generation, and most interestingly for one-step ahead density forecasting.

The present work shows how to account for time-varying dynamics in the variance by considering Generalized AutoRegressive Conditional Heteroskedastic (GARCH) errors in MS-AR models. A Monte Carlo Markov Chain (MCMC) approach is proposed for the estimation of the resulting MS-AR-GARCH models in a Bayesian framework. Inference on the regime sequence is performed through a data augmentation procedure using the Gibbs sampler and model coefficients are estimated with the Griddy-Gibbs sampler.

The interest of employing such models and related estimation method is illustrated by an application to 10-minute resolution wind power time series at the Horns Rev wind farm in Denmark. The assessment of the model forecasting ability is twofold. Focus is given first to one-step ahead point forecasts both in-sample and out-of-sample, and compared to benchmark models (random walk, AR, MSAR, AR-GARCH). Then, the possibility of generating density forecasts based on such models is considered, and such density forecasts evaluated in terms of both reliability and overall skill. It is shown that while the gain in terms of one-step point forecast accuracy is not that large (even though it exists), the main interest of employing such models lies in their ability to clearly identify the various dynamics present in wind power time-series, and also for probabilistic forecasting of their fluctuations.

Email: pjt@imm.dtu.dk**[Forecasting the Wind Generation using Meteorological Information](#)****Shu Fan** *

Monash University, Australia

James R. Liao

Western Farmers Electric Cooperative, United States

Wei-Jen Lee

University of Texas at Arlington, Arlington, United States

This paper proposes a practical and effective model to forecast the power generation of a wind farm with an emphasis on its scheduling and trading in a wholesale electricity market. A machine learning based forecasting model is developed based on in-depth investigations of meteorological information. This model adopts a two-stage hybrid network with Bayesian Clustering by Dynamics (BCD) and Support Vector Regression (SVR). The proposed structure is robust with different input data types and can deal with the non-stationarity of wind speed and generation series well. Once the network is trained, we can straightforwardly predict the 48-hour ahead wind power generation.

To demonstrate the effectiveness, the model is applied and tested on a 74 MW wind farm located in the south-west Oklahoma of the United States.

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[Short-term Wind Power Density Forecasting Using Exponential Smoothing of the Mean and Variance](#)

Ada Lau *

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Patrick McSharry

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Wind power is a rapidly developing renewable energy resource but its variability poses a number of challenges. Thus it is extremely important to generate reliable and cost-effective wind power density forecasts so as to efficiently operate and manage the power system. We develop a new approach for short term density forecasts using exponential smoothing methods. Exponential smoothing methods have been successfully applied to many areas from mean forecasts in inventory control to volatility forecasts in finance. However, they are rarely applied simultaneously to forecast both the mean and the variance. Our new approach proposes to smooth through both the mean and the variance simultaneously. An advantage of our approach over the ARIMA-GARCH models is that exponential smoothing methods are very simple and robust, which reduce the risk of model misspecification. Multi-step forecasts are more reliable and results show that our approach gives superior performance of density forecasts in terms of the continuous ranked probability score. We apply our approach to forecast real aggregated wind power generation in Ireland over a forecast horizon from 15 minutes up to 24 hours ahead. Our results show that exponential smoothing methods produce superior density forecasts which outperform standard benchmarks as well as the ARIMA-GARCH models. Also, we show that good density forecasts can be used to generate improved point forecasts. This demonstrates the value of forecasting both the mean and variance even when the primary interest is in point forecasts.

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Forecasting Practice IV [FP4]

Contributed Session:

Tuesday, June 23, 04:00pm-05:00pm

Room: Ballroom A

The Reputation Effects in Professional Forecast**Yasuyuki Komaki**

College of Economics, Nihon University, Japan

Some papers show that macroeconomic forecasts are distorted by professional forecasters for their own benefit. Owen Lamont (1995) finds that forecasters make more radical forecasts as they gain experience in order to acquire reputation. In this paper, We reexamine the robustness of Lamont's results using two types of forecasting reports concerning the US and Europe. The first type is an anonymous respondents survey: the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters and ECB Survey of Professional Forecasters. The second is non-anonymous: Consensus Economics for USA and Consensus Economics for Europe.

The results are summarized as follows:

- 1) The results contradict Lamont's in four forecasting reports.
- 2) However, bullish or bearish forecasts in the forecasting reports are found to be consistent. Some forecasters intend to maintain their previous position among forecasters. Therefore, the durability of forecast scenario as referred by Krane (2003) is tested. Krane finds that forecasters do not change medium- and long-term forecasts. This means that perceptions of long-term trends or potential GDP growth provide an important anchor for projections more than several quarters. We confirm Krane's results.
- 3) We test the degree of herding in forecast using Lakonishok, Shleifer and Vishny's (1992) method. We find that forecasting reports by anonymous respondents contain fewer herding behaviors than reports by non-anonymous respondents.

These results suggest that forecasters are at liberty to report the forecasts. In the four forecasting reports, forecasters make forecasts only with their own benefit in mind as they have a discretionary power. Therefore they prefer to maintain their original position among forecasters instead of the market consensus in order to maintain their reputation.

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Prediction Markets vs. Econometric Forecasting for Sports: Evaluating and Explaining Performance**James Reade ***

Department of Economics, University of Oxford, United Kingdom

Karen Croxson

Oxford-Man Institute, University of Oxford, United Kingdom

A small but growing body of evidence suggests that information markets, where participants buy and sell contracts whose payout is contingent on some unknown future event, yield remarkably accurate predictions in comparison to polls, expert judgement, surveys, and group deliberation. How do they compare to econometric approaches in the domain of sports prediction? This paper conducts a forecast competition between statistical methods and prediction markets. We describe the in-running forecasts for 1206 soccer match outcomes covered by Betfair prediction markets and compare the predictions from these markets with those from a range of statistical models. We evaluate relative performance and look to explain this. Among other things, we link relative prediction success to existing forecasting theory, notably that associated with the LSE Methodology, perhaps best elucidated in Clements and Hendry (1998, 2001). It emerges out of this exercise that a principal reason for the success of prediction markets as a tool for 'in-running' forecasts is their ability to rapidly update to structural breaks, consistent with the theory advanced by Clements and Hendry.

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Services Demand Forecasting and Planning—How does HP Address the Problem?

Jerry Shan *

Hewlett-Packard Company, United States

Alex Zhang

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Shelen Jain

Hewlett-Packard Company, United States

Despite a long history of research in forecasting in statistics and resources planning in operations research, there are many new challenges in developing and applying operational solutions to forecasting and planning for services demand in the current globalized IT services market. For product demand forecasting, when developing a forecasting model, one needs to incorporate many effects such as lead-time, seasonality, pricing and promotional effects, and product life cycle effect. For services demand forecasting, however, we need to address many brand new factors effectively, in addition to addressing many of those traditional effects. For example, the uncertainty in winning any customer project, the uncertainty of job skill mix and size required to deliver the services, the uncertainty in employee attrition, and the uncertainty in the availability and cost of certain skills in the job market (both full time regular employees and outsourced employees), all contribute complexity to the forecasting and planning problem. Given all those effects and factors, how do we forecast the service demand at various job skill levels so that an enterprise can make an optimal and effective workforce plan? In this paper, we will be describing some of the challenges that we have encountered, and some of the solutions that we have been developing and applying in the context of HP services demand forecasting and planning.

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Time Series Models/Methods IV [TSM4]

Contributed Session:

Tuesday, June 23, 04:00pm-05:00pm

Room: Ching

Detecting Structural Breaks in Time-varying Hedge Ratios for Agricultural Commodities Futures**Sheng-Hung Chen**

Department of Finance, Nan Hua University, Taiwan

Wan-Hsiu Cheng *

Department of Finance, Tamkang University, Taiwan

Motivation: Previous studies have indicated that the Ordinary Least Squares (OLS) method which gives constant hedge ratio is inappropriate and suggested the use of Bivariate Autoregressive Conditional Heteroskedasticity (BGARCH) model. However, the literature pays scarce attention to the evidence as to whether there are structural changes in hedge ratios over time, particularly in agricultural commodities futures. This issue is important for crop farmer or hedgers to adjust their hedge strategies with different phases once potential break points are successfully predicted in advance.

Purpose: This paper contributes to the literature by identifying endogenously regime changes in hedge ratios over time in the agricultural commodities futures markets using the multiple structural breaks approach developed by Bai and Perron (2003) and allowed for unknown break dates, whereby presenting some empirical evidences from for 11 futures contracts, including cocoa, corn, cotton, live cattle, live hog, oat, soybean, soybean meal, soybean oil, sugar, and wheat. Time-varying hedge ratios is generated by VARMA-BGARCH models with basis information while spot price and futures prices are changing over time

Empirical Results: Weekly hedge ratios in 11 futures contracts exhibited clear characteristics of both fluctuations and time-variations. Besides the futures contract of sugar and soybean, the empirical evidence indicates that hedge ratios series showed at least more than one clear regime changes over time, particularly four structural breaks in corn. This implies that corn farmer or hedgers have to pay more attention to mean-revisions within different phases of hedge ratios and would actively adjust their hedging strategies in response to regimes changes.

Conclusions: We indicate that there were four regime changes in mean of hedge ratio series for corn while existing three structural breaks in soybean oil, soybean meal, oat, and cotton. By identifying regime changes in hedge ratios with time-variation, hedging strategies may be able to better adjust against the hedge ratio changes stemming from a specific event.

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[A Multivariate Generalized Independent Factor GARCH Model with an Application to Financial Stock Returns](#)**Ester González-Prieto ***

Universidad Carlos III de Madrid, Spain

Antonio García-Ferrer

Universidad Autónoma de Madrid, Spain

Daniel Peña

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We propose a new multivariate factor GARCH model, the GICA-GARCH model, where the data are assumed to be generated by a set of independent components (ICs). This model applies independent component analysis (ICA) to search the conditionally heteroskedastic latent factors. We will use two ICA approaches to estimate the ICs. The first approach estimates the components maximizing their non-gaussianity, while the second one exploits the temporal structure of the data. After estimating the ICs, we fit an univariate GARCH model to the volatility of each IC. Thus, the GICA-GARCH reduces the complexity of estimating a multivariate GARCH model by transforming it into a

small number of univariate volatility models. We report some simulation experiments to show the ability of ICA to discover leading factors in a multivariate vector of financial data. An empirical application to the Madrid stock market is presented to compare the forecasting accuracy of the GICA-GARCH model to the orthogonal GARCH one.

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Measuring Forecast Uncertainty by Disagreement: The Missing Link

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Using a standard decomposition of forecasts errors into common and idiosyncratic shocks, we show that aggregate forecast uncertainty can be expressed as the disagreement among the forecasters plus the perceived variability of future aggregate shocks. Thus, the reliability of disagreement as a proxy for uncertainty will be determined by the stability of the forecasting environment, and the length of the forecast horizon. Using density forecasts from the Survey of Professional Forecasters, we find direct evidence in support of our hypothesis. Our results support the use of GARCH-type models, rather than the ex post squared error in consensus forecasts, to estimate the ex ante variability of aggregate shocks as a component of aggregate uncertainty.

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Finance IX [FIN9]

Contributed Session:

Tuesday, June 23, 04:00pm-05:00pm

Room: Ballroom C

A Reappraisal of the Leading Indicator Properties of the Yield Curve under Structural Instability**Qingwei Wang ***

Center for European Economic Research (ZEW), Germany

Andreas Schrimpf

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This paper provides an extensive reexamination of the leading indicator properties of the yield curve. We study whether the yield spread still qualifies as a useful predictor in the presence of model instability and forecast breakdowns. Multiple break tests provide strong evidence for structural change and allow us to pin down the exact dates associated with these breaks. We find that window selection methods newly developed for forecasting in the presence of structural change offer some improvements in terms of forecast accuracy. Overall, our results strongly suggest, however, that the yield curve has been losing its edge as a predictor of real activity in recent years.

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Does Disaggregation Improve the Forecast Quality of Earnings Forecasts?**Elizabeth Chuk**

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Lloyd Tanlu *

University of Washington/Harvard Business School, United States

Managers use earnings forecasts as voluntary disclosures to provide information about expected firm performance. These forecasts are informative to analysts and investors, and aid in the discovery of efficient market prices (Gleason and Lee 2003). In spite of the importance of earnings forecasts, empirical evidence overwhelmingly shows that these forecasts are almost always inaccurate, and oftentimes biased. One main reason for low forecast quality is that managers have incentives to disclose biased forecasts (Hirst, Koonce, and Venkataraman 2008). Research in forecasting suggests that estimating the disaggregate parts of a variable results in more accurate forecasts of the aggregate variable (Palm and Zellner 1992; Espassa 1994; Zellner and Tobias 2000). Similarly, experimental studies show that providing disaggregated forecasts mitigate perverse managerial incentives to bias forecasts and improve forecast credibility (Hirst, Koonce, and Venkataraman 2007).

Using a hand-collected sample of management forecasts, we investigate whether the release of disaggregated forecasts of earnings improves forecast quality. In particular, we examine how disaggregation impacts (a) the number of forecast revisions made by managers over the forecast horizon; (b) signed and unsigned forecast error; and (c) credibility of forecast updates, as measured by analyst updates and the market reaction following the disclosure of estimates of earnings components. We find that disaggregation is positively associated with the number of forecast revisions made by both managers and analysts, and that management forecasts that provide more components of earnings are less biased and more accurate. Furthermore, our findings suggest that managers use disaggregation to make their earnings forecasts more credible.

This study contributes to the practitioner and academic literature by providing evidence of the consequences of disaggregation in earnings forecasts.

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Keynote Speech [K3]

Plenary Session:

Wednesday, June 24, 8:30am-9:30am

Room: Grand Ballroom

Evidence-based Methods to Forecast Elections: The PollyVote Project**Scott Armstrong**

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We applied evidence-based principles to forecast U.S. presidential elections. The primary strategy was combining. We mechanically combined forecasts that used different methods and different data to produce the PollyVote. This involved unweighted combining within and across four categories of methods (polls, a prediction market, quantitative models, and a survey of political experts). We applied the PollyVote prospectively to the 2004 and 2008 elections, and retrospectively for three elections from 1992 to 2000. Improved accuracy was achieved by combining within components as well as across components. The errors were especially low in the 2004 and 2008 elections, when the PollyVote drew upon more methods and more data; the average election-eve error was 0.4%. Across the whole forecasting horizon, the PollyVote correctly predicted the winner on 99% of the 957 days on which comparable forecasts were made; no other method came close to this accuracy. Our future work is focusing on making longer-term forecasts (e.g., before candidates are selected) and in developing methods that can be used to select candidates and to inform campaign strategies. Given the large number of variables for these problems, we use “index models.” I will report on initial results for our PollyBio and PollyIssues models. (You are invited to take a short survey to predict the effectiveness of these two models. It is found at the bottom left-hand column of forprin.com.)

Scott Armstrong is author of Long-Range Forecasting, the most frequently cited book on forecasting methods, and Principles of Forecasting, voted the “Favorite Book – First 25 Years” by researchers and practitioners associated with the International Institute of Forecasters. He is a co-founder of the Journal of Forecasting, the International Journal of Forecasting, the International Symposium on Forecasting, and forecastingprinciples.com. He is a co-developer of new methods including rule-based forecasting, causal forces for extrapolation, simulated interaction, and structured analogies – and with the resurrection of “index models.”

In addition to forecasting, Professor Armstrong has published papers on survey research, educational methods, applied statistics, social irresponsibility, strategic planning, and scientific peer review. Among his findings is that competitor-oriented objectives are harmful to profits; formal planning improves profitability; and stakeholder management reduces social irresponsibility. Most recently, his research activities have involved forecasting for conflicts and terrorism. For the past 15 years, he has been writing a book. Persuasive Advertising, forecasted to appear in 2010.

Financial Time Series [OS11]

Organized Session:

Wednesday, June 24, 10:00am-11:00am

Room: Ballroom BC

[Generalized Extreme Value Distribution with Time-dependence Using the ARMA Model in State Space Form](#)**Yasuhiro Omori ***

University of Tokyo, Japan

Jouchi Nakajima

Bank of Japan, Japan

Tsuyoshi Kuniyama

University of Tokyo, Japan

A new state space approach is proposed to model the time-dependence in an extreme value process. The generalized extreme value distribution is extended to incorporate the time-dependence using a state space representation where the state variables follow an autoregressive moving average process with Gumbel error distribution. Using Bayesian approach, an efficient algorithm is proposed to implement Markov chain Monte Carlo method where we exploit the fine approximation of the Gumbel distribution by a ten-component mixture of normal distributions. The methodology is illustrated using extreme returns of high-frequency stock data. The model is fit to daily series of minimum return and the empirical results support the strong evidence of the time-dependence among minimum returns.

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Modeling Threshold Conditional Heteroscedasticity with Regime-Dependent Skewness and Kurtosis**Philip Yu ***

The University of Hong Kong, Hong Kong SAR, China

Wai-Keung Li

The University of Hong Kong, Hong Kong SAR, China

Xixin Cheng

The University of Hong Kong, Hong Kong SAR, China

Xuan Zhou

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In this paper, a threshold autoregressive model enabling regime-dependent skewness and kurtosis is proposed. The Gram-Charlier (GC) density is used as the innovation density. A threshold ARCH model with GC density (TARCHSK) is examined and the Lagrange-Multiplier (LM) test is developed. The test statistic is similar to Wong and Li's (1997) LM test on threshold ARCH model but allowing regime dependent kurtosis. This kurtosis-adjusted feature renders more accuracy and robustness. We apply TARCHSK models to some foreign exchange rate series. Our kurtosis-adjusted test generates different conclusions from Wong and Li's test in that our test is more likely to accept the no threshold structure hypothesis. The model is then extended to threshold GARCH model with GC density (TGARCHSK). The model is applied to the S&P 500 Index Series. Results show that estimated model have smoother predicted variances than those obtained in the GARCH model.

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Dynamic Conditional Correlations for Realized Covariances**Manabu Asai** *

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Mike So

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We extend the dynamic conditional correlation model for the following two purposes. One is to work with the data of the realized correlation matrices, while the other is to capture the long-memory property of the volatility and correlations. We investigated the finite sample properties of the maximum likelihood estimator. For the datasets of Hong Kong stock exchange, we compare existing models with the new model in forecasting VaR thresholds.

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Finance VII [FIN7]

Contributed Session:

Wednesday, June 24, 10:00am-11:00am

Room: Ching

Distributed and Forecasted in Commodity Volatility**Wan-Hsiu Cheng**

Tamkang University, Taiwan

This paper utilizes the generalized skewed distributions and GARCH-type models to forecast the risk in the oil and gold markets. One of the characteristics of prices in oil and gold commodity markets is volatility, which is both high and variable over time. The contributions of this paper are: (1) calculating value-at-risk based on skewed generalized t distribution (SGT), a flexible tool for modeling the distribution of asset returns exhibiting skewness and leptokurtosis. The choice of an appropriate distribution for the innovation process is important since it directly affects the quality of the estimate of the required quantiles. (2) Various economic activities are considered in this paper, for example, the OPEC behavior, the oil-gold relationship, the level effects and other financial variables. Factor analysis is conducted first to determine the main influence variables in mean and variance equations. It will improve the estimate efficiency. (3) The rolling window approach is used to calculate the out-of-sample VaR forecasts. Rolling estimates is able to examine whether the estimation is stability and whether the structural change exists.

For the ambiguous empirical results in measuring value-at-risk within oil and gold markets, this paper provide a comprehensive analysis using a flexible distributions of SGT, rolling approach, and the various influence variables related to conditional volatility. Several expected results are reported: (1) The SGT distribution would be the most appropriate in describing the reality distribution for oil and gold assets. (2) The OPEC behavior will affect the oil and gold prices, however, the magnitude of influence is changing. (3) The level effect is important to volatility not only in interest rate model, but also in oil and gold markets. (4) The GARCH models with concept of asymmetric would be the better approximate models in the high volatility oil and gold markets.

Email: whcheng@mail.tku.edu.tw**Forecasting Intraday Value-at-Risk using Tick-by-Tick Data with Application to the Hong Kong Stock Exchange****Rui Xu ***

Department of Economics, School of Business and Management, The Hong Kong University, Hong Kong SAR, China

Mike So

Department of Information & Systems Management, The Hong Kong University of Science and Technology, Hong Kong SAR, China

This paper explores six GARCH-type models in the one-period-ahead forecast of Intraday Interval Value at Risk (IIVaR). Among the six models, three assumed normal distribution and the other three assumed t-error distribution; four models were modified GARCH models that incorporated Realized Volatility; all models incorporated seasonal indices to eliminate the influence of intraday seasonality. The objective is to explore properties of intraday stock data and assess the six models by their performance to forecast one-period-ahead IIVaR. The six models were applied to tick-by-tick transaction data of four constituent stocks of Hang Seng Index. The results indicated that normal assumption worked well for 5% IIVaR; whereas for 2.5%, 1% and 0.5% IIVaR, t-error models that incorporated Intraday Realized Volatility performed the best among the six, indicating that Realized Volatility had forecasting power for one-period-ahead intraday volatility.

Keywords: Intraday Interval Value at Risk (IIVaR), realized volatility, GARCH model

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[A Decision Rule to Minimize Daily Capital Charges in Forecasting Value-at-Risk](#)**Juan-Angel Jiménez-Martin ***

Complutense University of Madrid, Spain

Michael McAleer

Complutense University of Madrid, Spain

Teodosio Perez-Amaral

Complutense University of Madrid, Spain

Under the Basel II Accord, banks and other Authorized Deposit-taking Institutions (ADIs) have to communicate their daily risk estimates to the monetary authorities at the beginning of the trading day, using a variety of Value-at-Risk (VaR) models to measure risk. Sometimes the risk estimates communicated using these models are too high, thereby leading to large capital requirements and high capital costs. At other times, the risk estimates are too low, leading to excessive violations, so that realized losses are above the estimated risk. In this paper we propose a learning strategy that complements existing methods for calculating VaR and lowers daily capital requirements, while restricting the number of endogenous violations within the Basel II Accord penalty limits. We suggest a decision rule that responds to violations in a discrete and instantaneous manner, while adapting more slowly in periods of no violations. We apply the proposed strategy to Standard & Poor's 500 Index and show that there can be substantial savings in daily capital charges while restricting the number of violations to within the Basel II penalty limits.

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Combined Forecasting [CBF]

Contributed Session:

Wednesday, June 24, 10:00am-11:00am

Room: Tang I

Multifrequency Forecasting with SAS® High-Performance Forecasting Software

Michele Trovero *

SAS Institute Inc., United States

Ed Blair

SAS Institute Inc., United States

Michael J. Leonard

SAS Institute Inc., United States

Forecasters often deal with data accumulated at different time intervals (for example, monthly data and daily data). A common practice is to generate the forecasts at the two time intervals independently so as to choose the best model for each series. That practice can result in forecasts that do not agree. The forecasts generated with the less frequent data are usually more reliable in the long term because the number of multistep predictions in the forecasting horizon is smaller. Additionally, the higher-frequency data might display intermittent features that make the application of traditional time series models impractical.

This paper shows how the SAS High-Performance Forecasting HPFTEMPRECON procedure uses the low-frequency forecasts as a benchmark to adjust the higher-frequency forecast to take best advantage of both forecasts.

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[Exploiting the Panel Data Structure of a Survey of Forecasts: Searching for a Proper Combination Scheme](#)

Rocio Sanchez-Mangas *

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Pilar Poncela

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In this paper, we exploit the panel data structure of a set of forecasts for forecast combination. Given a set of 1-step ahead forecasts, we can consider them as generated by three mutually orthogonal components: an individual component along the forecasting sample, representing intrinsic characteristics of each forecaster; an aggregate component, varying through time and common to all forecasters; and the residual effect that cannot isolate neither an only individual nor an only aggregate effect. Our benchmark model for comparison is the average of forecasts at each period of time. It is known that this simple procedure is difficult to beat in practice. We propose a refinement of this simple procedure that consists of the panel data structure to come up with a less noisy combined forecast. We will use the Survey of Professional Forecasters to illustrate the proposed combining scheme.

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The Virtues of VAR Forecast Pooling - A DSGE Model Based Monte Carlo Study**Steffen Henzel** *

Ifo Institute for Economic Research, Germany

Johannes Mayr

Ifo Institute for Economic Research, Germany

Since the seminal article of Bates and Granger (1969), a large number of theoretical and empirical studies have shown that pooling different forecasts of the same event tends to outperform individual forecasts in terms of forecast accuracy. However, the results remain heterogeneous regarding the size of gains. As there are numerous sources for the large variation of the resulting gains, it is difficult to estimate the improvement in accuracy based on empirical findings. Consequently, we use Monte Carlo techniques which enable us to identify the gains of pooling from VAR forecasts under lab conditions. In particular, the results are allowed to vary with respect to sample size, forecast horizon, number of pooled forecasts, weighting scheme and structure of the model economy.

Given strict lab conditions, our setup of the experiment yields a quantification of the virtues that can be obtained in almost any forecast situation. The analysis shows that pooling leads to a substantial reduction of MSE of about 20%, which is comparable to the elimination of estimation uncertainty. Most notably, this reduction is already obtained with an average of about four different forecasts.

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Neural Network Models II [NNM2]

Contributed Session:

Wednesday, June 24, 10:00am-11:00am

Room: Ming I

Time Series Modeling using Artificial Neural Networks with Heteroskedastic Errors**Reinaldo Souza ***
PUC-RIO, Brazil**Soraida Aguilar V**
Universidad Nacional de Colombia, Sede Medellín. F, Colombia**Juan David Velásquez H**
Universidad Nacional de Colombia, sede Medellín. Facultad de Minas., Colombia

It has been commonly accepted that the modeling and forecasting of many time series is difficult due to their nonlinear characteristics, and there are not enough physical or economic laws that allow us to formulate appropriate parametric models. It has motivated the use of different nonlinear techniques including statistical tools, artificial neuronal network and hybrid models, among others. Most of the previous research concerns the modeling of nonlinearity in the mean or in the variance of the studied time series; but research concerning time series exhibiting nonlinearity simultaneously in mean and variance is scarce.

Our research is focused on this topic. We use an artificial neural network (multilayer perceptron or MLP) for capturing the nonlinearity in the mean combined with classical conditional variance models. Thus, we propose the use of hybrid models that we call MLP-ARCH, MLP-GARCH and MLP-IGARCH.

In addition, we propose a systematic strategy for model selection based on the nonlinearity test of White and on the likelihood ratio test. In order to determine the properties of the proposed models for small samples, a simulation Monte Carlo was realized; the results allow us to conclude that the model is able to recover itself and that the specification strategy works in a suitable way.

The proposed strategy was used to model three financial time series: the changes in closing prices of the shares of IBM, the German/ British (DEM2GBP) currency exchange rate returns and the excess monthly returns of the index S&P 500. The results show that the developed model is able to representing in a better way the dynamics of the analyzed time series in relation to other models reported in the literature.

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Some Further Insights in Neural Network Forecasting of Seasonal Time Series

Marcus O'Connor *

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This study investigates the use of MLP neural networks for the forecasting of monthly and quarterly seasonal time series. We present the results of an experiment conducted on M- and M3- Competition time series data to assess the relative accuracy of neural networks in forecasting monthly seasonal time series. The stimulus for this experiment derives from a growing recognition that any effort to generalize results in neural network forecasting must consider a comprehensive modeling approach and follow guidelines for rigorous evaluation of forecasting methods. Several previous studies have compared the effectiveness of neural networks with traditional methods. There is little consensus on whether neural networks can or cannot model seasonality. Various theoretical arguments and experimental evidences are presented by researchers in favour of both viewpoints. These studies have however, failed to take into account, the relative performance of neural networks across periods of time. Such a comparison provides new insights into the relative efficacy of neural networks. Our experiments follow a rigorous modeling approach and guidelines that include out-of-sample testing and the use of multiple error measures. The evaluation of neural networks and traditional methods on both monthly and quarterly data suggest that the relative performance of neural networks cannot be indiscriminately labeled as better or worse but would rather depend on several factors, the time period being forecasted being an important one. Hence the time period for which a forecast is being prepared must be taken into account when neural networks are applied to seasonal data.

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Telecommunications Forecasting [TEC]

Contributed Session:

Wednesday, June 24, 10:00am-11:00am

Room: Tang II

Model Adoption for Mobile Telephony Diffusion

Wen-Lin Chu *

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Feng-Shang Wu

Chengchi University, Taiwan

The Gompertz, Logistic and Bass models are the most often utilized models when analyzing mobile telephony diffusion. Forecasting is achieved by extrapolating the curves of selected models. Selecting the most appropriate diffusion model improves forecasting precision. However, no criteria have been developed for model selection. This study compares the performance of the three models using the data for mobile telephony diffusion in Asian countries. This is both a cross-country comparison and longitudinal comparison of different stages of the S-shaped diffusion curve of each country. Empirical results indicate that the most appropriate model is case-dependent, i.e., country-dependent, and stage-dependent when comparing different growth stages (e.g., origin, diffusion, and saturation stages) of the S-shaped diffusion curve of one country. Overall, the Gompertz model outperforms in the initial stages of the diffusion, and the Logistic is the best during take-off stages. Moreover, the Bass model degenerates into the Logistic model after the diffusion inflection point. The mechanisms of the Gompertz, Logistic and Bass models are analyzed to validate the experimental results. The analytical results of the longitudinal study are the first, to our knowledge, to present empirical evidence indicating that the best model for mobile telephony diffusion is stage-dependent, complementing the case dependency of diffusion models demonstrated by previous cross-sectional studies.

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Mobile Broadband Rollout Business Case: Risk Analyses of the Forecast Uncertainties

Nils Kristian Elnegaard

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The paper presents a comprehensive rollout analysis of HSPA in a medium large European country with an operator who already has a GSM network. The rollout coverage will be higher in the densest areas. It is also assumed that the traffic per user is higher in the densest areas. Forecasts for mobile broadband accesses and the traffic per user in the peak hour is an important part of the analysis. The traffic forecasts are used to make a strategy for upgrading the capacity of the base stations based on throughput calculations for upgrading with additional sectors, additional carriers and HSPA 3.6, 7.2 and 14.4 Mbps respectively.

Techno-economic calculations are performed for the rollout cases based on ARPU predictions, cost evolution of the network elements, evolution of operational and maintenance costs and assumption of future market share and competition. Net present value and yearly payback of the mobile broadband rollouts are calculated.

The long-term access and traffic forecasts are uncertain, the ARPU predictions are uncertain together with future cost predictions of network components and operational and maintenance costs.

To examine the uncertainty impact in the forecasts and predictions on net present value and yearly payback, risk analysis is performed. The risk analysis uses probability distributions of the forecasting and prediction errors to simulate the economic value of the rollout. The output of the simulations shows the uncertainty impact generated by the different predictions and forecasts.

The mobile broadband forecasts are presented in a companion paper at ISF2009¹.

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¹ Kjell Stordahl, "Long-term mobile broadband forecasts. Forecasting when number of observations is limited".

Long-term Mobile Broadband Forecasts. Forecasting When Number of Observations is Limited

Kjell Stordahl

Telenor Norway

Mobile broadband is a rather new service, mainly introduced in 2006-2007. However, there has been a remarkable increase in broadband subscriptions in many countries since its introduction. In addition, the data traffic per subscription is exponentially increasing. Hence, additional investments are necessary to expand the network for carrying the mobile broadband traffic.

The availability of international mobile broadband statistics is limited. The operators have of course their own statistics, but international overview of mobile broadband statistics is so far missing except for information conducted by some consultant companies.

Long-term mobile broadband forecasts for subscriptions, traffic and income are necessary for investment strategies and rollout of 3G and 4G mobile networks with the technologies WCDMA, HSPA and later LTE. The forecasts are used as input for calculations of the economic value— net present value, internal rate of return and payback—for the rollouts.

The paper discusses different approaches for long-term forecasting like the Scenario method, Delphi method and other quantitative models. The models selected are diffusion models. The approach for the subscription model has been to estimate growth parameters based on the few available yearly observations and use additional information to estimate the saturation level separately. Demographic data of population and labor force and information of the penetration of mobile SIM card subscriptions for the consumer and business market are used in the estimation.

The mobile broadband traffic forecasts are difficult, because of the fast evolution mobile broadband applications. The mobile traffic forecasts are compound by forecasts of number of mobile broadband subscriptions and traffic forecasts per subscription.

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Technology and Innovation Forecasting II [TIF2]

Contributed Session:

Wednesday, June 24, 10:00am-11:00am

Room: Ballroom A

[A Diffusion Model with Non-uniform Internal Influence for New Product Demand Forecasting](#)**Satoshi Munakata ***

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In recent years, the release interval of high-tech products such as mobile phones is getting shorter and shorter. Thus, high-tech manufacturers desire to minimize excessive inventory because the value of the previous model plummets after the launch of a new model. The length of the sales record for each high-tech product is very short due to frequent new model launches. Accordingly, the accurate demand forecasting of new products with short sales record is required. The Bass model is a well-known diffusion process model and has three parameters which are the number of potential adopters, the coefficient of innovation, and the coefficient of imitation. It is known that the parameters of the model can be estimated with short-term sales record. Thus, the model is often employed for the demand forecasting of just-released new products. However, it is also known that the Bass model sometimes fails to achieve satisfactory forecasting performance. Some researchers pointed out that it is because the coefficient of imitation of Bass model which represents the word-of-mouth effect remains constant over the product's life-cycle whereas the actual word-of-mouth effect varies from time to time. In this paper, a new diffusion model called PNE model is proposed in order to overcome the limitation of the Bass model. It is an extension of a negative exponential diffusion model and has non-uniform word-of-mouth effect. From the observation of the actual sales records of high-tech products, we presume the word-of-mouth effect of the products in initial phase is larger than that in decline phase. PNE model is developed according to the presumption. The forecasting performance of PNE model is evaluated with the actual sales record of high-tech products and compared to the Bass model. It is confirmed that PNE model outperforms the Bass model in forecasting high-tech products.

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Improving Public Sector Services: Forecasting and Innovation**Yiannis Polychronakis**

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New modes of innovation in the public sector, notably national health systems, draw attention to "open innovation" and "user led innovation". That it to say the firm is not the center of innovation but rather an enabler. Furthermore, public sector organizations (such as primary care trusts) have been accused of not being innovative enough in service development and delivery. This is due to the fact that innovation is seen as a very "risky business" at a highly regulated and strictly managed public sector. In that respect, public sector organizations have also been accused of being "data rich but information poor". World class commissioning calls for innovative solutions in handling the problem of inappropriate usage of data to forecast future trends and needs in the area of health sector. It also calls for the appropriate collection of data in the first place at both the user end and the supplier end. This work, in association with primary care trusts, looks at introducing innovation as an integral part of the planning processes through the institution of formal forecasting procedures.

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[New Forms of Consumer Communication and Their Implication for New ICT Product Forecasting](#)

Tun-I Hu *

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Robert Fildes

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Recent years have seen the dramatic growth of new forms of communication. Besides using land-line and mobile phone for voice real-time communication, people spend increasing amounts of time reading and sending messages through social networks (e.g. Myspace or Facebook) and also via real-time communication software (e.g. Skype or MSN). As indicated by the significant decline on the amount of call volumes of land line and mobile phone during the period from 2000 to 2006 in UK and in Taiwan, we conjecture that consumers are transferring to these new forms of communication in order to satisfy their communication needs, diminishing the demand for established channels.

Various technology and telecommunications media such as land-line, mobile phone, short message service (SMS), E-mail, instant messaging and social networks have been categorized depending on each product's attributes. Attributes identified as potentially important include synchronism, multi-tasking, quality of speed, price, mobility and privacy. The purpose of this research is to develop methods to analyse the perceived value and weight of the specific attributes that drive people to adopt these communication media. Various existing methods will be considered including choice models based on intentions data, conjoint analysis and simple multi-attribute rating techniques.

Importantly, in order to distinguish consumers' intended media adoption and clarify the effects of different scenarios, two factors (time length and nature of communication) have been used to design six communication scenarios for the experimental design. This research will address the corresponding substitution effects under different scenarios that will be used to forecast end users' usage pattern, a critical element in the investment decisions made by telecommunications and internet providers. In this presentation we present preliminary results aimed at establishing substitution effects, comparing the results of existing methods and how this may affect forecasts of usage of these alternative communication channels.

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Featured Speech [FS3]

Featured Session:

Wednesday, June 24, 11:10am-12:10pm

Room: Ballroom BC

[Forecasting Support Systems and the Combination of Soft and Hard Information](#)

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The most common approach to forecasting in manufacturing and operations uses a statistical model within a forecasting support system (FSS) to produce a forecast. This is subsequently judgmentally adjusted to take into account any exceptional circumstances expected over the planning horizon based on both soft and hard data. Such forecasting support systems are wide spread, expensive and often poorly designed. Nor are they much researched. But the effect of such limited systems is increased forecast error.

Based on company case studies we have shown that improvements can be achieved over the statistical system forecast by effective judgmental adjustment. However, the company forecasts turned out to be inefficient and unnecessarily inaccurate in combining information. They all suffered from similar errors, depending on the direction and strength of information that the companies believed they possessed. We show here how non-linear models of the adjustment process can illuminate just what is going wrong. While various combining algorithms can be used to improve forecast accuracy, in practice it will prove difficult to capitalize on these inefficiencies. After examining the limitations of such systems in use, we suggest that a possible, indeed perhaps the only, route forward is through improved forecasting software design. We pose a series of challenges which FSS designers need to overcome if the substantial potential for improvement is to be achieved. Our claim in this presentation is that Forecasting Support Systems should lie at the heart of forecasting research if improvements are to be achieved in practice.

Robert Fildes is Professor of Management Science in the School of Management, Lancaster University and Director of the Lancaster Center for Forecasting. He was co-founder in 1981 of *the Journal of Forecasting* and in 1985 of the *International Journal of Forecasting*. For ten years from 1988 he was Editor-in-Chief of the IJF. He was president of the *International Institute of Forecasters* between 2000 and 2004. His research interests are concerned with the comparative evaluation of different forecasting methods, the implementation of improved forecasting procedures in organizations and the design of forecasting systems.

Paul Goodwin is Professor of Management Science in the Management School at the University of Bath (UK). He has a PhD in Management Science from Lancaster University. His research interests concern the role of management judgment in forecasting and decision making and he has published three books, and over forty research papers in journals. In addition, he is an Associate Editor of the *International Journal of Forecasting*, and three other international journals and was, until recently, a Director of the International Institute of Forecasters. With colleagues at Lancaster University he recently completed a large UK government funded research project that investigated the use of forecasting systems in supply chain companies.

Finance VIII [FIN8]

Contributed Session:

Wednesday, June 24, 11:10am-12:10pm

Room: Tang I

Forecasting UK Mortgage Default: A VAR Approach**Warapong Wongwachara ***

Darwin College, University of Cambridge, United Kingdom

Stephen Satchell

Trinity College, University of Cambridge, United Kingdom

The objective of this paper is to examine out-of-sample performance of competing econometric models that forecast the UK national rate of mortgage possessions. We adopt the Satchell and Chan's (2005) single-equation three-stage forecasting model, and formulate its Vector Autoregressive (VAR) counterpart. Using semi-annually data from 1990S1-2003S2, we estimate four classes of models: (i) univariate time series models for possessions; (ii) Satchell and Chan's models; (iii) VAR models for loan-to-value ratio, arrears, and possessions; and (iv) VARX models in which five additional macroeconomic variables (GDP growth, house price growth, mortgage rate, unemployment rate, and affordability) enter the VAR system. We generate ex ante real-time expanding-window forecasts for the holdout sample (2004S1-2008S1). The VAR-type models seem to produce forecast values that "track" actual rates of possessions better than the other two models do. Forecast evaluation, using conventional statistical criteria, supports VARX as the best forecasting model. Mincer-Zarnowitz regressions show that all our forecasts—except the Satchell-Chan type—are unbiased. Among these unbiased forecasts, we also find that the VARX encompasses the univariate model, but does not encompass the VAR.

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Constrained Factor Models**Henghsiu Tsai ***

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Ruey S. Tsay

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Factor models have been widely used in recent years to improve the accuracy of forecasting when many explanatory variables are available. However, the models often encounter the difficulty of over-parameterization and factor interpretation. In this paper, we consider constrained factor analysis to obtain a parsimonious factor model and propose likelihood ratio statistics to test the adequacy of factor constraints. Real and imulated examples are used to demonstrate the proposed analysis. In an application, we show that the constrained factor analysis can provide a better understanding of variations in monthly financial asset returns.

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The Semi-Parametric Examination of Industry Risk: The Australian Evidence

Juan Yao

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This paper examines the time variation form of the systematic risk measurement, betas, of Australian industry sectors. By using a semi-parametric approach, the variation of the systematic risk measurement, beta, is a combination of one stable parametric component and one varying non-parametric component. Two categories of industries are identified. The Energy, Material, Mining, Industrial, and Property Trust Industries have a generally increasing beta for most of the sample period, while the Consumer Discretionary, Financials Excluding Property Trust, IT and Telecommunications have a decreasing beta for the same period. The betas of Health and Utility industry are more stable than others. The variation of industry risk is linked with the market condition as well as the change of interest rates.

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Energy Sales and Markets VI [ESM6]

Contributed Session:

Wednesday, June 24, 11:10am-12:10pm

Room: Ching

[Using Hierarchical Profiling Approach \(HPA\) Forecasts of Multi-year Half-hourly Electricity Consumption as a Tool in Energy Management](#)**Hasan Al-Madfai ***

University of Glamorgan, United Kingdom

Akinbami Akinwale

University of Glamorgan, United Kingdom

Steve Lloyd

University of Glamorgan, United Kingdom

Steve Thomas

University of Glamorgan, United Kingdom

Steve Lakin

University of Glamorgan, United Kingdom

Energy management is an emerging field that aims chiefly to reduce energy costs incurred by organizations across a wide range of sectors. Established energy management tools are normally based on frequency-domain process control methods which ignore the time-driven components of the data.

This paper develops a forecasting-based energy management approach using the Hierarchical Profiling Approach (HPA). The HPA was developed as a forecasting approach and has been successful in modeling ill-behaved and complex time series data. It decomposes variability in time series into deterministic and stochastic components. This work extends the application of the HPA to develop prediction intervals (PI) for the HPA forecasts and calibrates these intervals to inform energy management and control operations.

The HPA was used to model the multi-year half hourly electricity consumption at an indoor sports center in South Wales, UK. The deterministic component of the HPA was used to explicitly model the event driven disturbances, the multiple seasonal patterns, the cyclicity and trend in a hierarchical setup while the stochastic component was modeled using ARIMA. High resolution electricity consumption data is complex by nature but the HPA forecasts performed as well as models from established approaches, giving MAPE < 10%. However, through hierarchical modeling the HPA provided superior understanding of the underlying dynamics of the sport center's electricity consumption and provided consumption profiles for the trend, base-load and the seasonal variations. The 99% PI for the forecasts were found to better represent the variability of the data. These forecasts and PI can be useful in evaluating consumption control interventions and as warning systems in detecting irregular demand patterns.

This work is part of a collaboration programme with RUMM Ltd., a leading energy management company based in South Wales, whose data is the subject of this work.

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Cointegration between Energy Markets: Analysis of Nord Pool and ICE Energy Commodities

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As energy markets in Europe become increasingly integrated, this paper investigates the cointegration between Nord Pool and ICE energy commodities. In particular, we use price series of the 1 month 1-position and 6-position forwards and futures contracts; and the 1 quarter 6-position contracts. Energy commodities analyzed include electricity, Brent crude oil, Rotterdam coal and natural gas.

Knowledge of how the prices of different energy commodities are related can be used to construct better models for both hedging and prediction of future prices. Cointegration between energy markets provides us with alternative models for prediction of future prices. A number of researchers, e.g. Engle and Yoo (1987) and Stock (1995) have shown that incorporating cointegration into the forecasting model can reduce mean squared forecast errors by up to 40 percent at certain time periods. In the short run, forecasting is useful in risk management and in the pricing of derivative contracts. In the longer run, forecasting is important for successful planning and is typically an integral part of investment decision making.

For the 1 month contracts, we find that cointegration exists between UK electricity and natural gas as well as between UK electricity and coal. A possible explanation is that natural gas and coal are used as inputs in electricity generation in the UK. We find no cointegration in Nord Pool electricity in either case, possibly because hydro power is the main input in the electricity underlying the contracts traded in Nord Pool. For the 1 quarter contracts, we find cointegration between UK electricity and natural gas.

Where cointegration exists, we establish Error Correction Models which will be of interest to market participants wishing to forecast future prices of electricity with models of high transparency and low complexity.

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Forecasting Techniques II [FT2]

Contributed Session:

Wednesday, June 24, 11:10am-12:10pm

Room: Tang II

Evolution of Forecast Disagreement and Uncertainty in a Heterogeneous Agents Model**Kajal Lahiri ***

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Using monthly individual forecasts from Blue Chip Surveys during 1978-2008, we examine different pathways to forecast disagreement and uncertainty. Professional forecasters are seen to hold different prior beliefs at the beginning of each forecasting round and revise their forecasts differently after observing public signals. Disagreement is postulated to have three components due to differences in: i) the initial prior beliefs, ii) the weights attached on priors, and iii) interpreting public information. The fixed-target, multi-horizon feature of the panel data allows us to estimate the relative importance of each time varying component precisely. The analysis is then linked to the dynamics of forecast uncertainty over horizons and target years.

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Forecasting Market Inefficiency in Competitive Events: Estimating the Winning Probabilities of Strong Favourites**David McDonald ***

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This paper develops a method of identifying those favourites in horserace betting markets which represent more profitable betting opportunities. In particular, prices are used to categorize strong favourites in the UK bookmaker market. Many empirical studies have found a favourite-longshot bias in racetrack betting markets, where bettors consistently overestimate the chances of longshots. This paper finds that, in addition to a favourite-longshot bias, there also exists a pricing anomaly such that the probability of favourites, with the same market price, winning a race, depends on the makeup of the rest of the field (even in markets with the same bookmaker over-round). Specifically, strong favourites, in races where each competitor has a low probability of winning, can offer better value. An empirical study, using a dataset of 8,545 races across 60 UK racetracks, demonstrates that indeed strong favourites have significantly higher winning probabilities. A Kelly betting strategy is employed to show improved returns when limiting choices to these strong favourites. This paper adds to the existing favourite-longshot bias literature, illustrating not only that favourites provide better value in general, but further that stronger favourites can be identified which are even more profitable.

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[Non-parametric Time Series Forecasting with Dynamic Updating](#)**Han Lin Shang ***

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Rob Hyndman

Monash University, Australia

We present a non-parametric method to forecast a seasonal time series. This method is to consider a univariate time series as a high-dimensional vector time series. We propose first to reduce the dimensionality by principal component analysis of the matrix of historical observations, and then to apply time series forecasting and regression techniques. As new observations become available, our three proposed dynamic updating methods can adjust forecasts for the remaining time period, thus improving point forecast accuracy. We also investigate a non-parametric bootstrap method to construct prediction intervals and compare the empirical coverage probability with an existing parametric method. Our approaches are data-driven and computationally fast, are thus feasible to be applied in real-time dynamic updating, as demonstrated by monthly El Nino time series from 1950 to 2007.

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Travel and Tourism Forecasting V [TTF5]

Contributed Session:

Wednesday, June 24, 11:10am-12:10pm

Room: Ming I

An Advanced Web-based Tourism Demand Forecasting System**Bastian Zixuan Gao** *

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The study aims to improve the existing web-based tourism demand forecasting system (WTDFS) using advanced network technologies. The new WTDFS would be fully automatic and a key distinction between the new WTDFS and the previous WTDFS is that the architecture of Java Server Pages (JSP) instead of Active Server Pages (ASP) will be used in the design of the new WTDFS. Another advantage of the new WTDFS is that the forecasting models are embedded in the WTDFS itself through R, a statistical programming language that is compatible with JSP. This allows a free transmission of the data between the forecasting models and the web system. The system also allows users to input their own data for forecasting from web browsers at various locations simultaneously. Therefore, this system is known as an intelligent forecasting system with a real-time interactive forecasting feature.

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An Analysis of Quality Estimations of Flash Indicators and Forecasts in Tourism Destinations: A Case Study: The Tourism Barometer of the Canton of Valais, Switzerland**Miriam Scaglione**

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Since 2006 the barometer of tourism of the canton of Valais produces estimations of tourism frequentation biannually (for the summer and winter season) for the latest months of the past season (flash estimations) and forecasts for the following season for each one of the 19 Valais' destinations. The method used is structural time series with the use of Stamp, a software version of Andrew Harvey's program for estimating structural time series models.

These estimations use several explanatory variables including receipts from the main supermarkets and drugstores, electricity consumption, the amount of trash and used water, and transportation statistics (cars and train frequentation).

This research project analyzes which factors affect the quality of estimations and forecasts: this could include variables such as the intensity of tourism for each destination (the ratio between inhabitants and numbers of overnights), the month forecasted or estimated (high or low season), changes in accommodation capacity, weather factors, holidays that vary such as Easter or the combined effects of Easter and Saint Joseph's day, and the percentage of national and foreign overnights.

Another difficulty is that the set dependant variables are not the same for all destinations. The theoretical methodology underpinning the study will be the measures of errors proposed in Hibon and Makridakis (2000).

The M3-Competition: Results, Conclusions and Implications, *International Journal of Forecasting*, vol. 14 N.4 pp 451-464.

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International Institute of Forecasters

The International Institute of Forecasters (IIF), a non-profit organization founded in 1981, is dedicated to developing and furthering the generation, distribution, and use of knowledge on forecasting through the following objectives:

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- Contribute to the **professional development** of analysts, managers, and policy makers with responsibilities for making and using forecasts in business and government.
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