



The Nineteenth International Symposium on Forecasting

ISF'99



June 27 - 30, 1999
Washington, D.C.

INTERNATIONAL INSTITUTE OF FORECASTERS

ISF'99

**The Nineteenth
INTERNATIONAL
SYMPOSIUM
ON
FORECASTING**

WASHINGTON, D.C. U.S.A.

June 27-30, 1999

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ISF'99

The 19th International Symposium on Forecasting

Washington, DC
June 27-30, 1999

GENERAL CHAIRPERSON

Peg Young
Immigration & Naturalization Service
425 I Street, NW (Room 5309)
Washington, DC 20536
USA
Phone: (202) 514-9090
Fax: (202) 305-0036
email: pegyoung@ix.netcom.com

PROGRAM CHAIRPERSON

Karen S. Hamrick
USDA Economic Research Service
1800 M Street, NW (MS 2061)
Washington, DC 20036-5831
USA
Phone: (202) 694-5426
Fax: (202) 694-5642
email: khamrick@econ.ag.gov

EXHIBITS CHAIRPERSON

John H. Phelps
Health Care Financing Administration
(N3-24-14)
7500 Security Blvd.
Baltimore, MD 21244-1850
USA
Phone: (410) 786-7939
Fax: (410) 786-6371
email: JPhelps@hcfa.gov

PUBLICITY CHAIRPERSON

Stephen A. MacDonald
USDA Economic Research Service
1800 M Street, NW (Room 5011)
Washington, DC 20036-5831
USA
Phone: (202) 694-5305
Fax: (202) 694-5823
email: Stephenm@econ.ag.gov

AT-LARGE

Herman O. Stekler

MESSAGE FROM THE GENERAL CHAIRPERSON

On behalf of the ISF'99 Organizing Committee and the International Institute of Forecasters (IIF), I welcome you to the 19th International Symposium on Forecasting in Washington, D.C.

One of the goals of this Symposium is to bring together individuals involved in the research and practice of forecasting in order to share ideas and research results. In particular, we hope to establish new links with those who have traditionally attended the symposium in the past and the newer attendees from the realm of government forecasters. By sharing techniques, concerns, ideas and data, perhaps new avenues of research can be developed to create forecasts.

We have also attempted to highlight the fact that three forecasting events are taking place in Washington, D.C. this summer. The Federal Forecasters' Conference took place last week (June 24), and the World Future Society's Ninth General Assembly will be taking place on July 27 to August 1. The existence this year of all three conferences in Washington brings home the point that Washington is an international center of forecasting activity.

We hope you find the 19th International Symposium on Forecasting to be a enjoyable event. We also hope that you get to take pleasure from the sights and sounds of this city.

Sincerely,

Peg Young, Ph.D.
General Chair, ISF'99



ISF 99 ORGANIZING COMMITTEE

GENERAL CHAIR:	Peg Young (Immigration & Naturalization Service)	pegyoung@ix.netcom.com
PROGRAM CHAIR:	Karen Hamrick (Economic Research Service)	khamrick@econ.ag.gov
PUBLICITY CHAIR:	Steve MacDonald (Economic Research Service)	stephenm@econ.ag.gov
AT-LARGE:	Herman Stekler (George Washington University)	hstekler@gwis2.circ.gwu.edu
LIAISONS:		
Academic:		
University of Maryland:	Ralph Monaco	ralph@inforum.umd.edu
Loyola College:	LeRoy Simmons	LFS@mailgate.loyola.edu
United Nations University:	Jerome Glenn	jglenn@ipe.apc.gov
Corporate:		
Federal Forecasters Group:	Pamela Geriner (Lockheed / Martin)	pgeriner@mitre.com
World Future Society:	John DeSaix (National Association of Security Dealers)	desaixj@nasd.com
American Statistical Association:	Debra Gerald (National Center for Education Statistics)	Debra_Gerald@ed.gov
Washington Statistical Society:	Kenneth Hunter	khunter100@aol.com
Washington Forecasters:	Jeffrey Osmint (U.S. Geological Survey)	josmint@usgs.gov
	Linda Atkinson (Economic Research Service)	atkinson@econ.ag.gov
	George Wesley (Dept. of Veterans Affairs)	George.Wesley@mail.va.gov
INTERNATIONAL CONTACTS:		
United Kingdom:	Nigel Meade (Imperial College, London, UK)	nme@ic.ac.uk
European:	Michele Hibon (INSEAD, France)	Michele.hibon@insead.fr
Pacific Rim:	Michael Lawrence (UNSW, Australia)	m.lawrence@unsw.edu.au
Latin America:	Reinaldo Castro Souza (PUC-RIO, Brazil)	Reinaldo@ele.puc-rio.br
WEBMASTER:	Monica Adya (University of Maryland - Baltimore Campus)	adya@umbc.edu
LOCAL ARRANGEMENTS:	Mike Fries (Diversified Engineering)	

ACKNOWLEDGMENTS

The ISF'99 Organizing Committee would like to thank the following for their support:

Organizations:

Immigration & Naturalization Service
Federal Forecasters' Organizing Committee
USDA Economic Research Service
VA Office of Inspector General
World Future Society

Session Organizers:

J. Scott Armstrong, University of Pennsylvania
Jan Beran, University of Konstanz
Prasad V. Bidarkota, La Trobe University
Robert Fildes, Lancaster University
Wilpen Gorr, Carnegie Mellon University
Karen S. Hamrick, USDA Economic Research Service
Michele Hibon, INSEAD
Robert E. Jarrett, U.S. Army Environmental Policy Institute
Colin Jex, Lancaster University
Frederick L. Joutz, The George Washington University
Suchada Langley, USDA Economic Research Service
Hans Levenbach, Delphus Inc.
Brian Monsell, U. S. Bureau of the Census
Gulnur Muradoglu, Warwick Business School
Lars-Erik Oller, National Institute of Economic Research, Sweden
James W. Taylor, London Business School

GENERAL INFORMATION

Meals

Breakfasts (7:00 a.m.- 8:30 a.m.) and lunches (12:15- 1:45 p.m.) will be held in the Congressional Room.

Complimentary Coffee Breaks

Refreshments will be made available in the Exhibit Area at the mid-morning (10:00 – 10:30 a.m.) breaks on Monday, Tuesday, and Wednesday and mid-afternoon (3:30 – 4:00 p.m.) breaks on Monday and Tuesday.

Registration

The Symposium registration desk is located in the Foyer on the second floor of the hotel. Desk hours are:

Sunday	June 27	1:00 – 5:30 p.m.
Monday	June 28	7:30 – 9:00 a.m.
Tuesday	June 29	7:30 – 9:00 a.m.
Wednesday	June 30	7:30 – 9:00 a.m.

Badges

Your ISF'99 badge serves as a pass for all program sessions, exhibits, and special events. PLEASE WEAR YOUR BADGE AT ALL TIMES WHILE ATTENDING SYMPOSIUM EVENTS.

USA HOSTS Tour Desk

There will be a USA HOSTS representative in the Exhibit area during the morning and afternoon hours to help persons with tours, social events and other sightseeing information.

PRE-CONFERENCE WORKSHOPS

Sunday, June 27, 1999

Workshop 1: Elements of Forecasting (Ohio Room)

This short course will follow in outline the recent textbook 'Elements of Forecasting' by Francis Diebold. It is intended for those needing an introduction or review of analytic forecasting techniques. Topics to be covered include ARIMA, smoothing, and regression models and forecast evaluation and combination. Examples will be demonstrated using the econometric package EViews. Both the textbook and the student version of the software will be provided to each student.

Hosted by Charlie Hallahan, Economic Research Service, U.S. Department of Agriculture.

4 hours: 1:00 p.m. - 5:00 p.m. **Fee: \$200**

Workshop 2: Robust Regression Analysis of Time Series Data (California Room)

This will be a comprehensive examination of forecasting models, focusing on robust methods capable of identifying very accurate lead and lag effects. Straightforward approaches, using real data, will be used to construct powerful models incorporating the detection of local time trends and level shift variables, changes in parameters and model forms.

Participants are invited to submit data (<http://www.autobox.com>), which will be used in this seminar. Participants will receive a student version of AUTOBOX along with the User's Guide, plus 90 days of free telephone consulting time, a value of more than \$2500.

Hosted by David Reilly, Automatic Forecasting Systems, Inc.

4 hours: 1:00 p.m. – 5:00 p.m. **Fee: \$250**

Please Note:

Workshops are not a part of the regular ISF program. Separate registration fees are required and are payable in advance (on registration form) or at the registration desk.

SOCIAL EVENTS

Sunday, June 27, 1999

WELCOMING RECEPTION

An informal reception will be held at the Capital Hilton.
2 hours: 5:00 p.m. to 7:00 p.m. Cost included in the registration fee.

Monday, June 28, 1999

AN EVENING AT THE EMBASSY OF THE RUSSIAN FEDERATION

A buffet reception will be served the Embassy of the Russian Federation, originally called the Soviet Embassy Complex, built in Washington in 1974 on Twelve acres near the Washington Cathedral and Georgetown. Transportation to and from the Capital Hilton will be provided.
3 hours: 7:00 p.m. to 10:00 p.m. Cost included in the registration fee.

Tuesday, June 29, 1999

ABOARD THE ODYSSEY DINNER CRUISE

Dinner and dancing on board the Odyssey, which cruises along the historic and scenic shores of the Potomac, from the heart of the District to Georgetown. Transportation to and from the Capital Hilton will be provided.

4 1/2 hours: 6:00 p.m. to 10:30 p.m. Fee: \$50.00 per person.

COMMITTEE MEETINGS

Saturday, June 26, 1999

International Institute of Forecasters (IIF) Board Meeting of Directors
3:00 p.m. - 7:00 p.m.
New York Room

Sunday, June 27, 1999

International Institute of Forecasters (IIF) Board Meeting of Directors
(continued)
1:00 p.m. - 3:00 p.m.
New York Room

International Journal of Forecasters Editors / Associate Editors Meeting
3:00 p.m. - 5:00 p.m.
New York Room

Tuesday, June 29, 1999

Future Organizers of International Symposiums on Forecasting
7:00 a.m. - 9:00 a.m. [Breakfast meeting]
Sales Conference Room

EXHIBITORS AT ISF'99

Exhibits will be located in the Senate Room. Exhibit Hours are 9:00 a.m. to 5:00 p.m. on Monday and Tuesday, and 9:00 a.m. to 1:00 p.m. on Wednesday.

SAS Institute Inc.	Address:	Cary, NC 27513 USA
	Contact:	Renee Samy
	Phone:	(919) 677-8000
	Fax:	(919) 677-4444
	Email:	sasras@wnt.sas.com
SPSS Inc.	Address:	233 S. Wacker Drive, 11 th Floor Chicago, IL 60606 USA
	Contact:	Pam Cozzi
	Phone:	(312) 651-3
	Fax:	(312) 651-3668
	Email:	pcozzi@spss.com
Automatic Forecasting Systems	Address:	P.O. Box 563 Hatboro, PA 19040 USA
	Contact:	David Reilly
	Phone:	(215) 675-0652
	Fax:	(215) 672-2534
	Email:	dave@autobox.com
Business Forecasting Systems, Inc.	Address:	68 Leonard Street Belmont, MA 02178 USA
	Contact:	Eric Stellwagen
	Phone:	(617) 484-5050
	Fax:	(617) 484-9219
	Email:	76773.7634@compuserve.com
Elsevier Science	Address:	655 Ave. of the Americas New York, NY 10010 USA
	Contact:	Carol Dellicicchi
	Phone:	(212) 633-3765
	Fax:	(212) 633-3112

EXHIBITORS AT ISF'99
(continued)

John Wiley & Sons	Address: Baffins Lane Chichester, Sussex PO19 1UD UK Contact: Sophie Honeybourne Phone: +44 1243 770 581 Fax: +44 1243 770 432 Email: shoneyb@wiley.co.uk
Blackwell Publishers	Address: 350 Main Street Malden, MA 02148 USA Contact: Alison Denby Phone: (781) 388-0401 Fax: (781) 388-0501 Email: aande@blackwellpub.com
Smart Software:	Address: Four Hill Road Belmont, MA 02748-4349 USA Contact: Pattie Camilli Phone: (617) 489-2743 Fax: (617) 489-2748 Email: pattie@smartcorp.com
John Galt Development, Inc.	Address: 39 S. LaSalle, Suite 815 Chicago, IL 60603 USA Contact: Kai Prepte Phone: (312) 701-9026 Fax: (312) 701-9033 Email: craft@johngalt.com
ISF2000	Address: New Jersey Institute of Technology Newark, NJ 07102 USA Contact: Nuno Crato Phone: (973) 596-3427 Fax: (973) 596-6467 Email: ncrato@m.njit.edu

USA HOSTS



Corporate Forecasting Award

The Directors of the *International Institute of Forecasters* are please to announce that the third Corporate Forecasting Award is made to British Telecom (UK), where the work was done by the "The Modelling & Analysis Team from the Products & Solutions Division of BTUK."

For many years, this group has made a continuing and effective contribution in British Telecom to the development of forecasting linked to issues in pricing, advertising and regulation. Their work has included a continuing contribution to research and training in forecasting. In particular, the award is made because of the successful development of a 'Forecasting Support System', TIDeS, which is described below.

The last 10 to 15 years have seen enormous structural change in the UK telephony market. The challenge to forecasters has been to retain the traditional strengths of whole market models, while adding the ability to flex a range of product and carrier development scenarios. They have also had to balance the need to understand and model the increasing complexity of the market place with the commercial pressures for greater forecasting accuracy and efficiency.

Within BT, this has led to the development of a unified forecasting system, TIDeS, written in SAS, working on a UNIX platform. It enables econometric based whole market demand to be segmented by customer, product & carrier, before applying generic price and optional discounting assumptions to derive revenues. It is a user friendly screen driven system, underpinned at all stages by comprehensive on-screen diagnostics and a report writing capability. Prior to the development of TIDeS, telephony service forecasting was carried out using spreadsheets - most of which were becoming increasingly difficult to operate as the number of competitors multiplied, new products (such as ISDN) assumed a greater importance, substitute services (such as mobile communications) played an increasing role, and it became increasingly necessary for volume forecasts to reflect pre-assigned top line revenue targets accepted by BT's Managing Directors.

BT's current planning process requires detailed volume and revenue forecasts for each year's annual operating plan, and projections of a less detailed nature covering a five year planning horizon. TIDeS is now used to support the production of both. In addition, demand forecasts play a major role in regulatory debates, eg the setting of the value of the price cap in the Network and Retail price controls. TIDeS is being used to provide the additional detail over and above the standard five year plan outputs which will be needed in the base case forecasts for the next round of negotiations with the regulator, Ofcom. It is also being used in other projects, such as in the support of negotiations over BT's Business Rating Valuation.

Although the implementation proved more complex than originally envisaged, BT is now benefiting from the investment through increased flexibility, improved accuracy, the ability to carry out more complex analysis, and increased forecasting efficiency. TIDeS provides a forecasting service that will meet anticipated divisional needs over a number of years.

PAST PRESIDENTS OF THE IIF

J. Scott Armstrong	1982 - 1983
The Wharton School, USA	
Spyros Makridakis	1984 - 1985
INSEAD, France	
J. Scott Armstrong	1986 -1988
The Wharton School, USA	
Estelle Dagum	1988 -1989
University of Bologna, ITALY	
Robert Winkler	1989 - 1990
Duke University, USA	
Everette Gardner, Jr.	1990 - 1992
University of Houston, USA	
Stuart Bretschneider	1992 -1994
Syracuse University, USA	
Hans Levenbach	1994 - 1996
Delphus, Inc., USA	
Michael Lawrence	1996 - 1999
University of New South Wales, Australia	
Robert Fildes	1999 -
Lancaster University, UK	

PREVIOUS ISF CONFERENCE VENUES

Year	Place
	Quebec City, Quebec, Canada
	Istanbul, Turkey
	Philadelphia, PA, USA
	London, England
	Montreal, Quebec, Canada
	Paris, France
	Boston, MA, USA
	Amsterdam, The Netherlands
	Vancouver, British Columbia, Canada
	Delphi, Greece
	New York, NY, USA
	Wellington, New Zealand
	Pittsburgh, PA, USA
	Stockholm, Sweden
	Toronto, Ontario, Canada
	Istanbul, Turkey
	Bridgetown, Barbados, West Indies
	Edinburgh, Scotland
	Washington, DC, USA

Keynote
Room: Presidential Ballroom

Monday
8:30 -10:00

Outlook of the Global Economy

Flemming Larsen

Deputy Director, Research Department
International Monetary Fund (IMF)
700 19th Street, NW
Room 10-700
Washington, DC 20431
USA
flarsen@imf.org

Flemming Larsen has held the senior responsibility for the International Monetary Fund's *World Economic Outlook* since 1992. Flemming has been with the IMF since 1985, when he started as a Senior Economist, and subsequently the Assistant Division Chief, Current Studies Division, of the Research Department of IMF. In 1988, he was promoted to Division Chief of the Current Studies Division. From 1990 to 1992, while on leave from IMF, he held the position of Division Chief of the European Commission in Brussels, with the responsibility for international monetary affairs.

Prior to his work at IMF, he was an Economist, and subsequently Senior Economist, at the Economics Department of OECD in Paris from 1974 to 1984. From 1984 to 1985, he held the position of the Director of Forecasting, World Economic Service, at Wharton Econometrics in Philadelphia.

Introduced by DeLisle Worrell, The World Bank

The International Financial Crises of the 1990's

The Asian financial crisis that erupted in July of 1997 and spread to other regions is considered the most serious event in decades. The severity of the crisis surprised most economists because of its depth, duration, and contagion. The panel will highlight the uniqueness of and draw on lessons learned from the crisis. Past crises in Europe and Latin America provided some insights into causes and consequences of the financial turmoil. Lessons from these crises have heightened the awareness of the global volatility of financial markets and its impact on the world economy. As weakened demand and depressed-commodity prices prolonged the recovery of the crisis-hit countries, attention should be given to the long-term effects on real sectors. In some sectors such as agriculture, stories of how producers and others cope with the ordeal are starting to emerge. Implications of the current financial crisis on agricultural markets will be discussed.

Moderator: **Praveen Dixit**

Chief of Asia and Western Hemisphere
USDA Economic Research Service, 1800 M Street, NW, Washington, DC 20036-5831,
pdixit@econ.ag.gov

Expert Panelists:

David Wyss

Chief Economist
Standard & Poor's DRI, 24 Hartwell Avenue, Lexington, Massachusetts 02421
dwyss@dri.mcgraw-hill.com
"The Financial Crisis and Global Outlook"

John Walker

President
Oxford Economic Forecasting, Ltd., Abbey House, 121 St. Aldates, Oxford OX1 1HB UK
jwalker@oef.com.uk
"Lessons from European and Asian Financial Crisis"

Marcelo Giugale

Lead Economist
The World Bank, 1818 H Street, NW, Washington, DC 20433
mgiugale@worldbank.org
"Lessons from Latin America: Mexican Experience"

Don Mitchell

Senior Economist, Commodities Team
The World Bank, 1818 H Street, NW, Washington, DC 20433
dmitchell@worldbank.org
"Implications for Agriculture"

Panel organized
and introduced by:

Suchada Langley, Senior Economist
USDA Economic Research Service, 1800 M Street, NW,
Washington, DC 20036-5831, slangley@econ.ag.gov

SESSIONS AT A GLANCE

MONDAY, JUNE 28

	Federal B	Federal A	So. Am. B	So. Am. A	California	Ohio	Michigan	New York	Mass.	Pan Am.	Continental
Session 1 10:30-12:00	1.1 Long Memory	1.2 Macro-economics	1.3 Methods	1.4 Financial	1.5 Business	1.6 Pop & Labor Force	1.7 Tourism	1.8 Business Cycles	1.9 M3-Competition	1.10 Time Series	1.11 Telecom
Session 2 2:00-3:30	2.1 Unit Roots	2.2 Trade	2.3 Methods	2.4 Financial	2.5 Business	2.6 Pop & Labor Force	2.7 Simulation	2.8 Business Cycles	2.9 Agriculture & Food	2.10 AR Processes	2.11 Telecom
Session 3 4:00-5:30	3.1 Cointegration	3.2 Macro-economics	3.3 Combining	3.4 Financial	3.5 Business	3.6 About Forecasting	3.7 Time Series	3.8 Government	3.9 Agriculture & Food	3.10 GARCH	3.11 Telecom

TUESDAY, JUNE 29

	Federal B	Federal A	So. Am. B	So. Am. A	California	Ohio	Michigan	New York	Mass.	Pan Am.	Continental
Session 4 10:30-12:00	4.1 State Space	4.2 Macro-economics	4.3 Judgmental	4.4 About Forecasting	4.5 Business	4.6 Exchange Rates	4.7 Crime	4.8 Government	4.9 Telecom	4.10 Evaluation	4.11 Energy
Session 5 2:00-3:30 Featured Sessions	5.1 X-12 ARIMA	5.2 Environmental	5.3 Improving Practice							5.4 US Federal Government Forecasting	
Session 6 4:00-5:30	6.1 Seasonality	6.2 Macro-economics	6.3 Judgmental	6.4 About Forecasting	6.5 Business	6.6 Inflation	6.7 vacant	6.8 Government	6.9 Technology	6.10 Evaluation	6.11 Energy

WEDNESDAY, JUNE 30

	Federal B	Federal A	So. Am. B	So. Am. A	California	Ohio	Michigan	New York	Mass.	Pan Am.	Continental
Session 7 10:30-12:00	7.1 Time Series	7.2 Macro-economics	7.3 Neural Nets	7.4 About Forecasting	7.5 Business	7.6 Economic	7.7 Environmental	7.8 Government & Data	7.9 Time Series	7.10 Evaluation	7.11 Energy

Session 1.1

Room: Federal B

Time Series–Long Memory

Monday

10:30-12:00

Chair: **Jan Beran**, University of Konstanz, GERMANY, beran@fmi.uni-konstanz.de**Wavelet-Based Approximate Maximum Likelihood Estimation for Long Memory Processes****D. B. Percival** and P. F. CraigmileApplied Physics Laboratory, Box 355640, University of Washington, Seattle, WA 98195-5640,
dbp@apl.washington.edu; and MathSoft, Inc., 1700 Westlake Ave. North, Suite 500, Seattle, WA
98109-9891

A well-accepted methodology for predicting future behavior of a time series is to base forecasts upon a stochastic model whose parameters have been estimated using the maximum likelihood (ML) method. Many time series exhibit a 'long memory' component such as a slow decay in the sample autocorrelation sequence. Exact ML estimation of the long memory parameter is computationally difficult, so there are approximate ML estimators. Here we consider an approximation based upon the orthonormal discrete wavelet transform (DWT) formed using the Daubechies wavelet filters of finite width. We show that use of an approximate likelihood function based upon the DWT coefficients leads to an appealing scheme that, in one uniform approach, can handle both stationary and nonstationary long memory processes observed possibly in the presence of a polynomial trend.

SEMIFAR Models with Applications to Financial Time Series

Jan Beran, University of Konstanz, beran@fmi.uni-konstanz.de

Yuanhua FengDepartment of Mathematics and Computer Science, University of Konstanz, Box 5560, 78457
Konstanz, GERMANY, yuanhua.feng@uni-konstanz.de

Dirk Ocker, University of Konstanz, ocker@soz.psychologie.uni-konstanz.de

The distinction between stationarity, difference stationarity, deterministic trends as well as between short- and long-range dependence has a major impact on statistical conclusions. The so-called SEMIFAR models introduced by Beran (1998) provide a unified approach that allows for simultaneous modeling of and distinction between deterministic trends, difference stationarity, and stationarity with short- and long-range dependence. In this paper, estimation of SEMIFAR models is investigated. The semi-parametric estimation combines maximum likelihood estimation of the parameters of the stochastic part and local polynomial fitting of the non-parametric trend. A data-driven algorithm based on the iterative plug-in idea is proposed. The potential usefulness of these models is illustrated by analyzing and predicting several financial time series. Predictions combine stochastic prediction of the random part with functional extrapolation of the deterministic part.

continued

Session 1.1		Monday
Room: Federal B	Time Series—Long Memory	10:30-12:00

S-Estimation in the Linear Regression Model with Long-Memory Error Terms

Philipp Sibbertsen

Institut fuer Wirtschafts- und Sozialstatistik, Fachbereich Statistik, Universitaet Dortmund,
Vogelpothsweg 78, 44221 Dortmund, GERMANY, sibberts@amadeus.statistik.uni-dortmund.de

The phenomenon of long-memory plays an important role in economics and hydrology. This paper considers the asymptotic properties of S-estimators, a class of robust estimates with a high breakdown-point and good asymptotic properties. In the linear regression model with long-memory, error terms under mild regularity conditions to the regressors are sufficiently weak to cover, for example, polynomial trends and i.i.d. carriers. It turns out that in the case of non-stochastic regressors, S-estimators are asymptotically normal with a variance-covariance structure which is, in the case of long-memory, similar to the structure in the i.i.d. case. In the case of long-memory, S-estimators have the same rate of convergence as the least squares estimator and the BLUE. In the case of stochastic regressors following a long-memory time-series, the asymptotic distribution of S-estimators is no longer a normal distribution.

Estimating the Memory Parameter with Observational Noise

Nuno Crato and Bonnie Ray

Department of Mathematical Sciences, New Jersey Institute of Technology, Newark, NJ 07102,
ncrato@m.njit.edu

Standard semi-parametric techniques for estimation of the long-memory parameter do not work well in the presence of added noise. Recent interest in the estimation of Long Memory Stochastic Volatility (LMSV) models reinforces the need to find more robust estimators of the model parameters of such processes. We discuss the properties of various estimators when applied to data which has been filtered to reduce the noise. We focus our study on the memory parameter of such processes, since this is a key parameter for characterizing the long-term dynamics and for multiple-steps-ahead forecasting.

Session 1.2		Monday
Room: Federal A	Macroeconomics	10:30-12:00

Chair: **Tracy L. Foertsch**, Joint Warfare Analysis Center, foertsch@erols.com

Issues in Macroeconomic Forecasting

Herman Stekler, The George Washington University, hstekler@gwis2.circ.gwu.edu

Robert Fildes, Department of Management Science, Lancaster University, Lancaster, UK, LA1 4YX, R.Fildes@Lancaster.ac.uk

Macroeconomic forecasts are used extensively in industry and government. This presentation first reviews different approaches to evaluating macroeconomic forecasts. The historical accuracy of US and UK forecasts are examined in the light of these different criteria. Issues discussed include the comparative accuracy of macroeconometric models compared to their time series alternatives, whether the forecasting record has improved over time, the rationality of macroeconomic forecasts and how a forecasting service should be chosen. The role of judgment in producing the forecasts is also considered where the evidence unequivocally favors such interventions. Finally the use of macroeconomic forecasts and their effectiveness is discussed.

Macroeconometric Forecasting and Co-Breaking

David F. Hendry, University of Oxford

Michael Massmann, Institute of Economics and Statistics, University of Oxford, Oxford, OX1 3UL, UK
michael.massmann@lincoln.oxford.ac.uk

Most macroeconomic time series display non-stationary behavior, in that their first and second moments change over time. This feature has been predominantly attributed to the non-stationarity of the stochastic components, and hence modeled via unit roots and cointegration. An alternative is that the processes are subject to structural breaks induced by legislative and technical change, especially shifts in their deterministic components. Co-breaking investigates whether such structural breaks in individual series cancel under linear combinations. Following an explanation of the central role of deterministic shifts in forecast failure, this paper presents an overview, emphasizing the importance of detecting co-breaking in macroeconometric modeling and forecasting. Recent advances in co-breaking theory are also presented.

A Review of the Chinese CGE Models from 1986 to 1998 Their Roles in Economic Forecasting and Policy Making

Shu-Heng Chen, AI-ECON Research Group, Department of Economics, National Chengchi University, Taipei, TAIWAN 11623, chchen@nccu.edu.tw

Sheng-Wen Tseng, National Chengchi University, g5261004@grad.cc.nccu.edu.tw

Based on a collection of 43 published papers in English and Chinese, this paper gives a review on the development of Chinese CGE model over the last decade. Among these 43 papers, 16 were devoted to the trade policy, 4 to environmental and energy policy, 3 to tax reforms, 3 to social insurance, 1 to monetary finance, 1 to external shocks, and 14 to general economic development. Therefore, this review enabled us to give a comprehensive evaluation of the CGE models in an economy, that experienced a transition from a planned economy to a market economy. This includes the highly active CGE models, which led to or are leading to policy designs for a smooth transition to the market economy, as well as the less active CGE models. From these two groups of literature, we shall examine some critical modifications of the CGE model that would make for a better service of policy designs.

Session 1.3		Monday
Room: South American B	Forecasting Methods	10:30-12:00

Chair: **Francisco F. R. Ramos**, University of Porto, PORTUGAL, [framoss@fep.up.pt](mailto:framos@fep.up.pt)

A Comparison of Classical and Bayesian Methods for Modeling Diffusion

Ronald Bewley

University of New South Wales, Sydney, NSW 2052, AUSTRALIA, r.bewley@unsw.edu.au William E. Griffiths, University of New England, AUSTRALIA, wgriffit@metz.une.edu.au

There are a number of standard parameterizations of Logistic and Gompertz models which, with additive disturbance terms, produce forecast confidence intervals with very different properties. When there is a known upper bound, for example in the case of market shares, specifications which bound the forecast and the interval below the upper bound can produce results which do not accord with reasonable priors. Bayesian methods of these models are introduced to circumvent this problem. An empirical comparison of the penetration of music CDs in twelve countries is used to explore properties of the alternative models.

Testing Forecasting Stability Under Non Gaussianity

Ignacio Mauleón

Dpto. de Economía e Historia, Fac. de Economía y Empresa (edif. FES), Campus Miguel de Unamuno, Universidad de Salamanca, 37007 Salamanca, SPAIN, imaul@gugu.usal.es

The distribution of most forecasting stability tests is known to be asymptotically when the errors of the underlying model are normally distributed. With Non Gaussianity, however, the distribution of these tests is not known. This paper derives the exact theoretical distribution of this type of test, when the errors follow a distribution based on the Edgeworth expansion. This density has been found to fit financial data adequately in previous work (Mauleón (1997), Mauleón et.al. (1999). The cumulative distribution function of the test is also worked out, and it is shown that it can be computed efficiently. The shape of this density, and the confidence intervals derived from it, are shown to be markedly different to those from comparable, and commonly used, Chi-squared distributions. Two specific applications to financial risk management are discussed and implemented.

continued

A Bayesian Belief Network Approach for Forecasting Using Genetic Search**Andy Novobilski**

Computer Science and Engineering, The University of Texas at Arlington, P.O. Box 19015, Arlington, TX 76019, novobils@cse.uta.edu

Farhad Kamangar, The University of Texas at Arlington, kamangar@cse.uta.edu

This paper presents a proof of concept forecasting system that utilizes a genetic algorithm approach to synthesize a Bayesian Belief net from time-series data. The purpose of this system is to evaluate the potential effectiveness of this discovered belief net in providing forecasted information for use by a probabilistic planner in creating complex plans that are resilient to change during their execution lifetime. For this experiment, the Genetic Algorithm uses a genotype structure that encodes both the organization (acyclic inference relationships) and node definitions (moving average filter) that make up the Belief Network. Fitness of resulting belief nets is judged on their ability to forecast future values one time period in advance. Test data used in the evaluation of the system was drawn from the 1998 M3-Competition Data sets with the results presented in the paper.

Development of an Embedded Fuzzy-Based Prediction Technique for Chaotic System**Jun Zhang, Henry Chung, and Ron S. Y. Hui**

Department of Electronic Engineering, City University of Hong Kong, Tat Chee Avenue 83, Kowloon, HONG KONG, jzhang@ee.cityu.edu.hk

This paper addresses an embedded Fuzzy-based prediction technique for chaotic dynamic systems. It hybridizes the advantages of Fuzzy Logic that is capable of handling complex, nonlinear and sometimes mathematically intangible dynamic systems and the global modeling capability of embedding phase space. The methodology is based on the fundamental characteristics of chaotic time series, which exhibits some stochastic behavior in the time domain, and its deterministic behavior can be displayed in the embedding phase space. For a given chaotic time series, an embedding phase space is firstly reconstructed by selecting same appropriate phase space points, the membership function in the fuzzy system will be optimized by using a back-propagation adaptive neural-fuzzy system. The proposed method is demonstrated by an example of Mackey-grass chaotic equation. The re-predicted time series are favorably compared to the calculated one.

Session 1.4	Monday
Room: South American A	Financial Forecasting

10:30-12:00

Chair: **Thomas A. Carnes**, University of Arkansas, Fayetteville, carnes@comp.uark.edu

* **The Impact of Financial Accounting Standard No. 133 on Forecasting Earnings, Risk, and Stock Price**

Claire Eckstein

Touro College; mailing address 1661 44 Street, Brooklyn, NY 11204, eckstein18@aol.com

Mostafa Elshamy, Kuwait University

Peter Kyviakidis, Deloitte & Touche, LLP

Financial Accounting Standard (FASB) 133, effective June 15, 1999, creates highly technical financial accounting rules for derivative instruments and hedging activities. The Standard is built on the premise that derivatives are assets and liabilities that should be reported using fair value, and that all gains and losses arising from fair value valuation should be included in income. Recognition of gains or losses will depend on the use of a derivative and whether it qualifies for newly defined hedge accounting. We will present the new accounting rules for derivatives, discuss the political controversy surrounding the Standard, and investigate the modifications that may be required to financial variables employed in forecasting models. We will also demonstrate the effects of FASB 133 on relevant financial ratios, the projected variability of earnings, and investment decision of management.

S&P 500 Future Volatility Forecasts with Neural Networks

J. S. Moore, M. E. Nelson, and I. J. Nikolov

U.S. Naval Academy, Department of Economics, 121 Blake Road, Annapolis, MD 21402,
nelson@novell.nadn.navy.mil

In order to evaluate risk and the practicality of hedging with index options, future market volatility needs to be accurately estimated. A study has been performed in which the future volatility of the S&P 500 was forecast using neural network models. The study focused primarily on predicting the S&P 500 volatility for one month time periods using historical market data for 1988-1998. Using traditional econometric methods, only stationary variables were used as inputs into the neural network models. Additionally, the effect of data time lags was investigated. The neural network approach tested many input variables including historical market volatility, expected market volatility (VIX), T-bond price volatility, crude oil price volatility, and associated time derivatives for their importance in predicting future market volatility. The most successful neural network models were found to have very high correlation coefficients in forecasting market volatility.

Is a Two-Billion Share Day On the Horizon? The Projection of Nasdaq Daily Share Volume

Simon Z. Wu and Jeffrey W. Smith

Economic Research, National Association of Securities Dealers, Inc., 1801 K Street, NW
Washington, DC 20006, wus@nasd.com

Will increasingly heavy trading loads break the back of the stock market? Capacity-management groups at Nasdaq and other securities firms must deal with the challenges of enhancing market systems to satisfy rapid growth in Nasdaq trading activity and future traffic increases. We developed a univariate trend-stationary model to project future Nasdaq trading volume. The model features ARMA error processes and day-of-week fixed effects. Based on the model parameters, we also simulated trading activity to determine the probability and frequency that a high volume day (e.g., 2 billion shares) would occur during any specified forecast period (e.g., 1999). Activity was also found to vary conditional on market price levels and lags. Our projections have been adopted and incorporated for capacity planning purposes by both Nasdaq and many individual firms.

Chair: **Hans Levenbach**, Delphus Inc, delphus@worldnet.att.net

Forecasting Inventory Behavior

Kevin Albertson and **Jonathan Aylen**

Department of Economics, University of Salford, Salford M5 4WT, ENGLAND,
j.m.aylen@economic.salford.ac.uk

Forecasting levels of stocks held by manufacturing industry is problematic in the U.K. Stocks are the most volatile component of GDP. The data itself is subject to chronic revision. Yet, forecasting inventory changes in the supply chain is crucial for manufacturing firms trying to manage output. This paper reports a successful approach to forecasting manufacturing stock behavior. The model exploits the seasonality of stock build-ups and run-downs, unlike existing econometrics approaches which rely on seasonally adjusted data. The forecasting performance of this seasonal ADL model is compared to alternative ARIMA time series approaches, error correction models, and models estimated with seasonally adjusted data. U.K. inventory levels plunged in an unforeseen and exceptional way in the early 1980's and early 1990's. We report attempts to model these "bungee jumps" in stocks using switching regime models. The aim is to forecast these severe but unusual shifts in stockholding behavior.

Web-Based Variance Accountability in a High-Mix Low-Volume Forecasting Problem

Gilbert C. Fitzgerald

Quantitative Analysis and Market Planning Group, Microelectronics Marketing, Sun Microsystems Inc., 901 San Antonio Road, MS USJC02-202, Palo Alto, CA 94303-4900,
gilbert.fitzgerald@eng.sun.com

The business costs of forecast inaccuracies are amplified in the case of high technology semiconductor products where short production runs and long sales cycles drive a highly diverse product mix. The forecast complexity is exacerbated by non-uniformity in product demand with relatively low volumes for all but a small fraction of the product portfolio. Forecasts drive critical revenue planning and supply chain parameters. Efforts are devoted to identifying the factors that determine the sources of forecast deviation for both portfolio aggregate measures and product line item components. We employ a Web-based forecast instrument to sample sales demand in a highly diversified manner. The forecast model is specified to track accountability for forecast variances using the analysis of variance analogy from classical statistics. Separate methods are adopted to provide feasible estimation of forecast components. Some observations on the impact on management decision-making are reported.

continued

Strategic Planning and Price Forecasting In the Chemical Industry**Csaba Ilyés**

Tiszai Vegyi Kombinát Ltd., H-3581 Tiszaújváros, P.O.B. 20, HUNGARY, ilyes_csaba@lotus.tvk.hu
Emese Molnár, University of Miskolc, H-3515,Miskolc-Egyetemváros, stime@gold.uni-miskolc.hu

In our paper we present and discuss how the most important problems connected with the planning process are managed in chemical companies. We show the general planning process from creating or updating strategy to making an operating budget. Forecasting is one of the most important tasks of the planning process, as business decisions are made using the forecasts. We also summarize the possible forecasting methods that can be used in the planning process and we discuss the computer/technical background needed to forecast.

Seasonality and Promotions in Weekly Retail Sales Data**Hans Levenbach**

Delphus Inc, 103 Washington Street, Morristown, NJ 07960, delphus@worldnet.att.net

With the advent of scanner technology, Point-Of-Sale (POS) data is being widely used in retail marketing and forecasting applications. To make every order count, retail and consumer goods manufacturers strive for a seamless flow of product (SKU) from manufacturers to retailers through tightly integrated information systems. The POS data coming from these systems are accessible in weekly periods for SKU's at the store level. The data are primarily influenced by calendar effects, seasonality and promotional events. In this talk we provide a framework for analyzing such weekly patterns when large numbers of forecasts are required for SKUs at multiple customer locations.

Forecasting Net Occupational Replacement Demand

Chandra Shah

Monash University-ACER, Centre for the Economics of Education and Training, Monash University, Wellington Road, Clayton, Victoria, AUSTRALIA 3168, chandra.shah@education.monash.edu.au

Information on job openings by occupation is vital for those looking for jobs, for those contemplating education and training options and for policy makers in education and training. Job openings in an occupation are a result of employment growth and the replacement of workers who leave the occupation. In Australia considerable research is done on employment growth, and on methods of forecasting it. But very little attention has been given to the analysis of the replacement of workers. In this paper, a methodology similar to that developed by Eck (1991) and Willems (1993), is used to estimate and forecast net replacement demand in 81 Australian occupation classes for the period 1998-99 to 2003-04. The results show net replacement demand in many occupations is substantial, and with wide variation across occupations.

U.S. Census Bureau's National Population Projections

Jeff Kallan

Population Division, U.S. Census Bureau, FB3, Washington, DC 20233,
jeffrey.e.kallan@ccmail.census.gov

This presentation gives an overview of the general assumptions and procedures used in this year's national projections by the U.S. Census Bureau, to be completed in late winter 1999. Projections prior to this "round" were done several years ago, using 1994 as a base year, with 1995 as the first projected year. This year's projections differ from previous rounds with respect to assumptions about future patterns of fertility, mortality, and immigration, and with regard to methodology to obtain the projected rates and numbers. Some of these changes relate to the treatment of detailed race/ethnic groups, and in some cases, sex/gender. In addition to these general changes, this is the first round of projections which incorporate "nativity" (country of birth) as a variable in the projection models. Finally, we are using a longer time horizon—to year 2100—than we did in previous rounds.

Chair: **Haiyan Song**, University of Surrey, h.song@surrey.ac.uk

Forecasting Tourism to Japan using Neural Networks

Hubert P. Fernando, Lindsay W. Turner and L. Reznik

Victoria University of Technology, PO Box 14428, Melbourne City MC, Victoria 8000,
AUSTRALIA, hubertfernando@vut.edu.au

This paper uses neural networks to forecast tourist arrivals to Japan from the USA, UK, and Australia. Univariate forecasts are made for total tourism to Japan from these countries and for the two disaggregated categories of tourist and business travel. Multivariate forecasts are made using the same data, combined with national indicators of the tourist's country of origin. The national indicators used are income, imports and exports. The forecasting models are evaluated for accuracy by comparing actual data with the forecast during a test period.

Modeling and Forecasting Business Trips to Australia

Nada Kulendran and Kenneth Wilson

Department of Applied Economics, Victoria University of Technology,
Footscray Campus (F063), PO Box 14428, MCMC, Melbourne 8001, Victoria, AUSTRALIA,
NadaKulen@Vut.edu.au

The main aim of this paper is to compare time-series models and econometric models in the context of predicting business trips to Australia from the major trading partners—USA, Japan, UK, and New Zealand. The models include the error-correction model, the autoregressive model, ARIMA, the basic structural model, regression based time-series model, and structural time-series model with explanatory variables. In forecasting business trips, we found that time-series models are better than econometric models. This paper also identifies the factors influencing business travel demand.

Forecasting Performance of Tourism Demand Models: The Case of Denmark

Haiyan Song

School of Management Studies for the Service Sector, University of Surrey,
Guildford GU2 5XH, ENGLAND, h.song@surrey.ac.uk

Stephen F. Witt

School of Management Studies for the Service Sector, University of Surrey,
Guildford GU2 5XH, England and Victoria University of Technology, Melbourne, AUSTRALIA

Thomas Jensen

Institute of Local Government Studies, Nyropsgade 37, DK-1602 Copenhagen, DENMARK

This paper examines the performance of six econometric models in forecasting inbound international tourism demand to Denmark from six origin countries. The models: a long-run static cointegration regression; two error correction models based respectively on Wickens-Breusch (1988) and Johansen (1991); an autoregressive distributed lag (ADL) model; an unrestricted vector autoregressive (UVAR) model; and a time varying parameter (TVP) model. Used as benchmarks are two univariate time series models, the ARIMA(p, i, q) model, and a no-change model. The results show that the TVP model generates the most accurate one-period-ahead forecasts, followed by the static model, but that the no-change model is not far behind. For two-period-ahead forecasts, the static model generates the most accurate forecasts, followed by the TVP model; as is the case with one-period-ahead forecasts, the no-change model is not ranked far behind.

Chair: **Ken Holden**, Liverpool Business School, UK, buskhold@livjm.ac.uk

A Cyclical Characterization of Economic Activity in the United States, 1887-1940

Antonio Garcia-Ferrer and Ana del Rio

Departamento de Analisis Economico: Economia Cuantitativa, Universidad Autonoma de Madrid,
28049 Madrid, SPAIN, antonio.garcia@uam.es

We analyze historical business cycles as a sum of short- and medium-term cycles defined for a particular class of unobserved component models. We base our work on the same Schumpeterian framework as the one used in Garcia-Ferrer and Queralt (1998). By associating the trend with the low frequencies of the pseudo-spectrum in the frequency domain, manipulation of the spectral bandwidth allows us to define subjective trends with specific properties. In this paper we show how these properties can be exploited to anticipate business cycle turning points, not only historically but also in a true ex-ante exercise. The procedure is applied to U.S. pre-World War II GNP quarterly data to characterize both the NBER and Romer's business cycle datings.

An Index of Coincident Economic Indicators for the Indian Economy

Pami Dua, Delhi School of Economics

Anirvan Banergi

Economic Cycle Research Institute Inc., 420 Lexington Avenue, Suite 1645, New York, NY 10170,
anirvan@businesscycle.com

An index of coincident economic indicators is a summary measure designed to track fluctuations in aggregate economic activity. A coincident index can therefore be used to help determine the timing of recessions and expansions, and speedups and slowdowns in economic growth. In the case of the Indian economy, the need for such an index is even more imperative than usual. One reason is that for India, the most comprehensive measure of aggregate economic output, Gross Domestic Product, is available only on an annual basis and with a considerable publication delay. Also, one of the few broad measures of output that are available monthly for India is industrial production. However, such a time series cannot come close to being a comprehensive measure of output in a country where the agricultural sector accounts for a substantial percentage of employment, and only a minority of the employed work in the industrial sector. Thus, to a greater degree than for most countries, the Indian coincident index is vital for tracking the current state of the economy, and for acting as a benchmark for the evaluation of leading indicators for the overall economy.

continued

The Time-Series Relatedness of State and National Indexes of Leading Indicators and Implications for Regional Forecasting**Gary L. Shoesmith**

Babcock Graduate School of Management, Wake Forest University, Winston-Salem, NC 27109,
gary.shoesmith@mba.wfu.edu

This study investigates the time-series relatedness of state and national indexes of leading indicators and the implications of these results regarding state employment forecasting. Composite indexes of leading indicators are constructed for the U.S. and each of the fifty states based on housing permits, initial claims for State unemployment compensation, and average weekly hours in manufacturing. The three-component U.S. index (USLI3) is shown to reflect much of the cyclical variation in the U.S. composite of 11 leading indicators (USLI11). FPE causality tests show that USLI3 predicts the State composite index in 49 of 50 cases, while evidence that individual State indexes cause USLI3 is relatively weak. Further tests show that 14 of the 50 state indexes are cointegrated with USLI3. Error correction and long-memory factor statistics show that USLI3 "drives" the State index in 11 of the 14 cases, while the State index drives USLI3 in the other three. These results suggest that national leading indicators may be more useful than similar State indicators in predicting State-level activity. Experimental forecasts surrounding the 1990-91 recession confirm that both USLI3 and USLI11 are generally more effective in improving forecasts of State nonfarm employment than the respective 50 State composite indexes.

A Leading Index for Small Metropolitan Areas**Barry R. Weller and James A. Kurre**

Pennsylvania State University-Erie, School of Business, Station Road, Erie, PA 16563,
brw@psu.edu, k12@psu.edu

Indices of leading indicators have been constructed for numerous nations and relatively large regions, for example States, and have proven to be useful for forecasting purposes. Similar indices have been developed for some major metropolitan areas. However, due to data constraints, relatively few small metro areas have useful leading indices. The purpose of this paper is to develop a leading index for a very small metropolitan area and to test the effectiveness of this index as a tool for forecasting monthly regional employment levels. The forecasting performance of the metro index will be compared with that of two other readily available indices, the U.S. composite leading index and a leading index developed for the State of Pennsylvania.

Chair: **Ken Holden**, Liverpool Business School, UK, buskhold@livjm.ac.uk

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Antonio Garcia-Ferrer and Ana del Rio

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continued

The Time-Series Relatedness of State and National Indexes of Leading Indicators and Implications for Regional Forecasting

Gary L. Shoesmith

Babcock Graduate School of Management, Wake Forest University, Winston-Salem, NC 27109,
gary.shoesmith@mba.wfu.edu

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Barry R. Weller and James A. Kurre

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M3-Competition, Final Results

The major aims of the M3-Competition are to extend and replicate the findings of the M- and M2-Competitions. The extension involves the inclusion of more researchers, more methods (in particular in the area of neural nets and expert systems), and most importantly, more series as the data base of the M3-Competition has been enlarged to include 3003 time series. The final results include 24 different methods, and are presented by categories of data: different time interval between successive observations (Yearly, Quarterly, Monthly, Other); and different types of data (Micro, Industry, Macro, Finance, Demographic, Other). The major accuracy measures give consistent results to identify which methods, under certain conditions, give the best results.

Michele Hibon will present her paper, "M3-Competition, Final Results," coauthored with Syros Makridakis, INSEAD. The panel members will discuss these results.

Chair: ***Len Tashman***

School of Business Administration, University of Vermont, Burlington, VT 05405-0158,
lentashman@compuserve.com

Panelists:

Michele Hibon
INSEAD, Blvd de Constance, F-77305 Fontainebleau, FRANCE, Michele.Hibon@Insead.fr

J. Scott Armstrong
The Wharton School, University of Pennsylvania, Philadelphia, PA 19104-6371
armstrong@wharton.upenn.edu

Fred Collopy
The Weatherhead School of Management, Case Western Reserve University, Cleveland, Ohio
44106, fcl2@po.cwru.edu

Sandy D. Balkin
Pennsylvania State University, Department of Management Science and Information Systems, 303
Beam Business Administration Building, University Park, PA 16802-1913, sxb31@psu.edu

V. Assimakopoulos
National Technical University of Athens, 42, 28th Octovriou Str., 10682 Athens, GREECE
vassim@epu.ece.ntua.gr

Panel organized by: ***Michele Hibon***, INSEAD, Michele.Hibon@Insead.fr

Session 1.10		Monday
Room: Pan American	Time Series	10:30-12:00

Chair: **Hans-Martin Krolzig**, University of Oxford, UK, hans-martin.krolzig@nuf.ox.ac.uk

Time Series Syntactic Analysis and Extrapolation

Ciresica Jalobeanu

Mathematical Department, Technical University of Cluj-Napoca, 28, Baritiu str. 3400, Cluj-Napoca, ROMANIA, e-mail:Ciresica.Jalobeanu@math.utcluj.ro

Syntactic methods have often been used in pattern recognition. In previous papers we have applied these methods in time series analysis. In this paper we present some new results on the segmentation and syntactic reconstruction of a time series in order to compress the data. The main aim of the study was to find conditions for a generalized interpolation procedure in the structure of segments. These conditions permit a classification of the time series in respect with the possibility of extrapolation. In our study we have used the time series delivered on Internet by Santa Fe Institute.

The Influence of Outliers on the Automatic Selection of a Suitable Exponential Smoothing Method

Richard Lawton

Faculty of Computer Studies and Mathematics, University of West of England, Frenchay, Bristol, BS16 1QY, UNITED KINGDOM, richard.lawton@uwe.ac.uk

This paper addresses the impact of outliers on the efficacy of various proposed methods for automatic selection of exponential smoothing methods. The methods considered include the Akaike Information Criterion, the Bayesian Information Criterion (used by Forecast Pro), and two methods proposed by Gardner and McKenzie. The choice of method is restricted to the three non-seasonal methods, simple exponential smoothing, Holt's method and damped Holt's method. Simulated data was used rather than real data, as this enables the optimal method to use to be known. The effects of a variety of types of outliers were considered. The results show that the impact of outliers does affect the ability to correctly select a method, but that the impact is not as great as may be feared.

continued

Forecasting Time Series from Clusters

Elizabeth Ann Maharaj and Brett A. Inder

Department of Econometrics and Business Statistics, Monash University, P.O. Box 197 Caulfield East, Victoria 3145, AUSTRALIA, ann.maharaj@buseco.monash.edu.au

Forecasting large numbers of time series is a costly and time-consuming exercise. Before forecasting a large number of time series that are logically connected in some way, we can first cluster them into groups of similar series. In this paper we investigate forecasting the series from each cluster. Similar time series are first grouped together using a clustering procedure that is based on a test of hypothesis. The hypothesis test is based on the difference between the autoregressive parameter estimates of every pair of time series. The time series in each cluster are then pooled together and forecasts are obtained. Simulated results show that this procedure for forecasting similar time series performs reasonably well.

Two-Dimensional Exponential Smoothing

Antonio J. Rodrigues

DEIO and CIO, Faculty of Sciences, University of Lisbon, Edif.C2, Campo Grande, 1749-016 Lisboa, PORTUGAL, ajr@fc.ul.pt

This paper discusses the possible extension of Holt's exponential smoothing method to bi-dimensional time series. In particular, it presents explicit equations for filtering and forecasting datasets structured as run-off triangles, as those commonly studied in the insurance business claims reserving problem. Some new methodological ideas are proposed to solve initialization and optimization issues, which can also be applied to other exponential smoothing methods. Experimental results from different real data sets expose both the advantages and the shortcomings of this new method when compared with other approaches, including the simple chain ladder method and radial basis function networks.

Chair: **Mårten Löf**, Stockholm School of Economics, SWEDEN, stmlo@hhs.se



Econometric Forecasting Principles and Doubts Unit Root Testing First, Last, or Never?

P. Geoffrey Allen

Department of Resource Economics, University of Massachusetts, Amherst, MA 01002,
allen@resecon.umass.edu

Robert Fildes

Department of Management Science, University of Lancaster, Lancaster LA1 4YX, UK,
R.Fildes@Lancaster.ac.uk

An avalanche of articles has described the testing of a time series for the presence of unit roots. Sometimes the characterization of the series is an end in itself. In other studies, unit root and cointegration testing is a preliminary step, intended to guide model specification. A third use is to specify a general vector autoregression model then work to a more specific model in the family of error correction models by testing and imposing parameter restrictions. An alternative general-to-specific strategy is to drop variables with insignificant coefficients based on a sequence of likelihood ratio tests. Some commentators have questioned the value of unit root and cointegration tests for any of these purposes. We argue for the middle ground of using these tests to improve the specification of an initial general vector autoregression model.

* Sensitivity of Univariate AR(1) Time-Series Forecasts Near the Unit Root

Anurag Banerjee

Department of Economics, Queens University, Belfast BT7 1NN, UK
A.Banerjee@Queens-Belfast.AC.UK

We consider the linear time-series model $y\{t\}=d\{t\}+u\{t\}$, $t = 1, \dots, n$, where $d\{t\}$ is the deterministic trend, and $u\{t\}$ the stochastic term which follows an AR(1) process, with various assumptions about the startup. Our main interest lies in the behavior that the l -period ahead forecast $y\{n+l\}$ near $\theta=1$. Unlike in other studies of AR(1) unit root process, we do not wish to ask the question whether $\theta=1$ or not, but whether what happens to the forecast estimate near and at $\theta=1$ is "significant." For this purpose we measure the sensitivity of the forecast at the unit root. We also develop a large sample procedure to measure the forecast sensitivity when we are uncertain whether or not to include the linear trend. We conclude that, to be on the safe side, it is better to put a time trend term in the deterministic part of the model, though this will depend on the initial condition assumption.

continued

*** Testing for Noninvertibility in ARIMA Models****José L. Gallego**

Departamento de Economía, Universidad de Cantabria, Avda. de los Castros, s/n, 39005 Santander
SPAIN 942201627, gallegoj@ccai3.unican.es

This paper proposes a two-step procedure to test for moving average (MA) unit roots in ARIMA models. Under the null hypothesis of MA unit root, the strictly noninvertible ARIMA model can be transformed into an invertible ARIMA model. Thus, the null hypothesis of MA unit root in the interest model corresponds to the null hypothesis of MA stationary root in the auxiliary model. The last hypothesis can be easily tested by classical inference procedures. The performance of the test in several common models is evaluated using a Monte Carlo study.

The Impact of Seasonal Unit Roots and Vector ARMA Modeling on Forecasting Monthly Tourism Flows**Jonas Nordström**

Department of Economics, Umeå University, SE-901 87 Umeå, SWEDEN, and School of Transport and Society, Dalarna University, SWEDEN, Jonas.Nordstrom@econ.umu.se

Patrik Gustavsson

Trade Union Institute for Economic Research and Stockholm School of Economics, SWEDEN

The effect of different numbers of unit roots on forecast accuracy is examined using univariate ARMA models. To see whether additional information improves forecasting accuracy and increases the informative forecast horizon, we cross-relate the time series for inbound tourism in Sweden for different visitor categories and estimate vector ARMA models. The mean and variance of the forecast errors for different filters indicate that models in which unit roots are imposed at all frequencies have the smallest forecast error. The result for the vector ARMA models with all roots imposed indicate that the informative forecast horizon is greater than it is for the univariate models.

Chair: **R. Darius**, Eastern Caribbean Central Bank, WEST INDIES, eccbrei@caribsurf.com

Forecasting the Retail Market Turnover, the Employment Level, and the Trade Balance, A Priori

Erik Cervén

Krokbacksv. 11, 680 63 Likenäs, SWEDEN

A mathematical model with simulations is presented based on defining the retail and labor market balance points in terms of the function variables consumers' budgets, propensity to consume, inflation, deposit interest rate, market differentiation, profit, VAT, propensity to sell, investment, payroll budgets, propensity to pay for work and to hire, labor market flexibility, and income tax. These variables may be measured or given judgmental ratings. The model provides numerical values of the retail market turnover, the employment level, the necessity for imports, and the margins for export based on these function variables. Additional forecasting scenarios based on the empirically consolidated statistical distribution of nominal values include the sizes of markets for investments in commodity production and the sizes of markets for new consumption niches.

Forecasting Trade Flows with Long Range Gauges

Philip A. Klein

Department of Economics, 516 Kern Graduate Building, Pennsylvania State University, University Park, PA 16802, pak11@psu.edu

A number of years ago Geoffrey Moore and I developed a technique for using leading indicators to forecast trade flows. The underlying assumption was that if leading indicators were helpful in forecasting domestic demand, they ought to also be helpful in forecasting demand for imports. Accordingly, countries where trade is especially important would find it possible to forecast their exports to any country or group of countries for which leading indicators were available. Recently the Economic Cycle Research Institute in New York devised Long Range Gauges for a number of G-7 countries. They forecast cyclical developments nine to twelve months ahead. In this paper I will utilize long range gauges for G-7 countries to forecast exports for developing countries, and in particular, African countries.

continued

Forecasting the Fiscal Impact of A Potential Free Trade Agreement Between the European Union and The Small Island Economies of the Caribbean Basin

Shelton Nicholls

Department of Economics, St. Augustine Campus, University of the West Indies, St. Augustine, Trinidad, TRINIDAD AND TOBAGO, nicholls@tstt.net.tt
Janice Christopher-Nicholls, Central Bank of Trinidad and Tobago, Eric Williams Plaza, Independence Square, P.O. Box 1250, Port-of-Spain, Trinidad, TRINIDAD AND TOBAGO, jnicholls@central-bank.org.tt
Philip Colthrust, Central Bank of Trinidad and Tobago

The small island economies of the Caribbean Basin are presently engaged in negotiations with the European Union over a successor agreement to the Lomé IV Convention which grants non-reciprocal preferential access to the European market for exports of African, Caribbean, and Pacific countries. Preliminary discussions have suggested the establishment of a Free Trade Area (FTA) between the CARIFORUM group of countries and the European Union, eliminating tariff and non-tariff barriers. This paper utilizes the Almost Ideal Demand System (AIDS) to compute import elasticities for SITC product groups in selected Caribbean economies. These elasticities along with proposed average tariff reductions are utilized to forecast the potential revenue gain or loss resulting from the establishment of a FTA. The preliminary results indicate that the smaller economies of the Caribbean Basin would suffer greater fiscal revenue loss from the establishment of a FTA.

Terms of Trade Shocks, the Current Account and Foreign Asset Accumulation in the ECCB Unified Currency Area

O. Williams, ***R. Darius***, and L. Sahely

Eastern Caribbean Central Bank, P. O. Box 89, Basseterre, St. Kitts, WEST INDIES.
eccbrei@caribsurf.com

This paper explores the impact of two types of terms of trade shocks on the ECCB transmitted through banana exports and tourism receipts on foreign asset accumulation and the current account. The ECCB—the Eastern Caribbean Central Bank—consists of eight countries in the Eastern Caribbean. The impact of these transitory shocks on foreign assets is critical to macroeconomic stability given a fixed exchange rate to the U.S. dollar and the other arrangements of the monetary union which operates as a quasi-currency board. The forecast error variances were decomposed, while the persistence of these shocks were evaluated. Attempts were made to address the size of the permanent and temporary components of movements in the terms of trade

Chair: ***Yun-Joong Yun***, Institute of Industrial Technology Policy, KOREA, yjy@mail.itep.re.kr

Influence and Deletion Diagnostics in Forecasting

John Haslett

Department of Statistics, Trinity College, Dublin 2, IRELAND, John.Haslett@tcd.ie

In forecasting, cases are influential if they significantly impact either point or interval prediction. Typical approaches are via deletion diagnostics, but despite clever algorithms there is a very considerable computational overhead. Recent research suggests a powerful approximation. Haslett (1999) shows that for the general linear model with correlated errors, the deletion of a subset is exactly equivalent to the replacement of the associated values by the predicted values from the rest of the data, provided that the correlation is taken to be unchanged by this deletion. In time series this is no longer an identity. However, it is a simple and excellent approximation. This paper motivates the approximation and illustrates how aspects of forecasting influence can be deduced very simply from these residuals.

Using the Gibbs Sampler in Analyzing Sales Data Problems

Francisco F. R. Ramos

University of Porto, Faculty of Economics, 4200 Porto, PORTUGAL, framos@fep.up.pt

Sales data is often characterized by irregularities, such as missing data, censoring, truncation, or measurement error. Practitioners often discard missing or censored data cases and ignore measurement error concerns. We argue here that we can remedy these irregularity problems through simulation based model fitting using the Gibbs sampler. We describe the Gibbs sampler in the context of these issues focusing primarily on the missing data problem. We illustrate using a sample of real estate sales data from the city of Porto, Portugal. We show dramatic improvement in inference by retaining the partially observed data cases rather than deleting them. We also detail how the other problems can be handled using the Gibbs sampler.

continued

A Note on Linear Combination of Predictors

Ediberto Ruiz and ***Fabio H. Nieto***

Department of Mathematics and Statistics, National University of Colombia, A.A. 72157 Bogota,
COLOMBIA, frieto@matematicas.unal.edu.co

An important concern in statistics is the linear combination of predictors of a random variable, which is based on several sources of information. In the context of time series, the technique is used, for example, for forecasting or estimating missing observations. In this paper we caution on using this procedure arbitrarily, in particular with weighted averages, to obtain an overall linear predictor of the random quantity. We illustrate the results with examples about estimating missing observations in time series.

Predicting the Outcomes of Professional Football Games

Bryan Boulier and ***H. O. Stekler***

Department of Economics, The George Washington University, Washington, DC 20052
mortile@gwu.edu, hstekler@gwu.edu

In an earlier paper we found that the rankings of teams in the basketball tournaments and of tennis players in the Grand Slam events were good predictors of the outcomes of these competitions. We used statistical probit models and concluded that there was predictive value in both the information that one competitor was considered superior to another and in the quantitative difference in the rankings. In this paper we will apply a similar type of analysis to determine the extent to which computer generated power scores and the resulting rankings of professional football teams can forecast the outcomes of games in the National Football League.

Session 2.4

Room: South American A

Financial ForecastingMonday
2:00-3:30Chair: *Simon Z. Wu*, National Association of Securities Dealers, Inc., wus@nasd.com**Varying Effects of Permanent and Transitory Changes in Financial-Statement Subcomponents On Stock Prices****Thomas A. Carnes**204 BADM, Department of Accounting, Sam M. Walton College of Business Administration,
University of Arkansas, Fayetteville, AR 72701, carnes@comp.uark.edu

The purpose of this study is to determine whether the size of deviations from predicted future quarterly values of six financial-statement subcomponents (accounts receivable, inventory, current liabilities, gross margin, selling and general administrative expense, and depreciation expense) is consistent with capital market valuation of the associated companies. ARIMA, random walk, and seasonal random walk expectation models are used to predict the values of the six subcomponents for 149 firms. Firms are ranked based upon the size of the deviation from the one-quarter-ahead prediction, and an event study tests whether the deviation introduces value-irrelevant noise into the earnings response coefficient. Coefficients on each subcomponent except inventory behave in the expected manner, but the choice of expectation model is often unimportant.

On the Significance of Brief Financial Signals: An Analysis Based on 11 Asia Pacific Stock Markets**Shu-Heng Chen and Ching-Wei Tan**AI-ECON Research Group, Department of Economics, National Chengchi University, Taipei,
TAIWAN 11623, chchen@nccu.edu.tw, g4258506@grad.cc.nccu.edu.tw

Considering financial time series consisting of a series of brief signals (Chen and Tan, 1998; Chen and Yeh, 1999), designs of dynamic learning schemes naturally play an important role in financial data mining. The purpose of this paper, while not intending to give a concrete design, attempts to empirically document the significance of picking a time horizon for relearning schemes in 11 Asia-Pacific stock markets. In the literature, this parameter can be chosen either in a deterministic manner or in a stochastic manner. The focus of this paper is on the former, that is, we would like to know: if the parameter is chosen in a deterministic manner, does there exist an optimum value of this parameter? For this purpose, different sizes of rolling windows are chosen for making comparisons. The sizes considered in this study are 50, 100, 200, 500, 1000, and 2000. For each size of the rolling window, a model selection criterion in spirit of Rissanen's predictive stochastic (PSC) complexity is employed to choose the best model from a class of linear ARMA models.

continued

Bayesian Networks for Forecasting Financial Markets

Farhad Kamangar, Maher Al-Khaiyat, and **Jeffrey Smith**

Computer Science and Engineering Department, The University of Texas at Arlington, Arlington
Texas 76019, kamangar@cse.uta.edu, al-khaiy@cse.uta.edu, smith@onramp.net

This paper presents a framework for forecasting financial markets by using Bayesian decision networks. The system utilizes uncertain reasoning based on Bayesian networks to infer possible changes in financial market movements or stock prices. It uses real-time and historical market activity feeds as input. Historical data on the economy and on fundamental measures include stock price to earnings ratio, price to cash flow, and market value to book value per share. The knowledge base also includes a collection of Belief networks. The system is able to calculate probability distributions over possible future economic trends. Investor profiles of preferences and habits are incorporated with portfolio databases to create recommendations and market orders. The rational choice among different recommendations is based on maximum expected utility.

A Theory of Analysts' Forecast Bias

* **Murugappa (Murgie) Krishnan**

Department of Accounting, University of Minnesota, 3-123 CARLSMGMT, 321 -- 19th Avenue South, Minneapolis, MN 55455, krishnan@msi.umn.edu
Konduru Sivaramakrishnan, Texas A&M University, Shivak@tamu.edu

In this paper, we provide an equilibrium explanation for the observed optimism in analysts' earnings forecasts. Our analysis provides theoretical support to the widely-held notion that analysts engage in earnings optimism to gain access to management's private information. We show that a strategic analyst, who is motivated by improving the combined accuracy of his forecasts, issues a biased initial forecast to extract information from management, but issues unbiased forecasts subsequently. Management, on the other hand, provides more access because this optimistic bias reduces the proprietary costs associated with disclosure at the margin. An important element of our model is the assumption that analysts also have private information relevant to assessing firm value. Despite rational expectations about analyst bias, analysts' private information cannot be fully unravelled by other agents due to the noise introduced by the diversity in analysts' incentives.

Chair: **Thomas Wassel**, Astra-Zeneca Pharmaceuticals, L.P., thomasx@icdc.com

Y2K Forecasts from Denial to Doomsday

Kenneth W. Hunter

World Future Society, 4916 Saint Elmo Avenue, Bethesda, MD, KHunter100@aol.com

Assessing Y2K—year 2000—conditions, the progress being made, and the likely impacts is now a challenge facing individuals, organizations, businesses, and governments. While many remain in denial, others are learning on the go and altering their forecasts daily. Yet others are seriously concerned about disasters, and the doomsayers are using the opportunity. This report will illustrate the types of forecasting and futures research being used for Y2K, including forecasting for complex socio-economic-technological emergencies, emergency management and contingency planning processes, technology impacts, and understanding how socio-economic groups and systems will respond and change during and after the Y2K events. Scenarios are being used extensively in this analysis.

The Role of TQM and Using Statistical Methods in the Corporate Strategies

Emese Molnár, University of Miskolc

Csaba Ilyés

Tiszai Vegyi Kombinát Ltd., H-3581 Tiszaújváros, P.O.B. 20, HUNGARY, ilyes_csaba@lotus.tvk.hu

Hungary is at the entrance of the European Committee. Consequently the role of Total Quality Management (TQM) has becomes more and more important. So, the Hungarian companies have to satisfy the European Union's standards, e.g. the ISO standards. Companies which want to be successful in the market have to modify their structure in every point of view. In this paper we show the most important features of Hungary in macro and micro levels, we summarize the statistical methods used in those areas, and we discuss the present situation of the Hungarian companies regarding TQM and business strategies.

Actuarial Forecasts Without Life Data

Larry George

Problem Solving Tools, 1573 Roselli Drive, Livermore, CA 94550-5852, pstlarry@home.com

Actuarial forecasts can be made for all service parts and some human illnesses, without age-at-failure data. Actuarial forecasts are $\text{Sum}[n(i)*a(i)]$ where $n(i)$ count population of age i and $a(i)$ are the actuarial rates. Actuarial forecasts make no unwarranted assumptions, are unbiased and have greater precision than alternatives, except those that track subjects by name or serial number. The former AFLC makes actuarial forecasts for expensive parts tracked by serial number. Health agencies make actuarial AIDS forecasts from death certificates. Such data aren't necessary. Generally accepted accounting principles require sufficient data. All you need are population ships—sales, installations, entrants, and births—and returns counts—failures, deaths, repairs, complaints, and spares. Bills-of-materials convert product ships if returns are parts. The methods used are maximum likelihood and least squares, plus deconvolving sell-through time and converting variable operating hours. Outputs include actuarial forecasts, their distributions, and hypothesis tests.

Chair: **Debra E. Gerald**, National Center for Education Statistics, U.S. Department of Education
Debra_Gerald@ed.gov

Effects of Labor Market Institutions on Unemployment and Employment Creation

Gema de Cabo

Departamento de Economía Cuantitativa, Facultad de Ciencias Económicas y Empresariales
Universidad Complutense de Madrid, 28223 Campus de Somosaguas, SPAIN,
eccua26@sis.ucm.es

The European labor markets hide a wide diversity with respect to labor market institutions and the rigidities induced by them on unemployment and job creation. This paper has three conclusions. First, rigidity does not imply, *per se*, high or persistent unemployment. Second, many characteristics of the labor market that are popularly viewed as serious rigidities have slight impact on unemployment. And finally, a wide range of labor market institutions have cumulative effects on unemployment and job creation, which can be amplified under specific combinations of institutions.

Forecast Models for the Demand for Nursing Personnel

Marshall S. Fritz

Division of Nursing, Bureau of Health Professions, Health Resources and Services Administration
Dept. of Health and Human Services, (HHS/HRSA/BHPr/DN), 5600 Fishers Lane, Room 9-21,
Rockville, MD 20857, mfritz@hrsa.gov

The Division of Nursing has developed forecasting models for the demand of nursing personnel. Recent applications have forecast through the year 2020. The two-stage framework for these models is based on: 1) estimates of health services utilized per capita, the services of which can be associated with various care settings where nursing personnel traditionally are involved with care; and 2) estimates of demand for nursing personnel per unit of health services utilization in 13 health care settings employing nurses. These national models are calibrated using discrete cross-sectional multivariate regressions for registered nurses, licensed practical nurses, and nursing aides, with observations by State. The Division is currently refining and updating model calibrations to incorporate more-recent data, improved state indicators using data mining, and increased robustness in the equations. For policy planning activities, these demand forecasts are compared against the Divisions' forecasting estimates of nursing supply to determine any anticipated registered nurse shortfall.

continued

Predicting the Need for Newly Hired Teachers in the United States to 2008-09**William J. Hussar**

National Center for Education Statistics, U.S. Department of Education, 555 New Jersey Avenue, NW Room 408J, Washington, DC 20208-5654, William_Hussar@ed.gov

There will be a need for many newly hired teachers in the United States over the next ten years as large numbers of teachers are expected to retire and enrollments are expected to increase. We examine this need using an algebraic model with no econometric analysis. We use age-specific continuation rates of teachers from several different School and Staffing Surveys (SASS) of the National Center for Education Statistics to predict how many teachers will continue teaching from one year to another. The demand for teachers is taken as exogenous and several scenarios are examined. We assume that the supply will meet the demand and that the age distribution of new teachers will be the same as the 1993-94 SASS distribution. The model predicts that approximately 2 million newly hired public school teachers will be needed by 2008-09. Most of these newly hired teachers will be needed to replace those leaving the profession.

Forecasting the Labor Markets for Research Scientists and Engineers in the European Union**Philip Marey, Andries de Grip, and Frank Cövers**

Research Centre for Education and the Labor Market, Maastricht University, P.O.Box 616, 6200 MD, Maastricht, THE NETHERLANDS, p.marey@roa.unimaas.nl

The aim of this study is to assess whether the higher education systems in the Member States of the European Union will produce sufficient numbers of science & technology (S&T) graduates to meet the demands for research scientists and engineers (RSEs) in the next few years up to 2002. On the demand side, we distinguish between job openings due to employment growth (expansion demand) and due to outflow (replacement demand). Employment of RSEs is modeled as an error correction mechanism with R&D expenditure as the explanatory variable. A recent survey of European R&D establishments enables us to determine replacement demand. On the supply side, the labor market inflow of RSEs is derived from data on S&T-graduates and RSE employment. We produce forecasts for demand and supply for 14 Member States of the EU under four alternative scenarios, which are based on two dimensions: economic growth and human capital policy. The forecasting results indicate considerable shortages of RSEs in certain fields of study in various Member States of the EU under certain scenarios. At the same time, for the EU as a whole there are excess supplies in each of the four fields of study distinguished, no matter which scenario will unfold up to 2002, illustrating the importance of international labor mobility.

Chair: ***Yasemin Bal Gunduz***, Undersecretariat of Treasury, TURKEY, baly@pm.treasury.gov.tr

On the Efficiency of Predictions from the Regression with Nonspherical Disturbances

Sal AmirKhalkhali and Sam AmirKhalkhali

Department of Economics, and Department of Finance and Management Science, Sobey Faculty of Commerce, Saint Mary's University, Halifax, NS, CANADA, B3H 3C3,
sal.amirkhalkhali@stmarys.ca

This simulation study attempts to shed some light on the relative forecasting performance of some widely applied estimators for regression models where the disturbances are serially correlated and/or heteroscedastic (nonspherical). We experiment with two alternative models: one with real trended series and another with real untrended series. The structures created within each model are the same except for the variance-covariance matrix and the assumption of the probability distribution the disturbances follow. In our Monte Carlo experiments with anti-thetic variates, we evaluate the forecasting performances of estimators in terms of the accuracy of the within-sample as well as post-sample predictions.

The Behavior of the Canonical Correlation Technique to Identify the Order of Multivariate Long-Range Dependent Processes: A Simulation Study

Valderio Anselmo Reisen, DEST, BRAZIL, valderio@cce.ufes.br

Ela Mercedes M Toscano

Departamento de Estatística, Instituto de ciências Exatas, Universidade Federal de Minas Gerais, Caixa Postal 702, 30161-970 BH - MG - BRASIL, mercedes@est.ufmg.br

The vector ARFIMA—autoregressive fractionally integrated moving average—model, here denoted by VARFIMA, has recently appeared in the literature to represent multivariate time series with long memory properties. Series exhibiting long-range dependence arise in many fields of application such as climatology, finance, and telecommunication. We are interested in evaluating the behavior of the canonical correlation analysis so that the order of the VARFIMA process can be determined. This method is compared to the methods Cooper and Wood, the Scalar Component Model, and the simplified procedure of SCM previously proposed by Toscano and Reisen. Our results are obtained by using Monte Carlo simulation.

continued

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Monte Carlo Comparisons of Estimators for Random Coefficient Models***Yasemin Bal Gunduz***

Undersecretariat of Treasury, Hazine Mustersarligi EKA (18. Kat), Ismet Inonu Bulvari 06510 Emek Ankara, TURKEY, baly@pm.treasury.gov.tr

Asad Zaman, Bilkent University, TURKEY, asad@Bilkent.edu.tr

This paper compares a range of estimators for Random Coefficient models. A Bayesian estimator is developed implementing Griddy Gibbs Sampler for Hildreth-Houck type Random Coefficient Models. Monte Carlo experiments are used for comparing this estimator with Swamy and Tinsley (1980), Method of Moments, and Zaman's (1998) Modified Maximum Likelihood estimators. Comparisons were made on the biases, Mean Square Errors, and efficiencies of parameter estimates. The results show that performance of estimators are affected by sample size, balance of design matrix, and variance structure of stochastic regression coefficients. The Bayesian Griddy Gibbs provides the least biased estimates for the variance of regression coefficients in most cases. The Bayesian Griddy Gibbs and the method of moments estimators show better performance compared with others, the best one changing with some observable and unobservable criteria. In empirical work, using both methods in estimation and selecting the estimates with minimum out of sample forecast Mean Square Error may be recommended.

The Identification of the Order of the VARMA Model by Comparing the Kronecker Index and a Simplified SCM Approach: Simulation and Application***Ela Mercedes M Toscano***

Departamento de Estatística, Instituto de ciências Exatas, Universidade Federal de Minas Gerais, Caixa Postal 702, 30161-970 BH - MG - BRASIL, mercedes@est.ufmg.br

Valderio A. Reisen, DEST, CCE, UFES, BRAZIL, valderio@cce.ufes.br

In Multivariate Time Series (MTS) analysis the problem of model identification has called the attention of several researchers due to the difficulty in determining the vector ARMA model order. This work is concerned with how canonical correlation can be used to identify the structure of a linear multivariate time series model by comparing both the Kronecker Index and the simplified procedure of the Scalar-Component model (SCM). We evaluate their performance on the identification of the structure of a vector ARMA. The former method—the Kronecker index approach—is a refined ARMA Echelon form presented by Nsiri and Roy (1996) and the latter was introduced by Toscano and Reisen (1998). The results are obtained by simulations and we also apply the methods to a well known multivariate time series.

Chair: **Gary L. Shoesmith**, Wake Forest University, gary.shoesmith@mba.wfu.edu

Asymmetries and Nonlinearities in the Spanish Business Cycle: An Exploratory Analysis

Jose Ramon Cancelo, Xose Manuel Martinez, and Pilar Uriz

Dpto. Economia Aplicada II, Facultad Ciencias Economicas, Campus de La Zapateira,
15071 La Coruna SPAIN, jramon@mail.udc.es

In the recent years there has been a growing concern about whether linear models can capture some of the most relevant features of business cycles, with the resulting implications for their usefulness for explaining and forecasting economic variables. Even though it is easy to find arguments against the linear approach on theoretical grounds, the extent to which these departures constitute a practical problem is still an open issue. In our paper we study the practical relevance of asymmetries and nonlinearities for modeling Spanish main macroeconomic variables. We apply a wide set of tests against several types of asymmetries and nonlinearities to twenty selected quarterly economic time series, covering more than 30 years of data. Our preliminary results point out that although some departures from the linear assumptions are found, they do not seem to be overriding characteristics which might render linear models useless.

Forecasting Political and Macroeconomic Cycles a New Dynamic Principal Components Approach

A. Zhigljavsky, Cardiff University

D. Peel, Cardiff University

C. Ioannidis

Department of Economics and Finance, Brunel University, Uxbridge, Middlesex UB8 3PH, UK,
Christos.ioannidis@brunel.ac.uk

The idea of "politically" induced business cycles has gained widespread acceptance in both the economics and politics literature. In this paper we employ a "geometric" approach to forecasting using dynamic principal components. We exploit the time-evolving correlations of three series—the president's approval rate, the rate of consumer price inflation, and the unemployment rate. Using quarterly U.S. data from 1950, we examine their relationships and identify "common" components at different frequencies. We establish a long-run decline in presidential approval rates and a long-run negative relationship in the worsening of the macroeconomic environment and the approval rate. Analysis of the short-run/cyclical fluctuations reveals there exist common short cycles and that rises in inflation tend to have a pronounced "negative" effect on presidential popularity despite falls in the rate of unemployment. This finding suggests that the modeling of the objective function of the monetary authorities needs to be reexamined, as the "rewards" from the inflation surprise—reduced unemployment—are not forthcoming. We evaluate the model's forecasting performance and estimate imputed confidence intervals for our predictions using simulations.

continued

Session 2.8

Room: New York

Business Cycles

Monday
2:00-3:30

**German Interest Rate Spreads as Predictors of German Inflation and Business Cycles,
1973-1998**

Detelina Ivanova, SUNY-Albany
Kajal Lahiri

Department of Economics, SUNY-Albany, 1400 Washington Avenue, Albany, NY 12222,
KL758@cnsvax.albany.edu
Franz Seitz, Fachhochschule Amberg-Weiden

We have studied the comparative performance of three interest rate spreads as predictors of the German inflation and business cycle in the post-Bretton Woods era. The three spreads are the slope of the public bond yield curve, the slope of the bank bond yield curve, and the spread between one-year rates on bank bonds and public bonds. The spreads are used in a regime-switching model, in which the dynamic behavior of the economy is allowed to vary between expansions and recessions in terms of duration and volatility. The bank yield curve and the public yield curve predict all recessions with a comfortable lead of at least 3 months, but lag the last two recoveries by a few months. The bank-public spread issues a series of false signals in the early 1980's but its performance improves greatly in the 1990's when it picks up all turning points with a lead of at least 3 months. When we apply the probabilistic inference from our regime-switching model to the forecasts of inflation turning points we find that the public yield curve and the bank yield curve predict correctly all inflation turning points with a lead of two to four years, suggesting they could be included in the list of so-called long-leading indicators

Session 2.9

Room: Massachusetts

Agriculture and Food

Monday

2:00-3:30

Chair: **Stephen A. MacDonald**, Economic Research Service, U.S. Department Of Agriculture,
stephenm@econ.ag.gov

The Challenges of Forecasting U.S. Retail Food Prices When Consumer Tastes and Preferences Change**Annette L. Clauson**

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW Rm. 2133,
Washington, DC 20036-5831, aclauson@econ.ag.gov

The Economic Research Service (ERS), U.S. Department of Agriculture, is the only government agency that forecasts U.S. retail food price changes. Many of the traditional models used to forecast retail food prices assume that past cycles, seasonality, and trends repeat themselves, however, consumers make changes in their food preferences over time. This paper combines ERS's forecast methods with a linear forecast combination method to test for improvements in the Root Mean Square Error (RMSE) for 16 food categories. These two methods are compared to an inverse demand model approach to forecasting retail food prices. The most recent actual and forecast CPI data for 1996, 1997 and 1998 are used.

A Stochastic Model to Predict National Coconut Yield**T. S. G. Peiris**

Coconut Research Institute, Bandirippuwa Estate, Lunuwila 61150, SRI LANKA, rescri@sri.lanka.net

Coconut is one of the most economically important crops and it comprises an important part of the diet in Sri Lanka. Prediction of annual national coconut yield is of vital importance for policy makers, scientists and coconut growers. The empirical statistical models have failed to predict national yield due to many reasons. In this paper an autoregressive integrated moving average of ARIMA (2,1,0) that best fits past national yield data was identified to forecast national yield using Box-Jenkins modeling. The adequacy of the model was tested based on various statistics. The percentage error of the predicted value for the year 1999 was 2540 million nuts. The strategies in finding the "best" time-series model vis PROC ARIMA of SAS will be discussed.

Forecasting Performance of Different Model Representations within an Almost Ideal Model of Meat Demand**Camilo Sarmiento**

Department of Agricultural and Resource Economics, University of Maryland, College Park;
mailing address: 7704 Adelphi Road, apt #34, Hyattsville, MD 20783, sarmient@arec.umd.edu

Meat demand analysis uses Deaton and Muellbauer's initial presentation of the almost ideal (AI) model that defines all the variables in the system in either levels or first differences. In contrast to these past studies, this paper will estimate, rather than impose, the representation of the variables in the AI model. Accordingly, I propose two extensions to classical meat demand analysis: (1) estimate an error correction model that includes unit root and co-integration tests as inputs in model building; and (2) use a maximum likelihood method that estimates simultaneously the representation of the variables, the parameters of the model, and the structure of the residuals. Both in-sample and out-of-sample testing will evaluate the performance of each extension.

Chair: **M. Karanasos**, University of York, Heslington, UK, mk16@york.ac.uk

Median Unbiased Forecasts for Highly Persistent Autoregressive Processes

Nikolay Gospodinov

Boston College; mailing address: 136 Hemenway St., apt.30, Boston MA 02115, gospodin@bc.edu

It is well known that the OLS forecasts in near-integrated autoregressive models lead to severe underprediction of the future value of the conditional mean. This paper derives the limiting distribution of the deviation of the forecast value from the true conditional mean. The asymmetry of this asymptotic representation suggests that the median unbiasedness would be a better criterion in evaluating the properties of the forecast point estimates. Furthermore, the dependence of the limiting distribution on the local-to-unity parameter precludes the use of the standard asymptotic and bootstrap methods for bias correction. We develop a computationally convenient method that generates conditional bootstrap samples backward in time and approximates the median function of the predictive distribution on a grid of strategically chosen points around the OLS forecast. Inverting this median function yields median unbiased forecasts.

Predicting Markov-Switching Vector Autoregressive Processes

Hans-Martin Krolzig

University of Oxford, Institute of Economics and Statistics, St.Cross Building Manor Road, Oxford OX1 3UL, UK, hans-martin.krolzig@nuf.ox.ac.uk

While there has been a great deal of interest in the modeling of non-linearities and regime shifts in economic time series, there is no clear consensus regarding the forecasting abilities of these models. In this paper we develop a general approach to predict multiple time series subject to Markovian shifts in the regime. The feasibility of the proposed forecasting techniques in empirical research is demonstrated and their forecast accuracy is evaluated.

Residuals in Autoregressive-Moving Average Models: Theoretical Finite Sample Properties and Practical Applications

José Alberto Mauricio

Universidad Complutense de Madrid, Departamento de Economía Cuantitativa, Facultad de Económicas - UCM, Campus de Somosaguas, 28223 - Madrid, SPAIN, jamauri@ccee.ucm.es

Three classes of residuals in autoregressive-moving average (ARMA) models are considered in a non-state-space framework, with regard to: (1) their computation, (2) their exact distributions in finite samples, conditional on parameter estimates being equal to the true model parameter values, and (3) potential applications of their numerical and statistical properties in both preliminary estimation and model diagnostic checking. In this paper, exact and computable expressions for the finite sample covariance matrices of those classes of non state-space residuals are derived. An equivalence between a class of normalized residuals and its state-space counterpart is also provided on both statistical and numerical bases. Results are first derived and illustrated for univariate (scalar) ARMA models and then extended to the case of multivariate (vector) ARMA models.

Chair: **David G. Loomis**, Illinois State University, dloomis@ilstu.edu

A Pragmatic Approach to Forecasting Telephony Demand

Clive Mason

British Telecommunications PLC, PP 3069, 8-10 Gresham Street, London, EC2V 7AG UK,
clive.mason@bt.com

British Telecommunications has developed a unified forecasting system, Telephony Information for Decision Support (TIDeS). TIDeS allows econometric-based whole market demand to be segmented by customer, product, and carrier before applying generic price and optional discounting assumptions in order to derive revenues. This paper expands on the modeling approach used to forecast the whole market. It describes how the relationships between telephony growth and its drivers, established by modeling past performance, can be adjusted for different forecasting scenarios, and to allow for the input of alternative strategic assumptions. Also discussed are some of the problems encountered by this approach and some ideas to improve the effectiveness of the models.

Telecommunication Services Demand in Yugoslavia: Analysis and Forecasting

Ranko R. Nedeljkovic

University of Belgrade, Faculty of Traffic and Transport Engineering, Department of Postal Traffic and Telecommunications, Vojvode Stepe 305, 11000 Belgrade, YUGOSLAVIA, rankon@eunet.yu, nrranko@afrodit.a.rcub.bg.ac.yu

Danijel M. Cvjeticanin, University of Belgrade, cdaniel@opennet.org

In the 1990's, Yugoslavia experienced great turmoil caused by a weakening economy, growing political tendencies towards the formation of several separate states, war activities on the large part of its territory, and UN economic sanctions imposed on the Former Yugoslavia (FRY). In such a framework, we decided to analyze the current demand and to forecast future demands in telecommunication services in FRY. Our aims were: (1) to test different forecasting models on telecommunication services data in FRY for the 1980-1998 period; (2) to obtain forecasts for the levels of telecommunication service demands for the 2000-2003 period; (3) to test the hypothesis of the existence of structural breaks in the 1991-92 period; and (4) to answer the question regarding the significance of changes in time series with data on volume and structure of telecommunication services under conditions of division of one state territory into several new ones.

Future Broadcasting Industry in Singapore

Ryota Ono

School of Communication Studies, Nanyang Technological University, Nanyang Avenue, SINGAPORE, toryota@ntu.edu.sg

In order to sustain and enhance economic growth, the Singapore government has been deliberately pursuing several goals, one of which is to make Singapore a broadcasting hub for the region. The government had identified and marketed business opportunities in the broadcasting sector to foreign programmers and broadcast service providers such as uplinking and post-production companies. While those deliberate efforts brought about an initial success in Singapore's movement toward a regional broadcasting hub in the mid-1990's, whether or not Singapore will keep flourishing as a regional base of foreign broadcasters and production and post-production houses depends on several key factors. This study was carried out together with the Singapore Broadcasting Authority to look into those factors and to explore alternative future broadcasting environments in Singapore. The study used a focus group discussion, a two-rounds Delphi questionnaire survey and Cross-Impact Analysis, and finally depicted three alternative future scenarios.

Chair: **P. Geoffrey Allen**, University of Massachusetts, allen@resecon.umass.edu

A Model-Free Characterization of Cointegration and a Linearity Test

Felipe M. Aparicio and **Alvaro Escribano**

Department of Statistics and Econometrics, and Department of Economics, Universidad Carlos III de Madrid, Madrid 126, 28903 Madrid, SPAIN, aparicio@est-econ.uc3m.es, alvaroe@est-econ.uc3m.es

In this paper we propose several model-free statistics to measure serial dependence that are useful to characterize the short memory and the long memory properties of series in the time and the frequency domain. Conditions on the joint memory properties of the series such as cointegration are also formulated by means of these statistics. In particular, our characterization includes the possibility to discriminate between fractional and integer cointegration. The extension of the usual linear model dependent framework to a model-free framework allows us to study the memory properties of time series in a nonlinear context. A small Monte Carlo simulation experiment report promising results for a new test statistic to detect nonlinearities in the cointegration relationship without having to estimate the unknown function.

A Beveridge-Nelson Decomposition for Fractionally Integrated Time Series

Miguel A. Ariño

IESE, Av. Pearson 21, 08034 Barcelona, SPAIN, aarino@iese.es
Francesc Marmol, Universidad Carlos III de Madrid, SPAIN, fmarmol@est-econ.uc3m.es

The purpose of this paper is to present a decomposition into trend or permanent component and cycle or transitory component of a time series that follows a nonstationary autoregressive fractionally integrated moving average (ARFIMA(p,d,q)) model. As a particular case, for $d=1$ we obtain the well known Beveridge-Nelson decomposition of a series. For $d=2$ we get the decomposition of an $I(2)$ series given by Newbold and Vougas (1996). The decomposition depends only on past data and is thus computable in real time. Computational issues are also discussed.

continued

Session 3.1		Monday
Room: Federal B	Time Series–Cointegration	4:00-5:30

Forecasting Performance in Large Seasonal Models with Cointegration and Other Restrictions

Mårten Löf and Johan Lyhagen

Dept. of Economic Statistics, Stockholm School of Economics, P.O. Box 6501, S-113 83
Stockholm, SWEDEN, stmlo@hhs.se

The forecasting performance of the seasonally cointegrated model of Johansen and Schaumburg (1999) is compared to related specifications and to a standard model based on first differences and seasonal dummies. The data generating process used in the Monte Carlo simulation is based on an empirical six-dimensional data set and the modeling procedure is more realistic. More specifically, lag order selection and testing procedures for cointegrating rank are included in each replication. Preliminary results show that the different seasonal cointegration specifications do not improve the forecasting accuracy, at least in small samples. Furthermore, the model suggested by Johansen and Schaumburg seems to work better than the original model presented by Lee (1992), at least when shorter forecasting horizons are considered.

Estimation of the Parameter in a Non-Stationary ARFIMA Process

B. P. Olbermann, Instituto de Matematica, UFRGS, BRAZIL, slopes@mat.ufrgs.br
S. Lopes, Instituto de Matematica, UFRGS, BRAZIL, slopes@mat.ufrgs.br

V. A. Reisen

Mestrado Engenharia Ambiental, CT, UFES, Vitoria, E.S., BRAZIL, valderio@cce.ufes.br

Non-stationary long memory time series appear in many practical situations. From this may arise the following question: is it possible that integer differentiation results in a fractional differentiation long memory models? Using the ARFIMA—autoregressive integrated fractionally integrated moving average—process for $d > 0.5$, we investigate the bias that can arise from estimating the differencing parameter considering two regression estimators and the approximate maximum likelihood estimator. We also analyze the invariance to the first differences of these estimates. This analysis is obtained by Monte Carlo's simulation. Some results related to this problem are also discussed and presented.

Chair: **Ted Covey**, Economic Research Service, U.S. Department of Agriculture, lcovey@econ.ag.gov

Monetary Block of the Central Bank of the Republic of Turkey's Monthly Macroeconomic Model

Cem Aysoy and **Kürsat Kunter**

Central Bank of Republic of Turkey, Research Department, Istiklal Caddesi, No: 10 06100 Ulus-Ankara, TURKEY, cem.aysoy@tcmb.gov.tr, kursat.junter@tcmb.gov.tr

After the financial crisis of 1994, the primary objective of Turkey's Central Bank became maintaining the stability of foreign exchange and money markets. In order to reach this objective, the Central Bank brought some limits on the certain items of its balance sheet and applied a monetary program under the targets of macroeconomic model. This paper examines the monetary block of the reconstructed Central Bank monthly macroeconomic model. In this block, sight, time, foreign exchange deposits, and M1 are estimated by behavioral equations. Forecasts are obtained for the next one-year period.

Default Probabilities on European Sovereign Debt: Market-Based Estimates

Laurence S. Copeland

Cardiff Business School, Colum Drive, Cardiff CF1 3EU, UK, sbslc@cardiff.ac.uk

Euros (EMUs) are effectively foreign currency as far as individual countries are concerned, since no single government can print Euros in order to service its debts. Since all existing debts of member countries must now be repaid in Euros, the previously remote possibility of default becomes a significant risk. This paper extracts market-based estimates of the default probabilities for a selection of countries, using a technique applied by Bierman and Hass (1979) and Fons (1989) in the corporate debt market. In essence, this technique involves solving the debt pricing equation for the probabilities which set the price of risky debt discounted at the riskless rate equal to the actual price, which is of course discounted at the rate incorporating the default premium. We make use of debt denominated in a number of pre-EMU national currencies and also in ECU to derive a time series of default probabilities in the years preceding EMU.

Forecasting International GNP Growth Rates Through Common Factors

Antonio Garcia-Ferrer and **Pilar Poncela**

Departamento de Analisis Economico:Economia Cuantitativa Universidad Autonoma de Madrid Cantoblanco, 28049 Madrid SPAIN, antonio.garcia@uam.es, pilar.poncela@uam.es

In this paper, we present an extensive study for annual GNP of sixteen countries of the OECD. We looked for intercountry dependence and analyzed how different economies interact. We built multivariate models for GNP incorporating all the common information among the variables. We used dynamic factor models to explicitly model the common structure of the variables. This common dynamic structure can be nonstationary (i.e., common trends) or stationary (i.e., common cycles). We wrote the models in state space form and estimated them through the EM algorithm. We compared our models with other approaches such as univariate forecasts, pooled forecasts, and time varying parameter models. Comparisons were made using the root mean square error for one-step-ahead forecasts.

Chair: **John Haslett**, Trinity College, IRELAND, John.Haslett@tcd.ie

Combining Forecasts

J. Scott Armstrong

The Wharton School, University of Pennsylvania, Philadelphia, PA 19104-6371
armstrong@wharton.upenn.edu

When combining forecasts, it is desirable to use reasonable methods that both differ substantially and draw upon different sources of information. Gains in accuracy are larger when using more methods; use five or more methods when feasible. Use formal procedures to combine forecasts. Equal weights offers a reasonable starting point, and a trimmed mean is desirable if there are five or more methods. Differential weights can be used if there is much information on which method is expected to be most accurate or if there is good domain knowledge. Combining is most useful in situations where much uncertainty exists, in particular, where the data are short-interval data or unstable. Combined forecasts are especially useful where there is a need to avoid large errors. Compared with the errors of the typical component, combining reduces errors. The average reduction in error was about 14 percent when averaged across 31 empirical studies. In some situations, combined forecasts were more accurate than the best of the components.

Taxonomies for Forecast Combination Techniques

Claudio M. Rocco S. and Douglas Torres

Universidad Central de Venezuela, Facultad de Ingenieria, Caracas-Venezuela; mailing address:
Apartado Postal 47937, Los Chaguaramos, Caracas 1041A, VENEZUELA, crocco@reacciun.ve,
douglastd@cantv.net

The idea of combining forecasting models was originally proposed by Bates and Granger (1969). Since the publication of their article, methodological and practical issues related to combining have been studied extensively in recent years and combined forecasts have generally performed quite well in practice. Several forecast combination techniques have been proposed, based on different qualitative and quantitative aspects. In order to understand the main differences among such techniques, this paper presents three different taxonomies for thirteen forecast combination techniques based on different attributes: the statistical procedures used in order to define weights, the behavior of weights, and the philosophical aspects used on the weights definition.

An Analysis of the Reliability of Technology Foresight Results

Yun-Joong Yun and Johong-Ihl Lee

Institute of Industrial Technology Policy, Lotte-Kwanak Tower 7th Floor 396-67, Shindaebang-dong,
Dongjak-ku, Seoul, 156-010, KOREA, yjy@mail.itep.re.kr

Although Delphi became the most popular tool for a large-scale technology foresight, some methodological issues remain unresolved. One of the issues is the reliability of information provided from the Delphi survey. Therefore, it is necessary to analyze the foresight results from the Delphi survey. This paper presents some empirical results related to the reliability of foresight results using the data from the Industrial Technology Forecasting to 2010. Two questions were analyzed: (1) Are the responses of each expert consistent? (2) Do the significant differences in the response patterns exist between panelists with high and moderate expertise? The conclusion is that panelists' responses are significantly consistent, although there exist some differences in the response patterns between panelists with high and moderate expertise. Also, we found that predicted time of realization for each of technological topics is found to be similar between the two groups.

Session 3.4		Monday
Room: South American A	Financial Forecasting	4:00-5:30

Chair: *M. E. Nelson*, U.S. Naval Academy, nelson@novell.nadn.navy.mil

Testing for Covariance Stationarity in the UK All Equity Returns

M. F. Omran and E. Mckenzie

Dept. of Actuarial Maths/Stats, Heriot Watt University, Edinburgh, EH14 4AS, UK,
m.f.omran@ma.hw.ac.uk

The paper investigates the proposition that the UK Financial Times Stock Equity index All daily returns, during the period from 1/2/1970 to 10/17/1997, are covariance stationary. The null hypothesis of variance constancy is rejected using the Loretan and Philips (1994) test statistic. An intervention model in the spirit of Box and Tiao (1975) is used to filter the effects of the 1973 oil crisis and the 1987 market crash on the variance of the returns. We then apply the Loretan and Philips (1994) test statistic to the residuals from the intervention model. The results suggest that the null hypothesis of constant variance is not rejected indicating that the initial rejection of the null for the original data was due to the oil crisis and market crash. This implies that financial time series can be assumed covariance stationary if properly filtered of the effects of known periods of trouble.

American Depository Receipts and Order Flow Migration: Evidence from Asian Equity Markets

Roberto Curci, George Petrie, and *Gökçe Soydemir*

College of Business Administration, The University of Texas Pan American, 1201 West University Drive, Edinburg, TX 78539-2999, soydemir@panam.edu

American Depository Receipts (ADRs) of foreign market companies in the U.S. may cause domestic markets to become fragmented, diverting portfolio flows toward the U.S. market. Using daily data, we examine return interactions among Asian ADRs, and equity markets by estimating a vector autoregressive (VAR) model and find that international cross listing decreases domestic market fragmentation. The results further indicate that investors can achieve better risk-return trade-offs by combining ADRs with equities in markets other than those in which the underlying equities are traded.

Application of Models of Futures Prices in Analysis of Power System Investments under Uncertainty

Janusz Sowiński

Technical University of Czestochowa, Institute of Electric Power Engineering, Armii Krajowej 17, 42-200 Czestochowa, POLAND, jansow@el.pcz.czest.pl

This paper discusses some aspects of the analysis of investment decision-making model under uncertainty. The model applies real options approach. The approach is appropriate to model investments that are irreversible and an investor can wait than invest immediately. The model developed by McDonald and Siegel assumes price uncertainty. Alternative forecasting models of uncertain prices (e.g., the random walk model, the reverting model of prices with one-factor, and the two-factor reverting model) are considered. The investment rule takes the form of a critical value such that it is optimal to invest once. The model is applied to analyze an investment in new power capacity. Some results of the model are presented.

Chair: **Hans Levenbach**, Delphus Inc, delphus@worldnet.att.net

Demand Signal Response: Strategic Technology Forecasting

Alex Bangash

Lucent Technologies, Bell Laboratories, Rm 2L 518, 101 Crawford's Corner Road, Holmdel NJ 07733, abangash@lucent.com

Lucent Technologies, Bell Laboratories, designed a consensus-based demand planning process for its telecommunication gear manufacturing. This collaborative process ties the plans of production, marketing, product management, and sales to define a common consistent plan. The process allows the functions to work in tandem, but without restricting the autonomy of any individual function. The process is characterized by the effective use of statistical tools for forecasting at the lowest possible level; shared strategic and tactical goals and metrics; instrumentation and gauges that measure the impact of forecast in terms of inventory; pooling domain expertise in a demand planning in competency group for managing product life-cycle libraries; capturing organizational learning; and sharing analysis with all functions. Also part of the process is the implementation of a new paradigm which focuses more on consensus valuation of decisions and consequences—capacity, inventory, speed up/delay introduction and discontinuation of products.

Estimating the Bias in Forecasts of Intermittent Demand

A. A. Syntetos and John E. Boylan

Buckinghamshire Business School, Buckinghamshire University College, Newland Park, Chalfont St. Giles, Bucks HP8-4AD, UK, asynte01@buckscol.ac.uk

Intermittent demand creates significant problems in the manufacturing and supply environment as far as forecasting and inventory control are concerned. Croston (1972) proposed a new method according to which intermittent demand estimates can be built from constituent events. This paper identifies certain limitations in his approach and presents a correction in his estimate of the variance and of the expected value of demand per time period. In addition, the bias associated with Croston's method implementation in practice is quantified, for all different smoothing constant values, and an even further approximation of the variance of Croston's estimates of demand per time period is achieved. Also presented are a modification in his method that gives unbiased demand per period estimates and two more methods for forecasting intermittent demand. All the theoretical findings are confirmed by means of a theoretically generated and a real data extended simulation experiments.

Using Time-Series Intervention Models to Analyze the Impacts of Sales Promotions

Thomas Wassel

Astra-Zeneca Pharmaceuticals, L.P., 735 Chesterbrook Blvd., Wayne, PA 19087,
thomasx@icdc.com

Time-series intervention models may be the best choice of *analytical technique for identifying and measuring the impact of a sales promotion on sales levels*. Intervention Analysis (IA), unlike the traditional ANOVA/ANCOVA pre- vs. post-test group comparison, does not require the existence of a separate group of control subjects, the construction of which can be a difficult or impossible task in a dynamic business environment. Rather, IA allows each test subject to serve as its own control, where "baseline" behavior is identified and modeled via time-series techniques, and unusual behavior, i.e., the change caused by the intervention, is identified in comparison to the modeled norms. This paper presents an extensive example of how intervention models were used to identify and measure the impact of a "physician education program" on the prescribing patterns of a group of physicians. Modeling methods and software will be discussed.

Issues in Teaching Forecasting: Applied Forecasting

Much of the forecasting literature focuses on theory, however, many forecasters are practitioners. Teaching forecasting to the student who plans to apply forecasting principals or who may already be a forecasting practitioner requires a different emphasis than that of most forecasting texts. This panel will discuss the challenges of teaching forecasting to students who will apply their forecasting knowledge to practical problems. All of the panelists teach courses that are primarily made up of current or future forecasting practitioners. Three of the panelists teach in the Washington, DC area to a large number of students who are economists and statisticians. Many of these students are U.S. Federal employees who are expected to forecast on their jobs. The panelists will discuss the courses they teach, their course goals, and how teaching to an applied audience is different than teaching a general forecasting course.

Chair: **Karen S. Hamrick**

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW Mail Stop 2061, Washington, DC 20036-5831, khamrick@econ.ag.gov

Panelists:

Colin Jex

Management Science Department, Lancaster University, Lancaster, LA1 4YX, UK,
c.jex@lancaster.ac.uk

Frederick L. Joutz

Department of Economics, The George Washington University, Washington, DC 20052,
fjoutz@ibm.net

J. Keith Ord

The McDonough School of Business, Georgetown University, Washington DC 20057,
ordk@gunet.georgetown.edu

David A. Torgerson

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW Room 5193, Washington, DC 20036-5831, dtorg@econ.ag.gov; and USDA Graduate School

Panel organized by:

Karen S. Hamrick, Economic Research Service, U.S. Department of Agriculture, khamrick@econ.ag.gov

Chair: **Nuno Crato**, New Jersey Institute of Technology, ncrato@m.njit.edu

Differentials in U.S. Forecasted Mortality by Race and Sex to 2070: A Co-integrated Approach

Lawrence R. Carter

Department of Sociology, University of Oregon, Eugene, OR 97403-1291,
lcarter@oregon.uoregon.edu

We explore differentials in observed and forecasted age-sex-race-specific mortality in the United States, 1900 to 2171. A nonlinear model, $m(x,t) = \exp(a(x)+b(x)k(t)+e(t))$, for each race (white and nonwhite) and sex is fitted to a matrix of age-specific U.S. death rates ($m(x,t)$), 1933 to 1996, using SVD to derive a single time varying index of mortality, $k(t)$. Box-Jenkins techniques are used to estimate and forecast $k(t)$. These forecasts generate age-specific mortality rates and life expectancies ($e(0)$) from 1990 to 2071. We examine life table entropy and excess mortality implied by these forecasts. Findings show the $e(0)$'s diverging by race and converging by sex. Parity is not likely for any of these pairs in the 21st century.

Time Aggregation and Error-Correction Models

Ken Holden

Liverpool Business School, 98 Mount Pleasant, Liverpool L3 5UZ, UK, k.holden@livjm.ac.uk,
buskhold@livjm.ac.uk

Error-correction models (ECMs) involving both levels and rates of change variables are commonly used in applied work for modelling and forecasting. This paper examines the effects of aggregation over time, e.g., from monthly to quarterly data, on the parameters of an ECM. The conclusion is that it is not possible to infer from a quarterly ECM anything useful about the monthly ECM and vice-versa. An application to monthly gross domestic product data demonstrates these problems. The conclusion is that the behavioral assumptions behind any ECMS need to be carefully considered.

Logistic Curve of N-th Order and Its Application to Compound Growth Modeling

Mikhail Ya. Postan

Odessa State Maritime University, 34, Mechnikov St., Odessa, 270029, UKRAINE,
postan@farlep.net

The simple logistic curve is well known, and some of its generalizations are widely used for modeling and forecasting the growth processes in economics and demography. Therefore, it seems natural to introduce and investigate logistic curves of N-th order. The important property of the logistic curve of N-th order is that it has several points of inflection. The generalized logistic curve may describe the growth of compound (multibranch) production or dynamics of trophic chain of biological population. This presentation discusses finding a stationary solution of a system of nonlinear differential equations which includes a logistic curve, and also the problem of evaluating the logistic curve's parameters on the basis of statistical data.

Chair: **Peter Hingley**, European Patent Office, GERMANY, 101575.1604@compuserve.com

Energy Taxation for Employment: A Strategic Choice

Lotfi Bouzaïane and Mohamed Salah Redjeb

Faculté des Sciences Economiques et de Gestion de Tunis; mailing address: 29, avenue du 13 août, 2036 La Soukra, TUNISIA, lbouz@planet.tn, salah.redjeb.isg.rnu.tn

The paper presents a prospective analysis of the impact of a price policy based on social costs for a non-renewable resource in the case of a developing country that is an energy importer. Simulations are made for Tunisia on the basis of a macroeconomic model in two stages. In the first stage, the model forecasts the main macroeconomic variables for the period 1998-2025 taking into account expected macroeconomic policies and structural reforms. In the second stage, the first projections are revised based on the estimated impact using the framework of the input-output model of an energy tax increase combined with fiscal measures designed to reduce labor costs. The results of the revised projections show significant improvements in the basic socioeconomic indicators.

Capital Gains Realizations and Tax Revenues

Gunnar Forsling and Bo Stoltz

Ministry of Finance, SE-103 33 Stockholm, SWEDEN, gunnar.forsling@finance.ministry.se

The capital gains tax revenues have increased dramatically since mid 1980's. Since capital gains in Sweden (and most OECD countries) are taxed on the sale of capital assets, forecasts of tax revenues have to control for economic factors that influence households' realization behavior. In this paper time series and panel data estimations are used to analyze how changes in the capital gains tax rate and other determinants affect realizations. Our results indicate that realizations are highly sensitive to temporary tax rate changes. Furthermore we find that the value of corporate equity and real estate, held by households, are variables that significantly affect realizations.

Time-Series Modeling of Daily Tax Revenues

Marius Ooms, Björn de Groot, and Siem Jan Koopman

Econometric Institute, Erasmus University Rotterdam, PO Box 1738, NL-3000 DR Rotterdam, THE NETHERLANDS, ooms@few.eur.nl

This paper discusses a time-series model for daily tax revenues. The main feature of tax revenue series is the pattern within calendar months. Standard seasonal time series techniques are modified, because the number of trading days per calendar month varies from month to month and from year to year. The model is an unobserved components model, with a trend and seasonal components that vary over time. The seasonality for inter-month and intra-month movements is modeled using stochastic cubic splines. The model is made operational and used to produce daily forecasts at the Dutch Ministry of Finance. A front-end for model configuration and data input is implemented with Visual C++, while the econometrics and graphical diagnostics are build around Ox, and SsfPack, which implements general procedures for the Kalman filter and state space models.

Session 3.9		Monday
Room: Massachusetts	Agriculture and Food	4:00-5:30

Chair: **Stephen A. MacDonald**, Economic Research Service, U.S. Department of Agriculture,
stephenm@econ.ag.gov

Forecasting Returns in a Fishery: A Spatial Autoregressive Model

Rita Curtis

Agricultural & Resource Economics, 2200 Symons Hall, University of Maryland—College Park
 College Park, MD 20742, ritac@arec.umd.edu

Fisheries may be viewed as assets that yield services over time and space. To analyze supply response, fishery managers often use forecasts of catch and revenue at fishing sites to predict how effort will be allocated within the fishery. However, these forecasting models incorporate only temporal effects and ignore spatial interactions. This study develops a spatial autoregressive model (SARMA) to forecast returns to fishing sites within a large, spatially-differentiated fishery.

Preliminary results suggest that an autoregressive model is an inadequate representation of the data generating process. Results from the SARMA indicate that there are significant spatial effects across fishing sites. That is, random disturbances occurring at a site are not completely absorbed at that site but are also transmitted to other sites and may persist into future periods.

The Effects of Dollar/Sterling Exchange Rate Volatility on Coffee and Cocoa Spreads

Adusei Jumah

Department of Finance, Institute for Advanced Studies, Stumpergasse 56, A-1060 Wien (Vienna),
 AUSTRIA, jumah@ihs.ac.at

Robert M. Kunst, Department of Economics, Institute for Advanced Studies, AUSTRIA, kunst@ihs.ac.at

Whereas the most dramatic price movements in international agricultural commodity markets are caused mainly by adverse weather conditions in the major producing countries, traders in perfectly competitive markets are expected to have equal access to all available information on changes in weather and in global demand and supply conditions. Thus, an observed trade spread between markets may be explained by expectations on exchange rate fluctuations and hedging behavior of traders. This paper investigates the extent to which the Dollar/Sterling exchange rate fluctuations affect the trade spread for coffee and cocoa on the London Futures and Options Exchange, on the New York Coffee, Sugar and Cocoa Exchange, and between both markets by means of multivariate GARCH models. We evaluate the model-based predictions on the basis of several cost functions and explore possible seasonal effects.

Changing Relationships Between Prices of Synthetic and Natural Rubber: A State-Space Model Approach

Ben Vogelvang and Hidde P. Smit

Vrije Universiteit Amsterdam, Faculty of Economics and Econometrics, De Boelelaan 1105,
 1081 HV Amsterdam, THE NETHERLANDS, evogelvang@econ.vu.nl

World market prices on commodity markets are often correlated because they react to similar cycles in the economy. This happens for inputs and (partial) substitutes into the same products. This paper investigates a relationship between prices for natural and synthetic rubber for the USA, EU, and Japan. Natural rubber prices lead synthetic rubber prices, although this is changing over time, and is checked and estimated by using the Kalman filter for a model with time-varying parameters. The relationships reduce in significance over time: both positive and negative coefficients tend to zero, implying that both markets are increasingly separated. The problem of how to forecast the synthetic rubber price with this state-space model was also investigated. Three methods were used. The best results were obtained when the synthetic rubber price is predicted by using the last estimated model parameters as forecasts with "intercept corrections."

Chair: **Elizabeth Ann Maharaj**, Monash University, AUSTRALIA, ann.maharaj@buseco.monash.edu.au

Prediction in ARMA Models with GARCH in Mean Effects

M. Karanasos

Department of Economics and Related Studies, University of York, Heslington, York, Y01 5DD, UK,
mk16@york.ac.uk

This paper considers forecasting the conditional mean and variance from an ARMA model with GARCH in mean effects. Expressions for the optimal predictors and their conditional and unconditional MSE's are presented. We also derive the formula for the covariance structure of the process and its conditional variance.

Conditional Density and Value-at-Risk Prediction of Asian Currency Exchange Rates

Marc Paoletta and Stefan Mitnik

Institute of Statistics and Econometrics, Christian Albrechts University at Kiel, Olshausenstr. 40,
D—24098 Kiel, GERMANY, Paoletta@stat-econ.uni-kiel.de, mitnik@stat-econ.uni-kiel.de

We first demonstrate the simultaneous need for both more general GARCH structures and nonnormal innovations distributions for modeling the returns on certain return series such as the highly volatile exchange rates on east Asian currencies against the U.S. Dollar. This is accomplished not only via in-sample goodness-of-fit criteria, but also in terms of the precision of value-at-risk calculations made on out-of-sample density predictions. Second, a forecasting paradigm using weighted maximum likelihood estimation is proposed. We show that it gives rise to considerably improved forecast performance over longer periods of time.

Markov Switching Models: Applications to Financial Time Series

Luiz Rabi, Jr., Bic Banco,Rua Boa Vista 192, 01014-030 Sán Paulo, S.P. BRAZIL, bicdifin@uol.com.br

Pedro L. Valls

Department of Statistics, University of Sán Paulo, Rua do Matão 1010, 05508-020, Sán Paulo, S.P.
BRAZIL, pvalls@ime.usp.br

Some of the stylized facts in financial time series models cannot be modeled by linear gaussian processes. This paper presents a class of non-linear models, the Markov switching, and applies to financial time series. One of the main conclusions is that Markov switching models in mean or in variance are more appropriated to model financial time series. Applications to Brazilian financial time series, the São Paulo stock exchange index, Telebrás and the spread between Brazilian C-bond and Par are presented.

Chair: **Xu Yan**, Hong Kong University of Science and Technology, xuyan@usthk.ust.hk

A Review of Models of Telecommunications Demand

Robert Fildes and Peter Normington

Department of Management Science, Lancaster University, Lancaster, UK, LA1 4YX,
R.Fildes@Lancaster.ac.uk

The last decade has seen rapid advances in telecommunications technology. Companies operating in these markets have relied on demand forecasts to justify the considerable investment needed to ensure capacity availability. These new markets typically consist of new entrants taking up the generic service for the first time, established users changing their usage patterns, users of competing services shifting to the new service and those exiting from this segment of the market altogether. This paper examines a number of telecommunications services and describes various models that have been used to understand the market's dynamics. Markets discussed include: mobile and broadband. Various issues are illustrated, and a research agenda is proposed.

ARIMA Models for Comparing Forecasted to Actual Values of CPU Workloads

Anthony C. Waclawski

MCI WorldCom, 2424 Garden of the Gods Road, Dept/Loc 1530/117, Colorado Springs, Colorado 80919, Anthony.c.waclawski@mci.com

The marriage of MCI and WorldCom has created an enormous worldwide computing network with over one billion dollars in computing assets. The MCIWorldCom computing environment includes several very large central electronic complexes containing arrays of central and distributed computers. The entire network is remotely managed from Colorado Springs, Colorado. To effectively manage these corporate assets, decision-makers need accurate forecasts of midrange workload performance in order to justify requests for acquisition of new central processing units. This paper describes our use of the Autoregressive Integrated Moving Average (ARIMA) technique to accurately forecast workload consumption of midrange resources with 95% statistical confidence. Comparisons of forecasted and actual values of CPU consumption are also presented.

continued

Chair: **Xu Yan**, Hong Kong University of Science and Technology, xuyan@usthk.ust.hk

A Review of Models of Telecommunications Demand

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continued

The Evolution of the Market Structure in Mobile Telecommunications

Livio Cricelli, University of Rome "Tor Vergata", Dipartimento di Informatica, Sistemi e Produzione,
Via di Tor Vergata 110, 00133 Roma, ITALY, cricelli@disp.uniroma2.it

Massimo Gastaldi, University of l'Aquila, gastaldi@ing.univaq.it

Nathan Levialdi, University of Perugia, levialdi@disp.uniroma2.it

The growth of the market of mobile telephony has been very fast in the recent years . The technological changes have induced a drastic cost reduction and a rising differentiation in supplying services. The Italian mobile market is forecast to grow from about 13 million users in 1998 to an estimated 22 million in the year 2003. Currently two network operators (TIM and Omnitel) share the market and a third operator (Wind) 1999 will start in 1999. The model introduced in the paper can be used to estimate the effects of new entrant carrier in terms of profits, final prices, and market share of competitors. The proposed dynamic optimal control model is useful in analyzing regulatory considerations as well as understanding relevant features related to the structure of the industry and the growth of subscribers.

Forecasting Telecommunication Service Subscribers in Competitive and Substitutive Environments

Duk Bin Jun, Graduate School of Management, Korea Advanced Institute of Science and Technology
(KAIST), 207-43 Cheongryangri-Dong, Dongdaemun-Gu, Seoul, 130-012, REPUBLIC OF KOREA,
dbjun@cais.kaist.ac.kr

Yoon S. Park, KAIST, s_bedays@cais.kaist.ac.kr

The mobile telecommunication service market is expanding rapidly and becoming more substitutive and more competitive. In this environment, accurately forecasting the number of service subscribers is a difficult problem, and yet is important for both practitioners and researchers. In this paper, we adopt the modeling approach proposed by Jun and Park (1999). The basic premise of the approach is that demand patterns for new products result from the choice behavior of customers, where customers choose a service/product to maximize their utility. We applied the choice-based multigeneration diffusion model to the Korean mobile telephone market where digital service is replacing analog service and also to the Korean pager service market. We then compared the fitting and forecasting results of the models with those of other Bass-type multigeneration diffusion models.

Chair: **J. Keith Ord**, Georgetown University, ordk@gunet.georgetown.edu

Fast Estimation of Parameters in State Space Models

Siem Jan Koopman

CentER * Econometrics, Tilburg University, PO Box 90153, 5000 LE Tilburg, THE NETHERLANDS,
s.j.koopman@kub.nl

This paper discusses computationally efficient methods for exact maximum likelihood estimation of parameters in state space models. The proposed strategy is based on direct maximization of the likelihood function and it can be applied to a wide range of practical univariate and multivariate models. Almost no extra computing is required to deal with diffuse initial conditions. Practical problems such as missing values and non-equal spacing are dealt with in a straightforward fashion. Applications are given for structural time series models, non-parametric splines and models for heteroskedasticity.

Nonsampling Information in Structural Time Series Models: A Bayesian Approach

Paz Moral

Department of Econometric an Statistics, University of Basque Country, Avda. Lehendakari Agirre, 83 48015 Bilbao, SPAIN, pm@alcib.bs.ehu.es

Time series analysis can be used to provide a description and an estimation of the different elements of the time series such as trend or seasonality, and also to predict future values. Structural Time Series Models (STSM) have shown to be a fruitful tool when we are more interested in some components of the decomposition, such as the trend. The components of a STSM are specified stochastically, in order to represent adequately the movements of the observed time series. One inconvenience is that by not limiting its variability, erratic variations may not be eliminated which result in a very noisy signal, particularly in small samples. This paper studies the problem of signal extraction in small samples within the framework of STSM. We develop a Bayesian approach, which offers the flexibility of incorporating prior information about the parameters and to measure the effect of these priors. Using proper priors of the parameters of the model, it is possible to avoid erratic variations in the evolution of the estimated components. The importance of this prior information is evaluated with the aim to determinate a sample size for which the prior information would be redundant.

continued

Session 4.1

Room: Federal B

Time Series–State Space Models

Tuesday

10:30-12:00

Multiple versus Single Source of Error State Space Models

Mark Leeds, Statistics Department, Pennsylvania State University, University Park, PA 16802,
leeds@stat.psu.edu

Anne Koehler, Miami University, Oxford, OH 45056, koehleab@muohio.edu

J. Keith Ord, The McDonough School of Business, Georgetown University, Washington DC 20057,
ordk@gunet.georgetown.edu

State space models, also known as structural models, may be formulated using either multiple or single sources of error. This paper reviews the differences between the two formulations. The key issues we consider for each model are the nature and size of the parameter space, the structure of the canonical form, and the asymptotic properties of the estimators for the state variables. We show that there are some key differences between the two formulations and that these differences have implications for forecasting. In particular, we justify the ad-hoc use of state space methods, such as Holt-Winters, that ignore the distinction between observed and underlying state variables.

Prediction MSE for State Space Models with Estimated Parameters

Benoit Quenneville and Avinash C. Singh

Benoit Quenneville, Time Series Research and Analysis Centre, Statistics Canada, Ottawa,
Ontario, CANADA, K1A 0T6, quenne@statcan.ca

This presentation focuses on the estimation of the prediction mean squared error (MSE) for state space models, when the model's parameters are estimated from the data. We review the contribution of Hamilton (1986) and Ansley and Kohn (1986). Both have proposed corrections to the naive approximation, which is obtained via substitution of the maximum likelihood estimates for the unknown parameters. We extend their work by identifying missing terms of the same order as that in their corrections. For simplicity of the presentation, we use the random walk plus noise model to highlight the theory. We also illustrate the differences between the various approximations with the Purse Snatching in Chicago series.

The U.S. Economic Outlook

The U.S. economy is currently in its eighth year of expansion. Despite the global financial turmoil of the last few months and the resulting world growth slowdown, U.S. growth has been strong and inflation and unemployment rates are low. How long will this last? Are there problems lurking such as low consumer savings rates, the strong value of the dollar, increased trade deficits, and continued mass layoffs than could bring a recession in the near- or moderate- term? What are the prospects for growth over the next 5 to 10 years? This panel discussion will address these issues. Christopher Williams will discuss the short-term outlook (over the next 3-6 months), Paul Sundell will discuss the two-year outlook, and Ralph Monaco will discuss the 5- to 10-year outlook. David Torgerson will critique the forecasts and offer insights into the risks and uncertainties of macroeconomic forecasting.

Chair: ***Karen S. Hamrick***

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW Mail Stop 2061, Washington, DC 20036-5831, khamrick@econ.ag.gov

Panelists:

Christopher Williams

Macroeconomic Analysis Division, Congressional Budget Office, Ford House Office Building, Second and D Streets, SW, Washington, DC 20515, chris@cbo.gov

Paul A. Sundell

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW Room 5192, Washington, DC 20036-5831, psundell@econ.ag.gov

Ralph Monaco

INFORUM, Department of Economics, University of Maryland, College Park, MD 20742, ralph@inforum.umd.edu

Discussant:

David A. Torgerson

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW Room 5193, Washington, DC 20036-5831, dtorg@econ.ag.gov

Panel organized by:

Karen S. Hamrick, Economic Research Service, U.S. Department of Agriculture, khamrick@econ.ag.gov

Session 4.3		Tuesday
Room: South American B	Judgmental Forecasting	10:30-12:00

Chair: **William Remus**, University of Hawaii, Remus@hawaii.edu

Super-Reversal in Judgmental Forecasting

David Clarke

School of Psychology, University of Nottingham, Nottingham, NG7 2RD, UK,
David.Clarke@nottingham.ac.uk

Rolling-horizon forecasts can be made faster or slower than the events in question. They can also be made backwards, to answer questions about the linkage between events, and how people comprehend it. In several domains, especially to do with accidents and violent scenarios, we have found 'super-reversal'—that is backward forecasts are significantly more accurate, and easier to make, than forward ones. There are several possible reasons for this: (a) event entropy increases over time; (b) subjects are more skilled at backward inference; or (c) the event descriptions contain asymmetrical cues to their linkage. All these possibilities have implications for forecasting research and practice. New experiments will be reported on which this is the case.

Judgmental Adjustment of Statistical Forecasts

Nada R. Sanders and Larry P. Ritzman

Department of Management Science and Information Systems, 271 Rike Hall, College of Business and Administration, Wright State University, Dayton, OH 45435-0001, nsanders@wright.edu, ritzman@bc.edu

Judgmental and statistical forecasts can each bring certain advantages to the forecasting process. One way to integrate these methods is for forecasters to adjust statistical forecasts based on judgment. However, judgmental adjustment can bias the forecast and harm accuracy. Forecasters should consider six principles that address when and how to judgmental adjust statistical forecasts. These principles are: (1) Adjust statistical forecasts if there is important domain knowledge; (2) Adjust statistical forecasts in situations with a high degree of uncertainty; (3) Adjust statistical forecasts when there are known changes in the environment; (4) Structure the judgmental adjustment process; (5) Document all judgmental adjustments made and periodically relate to forecast accuracy; and (6) Consider mechanically integrating judgmental and statistical forecasts over adjusting.

Principles for Using Domain Knowledge in Judgmental Knowledge

Richard Webby, **Marcus O'Connor**, and Michael Lawrence

School of Information Systems, University of New South Wales, Sydney 2052, AUSTRALIA,
M.OConnor@unsw.edu.au

This paper examines principles regarding when and how to use judgment in time series forecasting with domain knowledge. The evidence suggests that the reliability of domain knowledge is critical, and that judgment is essential when dealing with "soft" information. However judgment suffers from biases and inefficiencies when dealing with domain knowledge. We suggest that domain knowledge should be used when there is a large amount of relevant information, when experts are deemed to possess it and when the experts do not appear to have pre-determined agendas for the final forecast or the forecast setting process. Forecasters should only select the most important causal information, adjust initial estimates boldly in the light of new domain knowledge, and use decomposition strategies to integrate domain knowledge into the forecast.

Chair: **Carlo D. Smith**, University of San Diego, cds001@earthlink.net

The Rationality of Economic Forecasts: A Meta-Analysis

Robert Goldfarb and H. O. Stekler

Department of Economics, The George Washington University, Washington, DC 20052,
gldfrb@gwu.edu, hstekler@gwu.edu

This paper will examine the rationality literature testing the hypothesis that economic forecasts—of inflation and/or the growth rate of GDP—are or were rational. This literature is of particular and continuing interest to economists. It has generated conflicting results, with conclusions about the rationality of forecasts changing markedly and repeatedly over time. Our purpose is to systematically document this pattern of changing conclusions, identify and investigate the seeming causes of these shifts in findings, and to examine whether meta-analysis techniques might have been useful in shedding additional light on those findings.

Forecasting Practices in British Industry: An Empirical Assessment

Harry Kogotsidis and Brian Mathews

Luton Business School, University of Luton, Luton LU1 3JU, UNITED KINGDOM,
harry.kogotsidis@luton.ac.uk, brian.mathews@luton.ac.uk

The purpose of this paper is to review a number of empirical studies on forecasting practices with regard to the issues of technique familiarity, usage, and satisfaction, and to present the results of a new mail survey that the authors have carried out in Britain this year. The new study aims to provide new evidence as to how familiar British forecasting practitioners are with various forecasting techniques (both statistical and judgmental), and to report on the current level of usage of these techniques and the degree of satisfaction of British forecasting practitioners with the individual techniques.

continued

**Behavioral Factors and Their Influence on Forecasting Management Performance:
Results from an Empirical Investigation*****Carlo D. Smith***

University of Tennessee, Department of Marketing, Logistics and Transportation, 310 Stokely Management Center, Knoxville, TN 37996-0530, cds@utk.edu; after September: School of Business Administration, University of San Diego, 5998 Alcala Park, San Diego, CA 92110-2492, cds001@earthlink.net

Forecast accuracy is the most prominent and generally accepted measure of forecasting performance. However, as noted by Schultz (1992), to determine if an organization is better off having implemented a new forecasting technique, "we must go beyond measures of accuracy and look to objective performance measures such as sales, costs, and profits" (p. 410). To do so, we must consider the attitudes and behaviors which influence the implementation of forecasts in practice. This paper will present the results of an empirical investigation of factors which influence Forecasting Management Performance (FMP). FMP is conceptualized as a multi-dimensional construct consisting of perceived forecast accuracy, acceptance, and application. Perceived forecast accuracy involves user perceptions of traditional forecast accuracy measures. Forecast acceptance is a measure of the attitudes of those individuals who have contact with the development and application of forecasts. Forecast application is presented as a behavioral component which establishes the tie between forecasts developed and those used as input to organizational planning and management processes and systems.

Confronting Strategic Inertia in a Top Management Team: Learning from Failure***G. Wright and G. P. Hodgkinson***

Strathclyde Graduate Business School, 199 Cathedral Street, Glasgow G4 0GE, Scotland, UK,
g.wright@strath.ac.uk

The aim of strategic reflection is to attain the requisite variety in mental models in order to anticipate the future and develop a strategically responsive organization—thus mediating the potentially deleterious impact of cognitive inertia on strategic action. In this paper, we confront theory with practice and reflect critically on our own attempts to implement this prescriptive advice. We detail the outcomes of our use of scenario planning in a consultancy assignment. In contrast to the picture presented in the current literature, scenario techniques are not invariably successful. The scenario process puts the nature of the future in sharp focus. Consequently, if an appropriate strategy cannot be devised to be robust against multiple plausible futures, then unconflicted change to a new strategy is not possible. Under these circumstances, stress rises to an unacceptable level and, accordingly, a range of psychological defense mechanisms are deployed to reduce this stress. The present paper documents these mechanisms.

Chair: **Elliot Levy**, US Department of Commerce, Elliot_Levy@ita.doc.gov

An Evolutionary Forecasting Model Using Multiple Source Data

CHEN Xiao Ying

Lab. Biometrics, The University of Tokyo, Yayoi 1-1-1, Bunkyo-Ku, Tokyo, JAPAN
chen@peach.ab.a.u-tokyo.ac.jp

We develop an evolutionary model for new product forecasting. In this model, forecasting accuracy can be improved by integrating different source data, for example, human experience data (qualitative and quantitative data), pretest market data, daily prior ordering data and so on. Since forecasting performance is improved with the increasing of the source data before the launch of a new product, our approach can be characterized as an evolutionary model. Finally empirical studies using real data set are given.

Middle-Term Global Demand for Paper Machines

Seppo Pitkänen

Lappeenranta University of Technology, P.O. Box 20, FIN-53851, Lappeenranta, FINLAND,
spnen@csc.fi

This paper presents a programmed model system where several time series techniques are combined. The system produces up to seven years' forecasts for nine market areas. Of particular interest are the paper demand and the estimated financial investment opportunities of single paper producers. The model also allows for stepwise simulation. An effective databank with rules for updating data is an essential part of the system.

I. S. O. (In Search Of) Prediction Yardsticks

Elliot Levy

#H2220, Herbert C. Hoover Bldg., Office of Trade & Economic Analysis, International Trade Administration, US Department of Commerce-Main, Washington DC 20190,
Elliot_Levy@ita.doc.gov

In this presentation, a description of the dynamic programming solution and implementation of method is applied to a sales problem to determine a maximum of on-site vendors and items for sale on company premises. In order to arrive at the optimum, this programming method—a tool of Operations Research—was used on merchants commissions paid to the company for selling items of employee demand for personal needs, such as jewelry, fragrances, neckties, coupon books, etc. The optimum vending results can serve as prediction variables (yardsticks) for inventory needs if the company chooses to start a store for the employees.

Performance Evaluation of Exchange Rate Forecasts: a Benchmark-Study**Folke A. Rauscher**

Daimler-Chrysler AG, Research & Technology - FT3/KL, 89013 Ulm, GERMANY,
folke.rauscher@dbag.ulm.daimlerbenz.com

Forecasting foreign exchange rates is a major concern for strategic business decision making as well as for policy formulation. Due to increased globalization of business activities, growing international diversification and trade, as well as high exchange rate volatility, global currency crisis, and financial risks, the prediction of exact exchange rates becomes even more important. This paper carries out a benchmark-study to evaluate the forecasting performance and quality of publicly available professional exchange rate predictions. For the out-of-sample test period January 1996 to September 1998 more than 6000 exchange rate forecasts were evaluated in this work. The performance evaluation includes 1-, 3-, 6-, and 12-month forecasts of the 7 major world currency pairs by 22 of the most important U.S. and European banks and forecasting institutions. The forecasting quality is quantified by the following performance measures: hit rate, mean absolute percentage error, return of investment, and standard deviation. This paper compares different exchange rate forecasts and evaluates their predictive quality against each other. In addition, an overall ranking as well as a more detailed analysis of specific forecasting aspects is provided.

Misalignment of Real Exchange Rates: An International Comparison**Nigel Wilkins and G. C. Lim**

Department of Econometrics and Business Statistics, Monash University, Clayton Campus, Clayton Victoria 3168, AUSTRALIA, Nigel.Wilkins@BusEco.monash.edu.au

Identifying the extent of misalignment of the real exchange rate is important in determining appropriate policy responses to exchange rate fluctuations. This paper applies the fractionally integrated model to a number of bilateral real exchange rates and classifies the degree of misalignment according to their order of integration. The forecasting performance of the fractionally integrated model is then compared to that of conventional ARMA models using RMSE statistics for each of the currencies. Four cases of misalignment are considered—transitory, persistent, fundamental, and chronic. Six European currencies are analyzed relative to the U.S. dollar and the Deutschmark; and six Asian currencies are analyzed relative to the U.S. dollar and the Japanese yen. The results show that the French franc/DM and the Korean won/yen rates are transitorily misaligned, whereas the Swiss franc/DM rate is persistently misaligned. The majority of the bilateral real exchange rates are fundamentally misaligned, while a few are identified as chronically misaligned (these being the Spanish peseta/DM, the UK sterling/DM, the Indonesian rupiah/\$US and the Thai bhat/\$US rates).

Chair: **Wilpen Gorr**, Carnegie Mellon University, wg0g@andrew.cmu.edu

A New Model for Spatial-Temporal Event Prediction

Donald E. Brown and Hua LiuDepartment of Systems Engineering, University of Virginia, Charlottesville, VA 22903,
Brown@Virginia.edu

A new model for predicting the probability of occurrence of spatial-temporal random events is described. The model is based on the theory of point patterns. The model allows for the incorporation of observed event characteristics or features into space-time prediction. Effective and efficient prediction also involves identifying the key characteristics or features that explain the spatial pattern as a preliminary step. A clustering-based criterion is presented to address the feature subset selection problem. We have applied the model to problems of criminal event predictions. We describe the use of the model for this purpose and give results for predicting property crimes in Richmond, Virginia. We also compare our model with other approaches on these data.

Modeling and Forecasting Property Crimes in England and Wales

Jing Bai Song, Faculty of Human Sciences, Kinston University, Surrey KT1 2EE, UK
Xiaming Liu, Aston Business School, Aston University, Birmingham, B4 7ET, UK, liux@aston.ac.uk

This paper examines the economic and criminal justice determinants of property crime in England and Wales. Following the 'general-to-specific' modeling approach (Hendry 1995), the integration orders of variables are examined and three general auto-regressive distributed lag (ADL) models for theft, burglary and property crime—theft plus burglary—are constructed and tested down until well specified models are reached. The results from the estimation of the final preferred models suggest that income and real social benefit have a negative and significant impact on theft and burglary. "Habit persistency" is also significantly associated with the crime level. The final models are used to generate forecasts based on an assumption that the average growth rates of GDP and real social benefits over the last twenty years will be extended into the future.

Crime Space/Time Series Forecasting

Wilpen Gorr, Andreas Olligschlaeger, Janusz Szczypula, and Yvonne Thompson
H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, Pittsburgh,
PA 15213, wg0g@andrew.cmu.edu

This paper addresses the research agenda and preliminary empirical results of the grants awarded by the U.S. National Institute of Justice on forecasting crime. The first part is to develop small-area time series methods for use in the very popular and effective New York City approach to enforcement (Computer Statistics or COMPSTAT). Police need short-term forecasts for tactical deployment and as counterfactuals for evaluation of short-run performance in combating crime. The second part is to develop a suite of leading indicators of crime, in the context of crime "hot spots." This work includes a test of the so-called "Broken Windows" hypothesis that "soft crimes"—disturbances and vandalism—lead to "hard crimes"—assaults and robberies.

Chair: **Frederick L. Joutz**, The George Washington University, fjoutz@ibm.net

Forecasting Trademark Applications

Barrett J. Riordan

U.S. Patent and Trademark Office, Office of Planning and Evaluation, Washington, DC 20231,
barry.riordan@uspto.gov

A trademark is a word, name, symbol, or device, or any combination of these, adopted and used by a manufacturer or merchant to identify their goods and distinguish them from those manufactured or sold by others. The United States Patent and Trademark Office (PTO) examines trademark applications and grants federal registration to owners of qualified marks. Examination of registration applications is conducted by trained trademark attorneys. Because such specialized professional expertise is neither easy nor inexpensive to acquire, it is of major importance to PTO to be able match resources with demands through accurate forecasting. While trademark registration activity is known to be generally correlated with overall national economic activity and with the turnover of businesses and products, developing precise and useful relationships is a difficult endeavor. PTO has identified several variables that serve as leading predictors of trademark registration activity.

Forecasting Patent Application Filings

Costas Mastrogianis, U.S. Patent and Trademark Office, gus.mastrogianis@uspto.gov

Frederick L. Joutz and Robert P. Trost

Department of Economics, The George Washington University, Washington, DC 20052,
fjoutz@ibm.net

The U.S. Patent and Trademark Office (PTO) is the government agency responsible for examining and issuing patents in the United States. The PTO is not funded by tax dollars but by charging its customers fees for products and services. To effectively continue to plan for customer demand, the PTO requires accurate forecasting models. Since fiscal year 1993, the PTO has been developing new forecasting models with the collaboration of its Trilateral Partners, the European and Japanese Patent Offices. This effort has focused on a major PTO workload, patent application filings. Econometric and other types of regression models have been developed and used to forecast PTO patent filings in the aggregate and by domestic and foreign origin. The PTO is currently researching and developing new models to forecast patent filings by technology groupings. This new research will help further improve upon the forecasting and planning capability at the PTO.

Improvements to Methods for Forecasting Patent Applications at the European Patent Office Using Information on Patent Families

Peter Hingley, Marc Nicolas, and Bernard Paye

European Patent Office, Erhardtstrasse 27, D-80298 Munich, GERMANY,
101575.1604@compuserve.com

Accurate forecasting of patent applications is crucial for resource planning at the EPO, which faces a special situation as a supranational office. Inventors usually apply for patents first in their home country, and then again later in foreign countries quoting the earlier first filings as priority applications. The forecasting methods in use at the EPO are trend analyses, regressions on priority filings, and regular surveys of a panel of applicants to determine their future intentions. Recently a database has been constructed of patent families, indexed by the priority applications and describing subsequent filing activity throughout the world for particular inventions. This database will be described and additional new forecasting methods will be discussed, involving multivariate models of simultaneous worldwide patent flows, which should be able to improve the forecasting methods.

Chair: **Ryota Ono**, Nanyang Technological University, toryota@ntu.edu.sg

Strategic Forecasting for E-Commerce with SAP R/3

Paul Sheldon Foote

California State University, Fullerton, PO Box 6848, Fullerton, CA 92834-6848,
pfoote@fullerton.edu

Enterprise Resource Planning (ERP) has evolved rapidly on two fronts: (1) support for strategic planning in specific industries (2) support for e-commerce. PricewaterhouseCoopers, for example, is extending the SAP (Systems, Applications, and Products in Data Processing) Banking Strategic Enterprise Management set of solutions to include risk, profit, and strategy analyzers. SAP continues to add components to SAP R/3 to support e-commerce. This is an evaluation of the extent to which formal analytical methods of strategic forecasting are being and should be included in these advances.

Modeling the Development of a Supply Restricted Telecommunications Market

Towhidul Islam

Economics Department, Dalhousie University, 6214 University Avenue, Halifax, NS B3H 3J5,
CANADA, tislam@is.dal.ca

Denzil Fiebig, The University of Sydney, AUSTRALIA, denzilf@econ.usyd.edu.au

Nigel Meade, Imperial College, UNITED KINGDOM, n.meade@ic.ac.uk

Modeling and forecasting demand in a supply restricted market is difficult due to unobserved or suppressed demand. The subscribers' flow from waiting applicants to adopters is controlled by supply restrictions. This supply restriction is partly due to the resource constraints of the particular country or company. At some point of time when resources are available, the true demand patterns are unknown but become prerequisites for planning the provision of plant, switching equipment, cable, building capacity, and the numbering plan. The objective of this paper is to suggest alternative modeling approaches to capture the dynamics of supply restrictions on the true diffusion pattern. The alternative modeling approaches considered are diffusion model, partial adjustment model, switching regression and data envelopment analysis (DEA, and stochastic frontier models. An empirical analysis of diffusion of main telephones of 50 countries is presented to demonstrate the usefulness of the proposed models.

Chair: **Anurag Banerjee**, Queens University, UK, A.Banerjee@Queens-Belfast.AC.UK

Tests for Multiple Forecast Encompassing

David I. Harvey

Department of Economics, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK, D.I.Harvey@Lboro.ac.uk

Paul Newbold

Department of Economics, University of Nottingham, University Park, Nottingham NG7 2RD, UK, LEZPN@LEN1.Nottingham.ac.uk

In the evaluation of economic forecasts, it is frequently the case that comparisons are made among a number of competing predictors. A natural question to ask in such contexts is whether one forecast encompasses its competitors, in the sense that they contain no useful information not present in the superior forecast. We develop tests for this notion of multiple forecast encompassing which are robust to properties expected in the forecast errors, and recommend one test for practical application. Our preferred test is applied to forecasts of UK growth and inflation.

Bankers as Probability Assessors of Short-term Trends in Good Farmland Value

Ted Covey

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW, Washington, DC 20036-5831, tcovey@econ.ag.gov

This paper applies probability forecast evaluation techniques to Federal Reserve survey data of bankers' probability assignments to possible one-quarter-ahead trends in the market value of good farmland. The external correspondence of the bankers' expectations will be evaluated using the Yates Covariance Decomposition of the Brier Probability Score and contrasted to probabilities issued by a naive model and a model with foreknowledge of the future long-run relative frequencies.

continued

The Relevant Percentage Error Measures for Business Decision Making



Roy L. Pearson and Wanda A. Wallace

402 Jamestown Road, College of William and Mary, Williamsburg, VA 23185,
Rpear@dogwood.tyler.wm.edu

This paper argues that when the forecasting purpose is business decision making and reporting, APE should be calculated with the forecasted value in the denominator, and using MAPE and MdAPE in combination. For business assessment of forecast performance, the relevant benchmark is the plan—a forecast. The relevant error is percent variation from plan, not from actual (or from an average of the two, per Makridakis). The purpose of forecast error measurement here is not to determine how close the forecast is to actual results, but to the goal as detailed *a priori* in the form of a budget, a plan, or a forecast. The evolving practice of applying non-parametric error measures points to the value of blending the information content of appropriately calculated MAPE and MdAPE in combination in the forecast evaluation process is a simple and practical approach.

Forecast Performance Comparison Using White's "Reality Check"

Leonardo R. Souza and **Álvaro Veiga**

Electrical Engineering Department, Pontifícia Universidade Católica do Rio de Janeiro, Rua Marquês de São Vicente, 225 - Gávea - 22543-900, Rio de Janeiro - RJ - BRAZIL, leors@ele.puc-rio.br, alvf@ele.puc-rio.br

More and more, in practical data modeling, there are computer intensive algorithms to sequentially generate different models until finding the best one. However, when many models are tested, one can happen to get a good predictive power by simple chance. This paper presents an application of a non-parametric hypothesis test, developed by White (1997), to compare the forecast power of different time series models tested on the same data. The test makes use of bootstrap techniques to generate the distribution of the forecast power measure being used. The null hypothesis is that there is no model better than a departure model, the benchmark. The *reality check* test is evaluated in a Monte-Carlo experiment with time series models in different situations and is verified that it performs well and can be very useful in practical situations.

Session 4.11

Room: Continental

Energy Forecasting

Tuesday

10:30-12:00

Chair: **Max Stevenson**, University of Technology Sydney, m.stevenson@uts.edu.au**Modeling Neural Nets to Very Short-Term Load Forecasting**

Luiz Sabino Ribeiro Neto, Karla Figueiredo, Marley Vellasco, and Marco Aurélio Pacheco

ICA - Núcleo de Inteligência Computacional Aplicada, Departamento de Engenharia Elétrica,
Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro – BRASIL , Rua Marquês de
São Vicente, 225 – Prédio Cardeal Leme, Rio de Janeiro – RJ – BRASIL, ica@ele.puc-rio.br

Short-term forecasting is used to ensure secure operation and energy efficiency. The purpose of this type of prediction is to indicate to the operators, at the operation control centers of an electric power system, whether the system load tends to increase in a way that may cause load-demand problems. In these cases, an urgent decision need to be taken in order to maintain the generation/load balance. This paper investigates the application of Artificial Neural Networks in very short-term load forecasting—ten-minute intervals. The inputs to the network were: load data of the previous hour; load of the previous week; and time—hour and minute—of the day. A different network was used for each day of the week. In a multi-step prediction, the neural network predicted 144 steps ahead (1 day), with an absolute mean error of 2.56 percent. This result confirms the applicability of neural networks in very short-term forecasting.

An Application of Neural Networks to Hourly Load Forecasting**Eric W. Fox**, Frank A. Monforte, and J. Stuart McMenaminRegional Economic Research, Inc., 11236 El Camino Real, Suite A, San Diego, CA 92130-2650,
eric@rer.com

Electric utilities and system operators face a set of very short-term forecasting problems, involving loads in the next hour, the next day, and the next week. In addition to the standard tools of econometrics and time-series analysis, approaches using artificial neural networks (ANN) are being applied to these forecasting problems. In the case of very short-term problems—an hour ahead—these models operate like nonlinear time-series models. For short-term problems—a day ahead—these models place much less reliance on autoregressive terms and operate more like nonlinear regression models or transfer-function models. This paper will discuss the nature of these short-term forecasting problems and identify reasons why the neural network approach is well suited to these applications. It provides a direct comparison of the neural networks in terms of conventional statistical concepts, providing a bridge through which direct comparisons can be made.

continued

Short-Term Load Forecast Using Fuzzy Logic and Calendar of Events

Plutarcho M. Lourenco, Guilherme Ferreira Ribeiro, Celia Regina S. H. Lourenco,
and Victor Navarro A. L. da Silva

Electronic Department, Electric Power Research Center (CEPEL), Cidade Universitaria, Ilha do
Fundao, Rio de Janeiro - RJ - BRAZIL, taco@fund.cepel.br

The electric load has economic and technical importance to an electric power system. Knowing the load values beforehand is important in several parts of an electric power system not only to reduce difficulties in its operation but also to plan its maintenance and future expansion. In this paper a computational intelligent technique based on fuzzy logic is used to implement a short-term electric load forecasting procedure. A calendar of events is introduced in the system, where special days, such as holidays and sporting events, are inserted, which allows the system to treat them in a special way, improving forecast performance. The procedure is applied to some utilities in Brazil using observations collected during several years. The results obtained in these applications indicate that the proposed system is adequate to the matter. It is simple, matches to different utilities very easily and the forecasts produced by the procedure present small mean absolute percentage error (MAPE). Trying to simplify the utilization of the forecaster, a friendly man-machine interface was implemented having visualization and editing functions, making possible its immediate application.

Electric Load Forecasting with Theory of Extreme Values

Emil Pelikán

Institute of Computer Science, Czech Academy of Sciences, Pod vodarenskou vezi 2, 182 07
Prague, CZECH REPUBLIC, emil@uivt.cas.cz

Lubomir Petrak, West-Bohemian Power Co., Anglické nábřeží 1, 300 00 Pilsen, CZECH REPUBLIC,
petrakl@zce.cz

Knowledge of the future maximal values of an electricity load over a week or a month horizon is very important for dispatchers in power distribution companies, who use this information for operating and planning. Prediction of such maximal values is difficult with respect to uncertainty of input factors, which influence these extreme values. In this presentation we discuss the possibility of using results from the theory of extremes. We show that the extreme baseload part of the total load, as well as the extreme meteorological variables, have probability distribution functions from a family of extremes value distributions. The parameters of the extreme load distribution are estimated from the real load data, where meteorological, calendar, and other events are filtered. Probability of exceeding a given load level can be derived from such estimated distributions, as well as other useful information.

Chair: **Brian Monsell**, U. S. Bureau of the Census, bmonsell@census.gov

An Overview of the X-12-ARIMA Seasonal Adjustment Program

Brian Monsell

Room 3000-4, Statistical Research Division, U. S. Bureau of the Census, Washington, DC 20233,
bmonsell@census.gov

X-12-ARIMA is the Census Bureau's new seasonal adjustment program. X-12-ARIMA provides several enhancements to previous X-11 based seasonal adjustment methodologies, including: alternative seasonal, trading day, and holiday effect adjustment capabilities that include adjustments for effects estimated with user-defined regressors; stability diagnostics for seasonal and other adjustments; extensive capabilities for fitting combined regression and ARIMA models; and a new model comparison diagnostic that compares out-of-sample forecasting performance. An improved user interface with features to facilitate batch processing large numbers of series is also provided. An overview of these and other enhancements will be presented, including a new module for automatic ARIMA model identification taken from the work of Gomez and Maravall (1998).

The Role of regARIMA Modeling in X-12-ARIMA Seasonal Adjustment

Ray Soukup

Room 3000-4, Statistical Research Division, U. S. Bureau of the Census, Washington, DC 20233
raymond.j.soukup@ccmail.census.gov

X-12-ARIMA has incorporated extensive time series modeling and model selection capabilities for regARIMA models (linear regression models with ARIMA errors), with *optional robust estimation of coefficients*. Many regressors are built into the software, to permit the user to detect and model a variety of common outlier and calendar effects that occur in economic time series. Automated procedures for selecting transformations and regressors have been incorporated, as well as a variety of modeling and model selection diagnostics. This talk will discuss the capabilities of the regARIMA modeling module within X-12-ARIMA, and show examples of how this module can be used to improve seasonal adjustment by accounting for other effects in the data and by providing effective forecasts and backcasts for the seasonal adjustment filters used at the ends of the series.

Graphical and Other Diagnostics in X-12-ARIMA

Catherine Hood

Room 3000-4, Statistical Research Division, U. S. Bureau of the Census, Washington, DC 20233,
chood@census.gov

The X-12-ARIMA seasonal adjustment program has incorporated several diagnostics of the quality and stability of the adjustments achieved under the options selected. Applications of these diagnostics will be shown. In addition, graphics software has been developed for the Census Bureau's X-12-ARIMA seasonal adjustment program. The software utilizes SAS/GRAFPH and is available via the Internet in two versions, a screen version for analyzing adjustments of a single series and a batch version for producing diagnostics graphs for multiple series. The output options include graphs developed by Cleveland, Dunn and Terpenning (1979) and Cleveland and Devlin (1980) for the SABL seasonal adjustment program, and graphical time series model selection diagnostics proposed by Findley (1990, 1991). Features of this software will be described.

Improving Practice through Acceptance of Forecasting Principles in Texts, Journals, and Software

Historically, there have been long delays between (a) the publication of research offering new forecasting principles or improvements in forecasting methodology and (b) the assimilation of the research into forecasting textbooks, software, other research, and forecasting practice. This panel will examine why delays occur, how new forecasting principles are learned by researchers and practitioners, and what policies might make the diffusion process more efficient. Scott Armstrong will discuss the diffusion process, including such questions as whether the peer review process helps or hinders. He will also discuss whether the "iron law of important papers" applies to forecasting. Consideration will be given to citations studies, in an effort to examine the diffusion of principles. Jim Cox will discuss the adoption of new findings by textbook writers. Len Tashman will examine the diffusion of new research findings into forecasting software. Of particular interest is the reverse diffusion process, in which software developers lead the publication of peer-reviewed research. Information on the session can be found at <http://hops.wharton.upenn.edu/forecast/>

Moderator: ***Robert Fildes***

The Management School, Department of Management, Science, Lancaster University,
Lancaster, LA1 4YX, UNITED KINGDOM, R.Fildes@Lancaster.ac.uk

Panelists:

J. Scott Armstrong

The Wharton School, University of Pennsylvania, Philadelphia, PA 19104,
armstrong@wharton.upenn.edu

Jim Cox

Department of Marketing, Illinois State University, Normal, IL 61790-5590, jecox@ilstu.edu

Len Tashman

School of Business Administration, University of Vermont, School of Business
Administration, University of Vermont, Burlington, VT 05405-0158,
lentashman@compuserve.com

Panel organized by: ***J. Scott Armstrong***, University of Pennsylvania, armstrong@wharton.upenn.edu

Forecasting in the U.S. Federal Government

The U.S. Federal Government is a major provider of forecasts for use by government policymakers and by business. Many forecasting programs have changed dramatically and some have been disbanded over the last few years due to declining budgets and changing priorities. Yet still, there seems to be an insatiable demand for the forecasting products that agencies produce. In this session, the panelists—each of whom directs a forecasting program—look at the role of the public sector in an information economy and how forecasters can provide relevant and useful information to policymakers and the public.

Chair: ***Karen S. Hamrick***

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW Mail Stop 2061
Washington, DC 20036-5831, khamrick@econ.ag.gov

Panelists:

Debra Gerald

Project Leader, Projections
National Center for Education Statistics, U.S. Department of Education, 555 New Jersey Avenue,
NW, Washington, DC 20208-5654, Debra_Gerald@ed.gov

Charles Bowman

Chief, Division of Industry Employment Projections
Bureau of Labor Statistics, U.S. Department of Labor, 2 Massachusetts Avenue, NE, Washington
DC 20212, Bowman_Charles@bls.gov

Frederic M. Surls

Chief, Agriculture and Trade Outlook Branch
Market and Trade Economics Division,
Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW, Washington,
DC, 20036-5831, fsurls@econ.ag.gov

Panel organized by: ***Karen S. Hamrick***, Economic Research Service, U.S. Department of Agriculture,
khamrick@econ.ag.gov

Chair: *Win G. Liu*, VDL, WinLiu@yahoo.com

Econometric Analysis of Consumer Prices for the Euro Area: Seasonality, Co-movements and Forecasting

Riccardo Cristadoro, Gianluca Cubadda, and Roberta Sabbatini

Servizio Studi, Banca D'Italia, Roma - Via Nazionale 91, ITALY, cris.3341@interbusiness.it

In this paper we analyze the Harmonised index of consumer prices (HICP) for the countries of the euro area, which is widely used by the European System of Central Banks to conduct monetary policy. First, we characterize the short-run movements of consumer prices for each country and for the euro average, an important indicator of inflation. This requires the estimation of the seasonal components in the price series, which is done for the main sub-indices and for the overall HICP for both single countries and the euro average. The latter issue raises some relevant questions of aggregation and implies an evaluation of alternative methods of seasonal adjustment. Second, we compare the evolution of inflation across euro countries and test the degree of co-movements and co-cyclicalities of consumer prices. This analysis requires the estimation of small VAR models and application of techniques for the identification of common features. Third, we tackle the problem forecasting inflation in the short term. The forecasts are obtained via univariate models using information from the first stage of the work are then compared with those produced by the VAR models estimated at the second stage.

Comparing Seasonal Indexes for Business Forecasting

Peter T. Ittig

Management Science & Information Systems Department, College of Management, University of Massachusetts, Boston, MA 02125-3393, Ittig@umbsky.cc.umb.edu

It was shown in a prior paper (Decision Sciences, Spring 1997) that a seasonal index that is based on a centered moving average contains a systematic error when both a trend and a seasonal effect are present. That paper also presented a multiplicative seasonal index from a simultaneous decomposition procedure that is often superior to common alternatives in business applications. This paper considers the relative advantages of several seasonal indexing procedures in business forecasting applications, including simultaneous and sequential decomposition methods. The paper also discusses a convenient new method that represents a compromise between simultaneous and sequential decomposition methods, yet retains many of the advantages of each.

continued

Wavelet Analysis of Seasonal Patterns in Univariate Time-Series

Farhad Kamangar

Computer Science and Engineering, University of Texas At Arlington, Arlington, TX 76019,
kamangar@cse.uta.edu

This paper presents a wavelet-based methodology for analyzing seasonal patterns in univariate time-series. Wavelet basis functions are used to map a time series into the transformed wavelet space. The wavelet coefficients are represented in a three dimensional space as a function of time and the duration of the wavelet basis functions. This redundant representation of the time series gives an exploded view of the localized phase and frequency characteristics of the original signal. The seasonal patterns can then be detected and analyzed by studying the cross section(s) of the signal representation in the transformed space. It is shown that selecting different basis functions, such as the Morlet wavelets, can emphasize specific characteristics of the original signal. Experimental results are presented by using actual historical stock market and commodity data.

Forecasting Trend and Seasonality by Geometric Smoothing

Win G. Liu

Engineering Management Program, Portland State University, Portland, OR 97207-0751,
WinLiu@yahoo.com

This paper presents a new approach—geometric smoothing—to forecasting the trend and seasonality in time series data. This approach is based on the approximate geometric relationship among the historical data and the forecast values. Three simple forecasting methods, each possessing good adaptability and accuracy, are developed—one for trend and two for seasonality. Their effectiveness is demonstrated by comparisons with the exponential smoothing methods, Brown's linear and quadratic methods, Holt's method, Winters' method, and the procedure proposed by Makridakis and Wheelwright. The results show that for the trend and seasonal data used as samples by Makridakis, Wheelwright and McGee (1983), the proposed methods give more accurate forecasts than the other approaches tested.

Chair: **Robert Pereira**, LaTrobe University, AUSTRALIA, r.pereira@latrobe.edu.au

Modeling of Short Term Interest Rates

Nigel Meade

Imperial College Management School, London SW7 2PG, UK, n.meade@ic.ac.uk

Time series models of the behavior of short-term interest rates can be crudely classified as theory driven or data driven. Theory driven interest rate models imply reversion to a long term mean via a short memory auto-regressive process. Empirical evidence of a long memory process has been detected in nominal short term interest rates by other authors. The objective here is to evaluate the effectiveness of models from both categories over the medium term. This is done by comparing the forecasting performance of the models with the emphasis on relatively long forecast horizons of up to a year. In this analysis, the data are real rates derived from Eurodeposit 3-month interest rates corrected for inflation for ten countries. The estimation of both types of models will be described and their forecasting performance compared between themselves and a martingale benchmark.

Using the Bootstrapped Zero-Coupon Yield Curve to Produce Intermediate-Term Interest Rate Forecasts

Albert E. DePrince, Jr.

Professor of Economics and Finance, Middle Tennessee State University, Box 27, Murfreesboro, TN 37132, deprince@frank.mtsu.edu

While public attention typically focuses on interest rate forecasts over relatively short horizons, business and financial planning requires a longer view. This study evaluates forward rates as a viable forecasting approach for forecast horizon of up to three years. It uses zero-coupon yield curves bootstrapped from par-value Treasury yield curves to develop forward rates for the 6-month Treasury bill over a 30-year "forecast" horizon. This is done for each month in the 1/82-12/98 sample period. The forward rates are used to construct forecasts of coupon yields for forecast horizons of up to three years for the 2-, 5-, and 10-year Treasury securities for each month in the sample period. Forecast accuracy is evaluated, and results compared with forecast accuracy of the same maturities from a well-known interest rate survey.

Forecasting Ability But No Profitability: An Empirical Evaluation of Genetic Algorithm-Optimized Technical Trading Rules

Robert Pereira

School of Business, LaTrobe University, Bundoora, Victoria, AUSTRALIA 3083,
r.pereira@latrobe.edu.au

This paper evaluates the forecasting ability and the economic profitability of five popular technical trading rules applied to the USD/AUD foreign exchange rate. The optimal parameter values over the in-sample period of 1/4/82 to 12/31/89 for each rule are found using a genetic algorithm. These optimal rules are then evaluated in terms of forecasting ability and economic profitability during the out-of-sample period from 1/2/90 to the 12/31/97. The results indicate that the rules studied outperform the random walk benchmark model. However, once transaction costs are taken into account, the rules display very little, if any, evidence of profitability.

Session 6.1
Room: Federal B

Time Series—Seasonality

Tuesday
4:00-5:30

Wavelet Analysis of Seasonal Patterns in Univariate Time-Series

Farhad Kamangar

Computer Science and Engineering, University of Texas At Arlington, Arlington, TX 76019,
kamangar@cse.uta.edu

This paper presents a wavelet-based methodology for analyzing seasonal patterns in univariate time-series. Wavelet basis functions are used to map a time series into the transformed wavelet space. The wavelet coefficients are represented in a three dimensional space as a function of time and the duration of the wavelet basis functions. This redundant representation of the time series gives an exploded view of the localized phase and frequency characteristics of the original signal. The seasonal patterns can then be detected and analyzed by studying the cross section(s) of the signal representation in the transformed space. It is shown that selecting different basis functions, such as the Morlet wavelets, can emphasize specific characteristics of the original signal. Experimental results are presented by using actual historical stock market and commodity data.

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Chair: **Robert Pereira**, LaTrobe University, AUSTRALIA, r.pereira@latrobe.edu.au

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Forecasting Ability But No Profitability An Empirical Evaluation of Genetic Algorithm Optimized Technical Trading Rules

Robert Pereira

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Chair: **David Clarke**, University of Nottingham, UK, David.Clarke@nottingham.ac.uk

Improving Judgmental Forecasts with Bootstrapping and Cognitive Feedback Support

William Remus

University of Hawaii, 2404 Maile Way, Honolulu, HI 96822, Remus@hawaii.edu

Marcus O'Connor, University of New South Wales, M.OConnor@unsw.edu.au

Kai Lim, University of Hawaii

There are vast literatures on improving forecasting through improved statistical modeling techniques. Judgmental generated forecasts, however, are generally preferred to statistically modeled forecasts in spite of the improved accuracy of statistically modeled forecasts. In this experiment we examined and compared the two computer-based methods to support judgmental forecasting process. Major findings included that in both stable forecasting environments and when special events arose, support using cognitive/task feedback was superior to bootstrap support and no support at all. This was true in terms of forecast accuracy and in terms of the Brunswik Lens model measures of achievement, growth, and consistency reflected in the judgmental forecasts. The superiority of cognitive/task feedback was not reflected in the subjects' self-assessed accuracy, confidence, or comparative performance. Also, we found no differential impact based on the direction of the special events but we did note conservatism in reacting to them.

Correct or Combine? Mechanically Integrating Judgmental Forecasts with Statistical Methods

Paul Goodwin

Faculty of Computer Studies and Mathematics, University of the West of England, Frenchay, Bristol BS16 1QY, UNITED KINGDOM, paul.goodwin@uwe.ac.uk

One of the main justifications for the use of judgment in forecasting is that judges can bring to the forecast sporadic contextual information which cannot easily be captured by statistical methods. However, a large number of studies have shown that judgmental forecasts suffer from bias and inconsistency and this has led some researchers to recommend the use of both statistical methods and judgment in the forecasting process. This paper describes a study that compared the accuracy of forecasts obtained from two methods that allow judgment to be mechanically integrated with statistical methods: the statistical correction of judgmental biases and the combination of the two types of forecast. Two findings emerged: (a) mechanical integration improved judgmental forecasts even when the judge has exclusive access to contextual information with high predictive power, and (b) correction and combination should be regarded as complementary methods, rather than alternatives.

Managing a Forecasting Program

We all know that forecasting is difficult, but the really tough job is managing forecasters and insuring that a forecasting programs is successful. Four forecasting program managers will discuss management issues and challenges that they face. Norman Saunders and Frederic Surls are both managers in the U.S. federal government, Ralph Monaco is in academia and Lea Tyler operates in the private sector. Norman Saunders is Director of a unit that does long term (10-year) projections. Frederic Surls is Chief of a branch that provides both short term and long term forecasts as well as scenario analysis. Ralph Monaco manages a program that develops specialized models for contract customers and provides long term forecasts. Lea Tyler manages a program that provides a variety of short-term and long-term forecasts for government, financial, and business customers.

Chair: ***Karen S. Hamrick***

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW, Washington, DC 20036-5831, khamrick@econ.ag.gov

Panelists:

Norman C. Saunders

Director of Research Program, Office of Employment Projections
Bureau of Labor Statistics, 2 Massachusetts Avenue, NE, Washington, DC 20212,
Saunders_N@bls.gov

Neilson C. Conklin

Director, Market and Trade Economics Division
Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW, Washington, DC 20036-5831, nconklin@econ.ag.gov

Ralph Monaco

INFORUM
Department of Economics, University of Maryland, College Park, MD 20742,
ralph@inforum.umd.edu, monacorl@erols.com

Lea Tyler

Manager of U.S. Forecasting
Oxford Economics USA, Inc., 1240 West Chester Pike, Suite 205, West Chester, PA 19382,
lea.tyler@oef.com

Panel organized by: ***Karen S. Hamrick***, Economic Research Service, U.S. Department of Agriculture,
khamrick@econ.ag.gov

Chair: **Maurice Peat**, University of Technology, AUSTRALIA, Maurice.Peat@uts.edu.au

Forecasting the Role of the Accounting Profession in the Next Century

Ratnam Alagiah

School of Accounting and Finance, Griffith University, Gold Coast Campus, PMB 50 Gold Coast
Mail Center, Queensland 9725, AUSTRALIA, R.Alagiah@mailbox.gu.edu.au

Empirical contributions in international accounting have examined the functions of the accounting profession in the regional and global arenas which can now be used to forecast the role of the accounting profession into the next century along with the function of accounting standards in the Global Markets. Using evidence of how the world "has been" (historical state) and "is" (positive state), and how the world "might be" (the critical state), it is possible to forecast how the world "can be," using a theory of World Order (Effendi 1980). Consideration for the issues relating to World Order has the potential of providing a theory of how the capital market can function with swiftness and equity, through the use of a single accounting standard worldwide and a uniform and universal system of currency.

Intelligent Client Acceptance in the CPA Firm

Beata Jczkowska and Zbigniew Gontar

Department of Computer Science, University of Lodz, ul. Rewolucji 1905r. nr 39, 90-214 Lodz,
POLAND, beatajpa@krysia.uni.lodz.pl, zhgontar@krysia.uni.lodz.pl

In this paper, we investigate the decision making process of client acceptance in the CPA firm. We present this process in the sense of engagement risk identification and analysis, and apply Multilayer Perceptron (MLP), like an artificial neural network, to estimate overall engagement risk. The model was trained and tested using the data contained in over 10,000 observations concerning features of the client and assessments of overall engagement risk made by partners in the CPA firm. For the comparative study, we modeled the process of client acceptance in the CPA firm by a set of kernel rules developed on the base of the SE-Learn algorithm.

continued

Using the Data Warehouse to Improve the Budgeting and Forecasting Process

Kai Treppe

John Galt Development, Inc., 39 S. LaSalle, Suite 815, Chicago, IL 60603, craft@johngalt.com

This presentation will cover three important phases for constructing a budgeting data warehouse, including the critical items for success. A particular focus is on forecasts that are accurate and consistent across the organization. The first step is the data warehouse design and selecting the correct statistical analysis to measure business objectives. The second step is the development and implementation of the data warehouse. This step places high emphasis on effectively utilizing the forecasts and statistical results, classifying user requirements and analytical goals, and properly measuring return on investment. Finally, there is post implementation analysis, including methods for defining and tracking planning criteria that actualize corporate strategies, processes and procedures for performing what if decision analysis using a data warehouse, and methods for developing enhanced collaborative budget process using a data warehouse.

Forecasting the Probability of Financial Distress

Maurice Peat

School of Finance and Economics, University of Technology, Sydney, PO Box 123 Broadway 2007, AUSTRALIA, Maurice.Peat@uts.edu.au

This study predicts the probability of firm failure using a number of hazard based models. The hazard function is modeled by both semi-parametric (Cox proportional hazard), and parametric (Exponential and Weibull) hazard functions. The hazard methods have been chosen to deal with the problem of censoring. These probabilistic forecasts are then evaluated against probability forecasts from a standard logit model. Murphy's extension of the Brier score is used to evaluate the probabilistic forecasts generated.

Chair: **Jan Marc Berk**, De Nederlandsche Bank, THE NETHERLANDS, j.m.berk@dnb.nl

Alternate Regime Switching Models for Forecasting Inflation

Prasad V. Bidarkota

School of Business, La Trobe University, Bundoora, VIC 3083, AUSTRALIA,
p.bidarkota@latrobe.edu.au

U.S. inflation appears to undergo shifts in its mean level and variability. We evaluate the performance of three useful models for capturing such shifts. The models studied are the Markov switching models, state space models with heavy-tailed errors, and state space models with compound error distributions. Our study shows that all three models have very similar performance when evaluated in terms of the mean squared or mean absolute forecast errors. However, the latter two models are considerably more parsimonious, and easily beat the more profligately parameterized Markov switching models in terms of model selection criteria, such as the AIC or the SBC. Thus, these may serve as useful continuous alternatives to the popular discrete Markov switching models for capturing shifts in time series.

Co-Movements in Long-Term Interest Rates and the Role of PPP-Based Exchange Rate Expectations

Jan Marc Berk

Monetary and Economic Policy Department, De Nederlandsche Bank, PO Box 98, 1000 AB Amsterdam, THE NETHERLANDS, j.m.berk@dnb.nl
Klaas H. W. Knot, International Monetary Fund, kknot@imf.org

This paper investigates international co-movements in bond yields by focusing on uncovered interest parity. It supplements existing work in two ways: it focuses on long- instead of short-term interest rates, and, related to that, employs exchange rate expectations derived from purchasing power parity instead of actual outcomes. For the major floating currencies over the period 1975-1997, we cannot support the notion of further increases in co-movement beyond that associated with the wave of financial market liberalization and deregulation in the early 1980's.

Session 6.7
Room: Michigan

Tuesday
4:00-5:30

VACANT

Chair: **Bo Lennstrand**, Stockholm University, bl@fek.su.se

A Mean-Field Model for New Product Forecasting

Christos Emmanouilides

Centre for Marketing, London Business School, Sussex Place, Regent's Park, London NW1 4SA,
UK, cemmanouilides@lbs.ac.uk

In innovation diffusion modeling and forecasting, as well as in other branches of quantitative social science, aggregate models that reflect "true" individual-level processes are desirable. A model based on individual choice behavior in the presence of multi-agent interactions will be presented, and its mean-field (aggregated) version will be derived. The model's fit and forecasting performance are compared to those of more traditional diffusion models in an application of the diffusion of personal computers and the Internet in the UK.

Telecommunications Scenarios for Strategic Forecasting

Bartolomeo Sapiro and Enrico Nicolo

Fondazione Ugo Bordoni, Research Division for Telecommunications Evolution, Group of Scenarios and Methods for Strategic Planning, Via Baldassarre Castiglione 59, 00142 Roma, ITALY,
bsapiro@fub.it

Uncertainty today is not just an occasional, temporary deviation from what is reasonably predicted. Explicit treatment of uncertainty reduces the frequency and severity of surprises and encourages contingency planning. The technique of scenarios incorporates uncertainty into the forecasting process and lets the planner have a broader and more creative vision of future. The analysis of alternate scenarios leads to the correct formulation of strategic options. Once implemented, strategic options have enduring effects and can be difficult to reverse, hence the evaluation of different futures and of their impact on the decisions becomes crucial. This paper presents a complete application of SEARCH (Scenario Evaluation and Analysis through Repeated Cross impact Handling), an original probabilistic scenario methodology, to the definition of the most probable future scenarios of the evolution of the Internet.

continued

Chair: **Debra E. Gerald**, National Center for Education Statistics, U.S. Department of Education,
Debra_Gerald@ed.gov

Use of Forecasting in Operational Risk Evaluation

N. Capon, S. A. Jaffry, and D. Snowden

Portsmouth Business School, University of Portsmouth, Locksway Road, Milton, Southsea, Hants
PO4 8JF, UK, Nick.Capon@port.ac.uk, Shabbar.Jaffry@port.ac.uk

This paper explores whether an alternative approach using forecasting methods can usefully be applied to the area of Operational Risk. The case study described is from the British Royal Navy, where operational risk analysis of having the correctly trained people for each demand has been tackled using the dynamic modeling and the error correction model (ECM) methods. The ECM not only takes into account long- and short-run changes in the explanatory variables, but also the previous year's under- and over-estimate of naval manpower to explain the annual changes in the rate of naval manpower change. This case study finds that traditional Operational methods overstate the expected impact of risks. In contrast, forecasting methods more accurately identify the range of possible outcomes for which risk management must prepare.

A Structural Model of the Government Sector of Barbados

Roland Craigwell and Kevin Greenidge

Central Bank of Barbados, Tom Adams Financial Centre, P.O. Box 1016, Bridgetown, Barbados,
WEST INDIES, kgreenidge@sunbeach.net, cbb.libr@caribsurf.com

The paper utilizes the cointegration approach to estimate a four equation model of the government sector in Barbados. The model is then used to generate and evaluate both in-sample and out-of-sample forecasts under varying scenarios. The model is essentially intended to capture the relationship among government expenditure, government revenue, and the rest of the economy, for Barbados. It is our intention to identify the interaction among key variables (particular feedbacks) and in doing so throw some light on the sources and consequences of the growth of the government sector, while at the same time providing a forecasting model which can be informative in the process of policy formulation. The forecasts generated by the model should, on average, outperform those independently obtained by government.

Why Does the Federal Reserve Board of Governors Need to Have A Technological Diffusion Model?

Luigi Toma

5431 Connecticut Ave., NW, # 201, Washington, DC 20015, luigitoma@aol.com

The Federal Reserve Board of Governors (FED) considers that relentless technological progress in the United States will eventually lead to an increase in productive efficiency. How long will these efficiency gains take, when they will take place, and will US economic statistics capture them? This paper attempts to respond to these questions by providing an analytical framework that might be used in dealing with technological change issues. The model starts from the assumption that a model of technological diffusion is needed in order to understand the profound transformation that shapes the US economy. As Rosenberg pointed out, major improvements in productivity are seldom produced by single innovations, no matter how important they seem to be. However, the cumulative effect of multiple improvements within a technological system may ultimately be immense. This model suggests that we will witness a major increase in competitive pressures throughout the U.S. economy.

Diffusion Models—Tools for Forecasting or Self-Fulfilling Metaphors?

Bo Lennstrand

School of Business, Stockholm University, 106 91 Stockholm, SWEDEN, bl@fek.su.se

Information technology for consumers investments often stay unprofitable longer than expected technology diffusion speed is overestimated. In this paper, it is argued that diffusion models can be used as rhetorical elements to show rapid penetration and future profits. Whether the models are *quantitative*, based on mathematics/statistics, or *quasi-quantitative* (conceptually founded), they could be regarded as metaphors, sometimes with self-fulfillment capacity, rather than tools for forecasting. Looked upon as metaphor, Rogers' well-known S-curve tells the story of success. The GartnerGroup hype cycle tells another story, warning for expectations of rapidly increasing profit. However, the hype cycle ends on a "Plateau of Productivity," a stage many products never reach. This paper compares the mentioned models with a plain metaphor—The Ravine—which aims to highlight the possibilities for successful outcomes in both the short run and the long run, as well as for long-term failure.

Chair: **Gulnur Muradoglu**, Warwick Business School, UK, afingm@wbs.warwick.ac.uk

An Investigation of the Rationality of Fixed Event Judgmentally Estimated Sales Forecasts

Michael Lawrence

School of Information Systems, University of New South Wales, Sydney 2052, Australia; and Management Science Department, Lancaster University, Lancaster, LA14YX ENGLAND, m.lawrence@unsw.edu.au

Both theory and the opinions of practicing forecasters expect that as the lead time before an event decreases, updates to the forecast will result in a forecast of greater accuracy because they incorporate more recent information. Furthermore, the revisions to the forecasts should efficiently incorporate new information as it becomes available. This study tests these expectations using a large sample drawn from judgmentally estimated sales forecasts from eleven manufacturing organizations. The results suggest that for most of the organizations, forecast accuracy does not uniformly improve as the lead time decreases, and that the forecast revisions display first order negative autocorrelations. Thus weak efficiency is not displayed. The efficiency of the forecast revisions, or lack of efficiency, does not appear to be related to the company's forecast accuracy performance. This is in distinction to the one-period-ahead forecast errors where efficiency is strongly related to forecast accuracy performance. Some reasons for the findings are discussed.

An Evaluation of USDA's Agricultural Export Forecasts

Stephen A. MacDonald

Economic Research Service, U.S. Department of Agriculture, 1800 M Street, NW, Washington, DC 20036-5831, stephenm@econ.ag.gov

U.S. Department of Agriculture's forecasts of agricultural supply and demand are a benchmark for global market participants, particularly the forecasts for the United States. Other than weather, changes in exports account for most of the annual variation experienced by season-ending supplies of the major field crops produced by the U.S. This study will assess how well USDA's forecasts of U.S. agricultural exports meet the standards of efficiency and rationality.

continued

Comparing the Accuracy of European GDP Forecasts

Lars-Erik Öller and Bharat Barot

National Institute of Economic Research, Box 3116, S-103 62 Stockholm, SWEDEN, lars-
erik.oller@konj.se, bharat.barot@konj.se

One-year-ahead forecasts of annual growth of GDP of 13 European countries by OECD and by national institutes were analyzed for accuracy. The forecasts were over 1971-95. Average errors were large, 1.9 percent in RMSE and 1.4 percent in MAE. The Wilcoxon signed-rank test showed that only four OECD and two institute forecasts were significantly better than an average growth forecast (the last observed growth) as measured by RMSE. Still, both OECD and institute forecast could jointly beat the naive variants, but there was no significant difference in accuracy between OECD and the institutes. Few one-year-ahead forecasts were biased or had autocorrelated errors. Directional forecasts were also jointly informative. For some years, such as 1988, the direction was perceived wrongly by many forecasters. Only the OECD forecasts of Italy and Sweden improve significantly over time. OECD's two-year-ahead country forecasts were significantly correlated with the outcome only for half of the countries, and they were positively biased.



Predictability of UK Stock Returns by Using Debt Ratios

Gulinur Muradoglu and **Mark Whittington**

Accounting and FinanceGroup, Warwick Business School, Coventry CV4 7AL, UK,
afingm@wbs.warwick.ac.uk, afinmw@wbs.arwick.ac.uk.

The purpose of this study is to examine the ability of debt ratios in predicting company performance and stock returns in the short and long run. The UK companies included in the FTSE-all share index for the past ten years constitute our sample. We take the companies with significant changes in the ratio of debt to equity and rank them according to the degree of change. In doing so, we also control for company size, industry, and debt type. Then we examine the predictive ability of the debt ratio for company performance and shareholder wealth by investigating the following earnings per share and cumulative stock returns. Comparisons are made as to different holding periods of one to five years.

Session 6.11		Tuesday
Room: Continental	Energy Forecasting	4:00-5:30

Chair: **Emil Pelikán**, Czech Academy of Sciences, emil@uivt.cas.cz

Using Forecast Error Specification to Switch Between Alternative Combinations of Electricity Demand Forecasts

Lilian M. de Menezes

Department of Mathematical and Computing Sciences, Goldsmiths College, University of London,
New Cross, London SE14 6NW, UK, l.demenezes@gold.ac.uk

James W. Taylor, London Business School, UK, jtaylor@lbs.ac.uk

Combining forecasts is a practical and efficient way of making use of available information. However, in business models, one should also take explicit account of the underlying risk and uncertainty in the forecast, thus more is required than a single point estimate. In our previous work, we considered the use of criteria, other than minimum variance, for evaluating the combined forecast error. Here, we look at situations in which more than one combining method is available. The forecaster, as a decision-maker, is then interested in switching between alternative combinations according to their recent forecast history, and criteria such as accuracy and the shape of the forecast error distribution. We consider smooth transition combinations and present some results for electricity demand that illustrate their potential.

A Neural-Fuzzy Load Forecasting Model

Plutarcho Maravilha Lourenco, Electric Power Research Center (CEPEL), BRAZIL, taco@fund.cepel.br

Reinaldo Castro Souza

Electrical Engineering Department, Pontifícia Universidade Católica do Rio de Janeiro, Rua Marquês de São Vicente, 225 - Gávea - 22543-900, Rio de Janeiro - RJ - BRAZIL, reinaldo@ele.puc-rio.br

The electric load plays an important role in several parts of the power system, from generation to distribution. In order to avoid difficulties in the power system operation, a forecasting procedure is needed. This paper presents a new short-term load forecasting procedure mixing techniques from the traditional statistical models and those from the computational intelligent (CI) side. As such it takes advantage of the CI techniques to create an automatic classification procedure to establish the various standard load profiles without any need of prior information on the various cyclical/seasonal components present in these sort of data and to process climatic variables in a linguistic way. The model is an adaptation of the GUPTA's method, resulting from adding some CI techniques to the original method. The model is applied to a particular utility in Brazil using observations collected during two calendar years.

Prediction Intervals for Day-Ahead Electricity Demand Forecasts

James W. Taylor

London Business School, Sussex Place, Regents Park, London NW1 4SA, UK, jtaylor@lbs.ac.uk

Utilities need to produce predictive distributions for the efficient management of the system load. One approach to day-ahead demand forecasting predicts turning points on the demand curve using separate regression models, and then produces a load curve of half-hourly forecasts by a smoothing procedure based on a past demand curve. This paper addresses the problem of producing a prediction interval load curve around the forecasted load curve. The approach taken is to produce intervals for the turning points, and then to smooth between them. The study compares a range of methods, including econometric modeling of forecast error using quantile regression, and considers the use of weather probability forecasts. These methods are generalizable to the case where separate regression models are used for each half-hour of the day, and to other situations where regressors are stochastic in the forecast period and/or the predictive distribution is non-normal.

Session 7.1		Wednesday
Room: Federal B	Time Series–Non-Parametric Methods	10:30-12:00

Chair: **Janis Grabis**, Riga Technical University, grabis@itl.rtu.lv

Non-Parametric Smooth Non-Linear Model Identification and Construction

W. Haythorn

2095 Procter Road, Mosier, Oregon 97040, haythorn@gorge.net
S. Margetts, P. Durrant, and Antonia J. Jones, University of Wales, UK

We discuss the application of new techniques for the identification of smooth models of many variables. Based on the Gamma test, these non-parametric methods enable us to quickly evaluate, prior to model construction, an estimate for the best mean-squared error that can be achieved by a smooth model on unseen data for a given selection of inputs. By examining this estimate for alternative selections of inputs, we show how the best choice of inputs for modeling a particular target output can be selected. We also discuss how the distribution of the data in input space and the complexity of the unknown function that we seek to model influence the size of the required data set. The techniques have been implemented in a Windows application called winGamma™ licensed by the University of Wales, Cardiff. We demonstrate some typical winGamma analyses for time series prediction, including chaotic time series with lags.

Non-Parametric Factor Analysis of Time Series

Juan M. Rodriguez-Poo

Departamento de Economía, Universidad de Cantabria, Avda. de los Castros s/n, 39005 Santander,
SPAIN, rodrigjm@ccain3.unican.es
Oliver Linton, Department of Economics, Yale University, linton@econ.yale.edu

We introduce a non-parametric smoothing procedure for non-parametric factor analysis of multivariate time series. The asymptotic properties of the proposed procedures are derived. We will present an application based on the residuals from the Ray Fair macroeconomic model.

continued

Kernel-Based Multistep-Ahead Predictions of the U.S. Short-Term Interest Rate

Jan G. De Gooijer, University of Amsterdam, THE NETHERLANDS

Dawit Zerom

Tinbergen Institute, Keizersgracht 482, 1017 EG Amsterdam, THE NETHERLANDS,
zerom@tinbinst.nl

This paper presents a comparison of the prediction performances of three kernel-based non-parametric methods applied to the U.S. weekly T-bill rate. Predictions are generated through the rolling approach for the out-of-sample period 1989-1993. We compare the multistep-ahead prediction performance of the conditional mean, the conditional median, and the conditional mode with the performance of the benchmark random walk model. Using four prediction evaluation criteria, it is shown that two of the three predictors are superior—or at least equal—to the random walk at prediction horizons 1-5. In addition, by combining two of the three predictors, a significant improvement in prediction accuracy is obtained at all prediction horizons. Also, the combined predictions result in substantial improvement at predicting the direction of change. Further, we propose two prediction intervals based on the estimated non-parametric conditional distribution function. These intervals are useful when the predictive distribution underlying the time series process is asymmetric or multi-model. Finally, we assess the choice of the bandwidth in the kernel-based prediction methods through a recently proposed method for evaluating the estimated prediction densities.

Non-Parametric Modeling of Switching Regimes

Janis Grabis

Institute of Information Technology, Riga Technical University, Kleistu 6-26, Lv-1067 Riga, LATVIA,
grabis@itl.rtu.lv

A nearest-neighbor type non-parametric regression on the row with other non-parametric methods allows modeling a large number of nonlinear time series. This paper emphasizes a correspondence between the nearest-neighbor method and threshold models. The nearest-neighbor method defines a threshold dynamically and a transition between regimes that is smooth. A local regression model is used to make predictions. Coefficients of the local regression provide an additional explanatory information about the process. Multiple steps ahead forecasts are obtained by the direct forecasting method. Some simulation studies illustrate the behavior of the method. Forecasts of the U. S. macroeconomic series are obtained and the results are compared with those obtained by parametric modeling. The nearest-neighbor method allows vigorous treatment of the thresholds, though it struggles to make predictions near to regime change-points in the case of abrupt change.

Chair: **Suchada Langley**, Economic Research Service, U.S. Department of Agriculture,
slangley@econ.ag.gov

Government and Business Operations Simulation Based Global Strategic Risk Management

Warren Huang and Xiao Min Ji

OSA Int'l Operations Analysis, Box 130, 706 Sacramento St., San Francisco, CA 94108,
Whuang@osawh.com

OSA has developed an Expert system to provide Real Time Simulation of the impact of the Global Financial Crisis on government and business strategic risk management. The tracking includes simulating monetary and fiscal policy's impact on inflation, GNP, unemployment, financial markets, interest rates, currency exchange rates, commodities, bonds, corporate profit margin, stocks and derivatives prices, trade, and investment risk. This OSA (Operations Simulations Analysis) expert system has been developed by applying Artificial intelligence, neural net, fuzzy logic, chaos genetic algorithm in state space form, real time tracking, and simulating of the last 20 years of global government, central banks and daily business statistics. The average error is below 1.5 percent and correlation constants are greater than 0.95.

Examining the Role of Foreign Direct Investment in the Asian Financial Crisis in a General Equilibrium Framework: An Indonesian Case Study

Tracy L. Foertsch, Joint Warfare Analysis Center, 18385 Frontage Road, Dahlgren, VA, 22448-5500,
foertsch@erols.com

Susan F. Stone, Productivity Commission, AUSTRALIA, sstone@pc.gov.au

This question of how the international flow of capital affects the economy of a host country has been explored in the literature almost exclusively in a partial equilibrium framework. Our first objective is methodological—to introduce the analysis of foreign capital inputs, in the form of foreign direct investment, into a computable general equilibrium (CGE) model to capture the disparate consequences of the globalization of capital flows. The second is to use this model to determine the role foreign capital has played in the crises besetting Asian economies after 1997. We apply our CGE model to a seven sector 1990 social accounting matrix for Indonesia. Capital flows into Indonesia are segregated into foreign and domestic sources. We then simulate a currency market shock to determine how each capital input responds. Trade flows are further subdivided in order to identify linkages between foreign investment and trade flows.

GS-WATCH: A New Framework for Predicting Financial Crisis in Emerging Markets

Alberto Ades, **Rumi Masih**, and Daniel Tenengauzer

Emerging Markets Economics Research, Goldman Sachs & Co., 85 Broad Street (28th Floor),
New York, NY 10004, rumi.masih@gm.com

GS-WATCH is an econometric model that develops a more systematically-driven guide to the risks faced by emerging market currencies (EMCs). The model contains a variety of observable and objective indicators that provide useful predictive signals of impending currency pressures. GS-WATCH uses monthly data from 1983 to estimate 3-month forward probabilities of financial crisis for 27 emerging market economies. Our model's success is due to an appropriate definition of what constitutes a financial crisis, a thorough use of data, and a careful combination of self-exciting threshold autoregressive (SETAR) and probabilistic econometric estimation procedures, and also a novel approach to measuring contagion. Based on diagnostic tests of out of sample accuracy, GS-WATCH indicates superior predictive performance compared to alternative models.

Chair: *Sydney D. Howell*, Manchester Business School, ENGLAND, s.howell@fs2.mbs.ac.uk

A Statistical Implementation Of Neural Networks

Sandy D. Balkin

Pennsylvania State University, Department of Management Science and Information Systems, 303
Beam Business Administration Building, University Park, PA 16802-1913, sxb31@psu.edu

A Multilayer Perceptron Artificial Neural Network (ANN) is a nonlinear, non-parametric regression model designed to capture a broad range of nonlinear relationships. Model identification, estimation and validation are considerably more difficult since there is no statistical basis for the model, only rules of thumb suggested by various practitioners. This paper introduces a new implementation of the multilayer perceptron which uses traditional multivariate statistics to re-create the neural network structure. The result is a flexible, nonlinear modeling tool with a statistical interpretation and basis applicable wherever nonlinear structure needs to be exploited, but where the functional relationship between explanatory and response variables is unknown.

Hybrid Linear-Neural Conditional Heteroskedastic Models

Álvaro Veiga and Marcelo C. Medeiros

Electrical Engineering Department, Pontifícia Universidade Católica do Rio De Janeiro, Rua Marquês de São Vicente, 225 - Gávea - 22543-900, Rio de Janeiro - RJ - BRAZIL, alvf@ele.puc-rio.br

This paper considers a GARCH model with parameters controlled by a neural network to forecast volatility in financial series. We show that this formulation, called Hybrid Linear-Neural GARCH (HLN-GARCH), is in close relation to the Threshold GARCH and the Exponential GARCH models with the advantage of naturally incorporating linear multivariate thresholds and smooth transitions between regimes. With this formulation, a GARCH model can be estimated so as to adjust itself to situations like "negative/positive returns," "increasing returns" or "large movements." All parameters of the model can be obtained from the weights of the neural network, which are estimated by maximum likelihood. Application of a HLN-GARCH(1,1) model to 10 financial time series from the Brazilian capital market has shown strong evidence of the presence of asymmetry in 5 of them when compared to a GARCH(1,1) model.

continued

Neural Net for Forecasting Financial Chaotic Time Series: A New Approach***Chokri Slim***

Institut Supérieur De Comptabilité et D'Administration Des Entreprises (Business and Econometrics Statistical Modeling Laboratory), Rue des entrepreneurs, 2035 Tunis-Carthage, TUNISIA,
chokri.slim@isg.rnu.tn

Nonlinear modeling with neural networks offers a promising approach for studying the prediction of a chaotic time series. In this paper, we propose a neural network based on the Extended Kalman Filter to examine the nonlinear dynamic properties of some financial time series in order to differentiate between low-dimensional chaos and stochastic behavior. Kalman filtering, because it can deal with varying unobservable states, provides an efficient framework to model these non-stationary exposures. A controlled simulation experiment is used to introduce the issues involved and to present the proposed approach. Measures of forecast accuracy are also developed. The pertinence of this model is discussed in the light of some real word examples from the Tunisian Stock Exchange database.

Neural Nets as Regressions: New Heuristics and Some Unexpected Estimation Properties***Sydney D. Howell***

Department of Accounting and Finance, Manchester Business School, Booth Street West,
Manchester M15 6PB, ENGLAND, s.howell@fs2.mbs.ac.uk

We suggest new heuristics for deciding the required training sample size and the required number of coefficients for a neural net. According to these heuristics, training samples and parameter counts can be far smaller than previously thought. We confirm these effects both in simple simulations, and in some more complex empirical examples from the literature. Simulations also showed two unexpected effects, namely that a hugely over-parameterized net generated a parsimonious regression surface, when using tiny training samples, and that a net was improved by adding inactive parameters. These effects, and our tentative explanation of them, suggest that some widely recommended estimation practices, such as weight decay, regularization, and interrupting the training before an error minimum has been reached, may sometimes be inefficient.

Technology in Teaching and Learning Project**Colin Jex**

Management Science Department, Lancaster University, Lancaster, LA1 4YX, UK,
c.jex@lancaster.ac.uk

This session will present and discuss two consortial projects sponsored by the UK Higher Education Funding Council and authored by Colin Jex.

The first project, "Multimedia Educational Technology for Operational Research" (MENTOR), led by the University of Strathclyde, Glasgow, developed self-teaching materials for first-year business studies undergraduates, covering elementary forecasting techniques. The course material is in the 'electronic book' form and includes graphical techniques, moving averages, exponential smoothing and simple causal models. The software includes interactive demonstrations of dynamic graphics and the above techniques. It is intended for installation in a PC laboratory for self-study without the need for a tutor.

The second project, "Statistical Education through Problem Solving" (STEPS), led by the Statistics Department, Glasgow University, developed computer-based workshop materials based upon case-study-type problems for undergraduate classes. It was intended that this would replace tutored workshops. Many modules were developed in various statistical techniques. Colin Jex was the leader of the business group within the consortium and worked on forecasting problems.

During the session examples from both projects will be demonstrated along with some 'applets' in Excel which can be used to support standard lecture material. Time permitting, discussion of some issues involved in using computer-based material in teaching will be discussed. Reference material for the two projects will be available, including details of how to obtain the software.

Chair: **Hans Levenbach**, Delphus Inc, delphus@worldnet.att.net

Forecasting the Suez Canal Traffic: A Comparison of ARIMA and Neural Network Models

M. Mostafa

Manchester University, UK; mailing address: Flat 44, Ladybarn House, Fallowfield, Manchester M146ND, UK

Although the Suez Canal is the most important man-made waterway in the world, rivaled perhaps only by the Panama Canal, little research has been done on forecasting its traffic flows. This paper uses both univariate ARIMA and neural network models to forecast the maritime traffic flows in the Suez Canal. One of the important strengths of the ARIMA modeling approach is the ability to go beyond the basic univariate model by considering interventions, calendar variation, outliers, or other real aspects of typically observed time series. On the other hand, neural nets are being used in the areas of prediction and classification, areas where regression models and other related statistical techniques have traditionally been used. The models obtained in this paper provide useful insight into the behavior of maritime traffic flows since the reopening of the Canal in 1975, following an 8-year closure during the Arab-Israeli wars (1967-73).

Disaggregation Methods for Product Line Forecasting

Fabrizio Dallari and Remigio Ruggeri

Department of Mechanical Engineering, Politecnico di Milano, Piazza Leonardo da Vinci, 32, 20133 Milan, ITALY, fabrizio.dallari@polimi.it

In almost every organization sales forecasts are required at different aggregation levels under different planning horizon. This paper addresses the issue of forecasting individual items within a product line, where each line includes several independent but closely related products. A two-step procedure is employed: first, forecasts of the total aggregates for each product line are derived with three basic exponential smoothing techniques—Brown, Holt, and Winters; second, totals are disaggregated into individual product forecasts according to some predetermined weighting scheme. Several methods of disaggregating total forecasts of a product line to the related individual items are tested with reference to an Italian firm that markets several bicycles models within many product lines. A sliding simulation approach, based on a composite root mean squared error, was employed to evaluate the optimal combination of forecasting technique and disaggregation method for each product line under different forecasting horizons.

continued

Using POS Data for New Product Forecasting in Fast Moving Consumer Product Companies

Stephen B. Parkoff

SP Consultants, LLC, 23 Clive Hills Road, Edison, NJ 08820, spconsilt@worldnet.att.net

John E. Crowther, Dunelm, International, jecdunelm@worldnet.att.net

Modeling, planning, and monitoring new product introductions is not easy, but if done right can yield significant benefits to companies, in terms of reduced returns, lower logistical costs, improved customer service, and higher product profitability. The availability of point-of-sale (POS) data now makes it possible to model account and consumer behavior of past product introductions, which can be used to provide a basis for modeling new products. Several types of models will be discussed, including order flow during a pre-sell period and product sell-through during the first months of introduction. These data can then be used to create models of the next new product introduction, adjusted for current operating variables such as advertising, sales promotion and other product distribution expenditures. Integrating these models into the order management monitoring and control process determines the level of success in maximizing shipping and sell-through and minimizing returns.

Is Accurate Store-Level Forecasting Possible?

Bill Sichel

The Monet Group, 350 Fifth Ave, New York, NY 10018, scubaridr@aol.com

The retail industry and those involved with store managed inventory systems face an increasingly competitive environment. In order to remain competitive and reduce inventory cost, a forecaster will need to focus on using weekly Point-of-Sale (POS) data in their replenishment planning process. A vital aspect of the weekly forecasting methodology is to determine time-phased demand for large numbers of Stock Keeping Units (SKU) involving seasonality and planned marketing events. In this presentation, we present the results of an empirical study to help improve the accuracy of store-level forecasts in a retail business.

Chair: *S. Heravi*, Cardiff Business School, UK, Hearvis@cardiff.ac.uk

Econometric Model Of The Paraguayan Macroeconomy

Bernard J. Morzuch and P. Geoffrey Allen

Department of Resource Economics, University of Massachusetts, Amherst, MA 01003,
morzuch@resecon.umass.edu

This paper describes our vector autoregression model of the Paraguayan economy. Data limitations restrict the model to annual observations of seven variables. The lag order for the VAR is determined using a general-to-specific approach, with further simplification attempted using Hsiao's method. Johansen's method reveals that there are five cointegrating vectors. Construction of error correction models does not appear to offer much promise of improving forecasts. The final model is used to forecast out-of-sample. The restricted VAR model provides better forecasts than either the naive no-change method or an unrestricted VAR. We seek to improve the model by performing additional testing for parameter constancy. We do so by modifying a sequential Chow test to correct for possible heteroscedasticity between break periods. The date at which the samples are split is moved and the process repeated until all possible partitions have been estimated.

Regional Consumption Smoothing: An Econometric and Neural Network Investigation of the Life-Cycle Hypothesis

Jason Mendenhall and Matthew Severson

Department of Economics, United States Naval Academy, Annapolis, MD 21402,
m994320@nadn.navy.mil

The ability to understand consumption patterns can be extremely important to government agencies and private enterprise in determining whether to forecast nationally or regionally. This paper uses neural network technology along with traditional OLS regression to predict per capita retail sales, examine the robustness of life cycle theory, and evaluate regional impacts on consumption. The first stage of the investigation uses cross-sectional, 1994 county-level data with standard OLS regression. The explanatory variables include proxies for future expected income as well as regional dummies and other demographic variables. The second stage of the investigation applies the same data set and input variables to neural networks. All three models generate roughly equivalent average errors but the neural networks produce slightly higher correlation coefficients. While it is clear that the neural network forecasts may not be comparatively better than traditional techniques, both methods show consistent results which highlight the importance of age demographics, education, and regional location and downplay the significance of future expected income in the understanding of consumption patterns.

continued

Stochastic Model of Mass Equipment's Park Reproduction with Bulk Renewal and Write Off

Mikhail Ya. Postan and *Lyudmyla Shyryaeva*

Odessa State Maritime University, 34, Mechnikov St., Odessa, 270029, UKRAINE,
postan@farlep.net

The stochastic model analyzed is for unreliable equipment's park reproduction taking into account age structure. This model accounts for the possibility of bulk renewal of new equipment and writing off old equipment. The arrival of new equipment is described by an inhomogeneous Poisson process. The unreliable units of equipment are subject to breakdowns and to repairs. For this model, analysis of a system of differential equations and boundary conditions were deduced for determination of probabilistic distribution of age structure. This model may be used for calculating the expected number of operating (acting) units and the number of written-off units, as well as determining the optical age structure of the equipment.

Forecasts of Two-Digit Industrial Production Using Flexible versus Fixed Specification and Linear versus Neural Network Models

S. Heravi

Cardiff Business School, Aberconway Building, Colum Drive, Cardiff CF1 3EU, UK,
Hearvis@cardiff.ac.uk

Denise Osborn, University of Manchester, UK
Chris Birchinhall, University of Manchester, UK

In this paper we consider monthly industrial production in important sectors of the German, French, and UK economies. A number of tests for non-linear dependence in time series are presented and implemented on these data. These tests indicate that there is not much evidence of non-linearity in the data. When we compared the post-sample forecast accuracy of linear models with neural networks, linear models generally produced more accurate forecasts at horizons of up to a year. We also investigated the use of model selection criterion in post-sample accuracy of linear and neural network models.

Chair: **Abebe Yeshanew**, National Meteorological Services Agency, ETHIOPIA, nmsa@telecom.net.et

Social Aspects of Future Public Waste Management

Vicente Carabias, Walter Joos, Alex Stücheli, and Herbert Winistorfer

University of Applied Sciences Winterthur, Department of Ecology, Postfach 805, CH-8401
Winterthur, SWITZERLAND, Crb@zhwin.ch

It is becoming increasingly evident that a waste management program, in particular a waste treatment technique, which ignores social aspects is doomed to failure. Aspects concerning the problems of public acceptance, public participation in planning and implementation, consumer behavior, and changing value systems are no less important than the technical or economic aspects in waste management research and decision-making. As part of the Integrated Research Project "Waste," Swiss Priority Program Environment (SPPE) 1996-1999, this sub-project focuses on the future of waste management. The three-round written Delphi-Expert questioning "Contributions to the development of waste management in Switzerland" was intended to supply an overview of visions and scenarios of the future of waste management with emphasis on its social implications. Results show that decision transparency, financial incentive systems, interregional cooperation, information policy, and public participation are important factors with regard to the public awareness and acceptance of waste management in Switzerland.

continued

Forecasting Applications of Synoptic Observation for Some Selected Parameters at Addis Ababa***Yitaktu T. Tsion***

Research and Studies Department, National Meteorological Services Agency, P. O. Box 1090,
Addis Ababa, ETHIOPIA, nmsa@telecom.net.et

Prediction of weather on daily, short-term, or even long-term basis is important due to the fact that weather influences every human activity. The main objective of this study is to investigate important features of atmospheric parameters observed at Addis Ababa and to identify forecasting potentials. In this study the data used is for the Kiremt Season—June to September—for 1990-94. The parameters are: wind, dew point depression, present weather, and pressure. For all parameters observations are based on standard synoptic hours. Kiremt is the main rainy season for most parts of the country and it is during this period that there is a strong challenge in preparing forecasts based on users' interests. Simple frequency analysis based on a contingency table and time series plotting is used. In general, results of the analyses agree with other observations made at tropical inland stations during summer. Some of the details during night-time could, however, be misleading as there are higher possibilities for human error.

Practices and Strategies in Extended Weather Forecasting in the National Meteorological Services Agency***Abebe Yeshanew***

National Meteorological Services Agency, P. O. Box 1090, Addis Ababa, ETHIOPIA,
nmsa@telecom.net.et

National Meteorological Services Agency regularly provides ten daily, monthly, and seasonal forecasts in addition to short range forecasts. The long-range forecasts were started in the late 1980's. Since then, these forecasts have been used for agricultural sectors and climate and weather sensitive planning, and also for early warning purposes for decision makers. To proffer the extended forecasts, various methodologies have been used, namely teleconnection, synoptic, statistical, and analogue techniques. Moreover, recent study done on rainfall forecasting in Ethiopia using global sea surface temperature based on canonical correlation analysis shows promise in predicting Ethiopian rainfall. The practices of NMSA in extended forecasting and new findings found will also be discussed.

Chair: *Karl-Gustav Hansson*, Statistics Sweden, karlgustav.hansson@scb.se

Why do Multiple Governmental Agencies Generate Competing Forecast?

Matt Andrews and Stuart Bretschneider

The Maxwell School of Citizenship and Public Affairs, Syracuse University, Syracuse, NY 13244,
sibretsc@maxwell.syr.edu

Many governmental agencies forecast. These forecasts have multiple purposes and uses including internal agency management, policy development, and policy analysis. In one survey of forecasters working in the U.S. federal government, over 60 percent of the respondents identified that competing forecasts are generated by other agencies. This paper postulates a theoretical explanation for this phenomenon based on the utility of the forecasts to different groups. The theory also postulates that while use or demand characteristics influence the rise of competitive forecasts, the existence of competitive forecasts also influences the demand or use of those forecasts. Data from a survey of the federal forecasters are used to test the theory. Results suggest that demand and use by groups external to government drive the rise of competing forecasts and that there is little evidence the competition affect use.

Paranomics: Some Measuring and Forecasting Problems

Hasan H. Valiullin

Department of Economics, Dubna University, Universitetskaya street, 19, Dubna, Moscow region, 141980, RUSSIA, Yulia@r2.dub.incom.ru.

Under the definition of "Paranomics" the author implies a kind of an economics that deals with any paranormal, non-classical cases of economic activities. It is assumed by the author that paranormal economy is covering all non-classical sectors of common economy known in scientific practice as shady, parallel, hidden, informal, second, corrupted, criminal, virtual, unreported, and so on. The problem of paronomic activity scale forecasting needs the relevant measuring and modeling tools, being generally based on empirical approach. The following principal factors determining paronomic activities considered in the paper are: tax evasion, level of income, money supply, barterization rate, and corruption. The paper is statistically based on contemporary Russian economical data. Special attention is paid to an analysis of the Laffer curve efficiency in frame of Russian economy's predictability. Some indirect methods of paronomic activities' evaluation are proposed.

A Consolidation of Totally Consistent National Accounts

Karl-Gustav Hansson

Statistics Sweden, Box 24 300, 104 51 STOCKHOLM, SWEDEN, karlgustav.hansson@scb.se

Little has happened in 50 years of National Accounts with respect to quality and usefulness. Basedata seems to be collected as usual by using paper forms and paper mail. Promptness of delivery has not improved very much either, nor has adequacy. This contrasts sharply with the huge developments in data gathering, processing, and transmission techniques. Further, economic analysis and forecasting are still hampered by basedata and national accounts being: (1) inconsistent; (2) inaccurate; and (3) inefficiently produced. These problems could be solved by introducing on-line transmission of data, directly from the economic agents to the statistical office and back to the public. Thereby it can be shown, that a daily accounting in current and fixed prices, through a consolidation of on-line data, might be the only way to reach a robust and powerful national account. It will also be demonstrated that the proposed solution, as an additional benefit, will allow users to set up a specific national account, which will better suit their special needs.

Chair: **Zhuanxin Ding**, Frank Russell Company, zding@russell.com

The Power of the Durbin Watson Test when the Regression Errors are PAR(1)

Kevin Albertson, Jonathan Aylen, and K. B. Lim

Department of Economics, University of Salford, Salford M5 4WT, ENGLAND,
k.v.albertson@economics.salford.ac.uk, j.m.aylen@economics.salford.ac.uk

The Durbin Watson, DW, test for first order autocorrelation in regression residuals is probably one of the most widely applied tests in the time series and econometric literature. We consider the power of the DW test when the regression errors can be described by a periodic autoregressive, PAR, process. Increasingly, the accurate specification of seasonality is being used to improve in-sample fit and out-of-sample forecasting efficiency in time series models, and thus the specification of a PAR process potentially becomes a useful modeling tool. Considering the PAR(1) process, we derive the covariance matrix of the error term and show that it displays both (seasonal) autocorrelation and heteroscedasticity, even if the original data is homoscedastic. We also derive the power function of the DW test for given regressor data when such a process may describe the errors. This power function is compared to the power function when the errors display no periodicity.

Robust Direction Movement Forecasting Using a Pattern Matching Method Applied on Univariate Financial Time-Series

Georgios N. Banavas

Centre for Neural and Adaptive Systems, School of Computing, University of Plymouth, Kirby Pl. 7, Plymouth PL4 8AA, Devon, UNITED KINGDOM, Georgios.Banavas@soc.plym.ac.uk

Two criteria are applied to evaluate the performance of a financial forecasting system: accuracy and the ability to correctly predict the direction of the time-series movement. In this paper, we present a system concept for complex subsequence pattern matching and direction movement forecasting of one-dimensional time series, despite the high noise levels, the non-stationarities, and the nonlinear effects. The basis is the hypothesis: empirical matching is essentially prediction. The detection of user-designed complex "seasonal-cycle" trend-patterns within the past activity of a time-series, in accordance with the study of its historical information on the direction of movement, is the main objective of the matching-forecasting technique we propose. We evaluate our results against linear (Random Walk) or random direction movement selection, and a set of regression and incremental neural networks.

Modeling Long- and Short-Horizon Economic Relationships**Zhuanxin Ding and Steve Fox**

Frank Russell Company, 909 A St., Tacoma, WA 98402, zding@russell.com

Time-series econometrics models only allow data with the same observation interval to be analyzed together. In order to get good forecasts at different horizons, the typical practice is to build different models for the same data set by using information available for different horizons. This paper is an effort to bridge the gap between different models of different horizons. We propose a class of structured time series models that allow variables to have different relationships at different horizons. The structure preserves consistency across aggregation horizons, which allows the efficient use of information with different observation frequencies. The key innovation is to model a component of the high frequency mean using the low frequency relationship. Intuitively, the low frequency relationship determines the "unconditional" mean of the high frequency process. The overall level of the high frequency process shifts when there is new information revealed in the low frequency process.

Forecasting Seasonal Sales with Minimal Data**Vladimir Valenta and Mark Bloemeke**Retek Information Systems, Suite 150, 1057 Lenox Park Boulevard, Atlanta, GA 30319,
Vladimir_Valenta@retek.com, Mark_Bloemeke@retek.com

One of the immediate problems facing large-scale retail sales forecasting is the necessity of producing accurate forecasts for new products with a limited sales history, a situation that is made more complicated by the presence of seasonal effects in the data. The identification of such effects is crucial in minimizing the costs of inventory, ordering, and promotional planning. At no time in a product's sales cycle is this problem more apparent than when the continuation of that product's sales is considered, a decision that is usually made around the one-year sales boundary, when most seasonal forecasting methods are only vaguely applicable. This paper will examine a new data-driven technique for forecasting, with seasonal effects, which is tailored for the second year of a product's sale. The technique will be compared with traditional exponential smoothing techniques with an emphasis being placed on empirical results and quantifiable improvement.

Chair: **Gulnur Muradoglu**, Warwick Business School, afingm@wbs.warwick.ac.uk.

A Survey of Technical Analysts

Roy Batchelor and Steven Kwan

City University Business School, Frobisher Crescent, Barbican, London EC2Y 8HB, UNITED KINGDOM, r.a.batchelor@city.ac.uk

This paper analyses the results of a weekly survey of 18 technical analysts, working in London, New York, and Singapore, who forecast major currencies and stock markets through 1998. We examine the methods used, the accuracy of the forecasts, the calibration of the forecast trading ranges, the value to the traders of the forecasts, the existence of a consensus technical view in financial markets, and associated support and resistance levels. Among the surprising findings are the regular use of local trends in forecasting, the lack of any well-defined consensus about the state of the markets, and the better-than-random performance of the forecasters.

Analyst Earnings Forecast Bias: International Evidence

Lawrence D. Brown

Georgia State University, 35 Broad Street, Atlanta, GA 30302-4050, ldb@gsu.edu

Many studies have examined analyst earnings forecast bias in U.S. markets, but little is known of bias in international markets. A recent study (Brown 1998) found the following regarding analyst earnings forecast bias in U.S. markets: an optimistic bias in analysts' quarterly earnings forecasts exists; firms reporting losses are much more likely to evidence analyst optimism than firms reporting profits; when extreme forecast errors exist for firms reporting losses, the errors are far more likely to be negative than positive; and when small forecast errors exist for firms reporting profits, the errors are far more likely to be positive than negative. This study examines each of these four issues in an international context. It also examines whether results change by segmenting analysts' forecast errors on the basis of predicted (rather than reported) losses and profits, and whether results differ for countries that use different accounting models. In addition to the United States, which is used primarily as a basis of comparison, thirteen other countries are included in the study. The British American and Continental accounting models are also examined.

continued

An Examination of Company and Country Characteristics on the Accuracy of Analysts' Earnings Forecasts

Michael Firth, Hong Kong Polytechnic University

Michael J. Gift

Department of Accounting and Finance, Lingnan College, Tuen Mun, HONG KONG

mgift@ln.edu.hk

* There have been several studies that examined various characteristics of security analysts' earnings forecasts. In this paper, we investigate a much broader set of environmental variables and their impact on the accuracy of analysts' earnings forecasts. Over 37,000 individual analysts' earnings forecasts were examined. The earnings forecasts covered different countries over a five-year period, and are of a very short horizon and a moderate horizon. We have classified these countries into "emerging" economies and "mature" economies using two different selection criteria. Company specific information such as analyst following and a forecast risk measure (dispersion), as well as the forecasts themselves, is taken from the I.B.E.S. Individual Forecast Database. In addition, several accounting regimes/countries have had their accounting environment classified on the basis of perceived quality and audit quality dimensions. In many cases, these factors appear to play a significant role in explaining international differences in forecast accuracy.

Portfolio Performance of Market Professionals' Stock Price Forecasts

* *Gulnur Muradoglu*

Warwick Business School, Accounting and Finance Group, Coventry CV4 7AL, UK,

afingm@wbs.warwick.ac.uk

Aslihan Altay-Salih, Bilkent University, TURKEY, asalih@bilkent.edu.tr

Literature on subjective forecasts of experts is few and centered around forecast accuracy and various types of biases. However, these studies have important policy implications in modeling the behavior of investors and the nature of their errors. The investor's goal is the efficient utilization of human judgment together with secondary data so as to earn higher rates of return. Since investors do not necessarily hold securities in isolation, but construct portfolios using various approaches, portfolio performance of subjective price forecasts is of extreme importance. This research explores the comparative performance of portfolios based on professionals' stock price forecasts and historical data. We collected stock price forecasts by stock market professionals. Then, mean-variance efficient portfolios were constructed using Markowitz's (1959) approach by using two different probability distributions from subjective forecasts of professionals, along with the historical distributions. Finally, the three efficient frontiers are compared, so as to reach conclusions about the value added by professionals' forecasts to the investment process.

Chair: **Max Stevenson**, University of Technology Sydney, m.stevenson@uts.edu.au

Energy Consumption, Survey Data, and the Prediction of Industrial Production in Italy

Domenico J. Marchetti and Giuseppe Parigi

Bank of Italy, Research Department, Via Nazionale, 91 - 00184 Roma ITALY,
marc.2256@interbusiness.it, pari.3085@interbusiness.it

We investigate the prediction of Italian industrial production. We first specify a model based on electricity consumption, which provides a satisfactory forecasting performance. We show that the cubic trend in such a model mostly captures the evolution over time of the electricity coefficient, which can be well approximated by a smooth transition model, with no gains in predictive power, though. We also analyze the performance of models based on data of different business surveys. According to basic statistics of forecasting accuracy, the linear energy-based model is not outperformed by any other single model, neither by a combination of forecasts. However, a more comprehensive set of evaluation criteria sheds light on the advantages of using the whole information available. Overall, the best forecasting performance is achieved by estimating a combined model which includes among regressors both energy consumption and survey data.

Developing Short-Term Load Forecasting System for the Polish Distribution Company

Zbigniew Gontar

Department of Computer Science, University of Lodz, Computer Science Department, Lodz,
POLAND, zhgontar@krysia.uni.lodz.pl

In this paper, we present results of our investigations concerning developing Short-Term Load Forecasting (STLF) system for the Polish Distribution Company. The system is based on the perceptron-like neural network (MLP), and is developed for the two-day-ahead hourly load distribution forecasts. Here, we present the two separate models for normal days and for holidays. The models were trained and tested using the data contained one-year observations, including hourly energy demand, max and min temperatures for the day, and codings for the week-days. Additionally, we present results of application of the system for the forecast in the Polish Power System.

Modeling and Forecasting the Electricity Pricing Process Within Australia

Max Stevenson

School of Finance and Economics, University of Technology Sydney, 645 Harris Street, Ultimo,
2007, Sydney, AUSTRALIA, m.stevenson@uts.edu.au

Adam Kucera, Commonwealth Bank of Australia, kuceraa@cba.com.au

Ken Phang, Commonwealth Bank of Australia, phangk@cba.com.au

Modeling and forecasting the volatile spot pricing process for electricity is important from the perspective of pricing complex derivative products along with the risk measurement and management of such products. For deregulated electricity markets, like those in the Australian states of New South Wales and Victoria, there is a need to price a range of derivative securities used for hedging. Applying wavelet analysis, we examine both the price and demand series at different time locations and levels of resolution to reveal and differentiate what is signal and what is noise without imposing any structure on the data-generating process of noise. Further, using correlation analysis, we gain insight into the lag structure between price and demand for electricity. Finally, having defined what we believe to be the de-noised series at different levels of resolution, we explore a number of time series models as possible candidates for explaining the pricing process and evaluate their n-step ahead forecasting ability.

Chair: **Max Stevenson**, University of Technology Sydney, m.stevenson@uts.edu.au

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School of Finance and Economics, University of Technology Sydney, 645 Harris Street, Ultimo,
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EDITORS:

Robert Fildes

Dept. of Management Science
University of Lancaster
Lancaster LA 4YX
UK
Email: r.fildes@lancaster.ac.uk

Wilpen L. Gorr

The Heinz School
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213
USA
Email: wg0g+@andrew.cmu.edu

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Pierre Lefrançois
Faculté des sciences de l'administration
Université Laval, Québec (Québec)
Canada G1K 7P4
Voice: (418) 656-3010
Fax: (732) 494-2908
Email: pierre.lefrancois@fsa.ulaval.ca

Stephen Parkoff
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and NJIT, Newark,
NJ 07102, USA
ncrato@m.njit.edu

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