ISF 89

THE NINTH INTERNATIONAL SYMPOSIUM ON FORECASTING

VANCOUVER, B.C.
JUNE 18-21
1989

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Department of Economics
Simon Fraser University
Burnaby, B.C. V5A 1S6
Canada
(604) 291-4516

Program Chairperson
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Atmospheric Sciences
Oregon State University
Corvallis, OR 97331
U.S.A.
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Sciences de l'Administration
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Canada
(418) 656-7983

Exhibits Chairperson
Kenneth J. White
Department of Economics
The University of British Columbia
Vancouver, B.C. V6T 1W5
Canada
(604) 228-5360

American Contact
J. Scott Armstrong
Wharton School
University of Pennsylvania
Philadelphia, PA 19104
U.S.A.

Australasian Contact
Alan J.M. Catt
Department of Economics
Auckland University
Auckland, New Zealand

British Contact
Robert Fildes
Manchester Business School
Boot Street West
Manchester, M15 6PB
U.K.

European Contact
Jan G. de Gooijer
Department of Economics
University of Amsterdam
Amsterdam
The Netherlands

Asian Contact
Hajime Myoken
Faculty of Economics
Nagoya City University
Mizoho-ku, Nagoya 467
Japan

Convention Hotel
Hotel Vancouver

MESSAGE FROM THE GENERAL CHAIRPERSON AND THE PROGRAM CHAIRPERSON

On behalf of Simon Fraser University and the International Institute of Forecasters we welcome you to the Ninth Annual International Symposium on Forecasting.

The purpose of this symposium is to enhance the dissemination of research findings and to promote the synergy that develops when researchers and practitioners with mutual interests meet face to face. We are providing the milieu and the program to allow these to happen; our success depends on the way participants avail themselves of this opportunity. If the past is any guide, participants can expect the research results reported here, and the professional contacts made, to be of considerable value.

Along with this we provide the city of Vancouver, one of the world's most popular convention cities. We hope you are able to take full advantage of its attractions.

Peter Kennedy

Allan Murphy

ORGANIZING COMMITTEE FOR ISF 89

Peter Kennedy – *General Chairperson*
Department of Economics, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada

Allan H. Murphy – *Program Chairperson*
Department of Atmospheric Sciences, Oregon State University, Corvallis, Oregon 97331, U.S.A.

Muhittin Oral – *Financial Chairperson*
Sciences de l'Administration, Université Laval, Québec, P.Q. G1K 7P4, Canada

Kenneth J. White – *Exhibits Chairperson*
Department of Economics, University of British Columbia, Vancouver, British Columbia V6T 1W5, Canada

J. Scott Armstrong – *American Contact*
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.

Alan J. M. Catt – *Australasian Contact*
Department of Economics, Auckland University, Auckland, New Zealand

Robert Fildes – *United Kingdom Contact*
Manchester Business School, Manchester M15 6PB, United Kingdom

Jan G. de Gooijer – *European Contact*
Department of Economics, University of Amsterdam, Amsterdam, The Netherlands

Hajime Myoken – *Asian Contact*
Faculty of Economics, Nagoya City University, Nagoya 467, Japan

ACKNOWLEDGMENTS

The ISF 89 Committee thanks the following *institutions* that have made important contributions to the organization of the symposium and/or to the preparation of the program book:

Laval University
Oregon State University
Simon Fraser University
University of British Columbia

In addition, we thank our *colleagues* who organized sessions on specific topics and the many other individuals who contributed significantly to the overall success of this endeavor. The latter include:

Robert T. Clemen
Estelle B. Dagum
Everette S. Gardner, Jr.
Hans Levenbach
Penny Southby
Robert L. Winkler

Special thanks are due Naomi Weidner (Oregon State University) who, with great care and patience, prepared all of the material in the program book.

GENERAL INFORMATION

Badges
Your name badge serves as a pass for all program sessions, exhibit displays, refreshment breaks, luncheons, and the welcoming party. *Please wear your badge at all times while in the convention area.*

Meals
Monday and Tuesday luncheons are included in your conference fee; admission is by badge. For those on plan A or B, which includes hotel accommodation, breakfast tickets are included in your conference material. Breakfast tickets may be purchased separately at the registration desk. All meals are in the Pacific Ballroom.

Coffee Breaks
Coffee and tea will be available during the morning and afternoon breaks, in the exhibits area and along the Pacific Ballroom corridor.

Message Centre
The message centre is located near the registration area. A bulletin board will be provided for personal messages. Announcements and changes in program scheduling will be posted here as well.

Public Telephones and Washrooms
Telephones are located on the convention floor near the elevators. There are two sets of washrooms on the convention floor.

Copying Services
Copying services can be purchased through the hotel accounting office (on the mezzanine floor) at $0.20 per copy. We hope also to have a copier available in the exhibits area.

Sightseeing
Gray Line Tours is located in the main lobby of the Hotel Vancouver and is open from nine to five.

Additional Copies of Program Book
Additional copies of this program book may be purchased at the registration desk for $10. After the conference, copies may be purchased for $15 by writing to Penny Southby, Continuing Studies, Simon Fraser University, Burnaby, B.C. V5A 1S6, Canada. Make cheques payable to Simon Fraser University.

Social Events
The welcoming party is in the exhibits area in the British room on Sunday evening, from eight until ten; admission is by badge. Monday evening is free for you to explore Vancouver. Tuesday evening there is an optional harbour cruise with a salmon BBQ; if you purchased tickets when registering, your tickets should be included with your conference materials. If space is available tickets will be sold at the registration desk.

EXHIBITORS AT ISF 89

Business Forecast Systems, Inc.
681 Conard Street, Belmont, Massachusetts 02178, U.S.A

Business Forecast Systems, Inc. (BFS) is a highly focussed company specializing in providing forecasting services and software to business. BFS will be demonstrating three products at the conference: 1) *Forecast Pro*, a forecasting package designed for the business person (*PC Magazine's* "Editor's Choice," 1989), 2) *Forecast Master Plus*, a complete revision of *Forecast Master* designed for an analyst, and 3) *Foretell*, a new Add-in for *Lotus 1-2-3* that provides quick and easy forecasting for people who use *1-2-3*. In addition to these packages BFS offers custom software, seminars and consulting in the area of statistical forecasting. Robert Goodrich and Eric Stellwagen are the two representatives for Business Forecast Systems.

Automatic Forecasting Systems Company, Inc.
P.O. Box 563, Hatboro, Pennsylvania 19040, U.S.A.

Automatic Forecasting Systems has special competence in the area of time-series analysis, particularly the time domain methods of Box-Jenkins Modeling. AFS's products for the IBM-PC and compatibles have received rave reviews for their unique contribution to forecasting by incorporating "expert systems" features (AUTOBJ, AUTOBOX). AFS has been providing software to universities and industry since 1976 and recently introduced *MTS*, the first IBM-PC product for Vector-ARIMA. Now, AFS is proud to present a new version of *AUTOBOX*.

Elsevier Science Publishing Company
52 Vanderbilt Avenue, New York, New York 10017, U.S.A.

Elsevier Science Publishing Company is one of the world's leading publishers of scientific and technical books and journals. Sample issues of our many outstanding journals are available at the booth. Elsevier will be represented at ISF 89 by Joop Dirkmaat and Greg Pritchard.

John Wiley & Sons, Ltd.
Baffins Lane, Chichester, W. Sussex PO19 IUD, United Kingdom

Wiley publish a range of books and journals in the field of forecasting and econometrics, and their application in planning and management. A selection of publications are shown on our stand where the Wiley representative will be glad to assist you and discuss proposals or suggestions for new books and journals for worldwide publication. We hope to welcome you to our exhibit, or hear from you at our Editorial Department.

Concentric Data Systems, Inc.

Trendsetter Expert, a $149 Add-in for *Lotus 1-2-3* and *Symphony*, supercedes *Wisard Forecaster*. Tested against the 111 M-Competition series, *TrendSetter's* automatic results did better than the best of the 24 reported techniques 88% of the time. *Commercial Forecaster* processes an ASCII file in batch mode to forecast thousands of items without human intervention. The *TrendSetter Commercial* will be available in 1989. Concentric Data Systems, Inc., a supplier of PC software since 1983, has its headquarters at 18 Lyman Street, Westboro, Massachusetts 01581, U.S.A. A forecasting products branch is maintained at 2200 Riverside Drive, Green Bay, Wisconsin 53401, U.S.A. Concentric Data is being represented by David R. Vogt, Director of Product Marketing, and Barry Gerken, Vice President of Marketing & Administration.

Sorites Group, Incorporated
8136 Old Keene Mill Road, Springfield, Virginia, U.S.A

The Sorites Group, Inc., of Springfield, Virginia is exhibiting *SORITEC*, a problem-oriented fourth-generation language for econometric and statistical analysis. *SORITEC* has recently been adopted for general use by OECD and World Bank, and has been *PC Magazine's* Editor's Choice for Econometrics. *SORITEC* includes linear and nonlinear regression, 2SLS, 3SLS, FIML, SUR. Autocorrelation correction techniques, Almon lags, Shiller lags, ridge regression, GLS, RLS, mixed estimation, probit, ARIMA, transfer functions, smoothing. Nonlinear, dynamic simultaneous equation simulation. Crosstabs, correlation, ANOVA, discriminant analysis, descriptive statistics, nonparametric statistics, Matrix algebra operations, analytic differentiation, structured programming language, procedures, databanking. SORITEC applications include economic research; policy analysis; sales forecasting; market research; stock, bond, commodity price forecasting; production and cost function estimation. Sorites Group is being represented by John D. Sneed, President, and Seth A. Greenblatt, Vice President.

Smart Software, Incorporated
392 Concord Avenue, Belmont, Massachusetts 02178, U.S.A

Smart Software, Inc., a privately-held corporation founded in 1983, develops and markets sophisticated forecasting tools based on expert system technology that taps the customer's business judgment. The professional background of its principals include finance and management consulting; software development and marketing; and university teaching and research at Harvard, MIT and RPI. *SmartForecasts II*™, introduced in 1986, combines an expert system for AUTOMATIC Forecasting with interactive graphics for judgmental refinements. In December 1988, Smart Software expanded its product line with the release of the *SmartForecasts II BATCH Processing Edition*™ which forecasts hundreds or thousands of items. Business professionals in sales, marketing, inventory control and production can now process many items simultaneously in batch mode, saving time and money.

SHAZAM
Department of Economics, University of British Columbia, Vancouver, British Columbia V6T 1W5, Canada

SHAZAM is a comprehensive computer program for econometricians, statisticians, engineers, sociometricians, psychometricians, and others who use statistical techniques. Currently, SHAZAM is used in 42 countries from the northernmost (University of Tromso, Norway) to the southernmost (University of Otago, New Zealand) university in the world. SHAZAM is easy to use, has great flexibility, and provides extensive data manipulation capabilities including matrix commands which can be written as easily as MATRIX B=INV(X'X)*X'Y. To name a few of the many special features in SHAZAM include estimation of Box-Jenkins (ARIMA) time-series models, Robust regressions, Bayesian Inequality Restrictions, and Confidence Intervals and Ellipses, Regression Diagnostic tests.

International Institute of Forecasters

Visit us to join the International Institute of Forecasters, or to obtain information on ISF 90. Find out how to submit a paper to the *International Journal of Forecasting* (IJF), obtain information about the special issues for the IJF, purchase copies of the Program Book for ISF 89 and also for previous symposia, join the Consultants Clearing House, join the Placement Service, and leave your suggestions on how to improve future symposia. You can also examine the list of registrants to see who is at this symposium.

SCHEDULE OF KEYNOTE SPEAKERS

Monday, 19 June, 8:30 - 9:30 a.m.

Robert G. Brown

FORECASTS FROM THE SYSTEMS VIEWPOINT

Vancouver Island

Robin M. Hogarth

WHEN DO INCENTIVES MATTER?

Waddington

Tuesday, 20 June, 8:30 - 9:30 a.m.

Stanley L. Warner

USING RANDOMIZED RESPONSE FOR FORECASTING DIMENSIONS OF THE AIDS PROBLEM

Vancouver Island

Vijay Mahajan

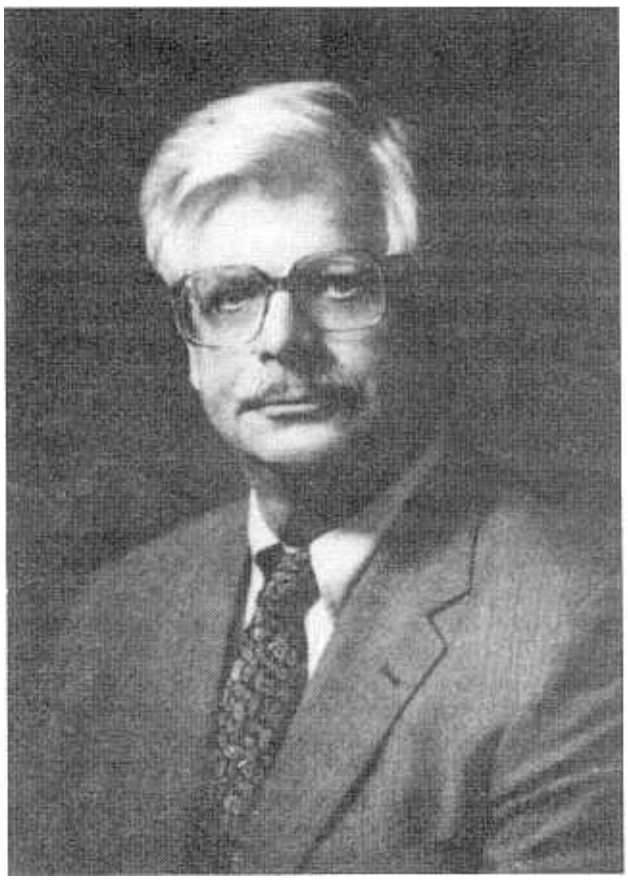
NEW PRODUCT DIFFUSION MODELS: STATUS AND OUTLOOK

Waddington

Robert G. Brown

Materials Management Systems, Inc.
Thetford Center, Vermont 05075, U.S.A.

The founder and president of Materials Management Systems Incorporated has degrees in mechanical engineering and mathematics from Yale University. He is a Fellow of the American Production and Inventory Control System, a member of the British Fellowship of Operational Research, and a member of various American and European scientific and professional societies. In the 1940s he did operations research work for the United States Navy and the Air Force, before joining the staff of Arthur D. Little, Inc. He has been vice-president for operational services of the Curtiss-Wright Corporation and an industry consultant at IBM. He has been a visiting professor in operations research, mathematics, and production management at Yale, Northeastern, Dartmouth, Boston, Lehigh, and Indiana universities.



Forecasts from the Systems Viewpoint

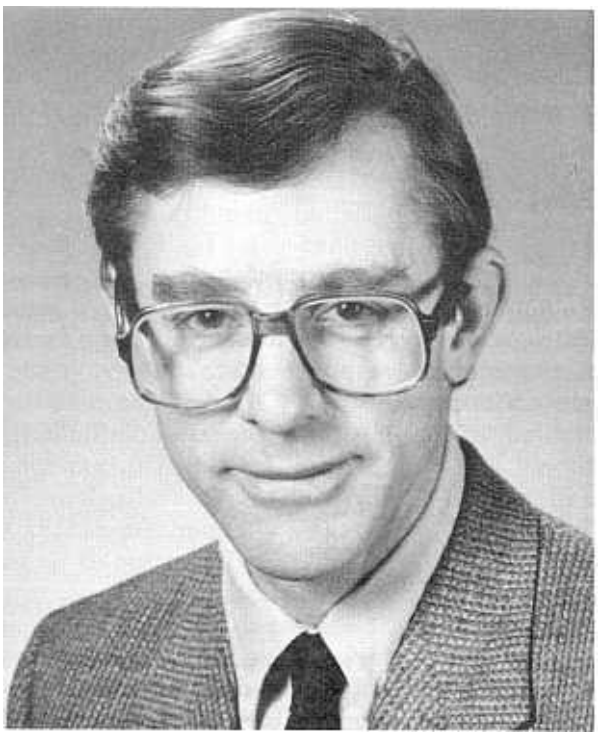
The focus of the paper is short-term forecasting of thousands of products for production, inventory, and distribution planning and control. The message may reach farther. The message is that one can get too engrossed in technical details and lose sight of the need for a forecast to make sense in the context in which it is used. The presentation discusses the following aspects of techniques of forecasting in the context of a complete system for planning and control: (1) the major elements of a forecast; (2) statistical forecasts, including smoothing to revise the forecast, initial conditions, measures of uncertainty, and quality assurance; (3) market intelligence; (4) net shipping requirements; and (5) scheduled backlog of firm orders for future delivery.

Chair: Everette S. Gardner, Jr.
College of Business, University of Houston, Houston, Texas 77004, U.S.A.

Robin M. Hogarth

Graduate School of Business
University of Chicago
Chicago, Illinois 60637, U.S.A.

Robin M. Hogarth is Professor of Behavioral Science at the University of Chicago, Graduate School of Business, where he is also Director of the Center for Decision Research. He earned his Ph.D. from the University of Chicago in 1972 and held previous appointments in INSEAD (The European Institute of Business Administration in Fontainebleau, France) and the London Business School (U.K.). His research centers on the psychology of judgment and decision making processes and theories of rationality and inference. Recently he has been particularly concerned with how people assess uncertainty in ambiguous circumstances and the identification and assessment of casual relations. He is on the editorial boards of *Management Science*, the *International Journal of Forecasting*, *Acta Psychologica*, and *Organizational Behavioral and Human Decision Processes*. He has published four books (including *Judgement and Choice, 2nd edition*, Wiley, 1987) and articles in many leading professional journals such as the *Journal of the American Statistical Association*, *Journal of Business*, *Behavioral Science*, *Management Science*, *Psychological Bulletin*, *Psychological Review*, and *The Journal of Risk and Uncertainty*.



When Do Incentives Matter?

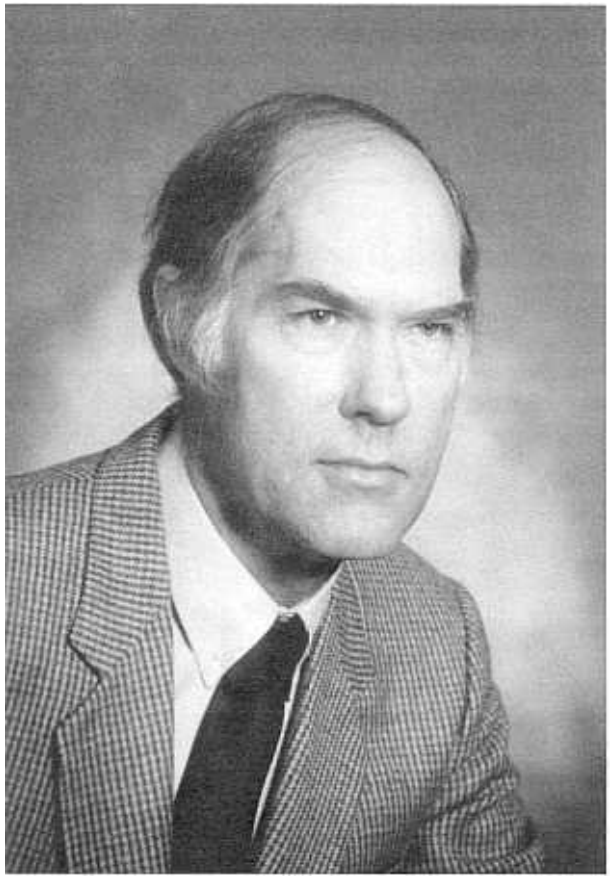
It is commonly held that economic incentives should improve the quality of decisions and forecasts. However, to what extent and under what conditions is this belief justified? Using an analogy of the time taken by a missile to hit a target (involving a speed-accuracy tradeoff), a model is developed to analyze the effects of incentives in different types of environments characterized by both sharp and flat loss functions and varying levels of task complexity. The model's predictions are tested in a series of experiments in which subjects make decisions under varying incentive and task conditions. Incentives, it is found, can both help and hinder the quality of decisions. Implications of these results are drawn for the practice of forecasting.

Chair: Allan H. Murphy
Department of Atmospheric Sciences, Oregon State University, Corvallis, Oregon 97331, U.S.A.

Stanley L. Warner

Faculty of Administrative Studies
York University
North York, Ontario M3J 1P3, Canada

Stanley L. Warner is Professor of Economics and Professor of Statistics in the Faculty of Arts and the Faculty of Administrative Studies at York University. He attended Iowa State University, the University of Michigan, and Northwestern University, and received his Ph.D. at Northwestern University. His early research helped introduce methodology for estimating discrete choice with given micro data and is represented by his 1962 book *Stochastic Choice of Mode in Urban Travel: A Study in Binary Choice* and related publications in the *Journal of the American Statistical Association*. His subsequent work has focused on methodology for improving the data and information on which forecasts and decisions are based. Methodology for obtaining better quantitative data was introduced in a series of articles on randomized response; methodology for obtaining better qualitative information was introduced in a series of articles on balanced information. He is a Fellow of the American Statistical Association and a member of the International Statistical Institute.



Using Randomized Response for Forecasting Dimensions of the AIDS Problem

In his 1963 book, *On the Accuracy of Economic Observations*, Oskar Morgenstern argued that social scientists should direct more theoretical attention to methodology for obtaining better data on which to base forecasts rather than to methodology for obtaining better forecasts based on given data. Partly motivated by this argument, randomized response was developed in 1965 as a theoretical approach to obtaining useful survey data even for highly sensitive questions. Unfortunately for many possible applications in the AIDS crisis, while some 250 articles have served to develop many facets of randomized response methodology, inadequate attention has been given to the practical problem of making the procedures sufficiently simple and inexpensive to establish randomized response as a well-known technology for the general public. This paper introduces a procedure designed to provide extremely quick and inexpensive randomized response surveys by computerized telephone. Also reported are simple illustrative university applications with built-in tests for measuring the understanding and cooperation of the surveyed population.

Chair: Peter Kennedy
Department of Economics, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada

Vijay Mahajan

School of Business
Southern Methodist University
Dallas, Texas 75275, U.S.A.

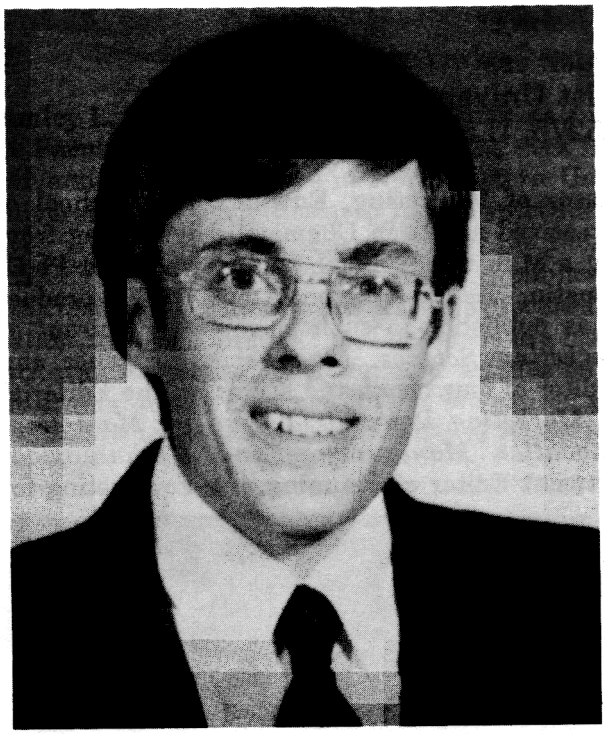
Vijay Mahajan is Herman W. Lay Chair Professor of Marketing, Edwin L. Cox School of Business at Southern Methodist University. He received a B.S. in Chemical Engineering from the Indian Institute of Technology, Kanpur, India; a M.S. in Chemical Engineering; and Ph.D. in Management from the University of Texas at Austin. He has written extensively on product diffusion, marketing strategy and research and has published in such journals as *Journal of Marketing Research*, *Journal of Marketing*, *Marketing Science*, *Management Science* and *Harvard Business Review*. He is co-author or co-editor of four books and serves on the Editorial Review Boards of *Marketing Science*, *Journal of Marketing Research*, *Journal of Marketing*, *Journal of Retailing*, *Journal of Produce Innovation Management*, and *Technological Forecasting and Social Change*. He is the Department Editor of Planning and Forecasting for *Management Science*.

New Product Diffusion Models: Status and Outlook

Since the 1960s research on the modeling of the diffusion of innovations has resulted in a body of literature consisting of several hundred articles, books, and assorted other publications. Attempts have been made to reexamine the structural, estimation, and conceptual assumptions underlying the diffusion models of new produce acceptance. This paper evaluates these recent developments and assesses the forecasting, normative, and descriptive applications of these developments. The paper concludes with a research agenda to make the diffusion models theoretically more sound and practically more effective and realistic.

Chair: J. Scott Armstrong
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.

SCHEDULE OF LUNCHEON SPEAKERS



Monday, 19 June

Robert L. Winkler
President Elect, IIF
(Fuqua School of Business, Duke University, Durham, North Carolina 27706, U.S.A.)

THE INTERDISCIPLINARY NATURE OF FORECASTING

Tuesday, 20 June

Spyros Makridakis
Past President, IIF
(INSEAD, 77305 Fontainebleau, Cedex, France)

FORECASTING IN THE 21ST CENTURY

SCHEDULE OF FEATURED SPEAKERS

Monday, 19 June, 4:00 - 5:00 p.m.

Arnold Zellner
(Graduate School of Business, University of Chicago, Chicago, Illinois 60637, U.S.A.)

FURTHER RESULTS ON BAYESIAN FORECASTING OF INTERNATIONAL OUTPUT GROWTH RATES AND TURNING POINTS

Board

Wednesday, 21 June, 8:30 - 9:15 a.m.

Harold A. Linstone
(Systems Science Program, Portland State University, Portland, Oregon 97207, U.S.A.)

BRIDGING THE GAP BETWEEN ANALYSIS AND ACTION: APPLYING MULTIPLE PERSPECTIVES

Board

SCHEDULE OF REGULAR SESSIONS

Monday, 19 June, 10:00 – 12:00

MB1	Combining Forecasts: An Overview and Panel Discussion	BOARD
MB2	Group Forecasting	GARIBALDI
MB3	Prediction Intervals I	LIONS
MB4	Electricity Load Forecasting	TWEEDSMUIR
MB5	Financial Forecasting	ROOM 209
MB6	Problem Solving Sessions I	ROOM 225
MB7	Judgmental Forecasting I	ROOM 227
MB8	Use of Survey Data	ROOM 228
MB9	Industrial Forecasting Applications I	ROOM 231
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MB12	Forecasting State and Provincial Economies	ROOM 237

Monday, 19 June, 2:00 – 3:30 p.m.

MC1	The Diffusion of Forecasting Thought (Panel)	BOARD
MC2	Accounting Information and Forecasts: Stock Price Effects	GARIBALDI
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MC4	Combining Forecasts	TWEEDSMUIR
MC5	Security Analysts' Earnings Forecasts	ROOM 209
MC6	Applications I	ROOM 225
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MC8	Forecasting with Vector Autoregression Models	ROOM 228
MC9	Industrial Forecasting Applications II	ROOM 231
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MC12	Regional Forecasting I	ROOM 237

Monday, 19 June, 4:00 – 5:30 p.m.

MD1	Featured Speaker (A. Zellner)	BOARD
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MD3	Forecasting Methods I	LIONS
MD4	Combining Forecasts: Applications	TWEEDSMUIR
MD5	Stock Markets	ROOM 209
MD6	Applications II	ROOM 225
MD7	Forecast Evaluation I	ROOM 227
MD8	Multivariate Time Series: Methods	ROOM 228
MD9	Industrial Forecasting Applications III	ROOM 231
MD10	International Economic Forecasting	ROOM 233
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Tuesday, 20 June, 10:00 – 12:00

TB1	Decision Making and Corporate Strategy	BOARD
TB2	New Product Forecasting	GARIBALDI
TB3	Forecasting Methods II	LIONS
TB4	Scenarios in Forecasting	TWEEDSMUIR
TB5	Public Sector Financial Forecasting	ROOM 209
TB6	Forecasting and Planning	ROOM 225
TB7	Forecast Evaluation II	ROOM 227
TB8	Mortality and Population Issues	ROOM 228
TB9	Technological Forecasting	ROOM 231
TB10	Forecasting Software	ROOM 233
TB11	Kalman Filters	ROOM 235
TB12	Forestry Forecasting	ROOM 237

Tuesday, 20 June, 2:00 – 3:30 p.m.

TC1	Strategic Planning and Forecast System Design	BOARD
TC2	Recent Developments in Market Share Forecasting	GARIBALDI
TC3	Forecasting Methods III	LIONS
TC4	Combining Forecasts: Methods	TWEEDSMUIR
TC5	Forecasting Issues in Finance	ROOM 209
TC6	Forecasting in Government and the Military	ROOM 225
TC7	Sales Forecasting: Challenges and Insights for Business (Panel)	ROOM 227
TC8	Knowledge-Based Forecasting Models	ROOM 228
TC9	Exponential Smoothing	ROOM 231
TC10	International Trade	ROOM 233
TC11	Model Identification	ROOM 235
TC12	Animal Diseases and Fish Populations	ROOM 237

Tuesday, 20 June, 4:00 – 5:30 p.m.

TD	Poster Session	BRITISH

Wednesday, 21 June, 8:30 – 10:00 a.m.

WA1	The Shifting Frontier of Forecasting I (Featured Speaker – H. A. Linestone)	BOARD
WA2	Sales Forecasting I	GARIBALDI
WA3	Forecasting Methods IV	LIONS
WA4	Telecommunications I	TWEEDSMUIR
WA5	Forecasting Corporate Earnings	ROOM 209
WA6	Problem Solving Sessions II	ROOM 225
WA7	Political Forecasting	ROOM 227
WA8	Multivariate Time Series: Applications I	ROOM 228
WA9	Seasonality I	ROOM 231
WA10	Macroeconomic Forecasting	ROOM 233
WA11	Bayesian Methods	ROOM 235
WA12	Forecasting for the Environment	ROOM 237

Wednesday, 21 June, 10:30 – 12:00

WB1	The Shifting Frontier of Forecasting II	BOARD
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WB3	Travel and Tourism	LIONS
WB4	Telecommunications II	TWEEDSMUIR
WB5	Applications and Issues Regarding Analysts' Forecast Information	ROOM 209
WB6	Socioeconomic Forecasting	ROOM 225
WB7	Selection of Alternative Forecasting Methods	ROOM 227
WB8	Multivariate Time Series: Applications II	ROOM 228
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WB10	Exchange Rates	ROOM 233
WB11	Future of Software (Panel)	ROOM 235
WB12	Weather and Climate Forecasting	ROOM 237

COMBINING FORECASTS: AN OVERVIEW AND PANEL DISCUSSION

Chair: Robert L. Winkler
Fuqua School of Business, Duke University, Durham, North Carolina 27706, U.S.A.

Participants: Robert T. Clemen
Graduate School of Business, University of Oregon, Eugene, Oregon 97403, U.S.A.
J. Scott Armstrong
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.
Francis X. Diebold
Federal Reserve Board, Washington, D.C. 20551, U.S.A.
Robin M. Hogarth
Graduate School of Business, University of Chicago, Chicago, Illinois 60637, U.S.A.
Spyros Makridakis
INSEAD, 77305 Fontainebleau Cedex, France

A recent paper by Clemen provides a review and annotated bibliography of the literature on combining forecasts, including contributions from forecasting, psychology, statistics, and management science. The primary conclusions of this line of research are that forecast accuracy can be improved through the combination of multiple individual forecasts and that simple combination methods often work reasonably well, relative to more complex combinations. Clemen offers some suggestions for future research directions and forecasting practice. In this session, a brief overview of the Clemen paper will be given, followed by a panel discussion on combining forecasts. The emphasis will be on the current state-of-the-art and on future directions for this area, considering both theoretical/methodological aspects and practical/operational aspects.

GROUP FORECASTING

Chair: Harvey Nussbaum
School of Business Administration, Wayne State University, Detroit, Michigan 48202, U.S.A.

GROUP MEMBERS INCLUSION NEEDS AND FORECAST ACCURACY: AN EMPIRICAL STUDY

M. A. Metcalfe
Department of Accounting, Otago University, Dunedin, New Zealand

This paper reports the results of an exploratory empirical study on the association between group members' levels of wanted and expressed inclusion and the group's performance given feedback. Inclusion is used as a personal measure of the desire to participate in group activities. The study used forty-three small groups of third-year accounting students who attempted to accurately forecast financial results using a substantial budgeting computer simulation. The measure of performance used was forecast accuracy (M.A.P.E.). The groups were self-selected, the simulation continued over three periods of two weeks each, with detailed period-end feedback being provided. The students were given the FIRO-B instrument to measure interpersonal needs and wants. The results confirmed that groups with a high level of desire for inclusion, or being inclusion compatible, were found to be positively correlation to performance levels.

AN APPROACH TO IMPROVING GROUP FORECASTS

K. L. McGown
Concordia Transportation Management Centre, Concordia University, Montreal, Quebec H3G 1M8, Canada

As business decisions become increasingly complex, the need for accurate long-range market forecasting techniques also increases. Technological forecasting methodologies are increasingly being adopted and utilized by corporations – methodologies once used primarily by "think tank" institutions and for military applications. One of these, the Delphi technique, has been widely used for the past twenty-five years. This paper describes a newer experimental technique developed as an alternative to the Delphi method. The SPRITE (Sequential Polling and Review of Interacting Teams of Experts) technique, unlike Delphi, does not seek consensus. It permits an orderly development of *dissenting* views by panelists, placing emphasis on the developments of different inputs.

THE EFFECTS OF EXPERTISE LEVEL ON DELPHI PREDICTIONS: A COMPARISON ACROSS A TEN-YEAR TIME SPAN

Harvey Nussbaum, Ariel S. Levi
School of Business Administration, Wayne State University, Detroit, Michigan 48202, U.S.A.

This paper reports the results of a study of Delphi predictions by three groups of subjects differing in level of expertise, i.e., undergraduate business students, MBA students and middle managers employed by one organization. A four-round Delphi procedure was conducted on two occasions, ten years apart. An essentially identical ten-item questionnaire pertaining to various future developments in the American business firm was administered in each Delphi run. We will compare the predictions made by the three groups of subjects in each time period, focussing especially on the variability of predictions across groups, and on the influence of item content and type.

THE USE OF THE DELPHI TECHNIQUE FOR BUILDING SCENARIOS IN BRAZIL

Henrique de Azevedo Avila
National Bank for Social and Economic Development, Rio de Janeiro, Brazil
Marcio Peixoto de Sequeira Santos
Transport Engineering Programme, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

After some general comments about the use of expert opinion in Brazil, this paper presents the main difficulties which have been found when carrying out DELPHI survey. The objective was to build alternative scenarios for the urban transport system of Rio de Janeiro. The study highlights the importance of being aware of influence of cultural and political aspects upon the experts' participation in the whole survey process. It is suggested that some precautions should be taken when formulating a DELPHI type survey in Brazil, so as to maintain the original objective of the survey and the quality of the experts' replies.

PREDICTION INTERVALS I

Chair: Arnold L. Sweet
School of Industrial Engineering, Purdue University, West Lafayette, Indiana 47907, U.S.A.

PREDICTION INTERVALS FOR ARIMA MODELS

Anne B. Koehler, Bruce L. Bowerman
Department of Decision Sciences, Miami University, Oxford, Ohio 45056, U.S.A.

Among the problems for prediction intervals for ARIMA models are two main ones. The first problem is that no one has determined a way to incorporate the error due to the estimation of the parameters. Box-Jenkins prediction intervals assume that the true model is being used to forecast. A second problem is the assumption of normality for the error terms. Both problems product intervals that are shorter than would otherwise be calculated. The purpose of this paper is to compare the usual Box-Jenkins prediction intervals with the prediction intervals proposed and examined only for smoothing models by Everette S. Gardner in *Management Science* (April, 1988).

CONFIDENCE INTERVALS FOR NON-STATIONARY FORECAST ERRORS: SOME EMPIRICAL RESULTS FOR THE SERIES IN THE M-COMPETITION

Pierre Lefrancois
Faculté des Sciences de l'Administration, Université Laval, Cité Universitaire, Québec, G1K 7P4, Canada

This presentation investigates the effectiveness of generating confidence intervals from an adaptive estimate of the variance of forecast errors. The investigation is performed on the sample of 1001 series first analyzed by Makridakis et al. It is shown that the accuracy of the intervals is improved and that the type of series and the forecasting model used are among the factors explaining the accuracy of forecast intervals.

PRACTICAL NONSYMMETRIC CONFIDENCE INTERVALS

J. Thomas Yokum
Department of Marketing, DePaul University, Chicago, Illinois 60604, U.S.A.

The purpose of this research is to suggest a simple procedure for creating unequal regression-based forecast confidence intervals that are trend-adjusted. Comparisons are made to standard confidence intervals for short and long-run horizons, various sample sizes, and brands in a sales response model. Factors that contribute to unequal intervals are analyzed.

ANALYSIS OF FORECAST CONFIDENCE MEASURES FOR POOLED ESTIMATION MODELS WITH DUMMY VARIABLES

Jerry Langin-Hooper
Langin-Hooper Associates, Phillipsburg, New Jersey 08865, U.S.A.
Mariano Klinge-Loy
AT&T Bell Laboratories, Murray Hill, New Jersey 07904, U.S.A.

Recent econometric forecasting models for interstate telecommunications demand have concentrated on the use of pooling estimation procedures (across geographic cross-sections) for models which have included dummy variables. These dummy variables have represented discontinuities in the historical data due to changes in data definitions. The impacts of the definitional changes have not been independently quantifiable, so the use of dummy variables has seemed appropriate. However, recent evidence has shown that the pooling estimation procedure may over-estimate the significance of the pooled coefficients if dummy variables are included in the model. The confidence which may be placed in the pooled procedure's forecasts are shown to have been significantly overstated.

ELECTRICITY LOAD FORECASTING

Chair: Tim McDaniels
College of Environmental Studies, Western Washington University, Bellingham, Washington 98225, U.S.A.

PROBABILITY DISTRIBUTIONS OF SHORT-TERM ELECTRICITY PEAK LOAD FORECASTS

Gail Adams
New England Power Pool, West Springfield, Massachusetts 01090, U.S.A.
P. Geoffrey Allen, Bernard J. Morzuch
Agricultural and Resource Economics, University of Massachusetts, Amherst, Massachusetts 01003, U.S.A.

Electric companies schedule generator maintenance so as to equalize the risks of capacity shortfall. The length of time that will elapse before a critical load level is exceeded with a given probability is important information. Day-to-day fluctuations in peak loads were assumed to be directly caused by weather variables whose distributions vary by week throughout the year. A daily peak load function was estimated, and non-parametric simulation on weekly subsamples generated more accurate forecast error distributions. These were used to simulate distributions for weekly, monthly, and seasonal peak loads.

LONG-TERM FRENCH ELECTRICITY CONSUMPTION FORECASTS: THE MULTI-ENERGY ANALYTICAL MODELS USED BY ELECTRICITE DE FRANCE

M. Heraud, I. Tournassoud, J.-F. Lhuissier, L. Thovert
Electricité de France, 75384 Paris Cedex 08, France

Planning the electricity system has always necessitated a sound approach to the future development of electricity consumptions. Awareness of load curve requires an approach by use, and the energy context, which is becoming more and more competitive, calls upon monitoring of potential markets. To meet these requirements, EDF has developed three models: SIAM, MARS and COMETE, corresponding to three broad sectors: industrial, residential and tertiary. This paper presents the main characteristics of methodology used for each of these three models.

MODELING PROBABILITY DISTRIBUTIONS FOR ELECTRIC UTILITY LOAD FORECASTS WITH EXPERT ELICITATION

Tim McDaniels
College of Environmental Studies, Western Washington University, Bellingham, Washington 98225, U.S.A.

The electric utility crisis of the early 1980s has spurred interest in techniques for formally representing uncertainty in load forecasts. This paper reports on an approach developed for British Columbia Hydro and Power Authority (B.C. Hydro) and employed as part of its annual forecasting activities. B.C. Hydro uses an end-use approach to load forecasting, so the probability modeling is structured in that manner. Structured expert elicitations are conducted to obtain conditional cumulative probability distributions for relevant variables within each sector; these are propagated with Monte Carlo simulation. Key issues include structuring the conditional assessments and avoiding assessor over-confidence.

THE PVDE COMPUTER MODEL: FORECASTING ELECTRIC ENERGY DEMAND IN DEVELOPING COUNTRIES

V. Fremaux
Electricité de France, 75384 Paris Cedex 08, France

Analysis of factors determining electricity demand in developing countries reveals three essential characteristics: importance of electrification policy; very strong spatial and socio-economic differences within the existing customer base; limited impact on substitution between electricity and other forms of energy. E.D.F. developed a simulation model to forecast electricity demand for those countries: PVDE model. PVDE is an analytical model operating on a sectorial and use basis; it could be adapted for each country, taking into account the local context and the degree of sophistication necessary. This model, written for micro-computer, has been used in many international studies.

FINANCIAL FORECASTING

Chair: John L. Kling
Department of Finance, Washington State University, Pullman, Washington 99164, U.S.A.

FORECASTING CORPORATE PERFORMANCE OF MULTINATIONAL ENTERPRISES

Raj Aggarwal
Department of Finance, John Carroll University, University Heights, Ohio 44118, U.S.A.
Paul Sheldon Foote
School of Business and Management, Pepperdine University, Culver City, California 90230, U.S.A.

The choice of appropriate corporate performance measures becomes more difficult when enterprises become multinational. This study evaluates current popular measures for evaluating the corporate performance of multinational enterprises and stresses the role of forecasts of foreign exchange rates.

STATUS OF FINANCIAL FORECASTING BY SELECTED WEST GERMAN MULTINATIONAL COMPANIES AFTER IMPLEMENTATION OF NEW 1987 REPORTING RULES

Klaus Fleischer
Department of Finance, Banking and Investment Economics, Fachhochschule München, 8000 München, Federal Republic of Germany

Publication of the new accounting rules in the Federal Republic of Germany has led to an incredibly large flood of theoretical papers and comments. The intense discussions that followed were almost exclusively retrospective in relation to evaluation, structure and informative guidelines. Essays related to financial forecasting, which is very important for international transactions, especially in relation to the Anglo-American standard, were often neglected. This paper thus analyzes the elements of forecasting publications about the economy, especially in relation to the financial effects of the accounting rules. After first stating the situation, a framework on which solutions can be based is developed, which has standardization and normalization of the new accounting rules as a goal.

USE OF FINANCIAL STATEMENT FORECASTING IN EVALUATING THE ABILITY OF A BUSINESS ENTITY TO CONTINUE AS A GOING CONCERN

Jay D. Forsyth
Central Washington University, Seattle, Washington 98106, U.S.A.

The American Institute of Certified Public Accountants (AICPA) recently issued ten new statements on Auditing Standards. One of those statements (SAS #59) requires the independent auditor to evaluate the ability of a business firm to continue as a viable entity for a reasonable period of time into the future. The use of forecasted financial statements by the independent auditor in making that evaluation is minimized in SAS #59. This paper is a critique of SAS #59 both in terms of deficiencies contained therein, and other issues left unanswered. A portion of this paper will present an alternative approach to SAS #59.

FORECASTING SMALL FIRM FAILURE – THE USE OF NON-FINANCIAL VARIABLES

Barbara A. Young
Manchester Business School, University of Manchester, Manchester M15 6PB, United Kingdom

The tradition within the literature on the forecasting of company failure has (a) concentrated on failure amongst quoted firms, and (b) forecasts using financial data. At best financial data provides symptoms rather than causes. This study employs hitherto untapped data on the reports of the Official Receiver that contain: period traded, creditors, value petitioned, estimated total assets and deficiency, Directors reasons for failure, Official Receivers reason for failure, industrial sector. It does not in itself provide improved predictions, but discusses how this information will facilitate more accurate forecasting.

JUDGMENTAL FORECASTING I

Chair: William Remus
Department of Decision Sciences, University of Hawaii, Honolulu, Hawaii 96822, U.S.A.

JUDGMENTAL ADJUSTMENT OF SALES-FORECASTS AND INVESTMENT DECISION QUALITY: SOME PRELIMINARY EVIDENCE

Alan E. Singer
Department of Business Administration, University of Canterbury, Christchurch, New Zealand

Should non-time-series information be incorporated into sales forecasts or independently communicated to the decision maker, if the goal is to improve decision quality? This pilot study investigated the differential impact on investment decision-making of supplying contextual information of moderate credibility to a forecaster-only (enabling judgmental adjustment to the sales forecasts) versus to a decision-maker-only. Preliminary results with MBA subjects indicate that where the contextual information is positive (i.e., supports the case for investment) approval of an investment is more likely in the latter condition.

THE WHEN AND HOW OF GRAPHICAL FORECAST ADJUSTMENT

Thomas R. Willemain
Department of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute, Troy, New York 12180, U.S.A.

Graphical adjustment is a method of subjective forecasting that modifies the graph on an objective statistical forecast, or anchor. This paper reports experiments evaluating forecast accuracy for two methods of graphical adjustment. One method anchored on automatic statistical forecasts, the other on naive forecasts. The relative error of the two anchors emerged as the key background variable.

ACCEPT OR MODIFY AN AUTOMATIC FORECAST: AN EXPERIMENT

Benito Flores
College of Business Administration, Texas A&M University, College Station, Texas 77843, U.S.A.

Should a forecast be accepted as generated by a computer software package or modified by the user on subjective or objective grounds? An experiment was conducted using three time series for a period of about eight weeks. The series varied in complexity considerably but were all items that the subjects had information about. The subjects were students that were enrolled in an undergraduate forecasting course. Results of the experiment and conclusions are discussed in detail.

AN EMPIRICAL INVESTIGATION OF SURROGATES FOR MANAGEMENT'S VOLUNTARY EARNINGS-PER-SHARE FORECASTS

Alex B. Cameron
Accounting Department, Eastern Washington University, Cheney, Washington 99004, U.S.A.

This study attempts to simulate management's earnings-per-share forecasts using six naive time series models. The results indicate two (random walk and random walk with a drift) of the six models were significantly more accurate than the other four models in simulating management's earnings forecast. Both exhibited a tendency to consistently underforecast earnings, and it was hypothesized that this could be due to an inherent bias in the data. The results for the remaining four models were not as favorable. The two submartingales and the simple linear trend models exhibited a high degree of variability in accuracy and significant biases based on the magnitude of the forecast. The arithmetic average model appeared to be unbiased but exhibited a high degree of variability. The results of the study indicate that it may be possible to simulate management's earnings forecasts using relatively naive forecasting models.

USE OF SURVEY DATA

Chair: Jeffrey Fisher
Research Department, Bank of Israel, 91007 Jerusalem, Israel

TRANSFORMING BUSINESS SURVEY ANSWERS INTO A LEADING INDICATOR FOR PRODUCTION

Lars-Erik Öller
Ministry of Finance, SF-00171 Helsinki, Finland

Regularly published business survey data are often presented as percentages of firms that are optimistic/pessimistic about the future. The relationship between these numbers and production data may be very inaccurate. Exponential smoothing with a parameter value that enhances swings on the business cycle frequencies, reveals if a survey model forecast can serve as a leading indicator for turning points. The Finnish forest industry is a case in point.

USING QUALITATIVE SURVEYS FOR FORECASTING: NEW INSIGHTS

David Gheva
Bank Examiner's Department, Bank of Israel, 91007 Jerusalem, Israel
Jeffrey Fisher
Research Department, Bank of Israel, 91007 Jerusalem, Israel

Qualitative surveys are advantageous since their results are generally published with a substantial lead and can, therefore, help to forecast official data. Three estimators are presented for quantifying survey results with special attention paid to a parameter B, which helps incorporate "no change in variable" survey answers into the quantification process. A new concept of confidence intervals of the estimators allows for testing significance of survey results between periods, with the intervals providing bounds to the forecasts. Estimates are defined both in "rate of change" and "level" forms. Time series of "levels" are shown to be smooth, thus helping to separate out random movements in official data.

DO PREDICTIONS OF PROFESSIONAL FORECASTERS CONFORM TO THE RATIONAL EXPECTATIONS HYPOTHESIS? TESTS ON A SET OF SURVEY DATA

Russell Edward Dabbs, Joe Brocato, Essam Mahmoud, Ken Smith
Economics Department, University of North Texas, Denton, Texas, 76203, U.S.A.

This paper shall serve as an abstract for a study designed to test a set of survey data for "rationality." The purpose behind such a study is to add more evidence to the current body of knowledge as to whether "rational expectations" may be accepted or rejected as a credible assumption underlying actual behavior. Forecasts made by various professional business economists surveyed for the purposes of publication in a monthly interest rate forecast newsletter will be utilized. Forecasts on four selected variables will serve in this study, then, as expectations of future values of those variables 1-, 2-, 3-, and 4-quarters ahead. Standard statistical tests for rationality will be employed. The final stage of the study will be a test of the data for adaptive expectations.

SURVEY DATA OF EXPECTATIONS AND ASYMMETRIC LOSS FUNCTIONS

Kajal Lahiri
Department of Economics, State University of New York, Albany, New York 12222, U.S.A.
Dongsoon Park
Research Department, Bank of Korea, Seoul, South Korea

Price forecasts derived from time-series models very often pass market rationality tests whereas survey forecasts do not. In this paper, we re-evaluate the accuracy of judgmental forecasts when the survey respondents may have asymmetric loss functions. Using the so-called LYNEX loss function, it is shown that tests for unbiasedness should include uncertainty as an additional explanatory variable. We use ARCH-M model and higher order moments from subjective probability distributions of survey forecasts to analyze multi-period predictions from the ASA-NBER and the Livingston surveys over 1953-1987. Our evidence supports asymmetry in loss functions.

INDUSTRIAL FORECASTING APPLICATIONS I

Chair: Markku Kallio
Helsinki School of Economics, SF-00100 Helsinki, Finland

SURVEY OF ENGINEERING SETTLEMENT PREDICTION PRACTICES IN THE U.S.

A. Karim Hamdy
Oregon State University, Corvallis, Oregon 97331, U.S.A.

Four groups involved in settlement prediction were surveyed: (1) engineers in government agencies, (2) engineers in private practice, (3) university professors, and (4) graduate students. The purpose was to evaluate the level of familiarity of these groups with, and the degree of their belief in the various methods available in the profession to predict settlement of structures. The survey questions dealt with familiarity, reliability, preference and overall rating of the methods, as well the degree of use of computer in design and the users' choice between the deterministic and statistical approaches. The results compiled in an interpretive report show an overwhelming trend toward conservatism, reliance on professional yet subjective judgement and much less use of computers and statistics than would have been inferred from the outlook in the profession's publications. The symposium on forecasting provides an opportunity to compare the civil engineering's forecasting practices with those of other disciplines.

FORECAST METHODS AND MODELS USED IN THE AIR TRANSPORT INDUSTRY

Mohsen Hamoudia
Centre d'Etudes Industrielles, Universite de Paris, 92190 Meudon, France

A survey of the forecast methods and models used in the air transport industry (airlines, airports, national aviation administrations, international organizations and local associations) is elaborated with the data and informations obtained from a hundred of air transport partners throughout the world. The first object of this survey is to be informed of the methods and models used in the air transport industry. The second is to analyse the problems and difficulties as well as the achievements met with by the users of those various methods and models. Lastly, the future developments and prospects are analysed especially in the light of a highly competitive environment and of a deregulation context.

MARKETING CULTURE AND SERVICE FIRM PROFITABILITY: THE IDENTIFICATION OF VARIABLES AND THE EVALUATION OF FORECASTING TECHNIQUES

Cynthia Webster
School of Business and Administration, St. Mary's University, San Antonio, Texas 78284, U.S.A.

This paper presents an approach for identifying the salient variables and evaluating several techniques for forecasting the success of a service firm. First, discriminant analysis results in the identification and weighting of those independent variables that best explain, and consequently predict, the profitability of a service firm. After the marketing culture variables are identified, data on the dependent and independent variables are collected from a representative cross-section of service firms. Third, the data are used to test the effectiveness of several of the most commonly-used forecasting models. As an end result, the model that establishes the most accurate forecast is identified.

FORECASTING IN EDUCATION

Chair: William J. Hussar
National Center for Education Statistics, U.S. Department of Education, Washington, D.C. 20208, U.S.A.

STUDENT POPULATION AND MANAGERIAL MANPOWER FORECASTING IN THE NETHERLANDS

Geert Dewulf
Organization and Policy Studies, University of Utrecht, 3508 T.C. Utrecht, The Netherlands

The paper presents the results of a study of methods and models used in forecasting the number of children in secondary education, students in higher education and managerial manpower in health care in the Netherlands during the period 1965-1985. In the paper I describe and evaluate methods used in these forecasts. One of the main conclusions of the study is that, although the amount of data has increased and the models are more sophisticated, the level of accuracy of the predictions (in both areas) hasn't increased. Furthermore, I shall try to explain the errors and to give a first attempt at theory-formation to explain the fact that in one domain (the health care system) predictions have been more accurate than in another domain (f.e. education). Factors which influence the level of accuracy shall discussed.

EDUCATING FORECASTERS IN SCHOOLS OF BUSINESS AND ECONOMICS

John Hanke
MIS Department, Eastern Washington University, Cheney, Washington 99004, U.S.A.

The study of forecasting techniques has received increased attention in recent years. How to incorporate this topic into the business school curriculum is a difficult problem. The purpose of this study was to determine whether forecasting is being taught in business schools and how it is incorporated into the curriculum. The survey instrument was sent to 574 member institutions of the American Assembly of Collegiate Schools of Business (AACSB).

UNITED STATES DEPARTMENT OF EDUCATION PROJECTIONS OF HIGHER EDUCATION EXPENDITURES

William J. Hussar
National Center for Education Statistics, U.S. Department of Education, Washington, D.C. 20208, U.S.A.

The United States Department of Education is publishing projections of higher education expenditures for the first time in several years. This paper describes the methodology used to produce these projections and presents the results of this analysis. The higher education system is broken up into four sectors: (1) public 4-year institutions; (2) public 2-year institutions; (3) private 4-year institutions; and (4) private 2-year institutions. For each sector, an equation consisting of economic and demographic variables was estimated using ordinary least squares. Expenditures are projected to increase for all sectors with expenditures in private 4-year institutions rising most rapidly.

FORECASTING OF LIBRARY EDUCATION IN THE USSR

V. M. Tyutyunnik
Michurinskaya 124-68, Tambov-32, U.S.S.R.
B. V. Borisov
Sovetskaya 6, Tambov-36, U.S.S.R.

Conclusions about the gradual deviation of library education from the library profession have been reached on the basis of statistical and functional analysis of curricula by the speciality "Library Science and Bibliography" for higher education institutions and universities in the U.S.S.R. over the last 20 years. A model of the long-term development of library education in the U.S.S.R., based on information-library technologies and computing machinery, has been proposed.

MATHEMATICAL PROGRAMMING IN FORECASTING

Chair: Ossama Kettani
Sciences de l'Administration, Université Laval, Ste-Foy, Québec, P.Q. G1K 7P4, Canada

SIMULATION ANALYSIS OF A MATHEMATICAL PROGRAMMING MODEL FOR MARKET SHARE PREDICTION

Muhittin Oral, Ossama Kettani
Sciences de l'Administration, Université Laval, Ste-Foy, Québec, P.Q. G1K 7P4, Canada

Mathematical programming seems to have gained some recognition as an alternative approach to statistical techniques in the area of estimation in general and in predicting market shares in particular. This paper proposes a mathematical programming model to predict the market shares of competing products. The predictive and explicative capacity of the proposed model is tested via a simulation model. The results indicate that the model has 100% predictive capacity in the case of "rational" market mechanism and a significantly high explicative ability.

A CLUSTERING METHOD FOR EVALUATING EFFICIENTS

Pascal Lang, Muhittin Oral, Ossama Kettani, Reha Yolalan
Sciences de l'Administration, Université Laval, Ste-Foy, Québec, P.Q. G1K 7P4, Canada

Data Envelopment Analysis (DEA), which is basically a mathematical programming technique aims to evaluate the relative efficiency of organizations where multiple outputs are produced with multiple inputs. Doing so, DEA allows the organizations to characterize their referent technologies in terms of production process similarity. If the observation set lacks similar technologies, then the extreme technologies become efficient and it is not possible to identify the "truly" dominant and competitor technologies. This paper tries to identify homogeneous clusters in a diverse set of observed production practices for dealing with the mentioned problem in the context of DEA. Also discussed are the related forecasting issues.

A MATHEMATICAL PROGRAMMING MODEL FOR EVALUATING REAL ESTATE VALUES

Ossama Kettani, Muhittin Oral
Sciences de l'Administration, Université Laval, Ste-Foy, Québec, P.Q. G1K 7P4, Canada

Evaluating of real estate values is of great interest to several organizations, along with the owners of real estate, among which one can name municipalities, local governments, real-estate companies and construction firms. Traditional methods of real estate evaluation usually consisted of statistical techniques, which are seemingly without some shortcomings. This paper proposes a new evaluation method which is based on mathematical programming and seems to have a more predictive capacity. The merits of the new method are discussed within the context of an empirical study.

A TAXONOMY OF THE MEASURES OF EFFICIENCY AND FORECASTING

Pascal Lang, Muhittin Oral, Reha Yolalan
Sciences de l'Administration, Université Laval, Ste-Foy, Québec, P.Q. G1K 7P4, Canada

It is possible to direct the future performance of organizations through the measures of control used. There are many efficiency measures suggested in the literature. A good number of these measures are based on mathematical programming models. This paper attempts to provide a taxonomy of such measures and their implications for forecasting.

FORECASTING STATE AND PROVINCIAL ECONOMIES

Chair: James H. Breece
Department of Economics, University of Maine, Orono, Maine 04469, U.S.A

THE MAINE QUARTERLY FORECASTING MODEL: A BVAR APPROACH

James H. Breece
Department of Economics, University of Maine, Orono, Maine 04469, U.S.A.

This paper presents the methodology and statistical techniques utilized in the development of the Maine Quarterly Forecasting Model (MQFM). The MQFM is a Bayesian vector autoregressive (BVAR) model based on the work recently conducted at the Federal Reserve Bank of Minneapolis, and in particular the work by Bob Litterman. The model is based on quarterly data, and forecasts key economic variables of the Maine economy. Policy simulations and forecasts are conducted covering a two-year (eight quarters) time horizon. The entire forecasting procedure and process is PC based. The model is estimated using the statistical program RATS, and national drivers are obtained from FAIRMODEL. This gives the forecaster complete control of the system and allows one to conduct national policy simulations and measure their impacts on the state economy.

PROVINCIAL MULTI-VARIATE TIME SERIES FORECAST MODELS: ALBERTA, BRITISH COLUMBIA AND MANITOBA

E. J. Chambers
Western Centre for Economic Research, University of Alberta, Edmonton, Alberta T6G 2H4, Canada
P. P. Talwar
Management Science, University of Alberta, Edmonton, Alberta T6G 2H4, Canada

The paper develops multivariate time series models based on statistical decision rules to predict the growth rate of seven seasonally adjusted quarterly variables in three Western Canadian provinces: Alberta, British Columbia, and Manitoba. The structures and indexes of instability in two of these provincial economies – Alberta and British Columbia – are quite different from the national average, while the Manitoba economy resembles quite closely the Canadian. Relevant provincial forecasting equations are developed and include the impact of national variables on each provincial economy. In following the decision rules a series of nested tests are performed by first examining the ability of a variable to predict itself, and then building successive equations based on additional variables applying a significance criterion of 0.20. Forecast results are compared with those of the Conference Board derived from a structural model.

AN ECONOMETRIC MODEL OF MISSOURI USING AN EXPENDITURE APPROACH

Donald Elliott
Department of Economics, Southern Illinois, Edwardsville, Illinois 62026, U.S.A.
Andrew Rutman
Southwestern Bell Telephone, St. Louis, Missouri 63101, U.S.A.

The proposed paper describes the specification, estimation, and testing of a small quarterly econometric model of the Missouri economy. The model differs from most previous works in that the specification is predicted on hypothetical state expenditure accounts rather than the more typical income account approach. Because the underlying framework is consistent with the national expenditure accounts, this state model is compatible with national econometric forecasting models. The model provides a practical perspective on the structure of the Missouri economy as reflected in gross state product and its linkages to national economic activity.

UNIQUE APPLICATIONS OF A COMPREHENSIVE MULTI-REGIONAL MODELING SYSTEM

M. Ray Perryman
Hankamer School of Business, Baylor University, Waco, Texas 76798, U.S.A.

This paper reviews several unique applications from a comprehensive econometric, demographic, input-output, industry-occupation, and impact assessment model which the author has generated on a county and multi-county basis for the economy of Texas. Among the applications described in the paper are: (1) the potential impacts of innovative tourist facilities, (2) the effects of major new technological initiatives, (3) the impacts of major legislative initiatives, and (4) the effects of technology transfer programs.

THE DIFFUSION OF FORECASTING THOUGHT (PANEL)

Chairs: J. Thomas Yokum
DePaul University, Chicago, Illinois 60605, U.S.A.
J. Scott Armstrong
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.

Participants: James E. Cox, Jr.
Illinois State University, Normal, Illinois, U.S.A.
Timothy A. Davidson
Temple, Barker and Sloane, Inc., Lexington, Massachusetts, U.S.A.
Steven P. Schnaars
Burach College, New York, New York 10010, U.S.A.
Richard C. Wiser
Mary Kay Cosmetics, Inc., Dallas, Texas, U.S.A.

Despite the creation of new information, new organizations, and new journals within the forecast discipline, barriers still exist between the supply and demand of forecasting thought. This paper discusses the problems of diffusing forecast theory from the perspective of four forecast markets: (1) researchers, (2) educators, (3) preparers, and (4) decision-makers. Evidence is drawn from a survey administered to each group during 1989. Particular attention is given to the diffusion of Box-Jenkins techniques, scenarios, and expert systems.

ACCOUNTING INFORMATION AND FORECASTS: STOCK PRICE EFFECTS

Chair: Gerald J. Lobo
Graduate School of Business, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

ACCOUNTING EARNINGS ANNOUNCEMENTS, INSTITUTIONAL INVESTOR CONCENTRATION, AND COMMON STOCK RETURNS

Gordon Potter
Carlson School of Management, University of Minnesota, Minneapolis, Minnesota 55455, U.S.A.

This study tests whether cross-sectional differences in stock price reactions to quarterly earnings announcements are partially determined by the selective information-search activities of institutional investors. The results indicate that the relative magnitude of stock price reaction to earnings announcements, after controlling for industry, earnings variability, and price-earnings ratios, decreases with company size and increases with institutional investor ownership. The results imply that, after controlling for firm size, differences in information search activities across firms are negatively related to the level of institutional investor ownership.

CROSS-SECTIONAL DIFFERENCES IN THE ASSOCIATION BETWEEN ALTERNATE INCOME MEASURES AND MARKET RETURNS: THE CASE OF REGULATED VERSUS UNREGULATED FIRMS

Thomas Linsmeier
College of Business Administration, University of Iowa, Iowa City, Iowa 52242, U.S.A.
Gerald J. Lobo
Graduate School of Business, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

This research examines whether the information content of alternative income measures reflecting the effect of changing prices (inflation) on firm income differs for regulated versus unregulated firms. It is hypothesized that information about the effects of changing prices on firm income provides greater information to shareholders when predicting the stock prices of unregulated firms. This is because rate setting commissions typically use only historical cost accounting data when determining the rates regulated firms are allowed to charge for their product. Thus, inflation adjusted accounting data may have limited usefulness for predicting share prices of regulated firms. Preliminary tests support the hypothesis.

MARKET VALUATION OF PERMANENT AND TRANSITORY COMPONENTS OF EARNINGS

K. Ramesh
College of Business, Michigan State University, East Lansing, Michigan 48824, U.S.A.
Sundararaman Thiagarajan
A. B. Freeman School of Business, Tulane University, New Orleans, Louisiana 70118, U.S.A.

Empirical evidence in accounting research suggests price changes are associated with earnings changes, but the relationship is not one to one. Consequently, it is inferred that earnings have permanent and transitory components. However, there has not been a direct test of the appropriate market valuation of these components. recent research in finance suggests that prices have temporary components not related to fundamental firm values. This study puts the two strands of thought together and shows that the permanent and transitory components of earnings are appropriately valued by the market as measured by the association with the permanent component of prices.

PREDICTION INTERVALS II

Chair: Anne B. Koehler
Department of Decision Sciences, Miami University, Oxford, Ohio 45056, U.S.A.

COMPUTING CONFIDENCE INTERVALS FOR FORECASTS WHEN USING DECOMPOSED TIME SERIES

Arnold L. Sweet
School of Industrial Engineering, Purdue University, West Lafayette, Indiana 47907, U.S.A.

The problem of computing confidence intervals for time series which are decomposed into seasonal, trend and random components is considered. An exact solution for the additive model with additive noise when the (linear) trend is modeled using regression or exponential smoothing is presented. For multiplicative seasonal models, the concept of using only the deseasonalized series to compute the confidence intervals is examined by the use of simulation. This concept seems to produce reasonable results when the noise component is additive, but not when the noise component is multiplicative. Empirical methods to improve the accuracy of computed confidence intervals are presented for both of the multiplicative models.

A FORECASTING TRACKING SIGNAL BASED UPON THE CHEBYSHEV INEQUALITY

B. A. Price, H. C. Haynsworth
School of Business Administration, Withrop College, Rock Hill, South Carolina 29733, U.S.A.

Gardner (1988) has described a "simple method of computing prediction intervals for time series forecasts" based upon Chebyshev's inequality. This paper describes a tracking signal technique that builds upon this study and provides the results of simulations conducting to evaluate the technique's effectiveness in identifying deteriorations in the accuracy of forecasts based upon exponential smoothing models. The performance of this tracking signal is evaluated under varying forecasting situations and is compared with the results obtained in prior studies of the tracking signals developed by Trigg (1964) and Batty (1969) (Price and Haynsworth, 1988).

MODELING UNCERTAINTY IN EXPERT SYSTEMS WITH INTERVAL ALGEBRA

Heinz G. Schild
Hopmannstrasse 6, D-5300 Bonn 2, Federal Republic of Germany

To cope with uncertainties in planning and forecasting managers and business professionals frequently use lower and upper boundaries, i.e., intervals. Expert systems which support business planning and forecasting problems therefore should allow intervals for modeling uncertain values and support an interval algebra for propagating uncertainty through the inference process. A concise and intuitively plausible solution is presented. First some consideration has to be given to "cut-off" probabilities and their calibration to secure compatibility between user-supplied intervals and those stored in the facts base. Then propagation procedures for additive, multiplicative and logical relations are shown. Finally, an expert system for cost-benefit analysis using this approach is demonstrated and its positive acceptance by the users discussed.

COMBINING FORECASTS

Chair: Sevket I. Günter
Department of Management, Temple University, Philadelphia, Pennsylvania 19122, U.S.A.

COMBINATION AND SELECTION OF BINARY FORECASTS

G. Anandalingam
Department of Systems, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.
Lian Chen
Department of Systems Engineering, University of Virginia, Charlottesville, Virginia 22901, U.S.A.

Statements indicating whether a particular set of events will or will not occur are called "binary" forecasts. We show that combining *binary* forecasts from many experts is better than relying on only one. However, only a subset of available experts would be chosen when forecasts are costly. We present a dynamic programming procedure to optimally combine and select the forecasting experts. We discuss such issues as the use of threshold probabilities by the decision-maker, a priori as opposed to dynamic selection of experts, and incentives for making the experts reveal their detection probabilities.

ON THE EFFICIENCY OF RESTRICTED COMBINATIONS WITH NONNEGATIVITY CONSTRAINTS

Sevket I. Günter
Department of Management, Temple University, Philadelphia, Pennsylvania 19122, U.S.A.
Celal Aksu
Department of Accounting, Temple University, Philadelphia, Pennsylvania 19122, U.S.A.

It is known that *inequality* constrained lease squares (LS) estimators of regression parameters are biased, but superior to the unconstrained estimators under a squared error criterion if the hypothesized restrictions are not severely violated. In combining forecasts, it may be justifiable to expect the combination weights to be nonnegative or their sum to lie between an upper and lower bound. We develop analytical conditions under which inequality restricted in-sample and ex-ante combined forecasts are superior to those obtained from both unrestricted regression combinations and combinations with weights constrained to sum to unity. Supporting empirical evidence is provided.

THE EFFECTS OF NON-STATIONARITY ON COMBINED FORECASTS

Chris Miller, Robert T. Clemen
College of Business Administration, University of Oregon, Eugene, Oregon 97403, U.S.A
Robert L. Winkler
Fuqua School of Business, Duke University, Durham, North Carolina 27706, U.S.A.

One speculation for the relatively robust performance of simple combining methods is that the statistical processes underlying more complex combination schemes are not stationary. This paper reports the results of a simulation project in which the forecast errors were generated from a multinormal distribution. Nonstationarity over time is induced through changes in the mean vector and covariance matrix. Within this nonstationary environment, we study the performance of a variety of forecast combination methods, giving special attention to their relative performance in the time periods just before and after the structural change.

SECURITY ANALYSTS' EARNINGS FORECASTS

Chair: Lawrence D. Brown
Department of Operations Analysis, State University of New York, Buffalo, New York 14260, U.S.A.

PREDICTING INDIVIDUAL ANALYST EARNINGS FORECASTS

Scott E. Stickel
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.

A model is developed and tested that predicts individual analyst forecasts of annual earnings per share. This study finds predictions of individual analyst forecasts can be significantly improved by using publicly available information disseminated between the date of the analyst's current outstanding forecast and the date of the analyst's next forecast. Implications of these findings for studies using analyst forecasts are discussed.

THE VOLUNTARY INCLUSION OF EARNINGS FORECASTS IN INITIAL PUBLIC OFFERING PROSPECTUSES

Peter Clarkson
Simon Fraser University, Burnaby, British Columbia, Canada
Alex Dontoh
University of British Columbia, Vancouver, British Columbia, Canada
Gordon D. Richardson
McMaster University, Hamilton, Ontario, Canada
Stephen Sefcik
University of Washington, Seattle, Washington 98195, U.S.A.

The Ontario Securities Commission has allowed companies to include earnings forecasts in prospectuses since December, 1982. Inclusion in a prospectus is a voluntary decision. The period since then has been viewed as an "experimental period." This study seeks to provide regulators and others with feedback on the experiment and will address fundamental issues such as: explaining the decision to forecast in the context of a voluntary disclosure literature, describing the properties of the forecasts (bias, accuracy, etc.), and establishing the valuation relevance of the forecasts. The study draws on the "signalling literature" for explanations regarding the decision to forecast and explores the robustness of the explanation that firms with "good news" will tend to signal this news through direct disclosures. The study provides empirical evidence consistent with the hypothesis that the direct disclosures (i.e., forecasts) were valuation relevant to investors.

SECURITY PRICE RESPONSE TO QUARTERLY EARNINGS ANNOUNCEMENTS AND ANALYST FORECAST REVISIONS

Brad Cornell, Wayne J. Landsman
University of California, Los Angeles, California 90032, U.S.A.

The degree to which earnings changes are thought to be permanent may determine the magnitude of the security price response to a given earnings announcement [Brown, Foster and Noreen (1985), Kormendi and Lipe (1987), and Easton and Zmijewski (1987)]. This study extends the literature by examining the impact on stock prices of quarter-ahead and year-ahead forecast revisions, as well as forecast errors. Our findings indicate that analyst forecast revisions provide significant incremental explanatory power in a pooled time-series, cross-sectional regression of abnormal returns on forecast errors and analyst forecast revisions. In addition, we find that the fourth-quarter announcement appears to provide more information to analysts and investors than interim announcements.

Session MC6
ROOM 225

Monday
2:00 – 3:30

APPLICATIONS I

Chair: Robert M. Oliver
Department of Industrial Engineering and Operations Research, University of California, Berkeley, California 94720, U.S.A.

FORECASTING ANNUAL FACULTY SALARY INCREASES

David J. Smyth
Department of Economics, Louisiana State University, Baton Rouge, Louisiana 70803, U.S.A.

This paper presents a forecasting model of the annual rate of increase in the nominal salaries of faculty in universities and colleges. The analysis is made for all faculty and faculty disaggregated by rank, both for continuing and continuing plus new faculty. In testing the forecast effectiveness the model is reestimated year-by-year to generate genuine forecasts. Quite accurate forecasts for academic year t are provided by the Livingston expected inflation series, lagged unemployment and a time trend all of which are known in year t-1.

CORRECTIONAL INMATE ADMISSIONS FORECASTING: A COMPARISON OF THREE REGRESSION-BASED MODELS

John Jarvis
Department of Corrections, University of Virginia, Richmond, Virginia 23225, U.S.A.

Forecasting inmate admissions to state prison systems is a widespread activity in the United States. The need for these projections are primarily for evaluating policies and planning for various capital expenditures by state and local governments. This paper will define some of the problems that escalating prison admissions pose for forecasting inmate populations. Three separate multiple regression models will be proposed. These models will then be compared and contrasted as to their performance in accurately modeling prison admissions. Implications for the utility of these types of admissions models as components of criminal justice forecasts will also be discussed.

FORECASTING OUTCOMES OF LEGAL DECISIONS USING HISTORICAL DATA

Duncan Simester, Rod Brodie
Department of Marketing and International Business, University of Auckland, Auckland, New Zealand

The techniques of mathematical modeling used in forecasting and planning need not be restricted to business-oriented applications. This paper describes the application of these techniques to forecasting legal decisions about sexual abuse cases. The judiciary have frequently refused to compare sentences, stating that the circumstances of an offence can rarely be compared with those of another. However, it was found that the significance of various mitigating and aggravating factors can be quantified in a stable model, which may be used to generate accurate forecasts.

Session MC8
ROOM 228

Monday
2:00 – 3:30

FORECASTING WITH VECTOR AUTOREGRESSION MODELS

Chair: M. Aynul Hasan
Department of Economics, Acadia University, Wolfville, Nova Scotia B0P 1X0, Canada

USING INTERINDUSTRY INPUT-OUTPUT RELATIONS AS A BAYESIAN PRIOR IN EMPLOYMENT FORECASTING MODELS

James P. Lesage, Michael Magura
Department of Economics, University of Toledo, Toledo, Ohio 43606, U.S.A.

This paper presents the results of using input-output tables as a source of Bayesian prior information in a national employment forecasting model. A Bayesian vector autoregressive (BVAR) estimation technique is used to incorporate the interindustry input-output table relationships into the labor market forecasting model. This technique requires that a simple translation of the direct use coefficients from the input-output table be used as prior weighting elements to depict the interindustry relations. The Bayesian model provides out-of-sample forecasts superior to those from unconstrained vector autoregressive, univariate autoregressive, a block recursive BVAR model and a naive BVAR model based on the Minnesota random-walk prior. This suggests that interindustry input-output table linkages provide useful information that can be effectively incorporated in labor market forecasting.

A DYNAMIC ANALYSIS OF MONETARY RESPONSES TO FISCAL INNOVATIONS

Mark Wheeler, John Hoag
Department of Economics, Bowling Green State University, Bowling Green, Ohio 43403, U.S.A.

The purpose of our paper is to examine the impacts of fiscal policy changes on the monetary base, money supply, and interest rates in a dynamic framework. The dynamic analysis involves the techniques of Bernanke. In the first state of the Bernanke approach a vector autoregressive (VAR) model is constructed. A structural model is next fit to the residuals from the VAR model. The restrictions imposed by the structural model provide a unique diagonalization of the VAR's covariance matrix. This diagonal covariance matrix is then used to construct variance decompositions (VDCs) and impulse response functions (IRFs). The VDCs and IRFs are used to evaluate the impacts of fiscal policy changes on monetary variables.

DIVIDENDS, EARNINGS AND THE GOVERNMENT POLICIES: A VECTOR AUTOREGRESSION APPROACH

M. Aynul Hasan
Department of Economics, Acadia University, Wolfville, Nova Scotia B0P 1X0, Canada

The purpose of this present study is to examine Campbell and Schiller's (1988) assertion that the future real dividends earning may be forecasted only by long historical averages of real earnings. We empirically tested their assertion by extending their model to incorporate the theoretically postulated financial and fiscal variables [by Tobin (1969) and Blanchard (1981)] as well as other relevant variables such as the real earnings, interest rate and inflation rate. In order to have a general applicability of our results, we consider the economies of the U.S., Japan, the Federal Republic of Germany, the United Kingdom and Canada, using annual data for the period 1946 (post-World War II) to 1987 and estimate a six-variable VAR model for each. These VARs are then converted to their moving-average representations, and Sim's (1980) innovation-accounting techniques are used to examine the impact of alternative monetary and fiscal policies on the real dividends.

INDUSTRIAL FORECASTING APPLICATIONS II

Chair: Ronald D. Schwartz
Department of Management Information Systems, Wayne State University, Detroit, Michigan 48202, U.S.A.

A MATHEMATICAL MODEL FOR EVALUATING THE MOST RELEVANT CAUSES OF INDUSTRIAL WORK ACCIDENTS

A. Aresti, F. D'Amico, A. Cassanelli
Statistical and Actuarial Department, I.N.A.I.L., 33-00145 Rome, Italy

This paper is an attempt to build a mathematical model for identifying and measuring the influence of the most relevant factors of industrial work accidents in the Italian provinces. Firstly, there have been collected or calculated more than a hundred parameters that represent the statistical "thesaurus" from which have been drawn, after an appropriate selection, four factors more potentially related to work accident which synthesize the working conditions (daily working time, compensation per hour, size of work-place and trade union power) plus a fifth: a regional one which points out the differences between southern Italy and the rest of the country.

A PC-MODEL FOR INTERNATIONAL TRADE IN FOREST PRODUCTS: METHODS AND SCENARIOS

Markku Kallio
Helsinki School of Economics, SF-00100 Helsinki, Finland
Risto Seppälä
Finnish Forest Research Institute, SF-00170 Helsinki, Finland

The article discusses experience with modeling of long-term development of production consumption and international trade in forest products. The basis of the research is on the partial equilibrium model developed by the Forest Sector Project at IIASA in 1981-85. However, we shall concentrate on some developments in Finland since the IIASA project was completed. They include a new and highly efficient solution algorithm which allows scenarios to be developed in a PC environment. A number of scenarios will be reported. They aim to analyze possible future developments of the Nordic forest industries.

DISCRIMINANT ANALYSIS: A MULTIVARIATE MODEL FOR RISK ASSESSMENT IN OIL-GAS EXPLORATION

Ronald D. Schwartz
Department of Management Information Systems, Wayne State University, Detroit, Michigan 48202, U.S.A.

While numerous articles have been written on the theoretical aspects of the discriminatory analysis model, very few articles have approached this technique from a practical or problematic viewpoint. In fact, if one researches the literature of multivariate analysis, one also discovers a noticeable absence of materials written on the techniques involved in the development of the discriminatory analysis model. As a consequence, this paper will emphasize the techniques involved in the solution of an actual applied research problem using a two-group discriminatory analysis model.

MACROECONOMIC MODELING

Chair: Christian C. Starck
Bank of Finland, SF-00101 Helsinki, Finland

MACROECONOMIC MODELING, SYSTEMS ANALYSIS, AND SIMULATIONS FOR AUSTRIAN ECONOMY

Junwei Jiang, Richard Hartl
Institute of Econometrics, Operations Research and Systems Theory, Technical University, Vienna, Austria
Andreas Woergoetter
Institute for Advanced Studies, Vienna, Austria

The purpose of this paper is to analyze the dynamic behavior and the performance of macroeconomic system, and to apply the systems theory to economic policy analysis. A small, linear, macroeconomic model was constructed on the basis of theoretical framework of IS-LM approach. The model includes several basic macro-economic variables – consumption, investment, export, import, real output, interest rate, price level, wage rate and unemployment rate – as well as some basic policy instrument variables – government spending and money supply. In order to show the performances of the model, dynamic simulations were done by given historical values of the control variables. To analyze the dynamic behavior of the endogenous variables in the model as a response to a change in the policy control variables, policy simulations based on the model were also made given the different policy control variables.

TO WHAT EXTENT ARE FLUCTUATIONS IN FINNISH OUTPUT DUE TO INTERNATIONAL OUTPUT SHOCKS?

Christian C. Starck
Bank of Finland, SF-00101 Helsinki, Finland

How are fluctuations in the aggregate output of the U.S., other major economies, and output of a small open economy like Finland related? We propose a hierarchial, three-country setup, and utilize the macreconometric framework of structural vector autoregression models to document instantaneous and dynamic relationships. In terms of output variability, the Finnish economy appears to have been not quite as open during the 1960s and the 1970s as previously thought. Nevertheless, it stands out as quite open in the latter part of the 1980s, with international factors accounting for more than half of the variability of domestic output.

A DISAGGREGATED FORECASTING MODEL FOR A SMALL OPEN ECONOMY

Celeste Wood
Central Bank of Barbados, Bridgetown, Barbados

This paper is expected to provide useful insights to the policy makers. The model takes into account critical relationships and key variables, which are likely to be ignored in a less aggregated model. It captures the effects of all the relevant macro-economic data. Policy variables include exchange rates, tax rates, government expenditure, interest rates, credit limits and wage increases. Changes in these variables will impact in some way on key economic variables – inflation, balance of payments, output and employment. Some variables are estimated using econometric techniques. Inferences from these equations are combined with other variables in an accounting framework using an electronic spreadsheet. Projections for five and ten year periods are obtained from the model. In the case of infeasible projections, the model can be used to identify the assumptions responsible. Modification of these assumptions will give useful insight into the working of the economy.

Session MC11
ROOM 235

Monday
2:00 – 3:30

ISSUES IN NONSTATIONARITY

Chair: Henrik Madsen
Institute of Mathematical Statistics and Operations Research, Technical University of Denmark, DK-2800 Lyngby, Denmark

THE IMPLICATIONS OF NONSTATIONARITY IN MODELING EMPLOYMENT TIME SERIES

Nozar Hashemzadeh
Radford University, Radford, Virginia 24142, U.S.A.

This paper uses Dickey-Fuller (1979) procedure to test for unit roots in levels of employment in 29 nonagricultural industrial groups using monthly data from January, 1958 through February, 1987, inclusive. The preliminary results indicate that these time series are non-stationary with regard to both the mean and the variance, and may not be adequately represented by a first- or second-order autoregressive process around a deterministic mean. An alternative formulation is suggested.

OUTLYING OBSERVATIONS IN A COINTEGRATED VAR SYSTEM AND THEIR INFLUENCE ON PREDICTION

Robert M. Kunst
Institute for Advanced Studies, Vienna, A-1060 Austria

A small macroeconomic vector-autoregressive system can be shown to contain cointegrating vectors which strongly affect predictive qualities. Here, research concentrates on possible gains in predictive accuracy by adjusting aberrant observations. Three criteria are used to identify outliers: bad (ex-post) prediction of the observation itself; improved prediction of the subsequent observation of the component variable after adjusting the observation; improved prediction of the whole subsequent variable vector after adjustment. For those cases passing the three tests, re-estimation of the system and prediction experiments are performed. A small Monte Carlo experiment demonstrates the reaction of model parameters to aberrant observations.

METHODS FOR TRACKING TIME-VARYING DELAYS IN DYNAMIC SYSTEMS

Henning T. Søgaard, Henrik Madsen
Institute of Mathematical Statistics and Operations Research, Technical University of Denmark, DK-2800 Lyngby, Denmark

For dynamic systems time delays are frequently observed between the input and output processes. this time delay may show variation in time, which causes problems at model identification. This paper describes a couple of recursive estimation methods for tracking varying time delays in stochastic transfer function models. The first method is based on an adaptively estimated cross covariance function and test procedures for switching between a collection of models estimated in parallel. The second method considers the embedded continuous time delay. Both methods are tested by simulation and illustrated on data from a district heating system.

REGIONAL FORECASTING I

Chair: Anthony H. Stocks
Department of Economics, Youngstown State University, Youngstown, Ohio 44555, U.S.A.

INPUT-OUTPUT RESTRICTION, STRUCTURAL MSA MODELS, AND ECONOMIC FORECASTS

Julia Lane, Dennis Glennon
School of Business, University of Louisville, Louisville, Kentucky 40292, U.S.A.

We use the regional purchase (r_{ij}s) coefficients from a MSA specific input-output model to identify the important interindustry relationships. Grouping the industries according to their r_{ij}s allows us to tie together those industries that are closely related through the production process. Moreover, the r_{ij}s can be used as weights when estimating the model. The interindustry weights impose, a priori, more structure than is usually imposed in most regional econometric models. The r_{ij}s, however, may not be constant over time. A large change in, say, employment in one industry may result in a change in the relationship between industries. Therefore, we also use a varying parameter-type model which will allow the r_{ij} to be updated over time, yet still to retain the underlying structure of the model.

A QUARTERLY ECONOMETRIC FORECASTING MODEL FOR THE CLEVELAND METROPOLITAN AREA

Yih-Wu Liu, Anthony H. Stocks
Department of Economics, Youngstown State University, Youngstown, Ohio 44555, U.S.A.

The Cleveland quarterly econometric model has a total of seventy-five stochastic equations and twenty-five identities. The model is designed to forecast quarter-to-quarter variation in hours of work, employment, weekly wages and wage bill by sector of activity. All variables included in the model are grouped into four blocks: namely, hours, employment, weekly wage, and wage bill blocks. Structural relationships among variables are shown in a flow chart. Causal relationships move from national variables to local variables, from hours worked to employment, from employment to weekly wages. The wage bill is then derived by identify. Stochastic equations are estimated by using OLS and 2SLS procedures. The estimated model is then simulated using the Gauss-Seidel method and the simulation results evaluated in terms of percent root mean square error for the major aggregates. Charts showing actual and simulated quarterly plots of hours worked, employment, weekly wages and wage bill for the Cleveland area also reveal how effectively the estimated model predicts variation in these aggregates through time.

URBAN TRANSPORT SCENARIOS FOR RIO DE JANEIRO: A REVIEW

Marcio Peixoto de Sequeira Santos
Transportation Engineering Programme, Federal University of Rio de Janeiro, Rio de Janeiro 21945, Brazil
Henrique de Azevedo Avila
National Bank for Economic and Social Development, Rio de Janeiro, Brazil

The present study is a review of urban transport scenarios which have been built for the year 2000 for the city of Rio de Janeiro, Brazil. A comparative analysis was carried out involving a different methodology. Originally, the scenarios have been obtained using mainly qualitative analysis of replies of a Delphi-type survey with specialists. In this study, a simulation technique has been used to produce another group of scenarios using some of the data which had been collected for the original study and also some new acquired information. A comparative analysis was carried out and the results are discussed.

FEATURED SPEAKER

Chair: Robert L. Winkler
Fuqua School of Business, Duke University, Durham, North Carolina 27706, U.S.A.

FURTHER RESULTS ON BAYESIAN FORECASTING OF INTERNATIONAL OUTPUT GROWTH RATES AND TURNING POINTS

Arnold Zellner
Graduate School of Business, University of Chicago, Chicago, Illinois 60637, U.S.A.

In this paper time-varying parameter, exponentially weighted autoregressive and fixed parameter models are utilized to forecast annual output growth rates and turning points for 18 countries from 1974 to 1986. Forecasting results with pooling are compared to those without the use of pooling. Results indicate that turning points can be predicted with some degree of success

ACCOUNTING VARIABLES: TIME SERIES BEHAVIOR AND ECONOMIC EFFECTS

Chair: Gerald J. Lobo
Graduate School of Business, University of Wisconsin, Madison, Wisconsin 53706, U.S.A.

MANAGERS' FORECAST DISCLOSURE PACKAGES, FIRM CHARACTERISTICS, AND STOCK PRICE BEHAVIOR

Jerry C. Y. Han, John J. Wild
Graduate School of Business Administration, Michigan State University, East Lansing, Michigan 48824, U.S.A.

This paper examines the association between firms' characteristics, including their stock price behavior, and the composition of managers forecast disclosure packages. The focus is on the characteristics that distinguish firms which release earnings *and* earnings component forecasts from those which release only earnings forecasts. Firms releasing earnings components forecasts are characterized as (1) possessing more variable earnings series, (2) having less profitable operations, and (3) being smaller in size. These firms' earnings forecasts are also less "informative" relative to firms that release only earnings forecasts. The results of tests on the incremental information in earnings component forecasts are conditional on certain economic characteristics of the firms.

DO EARNINGS FOLLOW RANDOM WALK? EVIDENCE FROM A NEW SPECIFICATION TEST

Sundararaman Thiagarajan
School of Business, Tulane University, New Orleans, Louisiana 70118, U.S.A.
Prakash Lougani
College of Business Administration, University of Florida, Gainsville, Florida 32611, U.S.A.

The view that annual accounting earnings can be described by a random walk seems to be well established in the accounting literature. We use a new specification test to show that, for the vast majority of firms in our sample, annual earnings do not follow a random walk. If a random walk were the best descriptor of earnings, then it would imply that changes in the earnings of firms could not be forecasted one period in advance. Our finding, on the other hand, suggests that earnings changes have forecastable components.

SALES AND EARNINGS FORECAST ERRORS: THEIR ASSOCIATION WITH SECURITY PRICE MOVEMENTS AND THEIR CORROBORATIVE EFFECTS

Richard R. Mendenhall, William D. Nichols
College of Business Administration, University of Notre Dame, Notre Dame, Indiana 46556, U.S.A.

This study investigates the joint information content of quarterly earnings announcements that simultaneously release quarterly sales data. Previous research which finds a positive association between quarterly earnings forecast errors and security returns doesn't consider the information effect of sales which is announced simultaneously with earnings and before the public availability of other financial statement data. It is hypothesized that sales data either supplement or corroborate simultaneously released earnings data. Our results suggest that the security market acts as if it uses sales information to corroborate earnings announcements that convey good news but is indifferent to sales information released simultaneously with earnings announcements that convey bad news.

FORECASTING METHODS I

Chair: Stefan Mittnik
Department of Economics, State University of New York, Stony Brook, New York 11794, U.S.A.

MAXIMUM-LIKELIHOOD ESTIMATION AND TESTS IN A GENERALIZED CLASS OF LOGISTIC CURVES

Lothar Knüppel
Department of Economics, University of Bielefeld, D-4800 Bielefeld 1, Federal Republic of Germany

In long-term new product forecasting logistic trend curves are widely known and used (Fildes, 1988), despite of their problems (Meade, 1984). To meet requirements from applications here a simple four-parameter logistic generalization covering the conventional logistic, the NSRL (Easingwood, et al., 1981, 1987), modified NSRL (Skiadas, 1985), simplified NSRL (Knuppel, 1988) and others is analyzed and applied. Its log-logistic family with some well-known members is derived. Problems with maximum-likelihood estimators and likelihood-ratio test to decide on the appropriate parameter set are given. An empirical application of a three-parameter submodel to the series of three new product data is used to compare fits and forecasts based on the ML-estimates.

MULTIVARIATE REDUCED-RANK STATE SPACE MODELING: ESTIMATION AND FORECASTING

Stefan Mittnik
Department of Economics, State University of New York, Stony Brook, New York 11794, U.S.A.

We present a simple procedure for estimating reduced-rank state space models from multivariate time series data. In standard state space realization procedures the system matrices are obtained by factorizing a Hankel matrix constructed from sample autocovariances or Markov parameters. In this paper we construct the Hankel matrix directly from the observed data and use the singular value decomposition method to achieve a factorization. Combining Kalman filter techniques with the resulting state space model allows us to produce k-step ahead forecasts.

A METHOD FOR ROBUST RECURSIVE ESTIMATION

Ken Sejling, Henrik Madsen
Institute of Mathematical Statistics and Operations Research, Technical University of Denmark, DK-2800 Lyngby, Denmark
Jan Holst
Department of Mathematical Statistics, University of Lund, S-22100 Lund, Sweden

For automatic control or supervision of a system on-line predictions are usually required. Since the system of interest possibly can change as time is passing, the model used for predictions much follow these changes. The estimation method therefore has to be adaptive, implying the use of a recursive estimation algorithm. Furthermore, because of the possibility of outliers in the incoming observations, it is advantageous, that the applied estimation algorithm minimize the influence of any sort of outliers. This paper investigates a method of the bounded influence type, in which the limitation in influence depends both on the size of the prediction error and the amount of new information in the regressors. The method is compared with other robust estimation methods based on the ordinary recursive least squares algorithm.

COMBINING FORECASTS: APPLICATIONS

Chair: Francis X. Diebold
Federal Reserve Board, Washington, D.C. 20551, U.S.A.

IMPROVING FORECASTING ACCURACY – A TELEPHONE INDUSTRY CASE STUDY

A. L. F. "Mukit" Hossain
Applied Technology and Development, Ameritech Services, Schaumburg, Illinois 60173, U.S.A.

After the deregulation of the telephone industry, the changing market caused high degree of fluctuations in the revenue-related variables. This offered an interesting opportunity to test the accuracy of different time-series and econometric forecasting methods. The current paper identifies a few models for residential switched access forecast, and compares the accuracy of the models – both in the short- and in the long-term. Furthermore, it probes the possibility of improving forecast results by combining (using simple techniques) the different model results.

THE USE OF A REVIEW BOARD IN FORECASTING – EMPIRICAL EVIDENCE

Michel Chalifoux
Forecasts, Telecom Canada, Ottawa, Ontario K1P 6H5, Canada

This paper analyses the performance of a forecast review board over a three-year period and a large number of revenue and demand variables in the Canadian telecommunication industry. Forecasts prepared by nine groups of forecasters in different (non-competing) telecommunication companies are submitted to a review board and are judgmentally adjusted by a panel of these experts. The results show that this forecasting review and consensus building approach has significantly improved the accuracy of the forecasts.

ESTIMATION WHEN FORECASTERS HAVE DIFFERENT AMOUNTS OF KNOWLEDGE: AN APPLICATION

Benjamin H. Eichhorn, James W. Dailey, Sanford Temkin
Department of Decision Sciences and Computers, Rider College, Lawrenceville, New Jersey 08648, U.S.A.

In the past, the authors developed a statistical model for assigning weights to the contributions of forecasters who have different amounts of knowledge about a forecasting context. In this paper, we describe an application of the original method to a college admissions situation in which experts (admissions staff) and non-experts (faculty, students) forecast several grade point averages that will occur four years later. The application also includes the use of Saaty's analytic hierarchy methods and employs computer simulation.

Session MD6
ROOM 225

Monday
4:00 – 5:30

APPLICATIONS II

Chair: Steven J. Cosgrove
Cambridge Reports, Inc., Cambridge, Massachusetts 02139, U.S.A.

PREDICTING MIDAIR AND UNREPORTED NEAR-MIDAIR COLLISIONS

K. Datta, R. M. Oliver
Department of Industrial Engineering and Operations Research, University of California, Berkeley, California 94720, U.S.A.

A probability model to predict midair and near-midair collisions that depends on weather, traffic density, detection and collision avoidance maneuvers. Risk of collision is the product of three factors: density, effectiveness of the collision avoidance system, and the probability that, by chance alone, a critical near-midair escalates to a collision. The paper finds that collision avoidance systems (such as TCAS) should be used by all aircraft in high-density regions if there is to be significant risk reduction. Proposed systems appear to have higher detection odds than See-and-Avoid but apparently lower odds of avoidance given that an aircraft has been detected. We present numerical predictions.

FORECASTING POSTAL MAIL VOLUMES

Joel B. Cohen
Postal Rate Commission, Washington, D.C. 20268, U.S.A.

With the Postal Reorganization Act of 1970, officials of the U.S. Postal Service, its Board of Governors, and the Postal Rate Commission have concentrated on the ability of the U.S.P.S. to operate efficiently in an environment of technological innovation and growing competition. Public scrutiny of the budget and product/service pricing activities of the U.S.P.S. has created an increasing, but as yet unsatisfied, need to develop accurate revenue and volume forecasting models and to determine price elasticites of demand. I present a model of first-class mail volumes – a set of simultaneous equations – that incorporates a representation of historical changes in rate structure, due to introduction of presort discounts and rate categories, and in demand function parameters, due to heightened competition in the communications industry.

THE BUILDUP EFFECT, AN ANALYSIS OF ROOM AIR CONDITIONING USAGE AND TEMPERATURE IN NEW YORK CITY AND WESTCHESTER 1985-1988

Steven J. Cosgrove, Jeffrey Banks
Cambridge Reports, Inc., Cambridge, Massachusetts 02139, U.S.A.
Joseph DelPriore
Forecasting and Economic Analysis, Con Edison Co. of New York, Inc.

This paper details an analysis of the relationship between room air conditioner usage and temperature in New York City and Westchester. Data for this study were drawn from several larger studies conducted by Cambridge Reports, Inc. for Con Edison Co. of New York between 1985 and 1988. The primary purpose of this paper is to analyze 1985-1988 survey and weather data to determine the quantity of the "buildup" residential electric peak load directly related to the unusual weather experienced during the summer of 1988, as well as to project the amount of such buildup peak load that will carry over to 1989 summer residential usage.

Session MD8
ROOM 228

Monday
4:00 – 5:30

MULTIVARIATE TIME SERIES: METHODS

Chair: Keith Ord
Pennsylvania State University, University Park, Pennsylvania 16802, U.S.A.

FORECASTING ECONOMIC SYSTEMS – HOW RELEVANT IS COINTEGRATION? A MONTE CARLO STUDY

Peter Brandner, Robert M. Kunst
Institute for Advanced Studies, A-1060 Vienna, Austria

This paper investigates the forecasting performance of cointegrated systems by simulation. It extends Engle and Yoo's (1987) investigation in two important directions. First, we also consider a conditional maximum likelihood procedure due to Johansen (1988) and find improved forecasting performance relative to previous suggestions, but the gain remains small. Second, examination of a three-dimensional system shows that even for long period forecasts those VARs which overestimate the true number of common trends (overdifferenced systems) perform only slightly worse relative to the correct model but considerably better than VARs on which too much cointegration is imposed.

FORECASTING MULTIPLE TIME SERIES USING AUTOREGRESSIVE INDEX MODELS

Siem Jan Koopman, Jan G. de Gooijer
Department of Economic Statistics, University of Amsterdam, 1011 NH Amsterdam, The Netherlands

Reinsel (1983) has introduced a class of so-called multivariate autoregressive index models to reduce the amount of significant information in multiple time series in terms of a smaller number of index series. In this paper a simple least-squares estimation method is proposed for estimating the parameters in a special subclass of these models. The index series resulting from this estimation method are uncorrelated and ordered from most predictable to least predictable. They represent the general structure in the data. Using the well-known U.S. hog data the estimation method is illustrated and the forecasting performance of the hog series is compared with forecasts obtained from several other multivariate time series methods.

COMPARISON BETWEEN THE TRANSFER MODEL AND THE BIVARIATE APPROACH

Jack Prins
Thomas J. Watson Research Center, IBM Corporation, Yorktown Heights, New York 10598, U.S.A.

Statistical Process Control can be considered as a series of phases or stages as follows: Data Collection, Data Analysis, Optimization, and Quality Control. The first three phases are the development of the product. One conceives a new product or product step, performs some experiments (in theory statistically designed, but in practice not always so), and wishes to study the correlative aspects between a set of responses and a set of controls. The usual techniques are "regular" and/or stepwise linear regression. One can then continue by EVOP methods to achieve optimum response(s). Another and perhaps better way is to use quadratic programming. Finally, when a suitable optimum with the associated controls has been accepted, the manufacturing stage is entered. Here the detection or quality control phase begins. To detect drifts or out-of-control situations, it is here suggested to incorporate stepwise autoregression. Its stochastic properties can be used to forecast, inclusive of confidence bands. This region can be utilized to set up decision criteria.

INTERNATIONAL ECONOMIC FORECASTING

Chair: J. Alex Murray
School of Business and Economics, Wilfrid Laurier University, Waterloo, Ontario N2L 3C4, Canada

THE ACCURACY OF OECD FORECASTS OF THE INTERNATIONAL ECONOMY: DEMAND, OUTPUT, PRICES AND THE BALANCE OF PAYMENTS

J. C. K. Ash, S. M. Heravi
University of Reading, Reading, RG6 2AA, United Kingdom
D. J. Smyth
Louisiana State University, Baton Rouge, Louisiana 70803, U.S.A.

This paper is an update of, and major extension to, research reported at ISF 84 London. We evaluate forecasts of the international economy made by the Organisation for Economic Cooperation and Development (OECD). Twice a year OECD publishes assessments of current economic activity in its member countries, together with semi-annual forecasts for at least the ensuing eighteen months. Thus our large data set, comprising over 9000 pairs of predictions and outcomes, includes one- two- and three-step ahead forecasts of the main components of demand, output, prices and the balance of payments in Canada, France, Germany, Italy, Japan, the UK and the USA for the twenty-year period 1968-1987. Various measures of overall accuracy are reported; also a comparison with competing time-series predictions. The analysis includes a full range of diagnostic checks on forecast performance, including rationality tests.

THE EUROPEAN CHALLENGE: FORECASTING A NORTH AMERICAN RESPONSE

J. Alex Murray
School of Business and Economics, Wilfrid Laurier University, Waterloo, Ontario N2L 3C4, Canada

It may well be that the American Challenge of the 1960s will become the European Challenge of the 1990s. This may never have happened if members of the European Economic Community hadn't felt that time was running out for a unified single market. By removing restrictions within the EC and improving allocation of resources, the single market target by 1992 will generate substantial economic benefits for Europeans. At the same time, there is a new challenge to North American business that will result from changed rules that, at times, may seem discriminatory. The focus of this paper is two-fold: 1) To examine that main measures that are projected to present the major difficulties for NA business; 2) To discuss several responses that are forecasted to be the most promising for firms whose current European markets are threatened. Several research inputs for this paper will be utilized. Major European research groups have shared their studies on the 1992 initiative, in addition, several on-site visits with NA companies operating on the continent were undertaken. Finally, executives of approximately thirty NA companies have been contacted to discuss their longer-term strategies for the unified European market.

FUTURE U.S. NET PAYMENTS ON INTERNATIONAL INVESTMENT

Lois Stekler
Division of International Finance, Board of Governors of the Federal Reserve System, Washington, D.C. 20551, U.S.A.

Persistent U.S. current account deficits have transformed the United States from a large creditor to a large net debtor nation. One consequence of this shift has been a substantial decline in U.S. net investment income. Forecasts of future deficits of net investment income can be made in a variety of ways; however, simply multiplying the projected negative U.S. international investment position times an assumed interest rate is likely to seriously over-predict the deficit. This paper will explain why, and, using a model of investment income receipts and payments, report on simulations employing alternative assumptions about future rates of return and growth of assets and liabilities.

REGIONAL FORECASTING II

Chair: Anne Pickford Cahill
Office of Research and Statistics, County of Fairfax, Fairfax, Virginia 22030, U.S.A.

FORECASTING LOCAL TAX REVENUES: A CASE STUDY OF FAIRFAX COUNTY, VIRGINIA

Anne Pickford Cahill
Office of Research and Statistics, County of Fairfax, Fairfax, Virginia 22030, U.S.A.

This paper describes the implementation and organization of a comprehensive tax revenue forecasting program in a local government jurisdiction, Fairfax County, Virginia. The case study highlights the need to involve high level managers from a number of agencies, to have active and thorough evaluation and documentation procedures, and to involve the forecasting staff in the development of computer systems for the County's corporate data base. In addition, the paper reviews the types of models used and their accuracy.

FORECASTING STATE TAX REVENUES: A SINGLE METHOD APPROACH

Harriet Hinck
Economics Department, Trenton State College, Trenton, New Jersey 08650, U.S.A.

A simple systematic method is particularly desirable in forecasting tax revenues as political and bureaucratic objectives often introduce biasing elements. Univariate methods are ideal candidates, then, if accuracy can be provided. Since research findings (Makridakis and Hibon, 1979; Makridakis et al., 1982) indicate that there is very little difference in forecast accuracy between exponential smoothing and ARIMA models, this paper reports on an analysis of exponential smoothing techniques for New Jersey sales tax revenues using AUTOCaST and 4CaST/2. The following factors are critical: the selection of number of periods ahead; initial parameter values; initial seasonal factors; adjustment for autocorrelation in residuals. These procedures are summarized; the results are encouraging.

FORECASTING SMALL REGION SECTORAL EMPLOYMENT LEVELS: A TIME SERIES APPROACH

Barry R. Weller
Behrend School of Business, Pennsylvania State University, Erie, Pennsylvania 16563, U.S.A.

Within a region sectoral employment forecasts are often desired to facilitate planning and policymaking. At the national level, such forecasts are often made with the assistance of a traditional econometric model. At the very small region level, however, few of these models exist. The purpose of this paper is to investigate the efficacy of an alternative modeling approach, contemporary time series analysis, in predicting regional sectoral responses to changes in the aggregate level of economic activity. Total regional employment levels as well as four sectoral employment levels will be forecast using a variety of national aggregates and indicators as model drivers.

DECISION MAKING AND CORPORATE STRATEGY

Chair: Alan E. Singer
Department of Business Administration, University of Canterbury, Christchurch 1, New Zealand

CORPORATE RATIONAL AGENCY AND STRATEGIC FORECASTING SYSTEMS

Alan E. Singer
Department of Business Administration, University of Canterbury, Christchurch 1, New Zealand

Recent developments in the theory of rational decisions have implications for the status of the rational-agency model of corporate planning and for the potential capabilities of strategic forecasting systems. The several different meanings of "rationality" may be used to: (1) Identify several determinants of forecast-leverage (i.e. impact) on strategic decisions, (2) Derive diagnostics for resolving conflicting prescriptions for strategic decisions, (3) Classify the various factors, issues or considerations that potentially affect strategic decisions, (4) Indicate what strategic-level forecasting systems might do and what they cannot do.

DECISION THEORIES AND DECISION AIDS

Lee R. Beach
Department of Psychology, University of Washington, Seattle, Washington 98195, U.S.A.

Decision making must be prefaced by forecasts of what will happen if this or that alternative is chosen. Economic decision theory characterizes these forecasts in terms of probability theory. Behavioral decision theory characterizes them in terms of mental models and causal logic. The difference between these two approaches is explored and the implications of the difference for decision aiding is examined.

TOWARDS A THEORY OF LINKING FORECASTING AND DECISION MAKING

William Remus
Department of Decision Sciences, University of Hawaii, Honolulu, Hawaii 96822, U.S.A.

This article describes a theory linking forecasting practices and decision making. The theory begins with arguments drawn from microeconomic theory to make the case that concave criterion functions characterize many important decisions. The theory then draws on the decision literature to identify the two general categories of decision making errors. Namely, bias (relative to the best decision) and consistency (of decision rule use). Through mathematical arguments and empirical research, it is shown that both bias and consistency have an impact on decision making – but that consistency has the greater impact. The link between forecasting and decision making is based on using key elements of the forecasting process to improve consistency in decision making. Through improved consistency, improved decision making results.

STRATEGIC DECISION MAKING

Annele Eerola
Swedish School of Economics and Business Administration, SF-00100 Helsinki, Finland

The paper discussed questions aroused by a survey among the subscribers of a long-range market forecast report. The results of the survey suggest that the usefulness of these general-purpose forecasts to the subscriber companies did not solely depend on their information value in constructing and evaluating alternative strategic plans. Other functional roles of forecasts – like using them as tools for group argumentation, as social symbols, or as means for increasing the companies' general preparedness in organizational decision-making – were often more apparent. The results of the survey are presented and indications for further research discussed.

NEW PRODUCT FORECASTING

Chair: Vijay Mahajan
School of Business, Southern Methodist University, Dallas, Texas 75275, U.S.A.

THE FORESEEABILITY OF SIX VERY SUCCESSFUL CONSUMER INNOVATIONS

Steven P. Schnaars, Barry N. Rosen
Department of Marketing, Baruch College, New York, New York 10010, U.S.A.

This presentation examines the accuracy of forecasts made for six very successful innovations: the fax machine, VCRs, microwave ovens, cellular telephones, the compact disk, and ATMs. It asks: How were the markets for those products expected to evolve? What physical forms did forecasters think those products would take? To what uses would they be put? Based on a review of forecasts published in the popular press over the past few decades, this study compares expectations with actual outcomes. A summary table of forecast performance and a list of recommendations are provided to those who attend this presentation.

EARLY-PHASE PREDICTING OF PRODUCT LIFE CYCLES: RELATIVE GROWTH RATE METHODS VERSUS MULTIPLE REGRESSION ANALYSIS – DEMAND FOR VIDEO RECORDERS AND MICROWAVE OVENS IN THE FINNISH MARKET

Seppo Pitkänen
Department of Industrial Engineering, Lappeenranta University of Technology, SF-53851 Lappeenranta, Finland

The life cycle of a product is one of the most important concepts in planning marketing strategies and tactics. Therefore, early-phase estimation of the life cycle is extremely crucial, e.g. with respect to forecasting cash flows and the strategic planning of future marketing mix. We have to distinguish between cycles on three different levels: the levels of single brand, product and production technology. Here we are dealing with the product level, where the demand remains at the saturation level for a relatively long time, i.e. the cycle can be mathematically described by a frending time series. Although some variants of traditional multiple regression models with easy-to-forecast predictors (income, relative prices and some dummies) yield a very high R^2 (more than .99) in the entire time series, early-phase predictions based on these models are very misleading. On the other hand, the relative growth rate method presented by Levenback & Reuter and further developed by the author, where the hypothesis concerning the shape of the time series is first tested and the parametres of the final model are "indirectly" estimated, apparently provides an effective way for early-phase predictions.

FORECASTING CONTAINER TYPE FOR PACKAGED FLUID MILK WITH A MULTI-GENERATION DIFFUSION MODEL

Mark Speece
School of Management, University of Alaska, Fairbanks, Alaska 99775, U.S.A.
Douglas MacLachlan
Department of Marketing, University of Washington, Seattle, Washington 98195, U.S.A.

New product forecasting in marketing often focuses only on the new product itself, neglecting the fact that older products remain on the market to provide competition. When the new product represents a technological advance, this situation can be modeled as a multi-generation innovation diffusion problem. We forecast use of three generations of packaging technology in the fluid milk market; glass, paperboard cartons, and plastic. We use a recently introduced model which was developed for high-technology industries and tested on a high-tech product class. Results show that the model can be successfully applied to industries not usually associated with advanced technology.

FORECASTING METHODS II

Chair: M. Masoom Ali
Department of Mathematical Sciences, Ball State University, Muncie, Indiana 47306, U.S.A.

SOLVING TIME SERIES PROBLEMS WITH MULTI-STAGE MONTE CARLO OPTIMIZATION

William Conley
University of Wisconsin, Green Bay, Wisconsin 54311, U.S.A.

Multi-stage Monte Carlo optimization (MSMCO) is used to solve a variety of time series problems. MSMCO is a general purpose optimization algorithm. Its generality allows the fitting of time series equations using least absolute deviation instead of least squares as a measure of goodness of fit for the data. This makes possible the finding of a time series equation that has less total absolute deviation from the data than the least squares equation in many cases. This tends to remove the distortion that outlier points can cause with the least squares technique.

THE USE OF BIASED PREDICTORS IN MARKETING RESEARCH

R. Carter Hill
Department of Economics, Louisiana State University, Baton Rouge, Louisiana 70803, U.S.A.
Phillip A. Cartwright, Julia F. Arbaugh
Nielsen Marketing Research, Northbrook, Illinois 60062, U.S.A.

Marketing data are often collinear. Multicollinearity can pose serious problems for estimation of models such as those generally specified for the analysis of price and promotions. In this paper, we analyze the relative performance of several biased estimators under an in-sample and out-of-sample mean squared error criterion and we consider the alternative estimators from the standpoint of addressing the problem of estimating models with collinear data.

EXPERIMENTS WITH DIFFERENT ESTIMATION CRITERIA

Niels Kaergard
Institute of Economics, University of Copenhagen, DK-1455 Copenhagen K., Denmark

The most popular estimation criteria is minimization of the sum of squared residuals. Some writers, however, have argued that minimizing the sum of the numerical value of the residuals is a preferable method because of more robust results. Others prefer to minimize the maximal residual. In the paper the three methods are used for estimation of five relations from the Danish econometric growth model CLEO (it is the consumption and investment functions), and the different estimates are evaluated by their forecast capability.

FORECASTING CREDIT-CHARGE-OFFS USING A MARKOV MODEL

Victor E. McGee
School of Business Administration, Dartmouth College, Hanover, New Hampshire 03755, U.S.A.

This is a case study of a large bank dealing with some two million credit card holders and the problem of forecasting for the next fiscal year what the dollar volume of credit-charge-offs is likely to be. Card holders are identified by solicitation groups (when a mailing was sent to them) and their status in any month is defined by a "bucket" (inactive, active-paid-up, 30-days late, 60-days late, . . ., up to 150 days late – at which time they become credit-charge-offs). A Markov model was developed to deal with month-to-month transitional probability matrices and to allow for differences among the various solicitation groups. In this instance, the accuracy of the forecast is not as important as the action that the bank takes on hearing the forecast.

SCENARIOS IN FORECASTING

Chair: Paul Schoemaker
Graduate School of Business, University of Chicago, Chicago, Illinois 60637, U.S.A.

WHEN AND HOW TO USE SCENARIO PLANNING

Paul Schoemaker
Graduate School of Business, University of Chicago, Chicago, Illinois 60637, U.S.A.

This paper offers a step-by-step analysis of the scenario approach to strategic planning. The method is first contrasted with traditional planning techniques, which tend to perform less well when faced with high uncertainty and complexity. A manufacturing example is used to illustrate the main steps in scenario construction. The essence of the approach is to identify relevant trends and uncertainties, and blend them into scenarios that are internally consistent. In addition, the scenarios should bound the range of plausible uncertainties and challenge managerial thinking. Links to decision-making are examined next, including administrative policies as well as integrative techniques. Monte Carlo simulation is suggested as one technique to formally combine scenario thinking with project evaluation (after appropriate translations). The paper concludes with a general discussion of scenario planning in relation to statistical techniques, decision analysis and traditional forecasting.

THE EFFECTS OF IMAGERY CONTENT, ISSUE INVOLVEMENT, AND EVENT VALENCE ON SCENARIO-BASED PROBABILITY ESTIMATES OF FUTURE EVENTS

Ariel S. Levi
Department of Management, Wayne State University, Detroit, Michigan 48202, U.S.A.

One widely-used heuristic for estimating the probability of a future event is to generate or imagine a scenario capable of producing the event. The easier it is to generate or imagine such a scenario, the higher the probability estimate accorded the event. In this study, I investigate the independent and interactive effects of three variables on scenario-based probability estimates of future events: (1) imagery content (i.e., the focal event vs. causes of the event vs. consequences of the event); (2) level of subjects' involvement in the issue; and (3) valence (positive vs. negative) of the event. The study's analysis of scenario-based probability estimates is shown to be relevant for both individual and organizational decision-making and planning.

MULTIPLE SCENARIO APPROACH – DOES IT INTEGRATE FUTURES STUDIES TO STRATEGIC DECISION-MAKING? EXPERIENCES IN EUROPEAN COMPANIES IN 1985-89

Tarja Meristö
School of Economics and Business Administration, SF-20500 Turku, Finland

Planning is just thinking before the action – and when talking about strategic planning, the action might be very far in the future. But we have to make required decisions today. What are the criteria for a good decision ex ante, how do we define which decisions are strategic and which kind of information base do we have when making strategic decisions? Futures research is not just telling stories about the future, but it is also analysis and intuition. How to combine these aspects together and to the strategic decision-making, is discussed in this paper. Multiple scenario approach seems to be one solution to introduce uncertainty to the planning and decision-making process. When the managers and leaders themselves take part in the scenario process, the commitment, and the relevance is reached during the process. Strategies based on scenario planning are more flexible than otherwise. When using scenarios the nature of the future "it is not predictable, but we can present different alternatives of it" can be considered, and futures studies will be an integrated part of strategic decision-making.

SCENARIO DEVELOPMENT FOR THE INDUSTRIAL FUTURE OF A FIRM BY THE PERSPECTIVE TREE METHOD

Todorka Moskova
Institute of Informatics, Complex Automation & Systems, Sofia 1574, Bulgaria

A flexible innovative policy in a firm is a basic condition for the competitiveness of a firm's products and for its survival. This problem is connected with the adoption of the products-properties and qualities to the user-requirements, and fast transformation of the production to the demands, with the necessity of entrance to the market on time, with the products, identified on the basis of forecasted demands for new functions and properties. In this paper, a technology is proposed for a scenario development for the industrial future of a firm, by using the perspective tree method. The task is to construct the netting of the tree, which connects three zones: the external mean, the zone "functions and properties" and the technological field. As a result, an exploratory forecast is obtained, containing the production list, the structure of the potential users of the products and perspective R&D program.

FORECASTING AND PLANNING

Chair: Erik Solem
Operational Research and Analysis Establishment, Department of National Defense, Ottawa, Ontario K1A 0K2, Canada

THE LINK BETWEEN FORECASTING AND PLANNING

Erik Solem
Operational Research and Analysis Establishment, Department of National Defense, Ottawa, Ontario K1A 0K2, Canada

Is there a "missing link" between forecasting and planning, particularly in very large organizations, and if so, what is it? Why is it so necessary that this link be identified and strengthened? What is the proper role of analytical forecasting and scenario building in organizational life?

LOAD FORECAST PROBABILITIES AND RESOURCE PLANNING

Ken Peterson
B.C. Hydro, Vancouver, British Columbia, Canada

B.C. Hydro, like all utilities, must make long-term electrical energy and demand forecasts as an integral part of its resource planning process. The range of forecast uncertainty expands the further out projections are made. While forecast bandwidths have been used by B.C. Hydro in the past, only in the last two years has a formal methodology been adopted to assign probabilities to forecast outcomes. The approach is based on an expert judgment solicitation process. This paper describes the methodology briefly and discusses the application of it to resource planning wherein probabilistic load outcomes are combined with probabilistic supply outcomes based on streamflow variability for the hydroelectric system and the availability of non-firm sources, such as low cost purchases.

Session TB7
ROOM 227

Tuesday
10:00 – 12:00

FORECAST EVALUATION II

Chair: Stephen K. McNees
Federal Reserve Bank of Boston, Boston, Massachusetts 02106, U.S.A.

THE EVALUATION OF EXTRAPOLATIVE FORECASTING MODELS

Robert Fildes
Manchester Business School, Manchester M15 6PB, United Kingdom

Extrapolative forecasting models are widely used in production and inventory decisions. Typically many hundreds of series are forecast and the cost-effectiveness of the decisions depends on the accuracy of the forecasting method(s) used. This paper examines how a forecasting method should be chosen. It is shown that a population of time series must be evaluated across time and across series. Of the alternative loss functions, only the geometric mean squared error is readily interpretable and well-behaved. The paper concludes that whatever error measure is used exponential smoothing and "naive" models, previously thought to be "robust" performers, inadequately represent the time series under analysis. As a consequence, forecasters should carry out a detailed evaluation of the type described rather than relying on a priori analysis developed from earlier forecasting competitions.

EXPONENTIAL SMOOTHING: THE EFFECT OF INITIAL VALUES AND LOSS FUNCTIONS ON POST-SAMPLE FORECASTING ACCURACY

Spyros Makridakis, Michèle Hibon
INSEAD, 77305 Fontainebleau Cedex, France

This paper describes an empirical investigation aimed at measuring the effect of different initial values and loss functions on post-sample forecasting accuracy. The 1001 series of the M-Competition are used on three exponential smoothing methods (Single, Dampen, and Holt) and the accuracy measures are computed over many forecasting horizons. The paper finds few differences in post-sample accuracy as a result of the initial values and/or the loss function being used.

FORECASTING ACCURACY OF NONLINEAR TIME SERIES MODELS

John Pemberton
Graduate School of Business, University of Chicago, Chicago, Illinois 60637, U.S.A.

Frequently, a nonlinear model achieves a better fit than a linear model, but gives only a marginal increase in forecast accuracy, even in simulations when the true structure is used for forecasting. We therefore address the problem of when to use a nonlinear model for forecasting, especially when it gives a better fit than a linear model. Illustration of the problem is given, using real data and simulations from nonlinear autoregressions. The analytically tractable class of piecewise constant autoregressive models enables investigation of theoretical issues, measures of nonlinearity for example, which may lead to an answer.

A COST/BENEFIT ANALYSIS OF FORECASTING WITH STATISTICAL VERSUS PROCESS ENGINEERING MODELS

Paul D. Holtberg
Strategic Analysis and Energy Forecasting Division, Gas Research Institute, Washington, D.C. 20004, U.S.A.

Strategic planning and appraisal of GRI R&D programs and projects depend upon a consistent analytical framework that establishes a likely projection of future energy supply and demand and defines the probable role of the gas industry during the time frame in which the GRI R&D program is expected to have its impact. The framework that forms the scenario and data base for these planning decisions is called the baseline projection. The baseline projection is developed independently by GRI using publicly available data and a framework of commercially available models that GRI has modified over several years. Specific models used include Data Resources, Inc.'s (DRI) Energy and Macroeconomic Models, the GRI Hydrocarbon Model maintained by Energy and Environmental Analysis, Inc. (EEA), the GRI Regional Sectoral Electricity Model (RSEM) maintained by DRI, the EEA Industrial Sector Technology Use Model (ISTUM) and Pipeline/Flowing Gas Model, and the Resource Data International (RDI) Coal Model. The baseline projection is representative of a projection produced using both statistical and engineering models. Through GRI's experience in using both types of models, the benefits and costs of each type of model structure have become apparent to us. This paper will discuss the pros and cons observed by GRI in using each type of model. Further, the paper will outline the appropriateness of each type of model to the decision criterion of the user.

MORTALITY AND POPULATION ISSUES

Chair: Dennis Ahlburg
Center for Population Analysis and Policy, University of Minnesota, Minneapolis, Minnesota 55455, U.S.A.

AIDS TO THE END OF THE CENTURY AND BEYOND

Q. P. Duong
Bureau of Management Consulting, Ottawa, Ontario K1A 0S5, Canada
V. K. Jandhyala
Department of Mathematics, University of California, Irvine, California 92717, U.S.A.
L. Liu, I. B. MacNeill
Department of Statistical and Actuarial Sciences, University of Western Ontario, London, Ontario N6A 5B9, Canada

The threat to Western society posed by the AIDS epidemic will be considerably less significant this century than originally forecast by many public health agencies. For example, close examination of the epidemic in the United States indicates that exponential growth in the number of diagnosed AIDS cases ceased in early 1984 and that the growth in the U.S. HIV-infected populations peaked in 1985/86 and has since precipitously declined. The implication for the future is that the number of new AIDS cases in the U.S. will soon begin to decline. Nevertheless, the number of latent cases of AIDS in the U.S. is presently approximately 500,000, and each of these infections is expected to become and AIDS case. Hence, the epidemic is expected to continue having a substantial impact during the 1990s as the group infected prior to the late 1980s falls victim to AIDS. However, the recent rapid decline in new infections indicates that the effect of the disease will diminish rapidly toward the end of this century and will be a much smaller problem after 2001 A.D.

FORECASTING THE NUMBER OF AIDS CASES IN BRAZIL

Dani Gamerman, Hélio S. Migon
Instituto de Matematica, Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brazil

This paper presents a method to describe and forecast the incidence of AIDS in Brazil using time series models. The method is based on the class of generalized exponential growth models and uses the ideas of non-linear dynamic modeling. The aim is to provide good predictions and to inform sequentially on the asymptotic or explosive behaviour of the data series. Intervention to model unexpected changes in the data, on-line variance estimation and variance dependence on the mean are used to adequately model the data. The data is analysed with some particular models from the above class and the resulting inferences compared in terms of short-term and long-term predictive performance and model fit.

PROJECTIONS OF THE U.S. POPULATION UNDER ALTERNATIVE FERTILITY, MORTALITY, AND MIGRATION ASSUMPTIONS

Dennis A. Ahlburg, James W. Vaupel
Center for Population Analysis and Policy, University of Minnesota, Minneapolis, Minnesota 55455, U.S.A.

The latest official population projections for the U.S. suggest that the U.S. population may cease to grow around 2030. However, the mortality, fertility, and migration assumptions made by the Bureau of the Census are conservative in that they assume modest improvements in mortality, continued low fertility, and relatively low migration. A case may be made that mortality gains may be much higher than assumed by the Bureau, that there may be an upturn in fertility, and that immigration may increase. We investigate the impact of these alternative assumptions on U.S. population projections and discuss their implications for policy in the labor market and aging areas.

THE EVALUATION OF METHODS OF DEMOGRAPHIC PROJECTIONS

Stevan Hadzivukovic
Institute of Agricultural Economics and Rural Sociology, University of Novi Sad, 21000 Novi Sad, Yugoslavia

National long-term demographic projections are grounded on the components method and usually are given in several variants according to age and sex as their basic form. Apart from the components method other methods have been attempted as well. They include naive, univariate and econometric methods thus comprising simple and sophisticated ones. The use of probabilistic methods in population projections give rise to the conceptual and methodological problems which are somewhat different in social and economic projections. The present paper has attempted, on the basis of some naive and univariate probabilistic methods, to project the fertility of Yugoslav population to the year 2000 and compare the results with the standard method. The evaluation of applied methods may be useful in the practical work on demographic projections.

FORECASTING SOFTWARE

Chair: Charles Smart
Smart Software, Inc., Belmont, Massachusetts 02178, U.S.A.

TIME SERIES ANALYSIS SYSTEM "MESOSAUR"

S. Kuznetsov, A. Halileev
Central Economics-Mathematics Institute, Academy of Science, U.S.S.R., Moscow 117418, U.S.S.R.

MESOSAUR system is being developed for IBM PC XT/AT and compatibles. The system is intended for analysis of time series consisting of up to 16,000 observations. The interval between observations can vary from one minute to several years. The system offers various possibilities for interactive graphics analysis of time series. MESOSAUR consists of four large sections: 1) Input/output and preliminary data processing; 2) Univariate time series analysis models; 3) Multivariate time series analysis models; and 4) Archive of models.

SIMPC: FAST SIMULATION WITH LARGE ECONOMETRIC MODELS ON A PC

Floor van Nes, Aire ten Cate
Central Planning Bureau, 2585 JR The Hague, Netherlands

SIMPC is a program which is rooted in the long tradition of macro-economic modeling and forecasting at the Netherlands Central Planning Bureau. It runs on a PC, a Cyber mainframe and a Cray supercomputer. The PC version, which is commercially available, is able to solve big econometric models (up to 2000 equations) very fast on an ordinary MS-Dos personal computer. In the lecture it will be explained why the model solution part is so fact. SIMPC uses state-of-the-art Newton-like solution techniques and is able to deal with rational expectations models. SIMPC will be compared with some well-known econometric software packages on the basis of experiences with simulations of small and large models of the Dutch economy.

ECONOMETRIC MODELLING ON MICRO-COMPUTERS: A SURVEY OF SIX MAJOR PACKAGES

Jean-Louis Brillet
Bureau 1007, I.N.S.E.E., 75675 Paris Cedex 14, France

Micro-computers are taking over the field of applied econometrics. Now even model simulation is feasible, and the power of available packages keeps growing. This paper updates a presentation given last year, showing how the new versions of the following packages: AREMOS, ESP, Micro-TSP, MODELER, SORITEC and SAS-ETS (a recent addition), all available on PC compatible machines, answer the needs of both economic researchers and operational forecasters. A series of tables will be based on actual production of a small model, using a format similar to a recent publication by J.-L. Brillet (*Journal of Applied Econometrics*, 1989). They will study both availability of options and effectiveness. Then a general appreciation of each package shall be given.

KALMAN FILTERS

Chair: Colin Jex
Operations Research Department, Lancaster University, Lancaster LA5 0DQ, United Kingdom

RECURSIVE MODEL TRACKING

Colin Jex
Operations Research Department, Lancaster University, Lancaster LA5 0DQ, United Kingdom

In many applications of statistical modeling and forecasting there may be uncertainty as to whether the underlying model is constant in structure and/or parameter values. This paper presents a simple yet powerful method for diagnosing model change. The method is a Bayesian interpretation of a special case of the Kalman Filter algorithm (Discount Weighted Regression) married to the use of quality control measures of stability of one-ahead residuals. Examples from fields of finance, marketing and quality control will be presented.

TIME SERIES MODELS FOR MULTIVARIATE COUNT DATA

Keith Ord
Pennsylvania State University, University Park, Pennsylvania 16802, U.S.A.
Andrew Harvey, Christiano Fernandes
London School of Economics, London, United Kingdom

Time series data sometimes consist of count data, where the number of events occurring in a unit time is recorded. Such data often follow a Poisson or similar distribution and Normal approximations are inappropriate when the mean is small. We develop a Kalman-type recursive scheme to describe the process over time and introduce a new form of bivariate distribution which enables us to extend the method to two or more series. The predictive distributions and the recursive likelihood function are then readily derived. An example, based on England vs. Scotland football games will be presented.

PREDICTION AND THE KALMAN FILTER

Amaresh Das
Department of Economics, Xavier University of Louisiana, New Orleans, Louisiana 70125, U.S.A.

The Kalman filter is a technique that has only recently begun to spill over to the area of forecasting in economics from the engineering literature on optimal control systems where the object is to estimate the parametric "state" of a control model at various points in time so that corrective action in its time path may be taken. Quite loosely, Kalman techniques arise when one attempts to find an optimal (least mean squared error) estimator for the "state" $\beta(t)$ in a linear model $y = x(t)\beta(t) + u(t)$ in which the parametric state is assumed to obey a first-order transition equation $\beta(t + 1) = A\beta(t) + U(t)$ where $U(t)$ is some appropriately specified stochastic term and A is a matrix of constants. In the case of Kalman filter, also known as the Kalman-Busy filter, one basically deals with a prediction problem for a Markovian process (conditional independence of past and future given precise knowledge of the present). The process is Gaussian. The purpose of the paper is to explore the usefulness of the Kalman filter in prediction and systematic parameter variation.

BAYESIAN FORECASTING: A THEORETICAL REVIEW AND CORRESPONDING SOFTWARES

R. C. Souza
DEE, PUC/RJ, Gavea, 22453, Rio de Janeiro, RJ Brazil
P. J. Harrison
Statistics Department, Warwick University, Coventry CV4 7AL, United Kingdom

It is well-accepted today that the area of time series analysis and forecasting has, undoubtedly, started its real development in the seventies, with the important work of Box and Jenkins. At approximately the same time, on the Bayesian side, Harrison and Stevens put forward their elegant parametric formulation, consisting of a joint use of the dynamic linear model and the Kalman filter, under a Bayesian framework. In this paper we present a brief review of the main theoretical developments which the Bayesian forecasting models have experienced ever since 1971, when they were first introduced by Harrison and Stevens. We also include in this review a description of the existing Bayesian forecasting microcomputer softwares, in particular BATS (Bayesian Analysis of Time Series), recently proposed by West, Harrison and Pole is discussed in detail.

Session TB12
ROOM 237

Tuesday
10:00 – 12:00

FORESTRY FORECASTING

Chair: Anders Baudin
Statistical Institute, University of Umeå, S-901 87 Umeå, Sweden

THE DEMAND FOR SAWNWOOD IN SWEDEN TO THE YEAR 2000

Anders Baudin
Statistical Institute, University of Umeå, S-901 87 Umeå, Sweden

Sawnwood is divided into homogenous end-use categories such as doors, windows, furniture, prefabricated houses. For each category the main competing materials of sawnwood are identified and the market share of sawnwood is used to define a logit model. The models are used to identify the main reasons for substitution, such as price competition, labor cost and standard of living. The market shares of sawnwood are predicted based on the models. The total demand of each end-use category are also predicted and thus, by multiplying and summing over categories, the total demand forecast of sawnwood in Sweden is obtained.

ON FORECASTING OF INNOVATIONS

Kurt Brännäs, Uno Zackrisson
Department of Statistics, University of Umeå, S-901 87 Umeå, Sweden

We focus on the forecasting of basic technological innovations and on key concepts in an analytical framework. The life cycle starts with a basic innovation following on an invention. The initial spread (supply side) or adoption (demand aspect) of the innovation is generally slow. Basic innovations are exogenously caused and imply structural changes. The choice of forecasting technique is suggested to e.g. depend on type of innovation, knowledge base and the market conditions. A distinction is made between normative and explorative forecasting. Scenario techniques are discussed. The forest industry is used for illustration.

A PC-MODEL FOR INTERNATIONAL TRADE I FOREST PRODUCTS: METHODS AND SCENARIOS

Markku Kallio
Helsinki School of Economics, SF-00100 Helsinki, Finland
Risto Seppälä
Finnish Forest Research Institute, SF-00170 Helsinki, Finland

The article discusses experience with modeling of long-term development of production consumption and international trade in forest products. The base of the research is on the partial equilibrium model developed by the Forest Sector Projectat IIASA in 1981-85. However, we shall concentrate on some developments in Finland since the IIASA project was completed. They include a new and highly efficient solution algorithm which allows scenarios to be developed in a PC environment. A number of scenarios will be reported. They aim to analyze possible future developments of the Nordic forest industries.

STRATEGIC PLANNING AND FORECAST SYSTEM DESIGN

Chair: Paul S. Foote
School of Business and Management, Pepperdine University, Culver City, California 90230, U.S.A.

USING ENTROPY MEASURES TO DISCLOSE THE EFFECT OF UNCERTAINTY IN STRATEGIC PLANNING

Can Simga
Department of Accounting, Istanbul University, Istanbul, Turkey
Paul S. Foote
School of Business and Management, Pepperdine University, Culver City, California 90230, U.S.A.

Here, "uncertainty" (entropy) is defined as the perceived uncertainty of certain activities as reflected by the entropy measures. Four indicators representing the outcomes of major activities of an enterprise i.e., financing, production, administration and marketing are employed in this research for the sample multinational companies. Entropy values calculated by Shannon's formula show that activities affected by the environmental factors carry higher uncertainty than the activities that are more under the control of the management. The findings indicate that if an activity is perceived as the most uncertain one, the firms take decisions to improve the performance in that area.

STRATEGIC PLANNING CONSULTANCY

Bent Sørensen
COWIconsult, Consulting Engineers & Planners, DK-2830 Virum, Denmark

A wide range of companies have found the role of strategic planning increasing, both as a basis for formulating concrete action plans, and as a foundation for establishing and maintaining awareness of company spirit among all types of employees. In order to serve these purposes, the process of producing a strategic plan must be conducted in a way which by itself reflects the company goals. Some of the considerations facing the planners of strategic planning are: (1) involvement of those employees which most likely will have an impact on the future (some of them would probably be found outside the current management group), (2) identification of company values worth preserving, as well as company habits which do not contribute constructively to the company development, (3) forming long-term goals that consistent with company history and yet independent from transient external conditions and internal problem fixes.

A GENERAL PROJECT PLAN FOR DESIGNING AN OPERATIONAL FORECASTING SYSTEM

A. Dale Flowers
Department of Operations Research, Case Western Reserve University, Cleveland, Ohio 44106, U.S.A.
Sue Lines
Western Publishing Company, Racine, Wisconsin 53404, U.S.A.

Many companies attempt to design and develop operational forecasting systems based on available hardware and software. In this presentation, a general project plan for such design projects is presented which includes: (1) develop functional specifications, (2) identify available software products, (3) develop historical data base for software testing, (4) design data base organization, (5) functional specification review, (6) statistical tests of software, (7) evaluate tests, reviews, select software, (8) education and training programs, (9) software modifications document (if needed), (10) interface requirements document, (11) implementation plan and (12) begin implementation. This project plan is designed to *do it right the first time.*

FORECASTING METHODS III

Chair: William Conley
University of Wisconsin, Green Bay, Wisconsin 54311, U.S.A.

ESTIMATING AND TESTING QUANTILES OF LOCATION-SCALE DISTRIBUTIONS USING SELECTED ORDER STATISTICS

M. Masoom Ali
Department of Mathematical Sciences, Ball State University, Muncie, Indiana 47306, U.S.A.

This talk provides an overview of the general theory of linear estimation of quantiles of location-scale families of distributions using a few optimally chosen order statistics. Reference will be made to both exact and asymptotic cases. Some specific distributions will be considered for illustration. Also, the problem of hypothesis testing for quantiles using a few selected order statistics will be discussed.

STATISTICAL SAMPLING TECHNIQUES APPLIED TO THE TRAVELING SALESMAN PROBLEM

William Conley
University of Wisconsin, Green Bay, Wisconsin 54311, U.S.A.

The problem of finding the shortest route to connect n points in a closed loop is addressed here by using a modified form of stratified sampling of the feasible solution space, called multi-state Monte Carlo optimization (MSMCO). Specifically, the five shortest air distance routes connecting 100 British Columbia cities in a complete tour are calculated using MSMCO applied to the great circle distances. This is followed by a comparison of the multi-stage algorithm to other traveling salesman solution techniques. Computer run times and numbers of samples drawn to solve the problems are presented.

COMBINING FORECASTS: METHODS

Chair: Spyros Makridakis
INSEAD, 77305 Fontainebleau Cedex, France

CONSENSUS-SEEKING BEHAVIOUR BY ECONOMIC FORECASTERS

Roy Batchelor
City University Business School, London EC2Y 8HB, United Kingdom
Pami Dua
Department of Economics, University of Connecticut, Stamford, Connecticut 06903, U.S.A.

Experiments in psychology show that individual judgments can be unduly influenced by the opinions of a peer group. This study tests whether this is true of macroeconomic forecasters. Our data consist of the track records of 30 leading US forecasters participating in the Blue Chip Economic Indicators consensus forecasting service, and a special survey of their forecasting techniques. The hypotheses tested are: (a) that revisions to individual forecasts are excessively sensitive to the previously published consensus forecast; (b) that judgmental forecasters are more sensitive than statistical forecasters. We find that the population of US forecasters can indeed by divided into "leaders," who display little consensus-seeking behaviour, and a larger number of "followers," whose forecasts are determined by the consensus.

RECURSIVE COMBINATION METHODS FOR FORECASTS EXHIBITING TIME DEPENDENT GROUP ERROR

David N. Sessions
BCIS/wQM Department, Hofstra University, Hempstead, New York 11550, U.S.A.

A group of forecasters, operating on the same information set but with different models, often exhibit group bias that has a time series structure. This source of bias is likely to be more significant than individual bias. Combination methods used in such circumstances should allow for time dependent group bias. It is intended to present recursive combination methods that simultaneously allow for time dependent group bias and constraints on the vector of fixed forecast weights. These methods will be compared to a "locally bias adjusted mean" which is likely to be more effective than the mean forecast under such circumstances.

DO CONSENSUS FORECASTS EXIST?

M. H. Schnader
Graduate School of Business Administration, Pace University, New York, New York 10038, U.S.A.
H. O. Stekler
Economics, Industrial College of the Armed Forces, Fort McNair, Washington, D.C. 20319, U.S.A.

In analyzing macroeconomic forecasts obtained from a number of different forecasters, it is customary to classify the median of that set as the consensus forecast. We believe that the median may not be a consensus forecast and that a considerable amount of information is lost if the entire distribution of forecasts is not analyzed. This paper examines the distributions of forecasts of a number of economic variables obtained from the NBER-ASA surveys. We devise tests for determining whether a consensus exists and relate the procedures to the studies of Lahiri (IJF, 87) and Zarnowitz and Lambros (JPE, 87).

FORECASTING IN GOVERNMENT AND THE MILITARY

Chair: Erik Solem
Operational Research and Analysis Establishment, Department of National Defense, Ottawa, Ontario K1A 0K2, Canada

EXPERT SYSTEMS AND THE MILITARY: SOME FUTURE PERSPECTIVES

Erik Solem
Operational Research and Analysis Establishment, Department of National Defense, Ottawa, Ontario K1A 0K2, Canada

This paper examines some military uses of Expert Systems (ES) in a futures perspective. ES is frequently – and quite correctly – claimed as a success story within the Artificial Intelligence (AI) field. Its potential is huge and growing. Several applications, none of them limited to strictly military usage, are envisaged. Whereas literally hundreds of expert systems either exist or are being developed, relatively few are being used routinely. Why is this? What are the obstacles to more general usage for forecasting and planning and how could or should they be overcome?

APPLYING FORESIGHT AND FORECASTING IN THE MILITARY: PROJECT 2010 – A CASE STUDY

W. R. Dobson, L. T. Rowbottom
Department of National Defense, Ottawa, Ontario K1A 0K2, Canada

Faced with rapid technological change, disarmament by cost inflation and the need to establish its proper place in national life in the future, Canada's Air Force Project 2010 developed global trends analysis and forecasts of demographic, socioeconomic political, environmental, military, resource and industry perspectives. These are discussed and their application for future forecasting and planning assessed.

GAINING A SENSE OF DIRECTION: "THE FULL CYCLE" APPROACH TO FORESIGHT IN GOVERNMENT

W. H. Clive Simmonds
66 Lyttleton Gardens, Ottawa, Ontario K1L 5A6, Canada

The institutional framework within which problems up to now were being examined was stable or changing relatively slowly. That situation has changed drastically in the sense that both the problems *and* their frameworks are changing simultaneously. This calls for a new, "full cycle" approach towards forecasting and planning of socioeconomic and technological problems, so as to understand and hopefully influence the context within which change is taking place.

SALES FORECASTING: CHALLENGES AND INSIGHTS FOR BUSINESS (PANEL)

Chair: Essam Mahmoud
College of Business, University of North Texas, Denton, Texas 76203, U.S.A.

Participants: Dwight E. Thomas, Jr.
AT&T Network Systems, Winston-Salem, North Carolina 27107, U.S.A.
Timothy A. Davidson
Applied Decision Systems, Temple, Barker and Sloane, Inc., Lexington, Massachusetts 02173, U.S.A.
Essam Mahmoud
College of Business, University of North Texas, Denton, Texas 76203, U.S.A.

Sales forecasts are critical inputs to a whole range of business decision-making processes. Sales forecasting aids company management in planning future actions and in assessing actual sales performance. This panel addresses practical aspects of sales forecasting and includes sharing of experiences at organizations such as those at AT&T. Important challenges to sales forecasters are how to achieve forecast accuracy and how to measure accuracy. The panel discussion provides insights into the management of accuracy in terms of dollars. From a managerial viewpoint it is important to have an accuracy measure which can translate forecasting error into a dollar amount.

KNOWLEDGE-BASED FORECASTING MODELS

Chair: Peter M. van der Staal
University of Technology, 2628 EB Delft, The Netherlands

A KNOWLEDGE-BASE SYSTEM FOR SELECTING A BUSINESS FORECASTING METHOD

Betty Brewer
Small Business Development Center, University of Georgia, Athens, Georgia 30602, U.S.A.
Donald Nute
Advanced Computational Methods Center, University of Georgia, Athens, Georgia 30602, U.S.A.

FORE is a prototype Prolog implementation of a published guide for selecting a business forecasting method. Ordinary Prolog rules give conditions when a method is indicated, counterindicated, or absolutely counterindicated. Defeasible metarules are applied to the output from these lower-level rules to make the final selection. An experimental defeasible inference engine interprets the metarules. The advice in the published guide was sometimes ambiguous or difficult to represent. The three types of lower-level rules and the defeasible metarules were used to simulate some of the ambiguity in the source. Some remaining problems of interpretation and representation are described.

INFLUENCE DIAGRAMS: COMBINING FORECASTING AND DECISION-MAKING

Robert M. Oliver
Department of Industrial Engineering and Operations Research, University of California, Berkeley, California 94720, U.S.A.

In recent years there has been a rapid growth in the use of influence diagrams to help model builders formulate, analyse and solve prediction and decision-making problems. The design of an influence diagram by a consultant in the presence of his or her client allows both parties to develop their analytical insights and skills in a common meeting place and with a common language so that critical dependencies and independencies and surprisingly sophisticated model formulations can be agreed upon in short time periods. Algebraic manipulations, incomplete information, the value of perfect information, clairvoyance, the sensitivity of decisions to independence assumptions can be approached with a clarity that has not been available heretofore. The early success of the use of influence diagrams in problem formulation is being nurtured by new theoretical developments and specially structured computational algorithms. Several software packages are able to propagate probabilistic information through influence diagrams, most of these are able to make inferences on parameters or other unobservables associated with the model; a smaller number are able to introduce and calculate optimal decisions for "reasonable" problem sizes and to assess the sensitivity of predictive distributions and optimal solutions. The speaker will illustrate his talk with examples based on the monitoring, predictions and actions being taken to reduce the risk of mid-air collisions between commercial and general aviation to show how the odds compare with See-and-Avoid doctrines.

THE COGNITIVE FRONTIERS OF DISCURSIVE FORECASTING METHODS

Peter M. van der Staal
University of Technology, 2628 EB Delft, The Netherlands

Stimulated by proliferating software, discursive methods for forecasting quantitative phenomena are increasingly and often uncritically and automatically applied. These methods are characterized by the application of explicit, scientific and inferential procedures on data and theories. Inferences of deductive, inductive and statistical nature can be distinguished. These main types are based on logical and probabilistic foundations. This paper analyses these elementary inferential procedures in e.g. time series and system modeling methods. It evaluates the strength of their foundations. The conclusion indicates that inherent limitations of entailing certain or probable future knowledge and suggests a necessary shift to a decision theoretical approach.

EXPONENTIAL SMOOTHING

Chair: J. Scott Armstrong
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.

CHOICE OF LINEAR OR EXPONENTIAL TREND IN WINTERS' MODEL: AUTOMATIC PROCEDURES

Blyth C. Archibald
School of Business Administration, Dalhousie University, Halifax, Nova Scotia B3H 1Z5, Canada

Winters' seasonal exponential smoothing model in its original form (and as usually implemented) assumes a linear growth (or decline) in the time series. In this form its forecasts compare favorably to more complex procedures. An additive form (fitted to the log of the series), that assumes the growth is exponential is well-known and often provides better forecasts. This article investigates automatic procedures for deciding which model should be used. A simple decision rule is determined that leads to improved forecasts.

DO WINTERS' MODELS SHOW POSSIBLE WEAKNESSES IN BJ METHODS?

John W. Birch
Departments of Economics and Statistics, University of Wyoming, Laramie, Wyoming 82071, U.S.A.
Terry Ziemer
Department of Mathematical Sciences, Northern Kentucky University, Highland Heights, Kentucky 41076, U.S.A.

Time series quite often show nonconstant variance as a result of an expanding seasonal pattern at higher levels. Typically this results in (1) the use of log transforms and (2) identification of a model, using D = 1. It can be shown that forecast performance is usually improved if no transformation is used. Rather, a seasonal model with D = 2, essentially Winters multiplicative model, is used. Cases of this sort suggest a circumstance under which the use of BJ procedure is inadvisable. This paper simulates a range of multiplicative seasonal data to illustrate the extent to which the problem exists.

INTERNATIONAL TRADE

Chair: Ronald Hoyt
Faculty of Management, University of Ottawa, Ottawa, Ontario K1N 6N5, Canada

FORECASTING THE IMPLICIT RATE OF INFLATION FOR MERCHANDISE TRADE OF THE PEOPLE'S REPUBLIC OF CHINA (1978-1988)

Ronald Hoyt
Faculty of Management, University of Ottawa, Ottawa, Ontario K1N 6N5, Canada

During the present decade China's liberalized trade policies have created (at times) severe foreign exchange shortages. In order to overcome these difficulties one strategy has been to modify the terms of trade ratio through price increases – a radical departure from the historical foreign trade organization operating policies. This paper seeks to employ the Purchasing Power Parity Model as an unbiased predictor of changes in trade prices with major trading partners of the P.R.C. for the period 1978-1988.

FORECAST OF WORLD TRADE BY THE YEAR 2000

Kusum Ketkar
Department of Economics, Seaton Hall University, South Orange, New Jersey 07079, U.S.A.
Suhas L. Ketkar
Marine Midland Bank, New York, New York 10005, U.S.A.

The objective of this paper is to propose and develop a methodology to forecast the net change in the rate of growth of world trade up to the year 2000. The forecast will take into account all factors mentioned above. The forecast will not only be for the world as a whole but also for various trading regions of the world and various commodity groups. Time series data from Trade Supplement of the International Financial Statistics and other publications will be used.

FORECASTING U.S. EXPORTS

Essam Mahmoud, Jaideep Motwani
College of Business Administration, University of North Texas, Denton, Texas 76203, U.S.A.
Gillian Rice
Mahmoud-Rice Associates, Denton, Texas 76203, U.S.A.

Recently it has been recognized that exports play an increasingly important role in the U.S. economy. Forecasting exports efficiently enables policy makers to plan more appropriately and thus to help to improve the U.S. balance of trade. Exports traditionally are forecast using econometric methods. A few studies have shown that time-series methods can also predict exports. Yet, the methods studied have been sophisticated ones such as Box-Jenkins. This study therefore focuses on a comparison of various simpler models. The models are evaluated individually and as combination of models using a number of accuracy measures.

MODEL IDENTIFICATION

Chair: Per-Olov Edlund
Stockholm School of Economics, S-113 83 Stockholm, Sweden

ON IDENTIFICATION OF TRANSFER FUNCTION MODELS FOR BUSINESS CYCLE FORECASTING

Per-Olov Edlund
Stockholm School of Economics, S-113 83 Stockholm, Sweden

The first phase of transfer function model identification is preliminary estimation of transfer function weights. Previous studies by the author have shown that ordinary least-squares estimates in most cases can be improved significantly by using ridge regression techniques. In particular, the use of the RIDGM and Lawless and Wang estimators are recommended. The main object of this paper is to compare the ridge estimators to other relevant estimators on real data. For this purpose business cycle data have been collected and transfer function models have been identified by different methods.

THE IDENTIFICATION OF ARMA MODELS

Tarmo Pukkila
University of Tampere, Tampere, Finland
Sergio Koreisha
Department of Decision Sciences, University of Oregon, Eugene, Oregon 97403, U.S.A.
Arto Kallinen
University of Tampere, Tampere, Finland

In the article we present a new, powerful method for determining the order of ARMA models having small sets of observations. The procedure is based on an autoregressive order determination criterion and on linear estimation methods. Simulated as well as real economic data are used to demonstrate the remarkable capabilities of the approach.

IDENTIFICATION OF LINEAR DYNAMIC SYSTEM MODELS

M. Akram
College of Business and Management, University of Bahrain, Isa Town, State of Bahrain

For the analysis of time series with coloured noise component, following Autoregressive process of order p, a robust method to identify the representative Linear Dynamic System model is presented. This method, non-parametric in nature, is based on the Average String Lengths (ASL) of the signs of one step ahead forecast error sequence. The model identified by this method provides optimum one step ahead forecasts in the sense of whiteness of residuals. For the model structure reasonable estimates of Autoregressive coefficients of coloured noise process are estimated following a step wise identification procedure. To see the relative performance of the method a comparative study of some commonly used identification techniques is given.

ANIMAL DISEASES AND FISH POPULATIONS

Chair: D. J. Noakes
Pacific Biological Station, Nanaimo, British Columbia V9R 5K6, Canada

COMPARISON OF MODELS USED TO FORECAST PACIFIC SALMON RETURNS

D. J. Noakes
Pacific Biological Station, Nanaimo, British Columbia V9R 5K6, Canada

Generating pre-season forecasts of salmon returns is of crucial importance to the management of Pacific salmon fisheries. The forecasts are used by both fisheries managers and industry to plan harvest strategies for the coming season. The forecasts are also of considerable important to the decision-making process that determines the allocation of catch among different areas and user groups. This paper outlines several models currently employed to generate pre-season forecasts of salmon returns. The ability of these models to produce accurate forecasts is tested using data from the Adams River sockeye salmon fishery.

FORECASTING PACIFIC HERRING (*CLUPEA HARENGUS PALLASI*) RECRUITMENT FROM ENVIRONMENTAL INFORMATION

J. Schweigert
Pacific Biological Station, Nanaimo, British Columbia V9R 5K6, Canada

Pacific herring are caught annually in a lucrative roe fishery targeting on sexually mature fish on or near the spawning grounds. The best product derives from the larger adult roe sacs but a significant proportion of the spawning run is comprised of the first time or recruit spawners. These two- and three-year old fish comprise up to fifty percent of the total spawning run. The ability to accurately forecast the size of this incoming year class is crucial to the rational management of these stocks. We have updated and augmented some recent work by Stocker and Noakes (1988) which examined the adequacy of a series of forecasting models for predicting Pacific herring recruitment throughout British Columbia. We examined several environmental variables using both ARMA and TFN models to forecast herring recruitment. In most instances, these models did not perform appreciably better than the simple long-term average indicating that more effort should be expended to collect biological information more closely linked to the factors determining recruitment in this species.

FORECASTING DISEASE LEVELS IN PRODUCTION ANIMAL POPULATIONS USING ABATTOIR PATHOLOGY AND METEOROLOGICAL DATA

Edward A. Goodall
Department of Biometrics, Queen's University of Belfast, Belfast BT9 5PX, United Kingdom

In 1969, the Department of Agriculture for Northern Ireland (DANI) initiated an extensive database of information received from all abattoirs in Northern Ireland on the reason for condemnations in cattle, sheep and pigs. These data enable the accurate monitoring of many specific diseases which have occurred during the production period. A new computerised system integrates this database with a meteorological database of all the weather variables prevailing over the same time period. In this paper, the system is described with results presented for forecasting models which have been developed to assist in the prevention of economically important diseases in production animal populations.

POSTER SESSION

A STUDY OF VARIATIONS IN CONTROL PARAMETERS

Ginés Alarcón
Esc. Univ. Ing. Técnica Aeronáutica, Universidad Politécnica de Madrid, 28040 Madrid, Spain

Analysis of the series generated by parameters that control the occupation of one aircraft flight during its booking period.

SIXTH SENSE

C. James Baird, Kenneth J. Sleyman, Gregory Spencer
Deseret Medical, Inc., Sandy, Utah 84070, U.S.A.

"Sixth Sense," developed by Becton Dickinson's Deseret Division in Utah, improves the linkage between Marketing Forecasting and Production Forecasting. The methodology tracks historical sales patterns and merges this output with forecasts of current marketing initiatives and trends to produce accurate 60- to 90-day demand estimates. It is unique in that it works without heavy reliance on complex mathematical techniques and formulas that estrange many business and sales executives who are vital to the development of realistic manufacturing plans. The system creates detail level forecasts that routinely capture much more of monthly sales demand than previously possible.

FAMILY AND FOOD: ARE NUTRIENT BASED MEASURES REFLECTIVE?

B. C. Barah
Department of Economics, University of Hyderabad, Hyderabad 500 134, India

We examine the hypothesis: Given the available food for the household, its allocation among the family members is optimal; alternatively, the distribution of available food items is disproportionately biased against the female members of the household family. Among adults, it is shown that whenever there is deficiency it is lower for females than for males, and whenever there is surplus, it is higher for females than for males. This contradicts the popular belief. The conclusion of the above study is that calorie intake is not at all an adequate measure to test the significant difference of food consumption between males and females. It may be useful to investigate other measures like literacy, morbidity rate, health care, and so on.

MICRO-DMS: A PACKAGE FOR TEACHING MACROECONOMICS

Jean-Louis Brillet
Bureau 1007, I.N.S.E.E., 75675 Paris Cedex 14, France

The Micro-DMS package uses a reduced version of an operational forecasting model, DMS (Dynamic Multi-Sectorial). Changes introduced by the user in external assumptions (government decisions, situation in foreign countries), through their influence on economic equilibrium, showcase the main macroeconomic mechanisms. The user-friendliness of this package, with on-line help, definitions, formulas and graphs, makes unnecessary both computer knowledge and user's manual. Written in Turbo-Pascal 5.0, it adapts itself without user set-up to any PC compatible machine. It has been adopted by many leading French teaching institutions. An English version will be presented, using a portable computer and an overhead extension.

POSTER SESSION

ELEMENTS FOR FORECASTING OF DEVELOPMENT OF PERSONNEL MANAGEMENT FUNCTION IN SELF-MANAGEMENT ENTERPRISE

Slobodan Camilovic
University of Organizational Sciences, 11000 Beograd, Yugoslavia

Personnel management function in self-management enterprise has a specific role and place, primarily because of the division of authority for personnel decisions and modes of decision process performance. When its development is concerned, beside these factors, the application of scientific knowledge is of great effect in the performance of personnel tasks, the inclusion of personnel experts, development of the technology of strategic and tactical decision-making in enterprise, etc. On the basis of all these and many other factors which are the elements for its organization projecting, the development of enterprise forecasting is realized.

CHAOTIC AND NON-LINEAR DYNAMICS IN STOCK RETURNS

Flavio Cocco, Irene Poli
Dipartimento di Scienze Statistiche, Università degli Studi di Bologna, 40126 Bologna, Italy

In this paper we look at the presence of chaos and specific non-linear dynamics in financial time series.

FORECASTING SPANISH INDUSTRIAL PRODUCTION

Antoni Espasa
Banco de España, 28014 Madrid, Spain

This paper deals with the monthly forecasting of the Spanish industrial production index (IPI) using ARIMA models with intervention analysis. The intervention analysis is needed to take into account the following facts affecting the industrial production: Calendar composition; National and regional bank holidays (14 per year); Easter holidays; Second energy crisis; Changing patterns of summer holidays. The univariate model is also used for seasonal adjustment and trend estimation distinguishing, in the case of trend and seasonal factors, between the stochastic and deterministic components. The results of the model are used for short-term analysis of the industrial activity in Spain, basing the analysis on a robust measure of the underlying rate of growth of the IPI.

FUNCTIONAL SPECIFICATION FOR AN OPERATIONAL FORECASTING SYSTEM

A. Dale Flowers
Department of Operations Research, Case Western Reserve University, Cleveland, Ohio 44106, U.S.A.

As companies are becoming more aware of the importance of operational forecasting to support production planning and inventory control activities, more careful designs for such systems are being developed. As a result of helping some companies in this design process, a number of functional specifications which such systems should perform have been identified. They will be discussed in this presentation under the headings: (1) statistical features; (2) features for using the system; (3) reporting features; (4) data features; and (5) interfaces with other systems. General comments about how well various software packages meet these specifications will also be presented.

POSTER SESSION

UNCERTAINTY, PREDICTION AND RELIABILITY IN GEOTECHNICAL ENGINEERING

A. Karim Hamdy
Oregon State University, Corvallis, Oregon 97331, U.S.A.

Geotechnical predictions rely on values of soil parameters estimated under conditions of "extreme uncertainty." A variety of uncertainties are inherent to soils such as inhomogeneity, anisotropy, random variation of loading, etc. In order to predict structural settlements, the engineer uses a combination of mathematical formulation, lab and field testing of soil samples, statistical manipulation and professional judgement. This paper presents an overview of the types of uncertainty encountered in settlement calculations, the methods used in the context of those uncertainties as well as the types of concepts and methods the engineer has borrowed from other disciplines to counter uncertainty and improve reliability.

APPLICATION OF THE METHODS OF LAG CORRELATION ANALYSIS AND AHP TO CONSTRUCT BUSINESS INDICES

Wen De Huan
Economic Research Institute of Sichuan Provincial Commission of Planning and Economy, ChengDu, Sichuan, P.R.C.

This paper describes a new method of selecting economic indicators and identifying their weights in formulating a business diffusion index. This method makes use of lag correlation analysis to select economic indicators and the AHP (Analytical Hierarchy Process) method to determine the weights of the indicators.

RESEARCH CONCERNING A BUSINESS DIFFUSION INDEX AND A COMPOSITE INDEX WARNING SIGNAL SYSTEM

Wen De Huan
Economic Research Institute of Sichuan Provincial Commission of Planning and Economy, ChengDu, Sichuan, P.R.C.

This paper describes research related to a business diffusion index and a composite index warning signal system. It identifies a method of determining the behavior of a warning signal system based on a survey of changes in index curves over a limited area and an analysis involving the differences in indices over time.

PREDICTION OF AN OPTIMUM ECONOMIC POLICY TO MAKE POOR PEOPLE RICH AND RICH PEOPLE RICHER

Stephen S. T. Kao
Center for Rating the Presidents, Racine, Wisconsin 53405, U.S.A.

An optimum economic policy to make poor people rich and rich people richer is the main interest of this paper. A free trade American and Asian common market should be established including the U.S.A., Canada, Hong Kong, Japan, South Korea, Singapore, and Taiwan in the first step, and China and U.S.S.R. or other countries in the second step after they succeed in their economic reform and are classified as developed countries. In the U.S.A., the growth rate of GNP will jump from the current 4% to 12% or more. The budget deficit and trade deficit will be wiped out automatically.

POSTER SESSION

CHANCE AND NECESSITY IN INDUSTRIAL DEVELOPMENT

Halina Kwasnicka, Witold Kwasnicki
Futures Research Center, Technical University of Wroclaw, 50 370 Wroclaw, Poland

An evolutionary model of a single industry describes development of a number of competing firms producing homogeneous products. Each firm searches for new routines and new combinations of routines. Decisions of a firm related to investment, modernization of production, price, etc. are based on firm's evaluation of behavior of other competing firms and expected response of the market. Profit seeking is the main objective of a firm. Firms tend to maximal profit through applying new combination of routines enabling to minimize unit cost of production, maximize productivity of capital, and maximize competitiveness of their products on the market. Results of simulation study of the model under different initial conditions are presented. The simulation results are a base of some findings concerning existence of reversible and irreversible processes as well as invariable phenomena in an industrial development. Possibilities of forecasting in economic processes are considered.

RELATIVE IGNORANCE AND RISK AVERSION

Charles van Marrewijk
Department of Economics, University of Groningen, 9700 AV Groningen, The Netherlands

The Arrow-Pratt measure of risk aversion is local and considers small bets or insurance risks. We study another measure of risk aversion in conjunction with a specific allocation mechanism. To do so an experiment, involving one hundred persons, was conducted at Groningen University. We looked, among other things, at people's reaction to this allocation mechanism, the difference in risk aversion between men and women, and whether or not people act in accordance with individual rationality. The results (women are more risk averse than men, and people are not individually rational) raise some questions which are briefly discussed.

IMPLEMENTING A SALES FORECASTING SYSTEM – A PRACTICAL APPROACH: EXPERIENCES AT MILES INC. PHARMACEUTICAL DIVISION

James Noller
User Systems Support, Miles, Inc., Elkhart, Indiana 46515, U.S.A.
Eric Stellwagen
Business Forecast Systems, Inc., Belmont, Massachusetts 02178, U.S.A.

In 1988 Miles Inc. implemented a PC-based forecasting system to enable their marketing staff to more accurately project product sales. This presentation will cover all aspects of the project including why such a system was necessary, how the software was selected, how the system was implemented, and the benefits of the new system. The presentation will also focus on FORECAST PRO the forecasting package selected by Miles and include a demonstration of the project.

POSTER SESSION

ISSUES MANAGERS: PROFILE OF A PROFESSIONAL

Harvey Nussbaum
School of Business Administration, Wayne State University, Detroit, Michigan 48202, U.S.A.
Diane K. Kasunic
Troy, Michigan 48075, U.S.A.

The emerging field of issues management in corporations and in public organisations offers expanded opportunities for the application of futures forecasting methodologies. The field is an extension of earlier "futures" research of the nineteen sixties and seventies. Using a sample drawn from several issues management networks, a study of actual corporate users of the techniques was conducted. This paper reports on a study of forty-three professional issues managers, representing nine industries. Respondents completed a mail-survey requesting their attitudes towards the field and their estimates of the effectiveness of the function. Eighty-one percent of the respondents had conducted issues management in their companies for three years or more. The paper will cover respondent's attitudes towards the profession, the locus of the function in their organization, and their evaluation of the effectiveness of issues management, as compared with crisis management.

RESULTS OF TESTING A REVISED FORECASTING MODEL FOR SOFTWARE DEVELOPMENT

Edward G. Rodgers
Division of Computer Science, University of West Florida, Pensacola, Florida 32514, U.S.A.

Results of testing revised PERT-type sizing estimates of module size used as input to effort forecasting models is presented in this paper. The revised model used variations to the PERT estimation equations which use percentile estimates for module size instead of the standard end-point estimates. An example of revised software sizing in the COCOMO (Constructive Cost Model) environment is presented. Effort forecasts calculated with these estimates are compared with the results using standard PERT sizing and the standard COCOMO models.

FORECASTING OF CHEMICAL SCIENCE AND TECHNOLOGY DEVELOPMENT AS COMMON LOGICAL SYSTEM

V. M. Tyutyunnik
Chair of Informatics, Tambov-32, U.S.S.R

Comprehensive analysis of the great mass of the most meaningful publications in chemistry and chemical technology in the last 100 years (about 12,000 original papers of the 112 Nobel Prize winners in chemistry from 1901 to 1988) has been undertaken. Conclusions have been drawn regarding the availability of a limited number of deep generalizing regularities in chemical science and technology which permit the gradual reconstruction of chemistry and chemical thinking from the totality of separate directions. Chemistry of the future appears to be evolutional chemistry – chemistry of artificial, highly organized chemical-biological systems.

STRUCTURAL STABILITY IN SOUTH AFRICAN ECONOMETRIC MODELS

Gilbert Wesso
Department of Statistics, University of Western Cape, Bellville 7535, South Africa

The rapidly changing economic and political environment in S. A. may cause economic relationships to become structurally unstable. A number of equations are re-estimated and rigorously tested for structural stability. It is shown that a substantial number of models fail one or more tests and that the incidence of structural breaks is on the increase.

POSTER SESSION

FORECASTING FINANCIAL STATE OF SELF-MANAGEMENT ENTERPRISE IN UNSTABLE ECONOMIC ENVIRONMENT

Nevenka Zarkic-Joksimovic
University of Organizational Sciences, 11000 Belgrade, Yugoslavia

The functioning of enterprise in contemporary conditions is necessarily deliberate, with beforehand defined plan. Planning of all the aspects of enterprise functions is all the more complex the longer the planning period and the greater the instability of economic conditions within which the enterprise activity is performed. Having all this in mind, planning of economic performance is conditioned by forecasting, and the planning of financial state and financial effects of enterprise performance is conditioned by forecasting of all of these relevant parameters. Having in mind that the objective function of every enterprise, self-management as well, is maximization of gains through optimization of financial structure, the forecasting of financial parameters is of great importance. With understanding of all the above conditions concerning the forecasting problematique, the field of forecasting methodology is of special importance, and this paper also includes a new methodological approach towards financial forecasting the self-management enterprise in economically unstable environment.

THE SHIFTING FRONTIER OF FORECASTING I

Chair: Harold A. Linstone
Systems Science Program, Portland State University, Portland, Oregon 97207, U.S.A.

BRIDGING THE GAP BETWEEN ANALYSIS AND ACTION: APPLYING MULTIPLE PERSPECTIVES

Harold A. Linstone **(FEATURED SPEAKER)**
Systems Science Program, Portland State University, Portland, Oregon 97207, U.S.A.

The augmentation of the analyst's technical perspective by organizational and individual perspectives is proving of value over a widening range of interdisciplinary tasks, from corporate strategic planning to issues management, from technology transfer to risk analysis, from political/economic forecasting to third world development planning. This talk presents an overview of the concept and a sampling of applications in recent years.

CREATIVITY AND INNOVATION IN ORGANIZATIONS: A MULTIPLE PERSPECTIVE APPROACH

Firdaus Udwadia
School of Engineering, University of Southern California, Los Angeles, California 90089, U.S.A.

Technological innovation is emerging as the single-most important factor to influence business success in today's intensely competitive and dynamic environment. Accordingly, scholars as well as practitioners are contributing to a rapidly growing body of knowledge for the effective management of innovations. However, very little attention is being paid to the organizational and managerial issues pertaining to creativity, which is the most important element in the process of innovation. To understand creative behavior and performance in organizations, this paper develops a multiple perspective model. This model includes three perspectives, the individual, the technical, and the organizational. Extensions of this model to the process of innovation are proposed. Thus, innovation is shown as being contingent on a cascade of creative efforts in various functional areas and across different fields of specialization.

FORECASTING THE SOCIAL PERFORMANCE OF TECHNOLOGY POLICY

Edward Wenk, Jr.
University of Washington, Seattle, Washington 98195, U.S.A.

With technology such a powerful force in modern society, its steering by public policy puts a special premium on careful policy design. From analysis of 70 cases of U.S. policy, criteria have been found by which social performance can be forecast. These can be highly useful in mitigating unwanted side effects or in their prevention.

GAINING A SENSE OF DIRECTION IN FUTURES WORK

W. H. Clive Simmonds
66 Lyttleton Gardens, Ottawa, Ontario K1L 5A6, Canada

The need to use a "full cycle" approach in forecasting as a way to avoid the unwarranted *ceteris paribus* assumption, i.e., everything but the forecast item remaining unchanged.

SALES FORECASTING I

Chair: Mick Silver
Accounting and Finance Section, University of Wales, Cardiff CF1 3EU, United Kingdom

USER SATISFACTION WITH RESPECT TO THE SALES FORECASTING TECHNIQUE SELECTION

James E. Cox, Jr.
Department of Marketing, Illinois State University, Normal, Illinois 61761, U.S.A.

Forecasters sometimes have difficulty in having their forecasts accepted by forecast users. Part of this difficulty is due to user distrust in the preparer's forecast generation. This paper reports the findings of an empirical study of companies and identifies factors found to be associated with user-preparer conflict when selecting the methods used to generate forecasts. Some of the factors examined are education levels, user perception of preparer expertise, user perception of user expertise, user input in selection process, and user familiarity with forecasting methods. Findings leading to improvement of the user-preparer communication process are also discussed.

FORECASTING PRODUCT SALES: ARE TIME SERIES MODELS APPROPRIATE FOR BUSINESS PLANNING?

Lilian Shiao-Yen Wu, Nalini Ravishanker, J. R. M. Hosking
IBM Research Division, T. J. Watson Research Center, Yorktown Heights, New York 10598, U.S.A.

Can time series methods model and estimate special features that are often present in sales data? Can they forecast accurately enough 3, 6 and 12 months ahead to be useful in business planning? This paper is a study of a closely managed product and two time series methods, the Box-Jenkins model and the Holt-Winters adaptive forecasting function. We show how forecasting models are constructed that can account for a variance change and for the special events in the data. We develop criteria for choosing a final model which differ from the usual methods and are specifically directed towards maximizing the accuracy of 3-, 6- and 12-month-ahead forecasts. We find that the best Box-Jenkins models give clearly better forecasts than the Holt-Winters forecast functions. In conclusion, we judge that the Box-Jenkins models can be appropriate for business planning.

CORPORATE POLITICS AND SALES FORECASTING

Charles W. McClelland
Western Center for Marketing Services, Inc., Palo Alto, California 94303, U.S.A.

Many general managers believe that higher forecasts will force commitment to higher goals and thereby produce superior results. This manipulation often has a negative effect upon forecasting accuracy. In many cases, operations managers borrow from the future in order to make the current numbers, which results in a "bubble" of dummy sales during the current fiscal year. In the short term, by manipulating the size of the "bubble," actual performance can be made to appear close to the forecast. Long term, however, the bubble can burst and cause serious problems for both the forecaster and the company. The rationale and mechanisms for this phenomenon are discussed, and a partial solution to the problem is suggested.

FORECASTING METHODS IV

Chair: Stephen Silver
Virginia Military Institute, Lexington, Virginia 24450, U.S.A.

BIASED FORECASTS AND INVENTORY CONTROL: A NEW APPROACH FOR TIME-VARYING PROBABILISTIC DEMAND PATTERN

Rene Gelinas, Pierre Lefrancois
Laval University, Ste-Foy, Québec G1K 7P4 Canada

A new approach is suggested to develop an inventory control procedure for the case of a time-varying probabilistic demand pattern. This heuristic procedure is partly based on decision rules proposed in textbooks on inventory management for such a situation, but it also incorporates the notion of biased forecasts. So far, preliminary results show that the implications of such an approach are twofold: a decrease in the costs of running the inventory control system can be achieved along with an increase of the service level. The basic idea behind the procedure is the irrelevance of safety-stocks calculation when biased forecasts that account for the inventory management cost structure are used. In that perspective, an attempt is made to answer the three key questions of inventory management: When to order? How many periods should the order cover? and What quantity to order?

OPTIMAL FORECASTING OF INDUSTRIAL PRODUCTION USING THE AUTOREGRESSIVE STRUCTURE OF THE ECONOMY

Stephen Silver
Virginia Military Institute, Lexington, Virginia 24450, U.S.A.
Scott Sumner
Bentley College, Waltham, Massachusetts 02154, U.S.A.

Employing a technique similar to the one used in their earlier paper (JPE June, 1989), the authors define periods of "demand" and "supply" shocks. The authors then attempt to forecast changes in output using a difference-stationary model during supply-induced episodes and a trend-stationary model during demand shock episodes. The authors then compare the relative forecasting ability of the two-model approach against a single, univariate forecasting model.

THE RELATIONSHIP BETWEEN DECOMPOSITION AND FORECASTING

LeRoy F. Simmons
Loyola College, Baltimore, Maryland 21210, U.S.A.

Should one decompose or not? Time-series forecasting assumes that patterns which have occurred in the immediate past will continue into the immediate future. In other words, the future is an extrapolation of the past. Time-series decomposition extracts the patterns from the immediate past and then forecast the near future by extrapolating some of the individual patterns and then combining these extrapolated patterns. Other time-series forecasting techniques (i.e., those that do not decompose the data) use curve fitting techniques to fit the historical data and then project the resulting curve into the future. If one is selecting a forecasting technique should he/she pick one that uses decomposition or curve fitting (or both)?

TELECOMMUNICATIONS I

Chair: Paul de Cintra
Economics Advisory Division, British Telecommunications PLC, London EC1A 7AF, United Kingdom

OPTIMAL STRATEGY FOR FORECASTING SHORT-TERM DEMAND OF INTERNATIONAL TELECOMMUNICATION SERVICES

H. K. Leung, C. W. Liu
Cable & Wireless, Ltd., Hong Kong

Accurate short-term forecast has become a most important issue for international telecommunication forecasting in Hong Kong. In this paper, we examine time-series on international telecommunication services in Hong Kong, compare the accuracy of individual forecasts generated by different forecasting methods and their combinations for different lead time, and devise a "selection strategy" for optimal forecasts at different lead time.

A COMPARISON OF THE ACCURACY OF NEW PRODUCT FORECASTING TECHNIQUES: AN APPLICATION TO HIGH TECHNOLOGY TELECOMMUNICATIONS PRODUCTS

Paul Bottomley
Manchester Business School, University of Manchester, Manchester M15 6PB, United Kingdom

Given the importance of forecasting the performance of new products and services in the marketplace, numerous new product forecasting models have been developed. Accurate forecasting of new product performance is vital and constitutes a critical input into business and marketing decisions. This study investigates the relative predictive efficiency of one class of such models, the early sales forecasting models (first purchase diffusion models). Various models are compared including those which specify marketing mix variables in (a) the coefficient of internal influence; (b) the coefficient of external influence; and (c) the total number of potential customers.

THE PRESENT STATE AND FUTURE PROSPECTS OF INFORMATION-TELECOMMUNICATION SERVICES IN JAPAN WITH FORECASTING

Hajime Myoken
Faculty of Economics, Nagoya City University, Nagoya 467, Japan

This paper is concerned with talk of "advanced information-oriented society" differing radically from present industrial societies. We examine the structural change of information-telecommunication market here in Japan through technological innovations to predict international information-telecommunication services. The impact of developments on these services is considered.

FORECASTING CORPORATE EARNINGS

Chair: Michael S. Rozeff
College of Business Administration, University of Iowa, Iowa City, Iowa 52242, U.S.A.

THE ASSOCIATION BETWEEN REVISIONS OF FINANCIAL ANALYSTS' EARNINGS FORECASTS AND SECURITY PRICE CHANGES

Thomas Lys, Sungkyu Sohn
Accounting and Information Systems, Northwestern University, Evanston, Illinois 60201, U.S.A.

This paper provides evidence on the formation of earnings expectations by analysts and on the interaction between analysts and investors. Using all publicly available analyst earnings forecasts for a sample of 62 companies in the 1980-86 period, the evidence indicates that the analyst earnings forecasts are informative with respect to contemporaneous stock price changes but are not efficient with respect to past stock price changes. Further, we document that analyst earnings forecasts are informative, even when they are preceded by earnings forecasts made by other analysts or by corporate accounting releases. However, analyst earnings forecast revisions are not informative when forecasts are not preceded by corporate accounting releases.

RETURN SENSITIVITY COEFFICIENTS IN AN ADJUSTMENT MODEL: TIME SERIES RESULTS

Nandkumar Nayar
College of Business Administration, University of Oklahoma, Norman, Oklahoma 73019, U.S.A.
Michael S. Rozeff
College of Business Administration, University of Iowa, Iowa City, Iowa 52242, U.S.A.

We derive a new model linking accounting earnings changes to stock returns, and show that the association between these variables depends upon five parameters. These involve the time series properties of both ungarbled earnings and accounting earnings, the discount rate on dividends, the growth rate of dividends, and the ratio of expected dividends to expected ungarbled earnings. The moving average parameter of ungarbled earnings is estimated to be -0.3, not -1.0 as reported in earlier papers, whose models are shown to contain bias. The theoretical and empirical relationships between the five parameters and firm size are examined.

A "MOST ACCURATE FORECAST" OF CORPORATE EARNINGS

Lawrence D. Brown, David Chen
School of Management, State University of New York, Buffalo, New York 14260, U.S.A.

This paper presents results of an algorithm for forecasting firms' annual earnings using individual analyst forecasts provided by Zacks Investment Research, Inc. First, the algorithm updates analysts' annual earnings forecasts for the information in the known quarterly reports. Second, it gives more (less) weight to analysts with a relatively superior (inferior) record of predicting past values of the firm's annual earnings. Third, it gives more (less) weight to analysts whose forecasts are relatively more (less) timely. The annual earnings forecasts generated by the algorithm are shown to be significantly more accurate than those generated by several benchmarks, including the most recent forecast.

Session WA6
ROOM 225

Wednesday
8:30 – 10:00

PROBLEM SOLVING SESSIONS II

Chair: Richard De Roeck
GM Corporation, New York, New York 10153, U.S.A.

Participants: J. Scott Armstrong
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.
Robert Lippens
Chrysler Corporation, Highland Park, Michigan 48288, U.S.A.
Muhittin Oral
Sciences de l'Administration, Universite Laval, Québec, P.Q. G1K 7P4, Canada

The problem solving sessions bring together practitioners and researchers. Questions should consider all aspects of forecasting: advantages and disadvantages of different techniques, short-term or long-term forecasting, specific projects or ongoing forecasting responsibilities. Participants are encouraged to give a description of their problems ahead of time to the chairperson, Richard De Roeck. The panel of experts will propose solutions.

POLITICAL FORECASTING

Chair: Michael McBurnett
Department of Political Science, Washington University, St. Louis, Missouri 63130, U.S.A.

THE SIMPLE ANALYTICS OF THE ARMS RACE

Murray Wolfson, Andrew Gill
Department of Economics, California State University-Fullerton, Fullerton, California 92634, U.S.A.

This paper provides a theoretical and statistical framework analyzing the tension between the competitive political and military dynamic of arms acquisitions on one hand and the international economic order on the other. It presents a simple transparent model which generates hypotheses relevant to the causal relations between military and economic processes. The model is applied to the US-USSR arms race and compared to the Anglo-German arms race before World War I.

NAIVE FORECASTING OF ELECTIONS

Jochen Schwarze
Abteilung Statistik & Operations Research, Technische Universität, D-3300 Braunschweig, Federal Republic of Germany

The paper is a report on the experiences of forecasting the results of different elections (State-, Community- and Federal-Parliament) in the Federal Republic of Germany. Using only very simple instruments (pocket computer, paper and pencil) we tried to forecast the results before preliminary results were available. The main difficulty was the estimation of the survey bias. The results (forecasting errors less than 1%) have been better than those of the Number 1 and Number 2 German TV.

COMPETITIVE DYNAMICS IN PRESIDENTIAL NOMINATING CAMPAIGNS

Michael McBurnett
Department of Political Science, Washington University, St. Louis, Missouri 63130, U.S.A.

Can we forecast the presidential nominees for the major parties? The presidential nomination campaign is a lengthy competitive process. This paper models the process with a three equation system dynamically relating monetary resources, television news coverage, and delegates won in various primaries and caucuses. This system can represent any number of candidates in party races and incorporates effects of incumbency and open races upon outcomes. Questions concerning why some candidates with few monetary resources can win many delegates (i.e., Jesse Jackson) and why some candidates with high media visibility (i.e., Gary Hart) are driven from the competition, are also considered.

REGIONAL INTEGRATION IN NORTH AFRICA – A PREDICTION

Janice Marshall
Political Science, University of Oregon, Eugene, Oregon 97403, U.S.A.
A. Karim Hamdy
Foreign Languages and Cultures, Oregon State University, Corvallis, Oregon 97331, U.S.A.

Anticipating Europe of 1992, North African leaders have engaged in a new and more promising attempt at unifying their economic and trade structures. Libya, Tunisia, Algeria, Morocco and Mauritania make up *The Great Arab Maghrib*, a region with a puzzling mixture of similarities and contrasts. However, unity has always been an appealing proposition to the people and politicians alike. We propose to assess the prospects of this new attempt by adapting the FUGI (interdependence) Model (Soka University, Japan) to the North African landscape. We plan to follow an approach similar to Dr. Onishi's *Global Early Warning System* (GEWS) *for Displaced Persons*. Selected indicators evaluating the states of the (1) environment, (2) development, (3) peace and security, and (4) human rights, in each country, would be applied. Our forecast would be based on a comparison of results for at least two pairs of those five countries.

MULTIVARIATE TIME SERIES: APPLICATIONS I

Chair: T. H. Lai
Department of Economics and Finance, Liberty University, Lynchburg, Virginia 24506, U.S.A.

IMPROVING THE ACCURACY IN FORECASTING THE MONEY MULTIPLIER

T. H. Lai
Department of Economics and Finance, Liberty University, Lynchburg, Virginia 24506, U.S.A.

Correctly forecasting the money multiplier will enable the Federal Reserve to control the money stock, providing that the Fed controls the reserves. In the past, the univariate ARIMA technique was used in forecasting the money multiplier. However, this technique fails to include the information which is contained in other related variables, such as interest rates and reserves. This study employs the vector autoregression (AR) technique, which includes the interaction among related variables in modeling, to forecast the money multiplier, and compares the forecast accuracy of the VAR model with that of the univariate ARIMA model.

FORECASTING THE DANISH TERM STRUCTURE OF INTEREST RATES USING MULTIVARIATE ARIMA MODELS APPLIED TO PRINCIPAL COMPONENTS

Kent Stevens Larsen, Soren Braes
Institute of Mathematical Statistics and Operations Research, Technical University of Denmark, DK-2800 Lyngby, Denmark

Being one of the world's largest bond markets, the Danish bond market is of special interest to forecasters. Estimates of the term structure of interest rates play an important role in most empirical work on the relative pricing of fixed income securities. By use of principal component analysis the term structure is decomposed into a few systematic components. These systematic components combined with leading indicators are modeled and forecasted using multivariate ARIMA methods. This approach shows to be very powerful when dealing with many highly correlated time series, which is the case with the term structure and other economic curves.

A VECTOR AUTOREGRESSION MODEL (VAR) OF HOUSING STARTS

Anil K. Puri
Department of Economics, California State University, Fullerton, California 92634, U.S.A.

The paper develops and estimates a Vector Autoregression (VAR) model for the U.S. housing starts. Monthly and quarterly data are used to calculate four-and eight-period ahead forecasts. These forecasts are compared with those derived from a simple ARIMA model and issues of forecast accuracy are discussed.

SEASONALITY I

Chair: Winfried Stier
University of St. Gallen, CH-9000 St. Gallen, Switzerland

UNSTABLE SEASONALITY: AN EMPIRICAL APPROACH

Stanley R. Schultz
Quantitative Business Analysis, Cleveland State University, Cleveland, Ohio 44115, U.S.A.
Tim Thomas
Cleveland State University, Cleveland, Ohio 44115, U.S.A.

Stable seasonality provides a reliable pattern that can be projected into the future. But if the pattern is changing over time, that reliable basis is suspect. About fifty time series from several industries are examined with special reference to whether they have unstable seasonablity. Four widely used models are examined for their degree of success in coping with this problem: Winters; decomposition; trend with dummy variables; and univariate Box-Jenkins. Implications for the practitioner are suggested.

SEASONALITY IN WEEKLY TIME SERIES

Joel Fingerman
Department of Management, Roosevelt University, Chicago, Illinois 60605, U.S.A.

The usual analysis of seasonality in time series has been limited to monthly or quarterly series. Yet, there are many business and economic series which are collected on a weekly basis. Rather than aggregating the series into monthly or quarterly data, this paper analyzes and forecasts series in their original weekly format. The paper begins with a discussion of the theory of weekly seasonality and then ends with examples of forecasting weekly time series.

A NEW APPROACH FOR SEASONAL TIME SERIES FORECASTING

Jun Zhang, Yuansheng Zhang
Market Forecasting and Analysis Section, State Economic Information Center, Beijing, P.R.C.

Grey System Theory, proposed by a Chinese scholar, Professor Deng Juniong in 1982, deals with uncertainty problem from the viewpoint of completeness of information about the system to be studied. In this paper, a new approach for seasonal time series forecasting, based on GM(1,1) Model from Grey System Theory, is proposed and its application on the monthly forecasting of the gross industry output value in China is also introduced.

MACROECONOMIC FORECASTING

Chair: Geoffrey H. Moore,
Center for International Business Cycle Research, Columbia University, New York, New York 10027, U.S.A.

UNIVARIATE MODELS AS A WAY TO CHARACTERIZE AN AGGREGATE ECONOMIC VARIABLE: AN APPLICATION TO THE SPANISH INDUSTRIAL PRODUCTION INDEX

Pedro Revilla, Pilar Rey, Antoni Espasa
Banco de España, 50, 28014-Madrid, Spain

The paper argues that univariate ARIMA models with intervention analysis are consistent instruments to characterize economic variables. This way of characterizing economic magnitudes is of particular interest to describe all the components of an aggregate variable. In these cases the number of components is considerable (i.e., several hundred) and we need an automatic procedure for identification, estimation, diagnostic checking of the models, and also for formulating the characteristics of the variables from the models. The paper presents an automatic procedure that chooses for each variable the more appropriate and parsimonious model from a general class of models. The procedure is applied to characterize the components of the Spanish Industrial Production Index.

STOCKBUILDING AND LIQUIDITY

S. G. Hall, S. G. B. Henry, T. S. Callen
Bank of England, London EC2R 8AH, United Kingdom

This paper is concerned with quarterly econometric models of stockbuilding and financial behaviour in the UK manufacturing sector. It assumes a precautionary motive is central, so stockbuilding depends upon the conditional variance of sales as well as financial variables. The model is estimated using a GARCH-M procedure.

STABILITY OF THE ECONOMIC STRUCTURE

Niels Kaergard
Institute of Economics, University of Copenhagen, DK-1455 Copenhagen K., Denmark

When econometric models are used for medium- or long-term forecasting it is evident that the relationships used should be unchanged from the beginning of the estimation period to the end of the forecast period. If the estimation period is 30-40 years and the forecast period extent this by 5-10 years, this assumes an economic structure unchanged for almost half a century. The assumption of long-run stability is tested for the Danish economy by means of an econometric model which is estimated for the period 1870-1970. First, the estimations for three subperiods (the pre-war period, the inter-war period, and the post-war period) are compared, and secondly the forecast capability for the post-estimation period 1971-1981 is evaluated.

THE FORECASTING VALUE OF CONSUMER EXPECTATIONS SURVEYS

Geoffrey H. Moore, John P. Cullity
Center for International Business Cycle Research, Columbia University, New York, New York 10027, U.S.A.

An examination of two consumer expectations surveys for the United States, compiled by the Conference Board, Inc., and by the University of Michigan, shows that these surveys resemble growth rates and diffusion indexes of measures of business activity. The expectations surveys exhibit some tendency to lead these growth rates by a few months. They also lead the consumer surveys that report recent changes or present conditions. The forecasting power of the expectations surveys is evaluated against that of several composite leading indexes.

Session WA11
ROOM 235

Wednesday
8:30 – 10:00

BAYESIAN METHODS

Chair: Robert T. Clemen
College of Business Administration, University of Oregon, Eugene, Oregon 97403, U.S.A.

AN ADAPTIVE MODEL FOR PRODUCTION AND INVENTORY MANAGEMENT WHEN A BAYESIAN ADJUSTMENT IS USED FOR SALES FORECASTING

Lassana Maguiraga, Yves Nobert
Université du Québec, Montréal, Québec, Canada

In most models for production and inventory management, sales is one of the key variables. We think that any relevant information for sales forecasting has to be taken into account and incorporated in the decision model. We propose a multiperiods decision model which allows a Bayesian adjustment not only for the predicted sales for the next period, but also for the predicted sales for all later periods. This Bayesian adjustment can be done because of the anticipation of the information. To solve our problem we used dynamic programming algorithm for sequential decisions in uncertainty environment. In our research we point out the mains parameters of the model, and their values for which the expected value of the information is significantly positive. This last point helps us to describe some concrete areas for which the anticipation of the information is worth.

A HYBRID POOLED-PDL/BAYESIAN DEMAND FORECASTING MODEL

Jerry Langin-Hooper
Langin-Hooper Associates, Phillipsburg, New Jersey 08865, U.S.A.

Recent econometric forecasting models for interstate telecommunications demand have concentrated on the use of pooling estimation procedures (across geographic cross-sections) for models with polynomial-distributed lag (PDL) terms. A major difficulty with this approach has been the restrictive assumption of identical model coefficients across each of the individual cross-sections. Considerable evidence suggests differences in the underlying characteristics of distinct geographical areas. This presentation details the use of a Bayesian estimation extension of the pooling method to address the issue of distinct geographical characteristics. Particular attention is given to the measures of forecast confidence from the hybrid approach.

A FULLY BAYESIAN APPROACH TO NONLINEAR ESTIMATION AND FORECASTING

Jeffrey A. Mills
Department of Economics, Florida State University, Tallahassee, Florida 32306, U.S.A.
Stefan Mittnik
Department of Economics, State University of New York, Stony Brook, New York 11794, U.S.A.

The paper presents an algorithm for Bayesian estimation of nonlinear models. The approach utilizes Monte Carlo integration methods to derive the marginal posterior distribution of the model parameters as well as the posterior distribution of forecasts generated with the model. We discuss the advantages and disadvantages of this approach and present an illustrative example.

FORECASTING FOR THE ENVIRONMENT

Chair: James E. McMahon
Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720, U.S.A.

U.S. REFRIGERATORS AND FREEZERS: IMPACTS ON GLOBAL CLIMATE

James E. McMahon
Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720, U.S.A.

Household refrigerators and freezers have significant impacts on global climate, both through requirements for power plants and through depletion of stratospheric ozone when refrigerant and chemicals in the insulation are released to the atmosphere. Household refrigerators and freezers account for 22% of U.S. residential electricity consumption, equivalent to 31 large power plants whose emissions contribute to acid rain and global warming. Recent projections of sales and energy consumption of refrigerators from the LBL Residential Energy Model, and associated climate impacts, are discussed. Design choices, including insulating material and refrigerant, have significant implications for ozone depletion, and, through energy efficiency, for global warming.

FORECASTING DEMAND FOR OPEN SPACE AS RECREATIONAL AMENITIES

Michael Moore
1400 Tenth Street, Sacramento, California 95814, U.S.A.
Bernard M. Walp
430 Point Lobos Avenue, San Francisco, California 94121, U.S.A.

Value and use of recreational amenities is often measured as a function of willingness to pay fees or equivalent values such as travel time or distance driven. Reliance on this approach seriously undervalues passive recreational amenities such as open space or greenbelts. We suggest that the value and demand for open space areas is an important component of overall recreational demand and changes as a function of population density. Further, the ratio of this value to perceived urban encroachment yields a surrogate measure of willingness to pay for future acquisitions. Anticipating this demand will prove important in the planning of regional systems.

RELIABILITY OF DECISIONS FOR ENVIRONMENT PROTECTION

Erzsébet Nováky
Section of Future Research, Karl Marx University of Economic Sciences, Budapest 1093, Hungary

Decisions for environment protection have to be made, generally on the basis of measuring results, considering the relation between quantity of emitted pollutants, the measurement of pollution, and norms for quality of environment. Decision-making can be based on the information originated from mechanic-stream and probability-reliability theories. The information are connecting with models of emission and emission-calculations. It is reasonable to make heuristic and reliable decisions in spite of the presumption of physical-mechanical models. The base of these decisions is given on the one hand considerations of reliability theory, on the other various connections (e.g., recurrent) being in the theory of stochastic processes. In this paper (based on the previous paper, G. Fáy and E. Nováky: Towards Conflict Prognostics, presented in the Eighth International Symposium on Forecasting, Session 62, Amsterdam, 1988. International Institute of Forecasters, p. 87) the reliability of decisions aimed at the emitted pollutants is presented as a tool for avoiding catastrophic events, in accordance with models of stochastic processes, on the base of surprise, risk and reliability, taking into consideration of expectable damages.

THE SHIFTING FRONTIER OF FORECASTING II

Chair: Harold A. Linstone
Systems Science Program, Portland State University, Portland, Oregon 97207, U.S.A.

TWENTY YEARS OF *TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE*

Harold A. Linstone
Systems Science Program, Portland State University, Portland, Oregon 97207, U.S.A.

A look back and a look ahead on the occasion of the twentieth anniversary of the Journal. A profile: 35 volumes – trends and highlights.

ARE WE ANY CLOSER TO UNDERSTANDING THE STUFF OF WHICH SOCIAL REALITY IS MADE

Ian I. Mitroff
Graduate School of Business Administration, University of Southern California, Los Angeles, California 90007, U.S.A.

Striking paradoxes characteristic of complex systems force a change in the way we look at them. The global economy is a case in point.

REFLECTIONS ON THE PAST AND FUTURE OF THE FUTURE

Marvin Adelson
Graduate School of Architecture and Urban Planning, University of California, Los Angeles, California 90024, U.S.A.

New roles emerging for futurists – action orientation as contrasted with knowledge orientation. Built-in distrust of futures work in our society, resulting in futurists shying away from problems that could not be dealt with according to strict methodological dictates. Reexamination of this attitude.

LOOKING BACK AND LOOKING AHEAD – PANEL DISCUSSION ON THE SHIFTING FRONTIER OF FORECASTING

Marvin Adelson
Graduate School of Architecture and Urban Planning, University of California, Los Angeles, California 90024, U.S.A.
Ian I. Mitroff
Graduate School of Business Administration, University of Southern California, Los Angeles, California 90007, U.S.A.
W. H. Clive Simmonds
66 Lyttleton Gardens, Ottawa, Ontario K1L 5A6, Canada
Firdaus Udwadia
School of Engineering, University of Southern California, Los Angeles, California 90089, U.S.A.
Edward Wenk, Jr.
University of Washington, Seattle, Washington 98105, U.S.A.
Harold A. Linstone
Systems Science Program, Portland State University, Portland, Oregon 97207, U.S.A.

Successes and failures in forecasting, shifting areas of emphasis, new insights on complexity and uncertainty. Where next?

SALES FORECASTING II

Chair: James E. Cox, Jr.
Department of Marketing, Illinois State University, Normal, Illinois 61761, U.S.A.

SALES FORECASTING, PROMOTIONS AND PRODUCT MODIFICATIONS

Mick Silver
Accounting and Finance Section, University of Wales, Cardiff CF1 3EU, United Kingdom
Rodney Green
University of Bath, Bath, United Kingdom

This paper is concerned with incorporating the effects of sales promotions and product modifications into short-run forecasting models. Attention will be focused on the use of models based on regressing sales on time with dummy variables incorporated to represent the effects of the sales promotion/modification. Possible effects are outlined and alternative specification of the dummy variables considered. An attraction of the method is that the user is able to consider first, whether the promotion/modification has had an effect over and above those due to sampling errors and, if so, the extent of the effect. Second, if an effect is apparent it can be incorporated directly into the forecasting model. The importance of the correct specification of the promotion/modification will be demonstrated. Some of the tests normally employed to ascertain such effects will be shown to be invalid for some of the models specified. The methods outlined will be demonstrated by using monthly sales data for a UK company. The practical problems involved in devising such models will be considered and the results contrasted with smoothing methods based on local means. While the problems apply to sales promotions and product modifications, the context of this study, they also apply to many situations where one-off shocks lead to a variety of different forms of "ripples," an example being the effect of sales of D.I.Y. stores of a national holiday.

JUDGMENTAL ADJUSTMENT OF SALES-FORECASTS AND INVESTMENT DECISION QUALITY: SOME PRELIMINARY EVIDENCE

Alan E. Singer
Department of Business Administration, University of Canterbury, Christchurch 1, New Zealand

Should non-time-series information be incorporated into sales forecasts or independently communicated to the decision maker, if the goal is to improve decision quality? This pilot study investigated the differential impact on investment decision-making of supplying contextual information of moderate credibility to a forecaster-only (enabling judgmental adjustment to the sales forecasts) versus to a decision-maker-only. Preliminary results with MBA subjects indicate that where the contextual information is positive (i.e., supports the case for investment) approval of an investment is more likely in the latter condition.

MOTOR MARKET FORECASTING IN CHINA

Yuansheng Zhang, Jun Zhang
Economic Forecasting Department, State Economic Information Center, Beijing, P.R.C.

China's motor market, in which more than 70 percent of total motor supplies are sold, is preliminary formed. In this paper, the methods and steps for motor market forecasting are illustrated and the Motor Market Forecasting Model of China – an econometric model describing the quantitative relationships among the demand, production, import of motors and national macroeconomic situation, is especially studied.

TRAVEL AND TOURISM

Chair: Alex Tunner
British Columbia Research Corporation, Vancouver, British Columbia V6S 2L2, Canada

PREDICTION OF TRAVEL DISTANCES

Kurt Brännäs, Thomas Laitila
Department of Statistics and Transportation Research Unit, University of Umeå, S-901 87 Umeå, Sweden

The paper presents a theoretical basis and empirical results for the prediction of Swedish travel distances by car. The results from the basis for an assessment of the consequences of Swedish petrol price adjustments on travelled distance. Linear models including limited dependent variable versions are estimated within a general distribution class and with robust limited dependent variable estimators. Predictors and prediction intervals are derived and shown to be applicable to other models as well. The empirical prediction intervals suggest that price effect assessments can be made with reasonable certainty for some travel types. The models are subjected to a number of specification tests.

AN EVALUATION OF TOURISM EXPENDITURE FORECASTING METHODOLOGIES

Pauline J. Sheldon
School of Travel Industry Management, University of Hawaii, Honolulu, Hawaii 96822, U.S.A.

This paper will examine forecasting methodologies appropriate for predicting tourism expenditures in a destination. It will examine aggregate expenditures for a given destination and different categories of tourism expenditures such as food, entertainment, transportation and shopping. A review of the literature will summarize techniques used thus far. Data on tourism expenditures in Hawaii and other parts of the world will be used to test the predictive capabilities of different models including time series, and causal models.

TOURISM MONITORING AND FORECASTING USING CONVENTIONAL TRAFFIC DATA

Alex Tunner
British Columbia Research Corporation, Vancouver, British Columbia V6S 2L2, Canada
G. Lam, R. A. Holmes
Business Administration, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada

Time series of routinely obtainable traffic data can be used to monitor and project tourism activity in a province, or state, or country, and in regions within it. Tourist traffic arriving via major routes and modes is estimated and projected. Tourist flows are distributed regionally using data from travel surveys and/or origin-destination surveys. Tourist volume estimates are then used in conjunction with tourist survey data to estimate tourist person-days, expenditures and ultimately economic impacts. This general procedure has been used to develop operational computer models to estimate the economic impacts of tourism on an on-going basis in two Canadian provinces, Alberta and British Columbia. This paper describes a PC/XT version of the British Columbia tourism model, and examines its forecasting capability using Exponential Smoothing and Box-Jenkins procedures.

TELECOMMUNICATIONS II

Chair: Hajime Myoken
Faculty of Economics, Nagoya City University, Nagoya 467, Japan

COMPARATIVE FORECAST PERFORMANCE OF ECONOMETRIC TELECOMMUNICATION DEMAND MODELS: SHORT-TERM ACTUAL VERSUS LONG-TERM ESTIMATED DATA

Jerry Langin-Hooper
Langin-Hooper Associates, Phillipsburg, New Jersey 08865, U.S.A.
John Ehlen, Peter Chung
GTE Telops Group, Irving, Texas 75038, U.S.A.

Forecasts of interstate telephone demand have played a critical role in long distance rate-making since 1984. Yet, consistent economic growth has created estimation problems for econometric demand models; multicollinearity has been especially severe. This analysis presents the improvement in the forecasts resulting from the use of much longer historical data series. Construction of pre-1984 data, improvements in estimated coefficient values, and results for prediction confidence intervals are included in the discussion. The conclusions compare forecast performance between the long-run estimated data basis and the short-run, but more concrete, data foundation of the models.

FORECAST PRODUCTION TRAINING FOR THE NON-EXPERT: THE BRITISH TELECOMMUNICATIONS PLC EXPERIENCE

Paul de Cintra
Economics Advisory Division, British Telecommunications PLC, London EC1A 7AF, United Kingdom

The aim of this paper is to outline the structure and methods used for forecast technique training in British Telecommunications PLC (BT). First the background to the corporate forecasting environment is explained and a description of the expertise of the average company forecaster outlined. An overview of the forecast production process is then given and the role of the trainer examined. Details of some of the techniques used to provide non-experts with an intuitive appreciation of the complex techniques recommended for corporate forecast production are then discussed. Finally, the implications of expert forecasting systems for technique training in this area are explored.

FORECASTING CIRCUIT COUNTS FOR SPECIAL SERVICES

Jack C. Lee, Nabil Ahmed, S. C. Horng
Statistics Research Group, Bell Communications Research, Morristown, New Jersey 07960, U.S.A.

"Special Services" is a generic term referring to all Bell Operating Company services offered other than ordinary message telephone services. Some examples are: private lines, WATS, etc. Data are in the form of monthly time series from many wire centers. In the proposed procedure we will first group the time series into several homogeneous clusters. Annual data, which could be of different lengths for different clusters depending on stationarity conditions, will then be used for forecasting purposes unless no homogeneous wire centers can be found within the cluster. Forecasting performance of the proposed method is compared favorably, via real data sets, with more than ten other methods including ARIMA, empirical Bayes and exponential smoothing.

APPLICATIONS AND ISSUES REGARDING ANALYSTS' FORECAST INFORMATION

Chair: Michael J. Gift
College of Business Administration, University of South Florida, Tampa, Florida 33620, U.S.A.

TRADING VOLUME VOLATILITY AND DISPERSION IN FINANCIAL ANALYSTS' FORECASTS

S. M. Khalid Nainar
Faculty of Business, McMaster University, Hamilton, Ontario L8S 4M4, Canada

This paper examines the relationship between accounting information as proxied by dispersion in financial analysts' forecasts and market volatility in its trading volume dimension. It is hypothesized that the dispersion in analysts' forecasts contributes to trading volume volatility but not excessively. The hypothesis is tested empirically using the GARCH framework of Bollerslev (1986). In particular, it is found that the coefficient for the DISP (dispersion in analysts' forecasts) variable in the variance equation of the GARCH model for trading volume on a monthly basis is positive and less than one, as hypothesized. Implications for finance and accounting research are noted.

MANAGEMENT VERSUS ANALYST'S FORECASTS OF EPS: TIMING AND COMPARATIVE ACCURACY

Michael J. Gift
College of Business Administration, University of South Florida, Tampa, Florida 33620, U.S.A.
Teri Lombardi Yohn
School of Business, Indiana University, Bloomington, Indiana 47405, U.S.A.

Prior literature regarding comparative accuracy of EPS forecasts by management and analysts has not clearly addressed the speed of adjustment in the analysts community to this new information release. Using a data base of individual analysts forecasts, we are examining the speed of the analyst's adjustment to management forecast releases and the relationship of that adjustment process to the comparative accuracy of the forecasting agents.

IBES INTERNATIONAL ESTIMATES

Michael Knoll
Lynch, Jones and Ryan, New York, New York 10014, U.S.A.

The international IBES data file is examined to determine whether the quantitative techniques used by U.S. asset managers could be as productive in other markets. Some U.S. uses are: (a) Valuation models, based on forecast growth, (b) Dividend discount models, using forecast EPS, (c) An identifier of possible future relative price, (d) Estimating forecast error or earnings surprise. Tests of (a) imply that the correlation between forecast growth and relative PE is strong in the U.S., U.K., Canada, Japan and other markets. Tests of (c) are very encouraging for the U.K. and Japan (significant excess returns from outlier rising forecasts).

SOCIOECONOMIC FORECASTING

Chair: Gerard Keijzers
Scientific Council for Government Policy, 2500 EA The Hague, The Netherlands

THE SIMULTANEOUS REALIZATION OF ENVIRONMENTAL AND SOCIOECONOMIC GOALS

Gerard Keijzers, Henk C. van Latestiejn
Scientific Council for Government Policy, 2500 EA The Hague, The Netherlands

In a recent study by the Netherlands Scientific Council for Government Policy entitled "Scope for Growth" an analysis is made of the possibilities for the simultaneous realization of environmental and socioeconomic goals on a national scale. The analysis is based on a dynamic linear programming model and the method of Interactive Multiple Goal Programming is used. The optimization procedure is applied to an 18-sector input-output model, extended with four pollution abating sectors. In an iterative process environmental and socioeconomic goals are optimized, resulting in a number of balanced growth scenarios. The study demonstrates a possibility to incorporate technical knowledge in an economic recovery. As a result the costs of pollution control are shown in trade-offs between the various socioeconomic and environmental goals. The method is useful to policy-makers by assisting them in solving complex decision problems.

TOWARD A SOCIOLOGY OF FORECASTING: PREDICTION OR SELF-FULFILLING PROPHECY?

Louis Gaydosh
William Paterson College, Florham Park, New Jersey 07932, U.S.A.

From the perspective of the sociology of knowledge, the concept of the "social construction of (social) reality" is developed. The interdependence of objective and subjective aspects of the institutional structure of society is analyzed, with particular attention to the role of ideational elements of the process of "(social) reality construction." The power of belief systems such as science to legitimate institutions and their supporting ideologies is explored. In this conceptual framework, forecasts of future social developments, especially scientifically-based forecasts, are not simply value neutral predictions, but can become self-fulfilling prophecies, helping to bring about the future they predict.

THE ALTERNATIVE WAYS OF SOCIAL DEVELOPMENT

Erzsébet Gidai
Hámán K. Ulitsa 70, 1096 Budapest, Hungary

In the course of the world economic crisis in the mid-1970s the alternative methods of socioeconomic development were analyzed again, and the ways of getting out of that crisis were also meant to revealle in the developed industrial states. In the socialist countries the protracted socioeconomic crisis in the 1980s has made the elaboration and forecasting of alternative social models, among them the reconsideration and clarification of the content of the socialist way of development, necessary. In this paper we deal with the analysis of the questions concerned. In the first part of it the theoretical and methodological problems of the alternative prognoses and the international comparative analysis are discussed; in the second part, the Hungarian ways of the development are analyzed.

SELECTION OF ALTERNATIVE FORECASTING METHODS

Chair: W. J. Selen
Department of Econometrics, Tilburg University, 5000 LE Tilburg, The Netherlands

A FORMAL PROCEDURE FOR SELECTING THE APPROPRIATE FORECASTING METHOD. PART I: METHODOLOGY

W. J. Selen
Department of Econometrics, Tilburg University, 5000 LE Tilburg, The Netherlands

Selecting the most appropriate forecasting method is not an easy task. Besides objective criteria such as procurement, maintenance and training costs, as well as forecast performance; subjective factors like complexity of the methodology in combination with management interpretability play an important role. In this research an earlier plant location model is modified to provide a selection procedure that incorporates both objective and subjective factors, which are evaluated, converted to consistent, dimensionless indices, and then combined to yield a formal "forecasting preference" measure. Finally, the subjective versus the objective factors are weighted differently in the decision process, out of which a sensitivity analysis for the selection of the "best" forecast procedure results.

A FORMAL PROCEDURE FOR SELECTING THE APPROPRIATE FORECASTING METHOD. PART II: COMPUTATIONAL ILLUSTRATION

Rudd Heuts
Department of Econometrics, Tilburg University, 5000 LE Tilburg, The Netherlands

The methodology for selecting the preferred forecasting method described in Part I is illustrated by means of a simple example. Objective decision criteria include procurement, maintenance and training costs; as well as the relative forecast accuracy, such as MAPE. Based on extensive earlier research regarding the assessment of subjective attributes of various forecasting methods, measures of "complexity" are used in assessing popular methods, such as exponential smoothing (AUTOCAST) and ARIMA modeling (AUTOBOX) and X-11-ARIMA-modeling. The relative forecast accuracy is measured by computing the MAPE for about twenty-five different data sets used with each method. The relevant cost figures used are hypothetical, but merely severe to illustrate the formal selection procedure. Finally, the selection procedure is extended with a mathematical programming model that includes minimum forecast accuracy and maximum budget constraints.

SELECTION RULES FOR EXTRAPOLATION METHODS

Fred Collopy, J. Scott Armstrong
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania 19104, U.S.A.

Rules for selecting the best extrapolation methods for specific situations were derived from studies of some of the world's leading academic experts and from some practicing forecasters. Direct assessments and protocol analyses were used. We examined rule conflicts among the academic experts, between academics and practicing forecasters, and between experts and the empirical literature. The validity of the rules was assessed using a wide variety of time series. Suggestions are provided on the procedures that are effective for identifying the best rules for a given situation. Generalizations are also made as to what rules might be expected to be best for a given situation.

THE ROBUSTNESS OF SOME CLASSIFICATION MODELS IN FORECASTING DELINQUENCIES OF CREDIT CARD ACCOUNTS

Kamal M. ElSheshai
Department of Decision Sciences, Georgia State University, Atlanta, Georgia 30303, U.S.A.

This study contrasts the following five classification models: linear discriminant analysis, probit, logit, integer programming, and inductive inference. The study examines the robustness of the models in response to variations in sample size and number of explanatory variables. The models are evaluated based on their predictive classification of accounts in a credit-card portfolio. Accounts are classified into good and bad risk categories. A good risk account is one which remains current, while a bad risk account is one which is written off due to personal bankruptcy or severe delinquency.

MULTIVARIATE TIME SERIES: APPLICATIONS II

Chair: Kent Stevens Larson
Institute of Mathematical Statistics and Operations Research, Technical University of Denmark, DK-2800 Lyngby, Denmark

ARIMA AND VAR FORECASTS OF NONCONTROLLED FACTORS IN BANK RESERVES FOR OPEN MARKET OPERATIONS

T. H. Lai
Department of Economics and Finance, Liberty University, Lynchburg, Virginia 24506, U.S.A.

In defensive open market operations, the Federal Reserve, first, forecasts the noncontrolled factors in bank reserves, such as float and currency in circulation, and then, through open market purchases and sales to offset the net change of these factors in order to achieve its reserves target. The Federal Reserve is currently using regression and simple time series methods in forecasting individual noncontrolled factors, and sum them together to obtain the aggregate forecast. This study employs the univariate autoregressive integrated moving average (ARIMA) and vector autoregression (VAR) methods to forecast directly the aggregate non-controlled factor in bank reserves, and compares the forecast accuracy of this approach with that of the Federal Reserve.

APPLICATION OF SPECTRAL ANALYSIS AND FILTERING PROCESSES ON AIRLINE TIME SERIES

Wolfgang Millin
Deutsche Lufthansa Aktiengesellschaft, D-5000 Koeln 21, Federal Republic of Germany

The paper deals with the application of spectral analysis and filtering methods to analyse and model time series, which are taken from airline data base. After examination of stochastic processes with respect to their covariances and correlation functions, a change of view from the time-domain to the frequency-domain will show rewarding insights into time series vis a vis their cyclical behavior. After introducing filtering and estimates of the spectral density of an univariate series a more complex multivariate series will be examined: the passenger demand function of an individual airline and an airline market. This empirical application of cross-spectral analysis will try to answer questions like: 1) Can the cycles within the series be compared? 2) Are there any lead-lag relationships? and 3) Are the Series synchronized? These models can be helpful in marketing research and decision problems to develop strategies on expanding market-shares and decision on seasonal aspects (tourism, business travel, hotel, car rentals, etc.).

EMPIRICAL CAUSAL MODELING OF ITALIAN FEMALE LABOUR MARKET

Giuliana Passamani
Dip. Scienze Statistiche, University of Padova, 33-35121 Padova, Italy

The aim of the paper is to give a somewhat useful insight into the working of the relationships among some variables which we retain important for modeling the female labour market at the aggregate level. According to some results obtained recently by analysing together some price variables (e.g., hourly wages, consumer's price index, bank rate) with some variables taken as indicators of the tension in the labor market, we came to the conclusion that the cause and effect relationships are not clearly definable by a simple regression analysis and that they need a deeper empirical analysis in order to be able to assert them. The approach we adopt is that suggested by Hsiao (1982), that is the use of autoregressive modeling of a vector of variables in order to have a better understanding of the causal ordering among the variables of interest. Particular attention will be given to the problem of detrending and seasonally adjusting the time series used for the empirical analysis.

SEASONALITY II

Chair: Joel Fingerman
Department of Management, Roosevelt University, Chicago, Illinois 60605, U.S.A.

AMPLITUDE- AND PHASE-CHARACTERISTICS OF SEASONAL ADJUSTMENT PROCEDURES

Winfried Stier
University of St. Gallen, CH-9000 St. Gallen, Switzerland

For some of the most widely used seasonal adjustment procedures the filter-properties (amplitude- and phase-characteristics) are not know. This is mostly due to the fact that they contain non-linear procedures which make it hard or even impossible to derive them analytically. Besides that, it is sometimes not easy for "outsiders" to understand adjustment procedures in all details. In this paper it is shown how they can be derived quasi-experimentally. This is of a highly practical interest, since they mostly are not known for the most recent adjusted values which are used for diagnosis and forecasting.

AUTOCORRELATION ANALYSIS AND THE AUTOMATIC DETERMINATION OF SEASON LENGTH

David R. Vogt
Concentric Data Systems, Green Bay, Wisconsin 54301, U.S.A.

Autocorrelation analysis is widely used in the detection of regularly recurring patterns, such as those associated with seasonality. It has been shown that once season length is correctly determined, calculation of seasonal factors is one of the strongest features of forecasting techniques based on univariate time series analysis. This paper describes a methodology that automatically determines season length. Particular attention is paid to examples where trend and level changes tend to mask underlying seasonal patterns. This methodology is incorporated in the TrendSetter line of micro-computer based forecasting products that supercedes the former Wisard product line.

SERIAL AVERAGING OF SEASONAL INDICES

Richard Withycombe
Department of Management, University of Montana, Missoula, Montana 59812, U.S.A.

A modification to the classical decomposition method of seasonal adjustment is proposed, whereby the seasonal index for each month is averaged with the month before and after. This averaging is predicted on the hypothesis that whatever is causing the seasonality does not act on each month independently, but may be displaced or spread over several months. For example, hot weather may arrive in July one year and June the next. Preliminary tests are made by comparing ten monthly forecasts for thirteen products. Averaged indices yield lower MSEs for eleven of the thirteen.

EXCHANGE RATES

Chair: Carlos Samur
Department of Corporate Development, Petro-Canada, Calgary, Alberta T2P 3E3, Canada

A PROBABILISTIC APPROACH TO FORECASTING EXCHANGE RATES

Carlos Samur
Department of Corporate Development, Petro-Canada, Calgary, Alberta T2P 3E3, Canada

Uncertainty about future levels of the Canada/U.S. exchange rate imposes substantial risks on business and decision-makers in Canada. Despite wide recognition of both the uncertainties and risks involved, the most common procedure in forecasting exchange rates still is the use of single-line projections based on "informed" judgement or formal modeling approaches which strongly rely on historical trends. The main thesis of this paper is that, given the uncertainty surrounding the prospective evaluation of exchange rates, such an approach provides a weak basis for both understanding the forecasts that are most likely to drive future movements in the Canada/U.S. exchange rate and for explicitly incorporating into the analysis the uncertainties that permeate any assessments of the future behaviour of those driving forces. An alternative probabilistic approach, based on recent developments in the theory of Decision Analysis, open new possibilities that explicitly incorporates risk into the evaluation of the impact of alternative paths of the Canada/U.S.A. exchange rate on corporate decisions.

PURCHASING POWER PARITY IN THE SHORT AND LONG RUN: A REAPPRAISAL OF THE POST-1973 EVIDENCE

D. M. Nachane
Department of Economics, University of British Columbia, Vancouver, British Columbia V6T 1W5, Canada
A. Chrissanthaki
Statistical Division, European Communities, Luxembourg

In this paper an attempt is made to separate the short-run and long-run aspects of the Purchasing Power Parity (PPP) relationship, using the techniques of Bank Spectral regression and Cointegration, for eight industrialized countries. The long-run PPP is first tested for all the eight countries with reference to their nominal bilateral exchange rates vis-a-vis the U.S. dollar. For five European currencies, the analysis is repeated with respect to the German DM, with a separate consideration of the post-EMS period. In the concluding sections, possible reasons for PPP deviations are examined.

EXPLAINING THE BEHAVIOR OF THE EXCHANGE RATE IN LEBANON: A MONETARY APPROACH

Pierre Abou-Ezze
Department of Economics, University of Ottawa, Ottawa, Ontario K1N 6N5, Canada

Ever since the flexible exchange rate regime became the pertinent regime in most countries, a considerable amount of research has been conducted to explain the change in the exchange rates. The empirical performance of most exchange rate models has been cast with a considerable amount of doubt and skepticism. The objective of this paper is to see what model of exchange rate determination can explain the recent rapid and accelerating depreciation of the Lebanese pound. Added to the existing models a modified flexible-price monetary model that takes account of the phenomenon of currency substitution which constitutes the main argument in the demand for money function.

FUTURE OF SOFTWARE (PANEL)

Chair: Kenneth J. White
Department of Economics, University of British Columbia, Vancouver, British Columbia V6T 1W5, Canada

Participants: Seth A. Greenblatt
Sorites Group, Ltd., Springfield, Virginia, U.S.A.
David Reilly
Automatic Forecasting Systems Company, Inc., Hatboro, Pennsylvania 19040, U.S.A.
Charles Smart
Smart Software, Inc., Belmont, Massachusetts 02178, U.S.A.

This panel will discuss dimensions of software development relating to forecasting methods, with particular emphasis on the future directions which such developments are expected to take.

WEATHER AND CLIMATE FORECASTING

Chair: Allan H. Murphy
Department of Atmospheric Sciences, Oregon State University, Corvallis, Oregon 97331, U.S.A.

MULTIVARIATE VERSUS UNIVARIATE AUTOREGRESSIVE FORECASTS OF WEATHER VARIABLES

Nirmal Pugh
MSAE, Fairfield, Iowa 52556, U.S.A.
Kenneth L. Cavanaugh
Department of Management and Public Affairs, Maharishi International University, Fairfield, Iowa 52556, U.S.A.

In this paper we compare the short-term forecasting performance of multivariate and univariate autoregressive models of daily average temperature, air pressure, and wind velocity. The order of the univariate and vector autoregressive models is determined through minimization of the Akaike Information Criterion (AIC) and models are estimated by maximum likelihood. Comparison of forecasts of the deviation of the weather variables from their long-term average for that day indicate that the multivariate model provides better forecasts over horizons of 1, 2, 3, and 7 days as measured by the Mean Squared Error (MSE) and Mean Absolute Error (MAE) of forecasts. Examination of Theil's U Statistic, however, reveals that, with the exception of multivariate forecasts of wind velocity, both multivariate and univariate forecasts for more than one day ahead are inferior to the random-walk forecast of no change in each series. We also decompose the MSE into bias, regression, and disturbance proportions to look for evidence of systematic forecast errors.

THE SECULAR TIME SERIES AND SOME POSSIBILITIES OF USING THEM FOR LONG-TERM FORECASTING IN MIDDLE EUROPE

V. Bruzek
Czech Hydrometeorological Institute, 151 29 Praha 5 – Smichov, Czechoslovakia

Temperature time series of Prague-Klementinum (1771-1987) and precipitation in Bohemia (1876-1987) are searched by using a method of integral curves. So the increasing and decreasing trends were obtained. The cold and warm or dry and wet epoches were determined by these trends. The forecast rules concerning three temperature and precipitation categories were formed: below normal, normal, and above normal. Also the correlation connections among the meteorological parameters together with the sun activity were studied and so-called "forecast point graphs" were constructed. The linear regression was used too. The obtained conclusions can be applied for the estimation of the future temperature and precipitation character of a new months and probably of several years.

THE MEAN GENERAL ATMOSPHERIC CIRCULATION AND THE MEDIUM- AND LONG-RANGE WEATHER FORECASTING

V. Seifert
Czech Hydrometeorological Institute, 151 29 Praha 5 – Smichov, Czechoslovakia

Problems connected with the interpretation of various numerical weather forecasting models (ECMWF, DWD, NMC) for the medium-range weather forecasts in the central Europe. A possibility to use mean grid-charts of previous periods for medium- as well as long-range (monthly) weather forecasts. A possibility to use the orientation of the mean polar vortex axis for the forecast of monthly temperature and precipitation characteristics. The pressure anomalies between 5-days grid mean charts and their influence for the future general atmospheric circulation. Possible links between tropical sea-surface temperature anomalies and seasonal temperature characteristics in Bohemia.

LIST OF CHAIRPERSONS AND SPEAKERS

The sessions are presented in this program book as follows:

	Session	Time	Pages
Keynote Sessions			
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Tuesday	TKEY	(8:30 – 9:30)	14-15
			Pages
Regular Sessions			
Monday	MB	(10:00 – 12:00)	21-32
	MC	(2:00 – 3:30)	33-44
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Tuesday	TB	(10:00 – 12:00)	57-68
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Wednesday	WA	(8:30 – 10:00)	87–98
	WB	(10:30 – 12:00)	99–110

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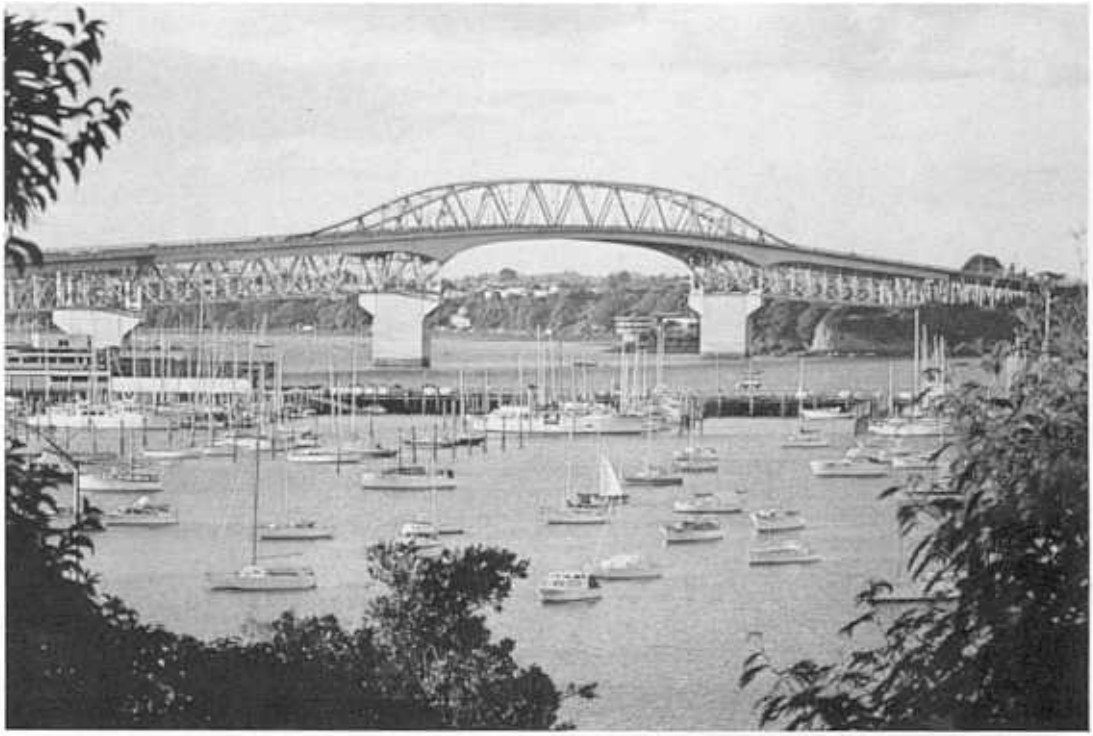

For further information concerning this symposium, please contact:

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University of Auckland
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Dr. Lilian Wu
IBM Research Division
T.J. Watson Research Center
Yorktown Heights, New York 10598, U.S.A.
Telephone: 914-945-2930
Fax: 914-945-2141
Bitnet: WUL@YKTZMX