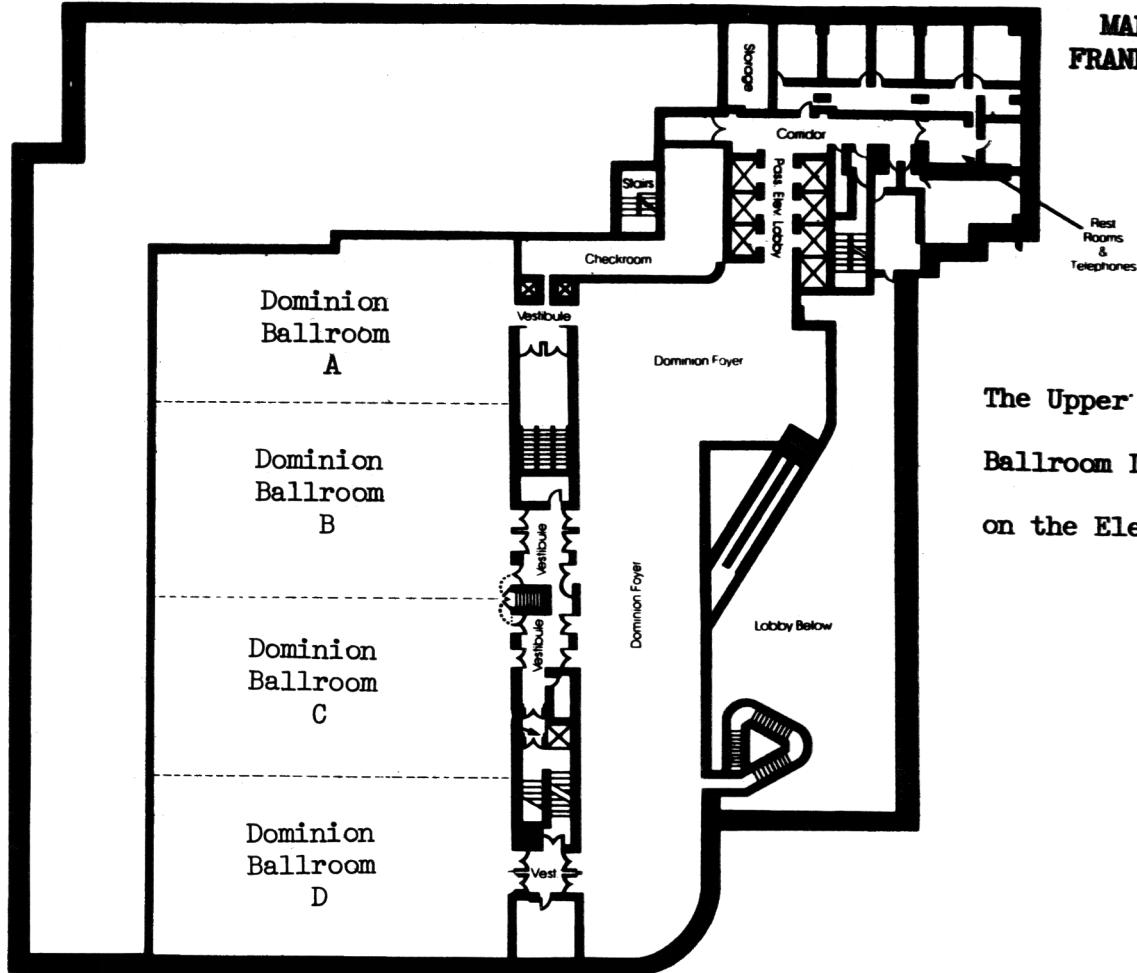


**Theme:  
Pragmatic Research  
PHILADELPHIA  
June 5-8  
1983**

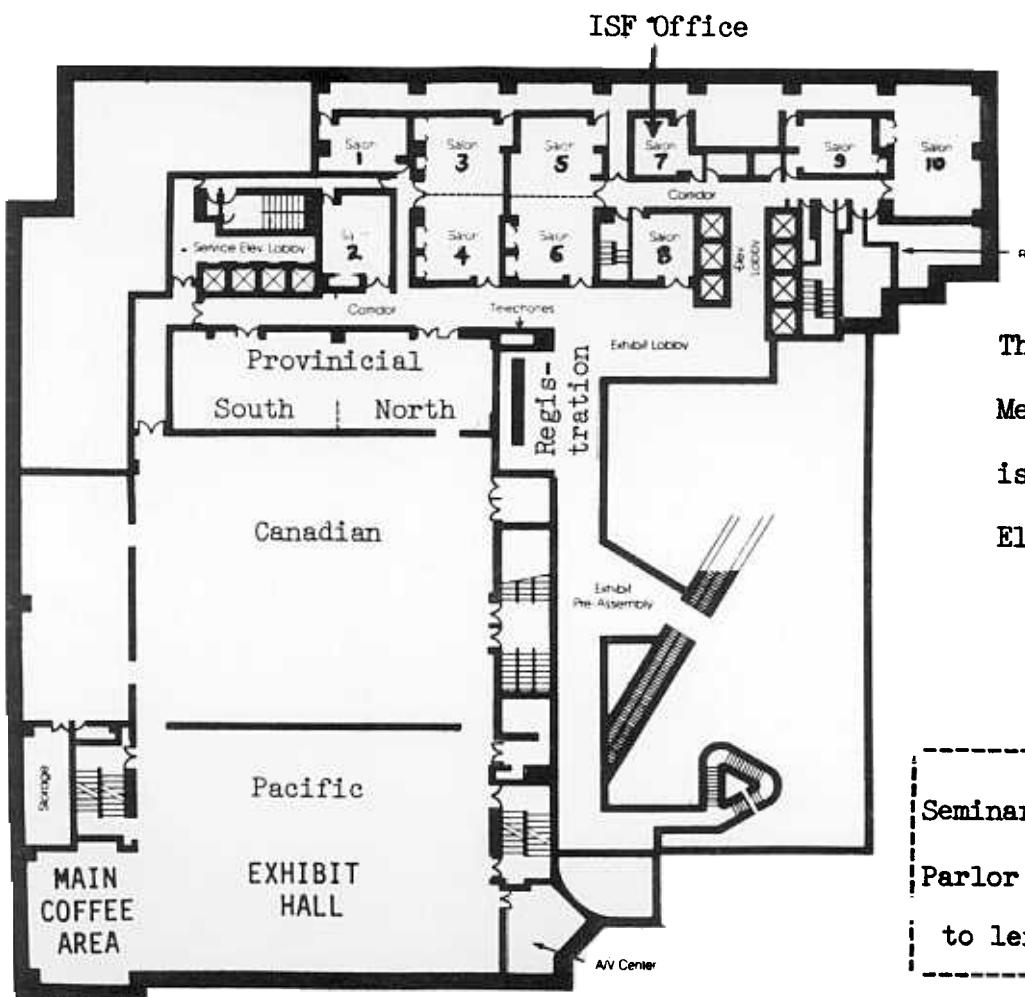
**The Third  
INTERNATIONAL  
SYMPOSIUM  
ON FORECASTING**

**PR**

MAP OF THE  
FRANKLIN PLAZA



The Upper or Dominion Ballroom Level is "B" on the Elevator.



The Lower or Mezzanine Level is "M" on the Elevator.

Seminar Rooms (1st Floor)  
and  
Parlor Rooms (2nd Floor)  
to left from elevators

ISF SCHEDULE: JUNE 5-8, 1983

<u>Day</u>	<u>Time</u>	<u>Event</u>	<u>Location</u>	<u>EXHIBITS OPEN</u>
SUNDAY (June 5)	1:00 pm	Registration Opens	Foyer	I
	8:00-10:00 pm	Welcoming Party	Canadian Hall	
MONDAY (June 6)	8:30-9:30 am	Keynote Speech by Baruch Fischhoff	Dominion Ballroom A	
		Keynote Speech by Robert U. Ayres	Dominion Ballroom D	
	9:30-10:00	Coffee Break	Pacific Hall	I
	10:00-11:30	Panel: Input-Output	Dominion Ballroom A	
	"	Chaired Sessions	All Meeting Rooms	
	11:30-12:45	Luncheon (ticket required)	Dominion Ballroom B&C	
	12:45-1:45 pm	Keynote Speech by Lawrence R. Klein	Dominion Ballroom D	
	2:00-3:30	Panel: Judgmental	Dominion Ballroom A	
		Chaired Sessions	All Meeting Rooms	
	3:30-4:00	Coffee Break	Pacific Hall	
	4:00-5:30	Keynote Speech by Hillel J. Einhorn	Dominion Ballroom D	
		Panel: Strategic Planning	Provincial South	
		Chaired Sessions	All Meeting Rooms	
TUESDAY (June 7)	8:30-9:30 am	Keynote Speech by Robert G. Brown	Dominion Ballroom A	
		Keynote Speech by Robert L. Winkler	Dominion Ballroom D	
	9:30-10:00	Coffee Break	Pacific Hall	I
	10:00-11:30	Panel: Econometric Methods	Dominion Ballroom A	
		Chaired Sessions	All Meeting Rooms	
	11:30-12:45	Luncheon (ticket required)	Dominion Ballroom B&C	
	12:45-1:45 pm	Jenkins Memorial Lecture by George E.P. Box	Dominion Ballroom D	
	2:00-3:30	Panel: Univariate Time Series	Dominion Ballroom A	
		Chaired Sessions	All Meeting Rooms	
	3:30-4:00	Coffee Break	Pacific Hall	
	4:00-5:30	Keynote Speech by Donald T. Campbell	Dominion Ballroom D	
		Panel: Forecasting Natural Resources	Provincial South	
		Chaired Sessions	All Meeting Rooms	
	6:00-8:00	University Museum Wine Party (Buses leave Franklin Plaza starting at 5:30.)	U. of Pennsylvania Museum 33rd & Spruce Streets	
WEDNESDAY (June 8)	8:30-9:30 am	Keynote Speech by Rudolf E. Kalman	Dominion Ballroom A	
		Keynote Speech by Spyros Makridakis	Dominion Ballroom D	
	9:30-10:00	Coffee Break	Pacific Hall	I
	10:00-11:30	Panel: Seasonal Adjustments	Dominion Ballroom A	
		Chaired Sessions	All Meeting Rooms	
	11:30-12:00	Coffee Break	Pacific Hall	
	12:00-1:30 pm	Panel: Multivariate Time Series	Dominion Ballroom A	
		Chaired Sessions	All Meeting Rooms	



ISF 83 is sponsored by the  
**INTERNATIONAL INSTITUTE  
OF  
FORECASTERS**



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**OBJECTIVES**

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The International Institute of Forecasters is a non-profit organization devoted to unifying the field of forecasting. IIF brings together, from all nations, decision makers, forecasters, and researchers involved with forecasting in the management, social, engineering and behavioral sciences.

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**BENEFITS**

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IIF provides information on:

- new forecasting methods
- assessments of forecasting methods
- data sources
- computer programs
- methods to assess uncertainty in forecasts
- uses and abuses of forecasting
- ways to implement new forecasting methods
- methods to gain acceptance of forecasts

IIF currently has two major vehicles for providing information:

- The *Journal of Forecasting* (received by all members)  
The International Symposium on Forecasting (held each year)

---

**DIRECTORS**

---

J. Scott Armstrong, Wharton School, U. of Pennsylvania,  
Phila, PA 19104 **U.S.A.**

Robert Carbone FSA, U. of Laval, Québec G1K 7P4  
**CANADA.**

Robert Fildes, Manchester Business School,  
Manchester M15 6PB, **ENGLAND.**  
Spyros Makridakis, INSEAD, 77305 Fontainebleau,  
**FRANCE.**

---

**FOUNDING PARTNERS**

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- School of Engineering, Bosphorous University, Istanbul, **Turkey**
- IMEDE, Lausanne, **Switzerland**
- INSEAD, Fontainebleau, **France**
- Faculte des sciences de l'administration, Universite Laval, Quebec, **Canada**
- Manchester Business School, Manchester, **England**
- The Wharton School, University of Pennsylvania, Philadelphia, **U.S.A.**

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**ISF 84**

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The Fourth International Symposium on Forecasting will be held  
in London, England on July 8-11, 1984  
at the London Business School

sponsored by the **International Institute of Forecasters**  
in collaboration with the Manchester Business School

Send abstracts of *not more than 100 words* to:

Robert Fildes, Manchester Business School, Manchester M15 6PB, England  
Telephone 61-273-8228 Telex 66 8354

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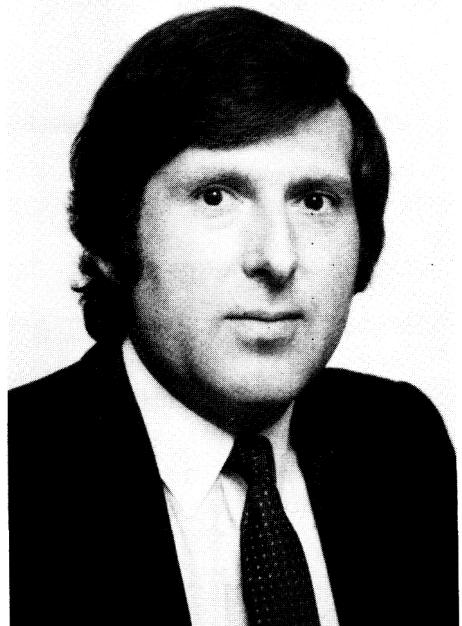
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ISF 83: ORGANIZING COMMITTEE

---



J. Scott Armstrong  
General Chairperson



Robert Carbone  
Administrative Chairperson



Ralph P. Day  
Local Arrangements Chairperson



Edward J. Lusk  
Program Co-Chairperson



## THE THIRD INTERNATIONAL SYMPOSIUM ON FORECASTING

Theme: "Pragmatic Research"  
PHILADELPHIA, PA.  
June 5-8, 1983

**General Chairperson**

J. Scott Armstrong  
Wharton School  
U. of Pennsylvania  
Philadelphia, PA 19104  
Tel: (215) 898-5087

**Program Co-Chairperson**

Edward J. Lusk  
Wharton School  
U. of Pennsylvania  
Philadelphia, PA 19104  
Tel: (215) 898-8296, or  
(215) 898-5112

**Administrative Chairperson**

Robert Carbone  
Faculté des Sciences  
de l'administration  
Université Laval  
Québec, Canada G1K7P4  
Tel: (418) 656-2057

**Local Arrangements Chairperson**

Ralph P. Day  
Weightman Advertising  
1818 Market Street  
Philadelphia, PA 19103  
Tel: (215) 561-6100

### MESSAGE FROM THE GENERAL CHAIRPERSON

On behalf of the ISF 83 organizing committee and the International Institute of Forecasters, I welcome you to Philadelphia and to the Third International Symposium on Forecasting. This meeting is the largest gathering of forecasters ever held.

The Symposium brings together academicians and practitioners from different countries, different organizations, and different fields in the hope that we may learn from one another. You are an eclectic group! We are proud and honored that so many world-renowned forecasters have come to this symposium.

Our theme, "Pragmatic Research," underlines the need for us to address real and important problems in a way that can be understood by practitioners. Improved forecasting can help to improve efficiency, reduce waste, and minimize potential conflicts. It can help to create a better future.

I am impressed by the quality of the papers that have been submitted and hope that many of them will be published in the Journal of Forecasting.

The Organizing Committee thanks the hundreds of people who have helped us, especially our collaborators at the Wharton School and the session chairpersons.

We hope that you find this to be an enjoyable and "pragmatic" experience.

J. Scott Armstrong  
General Chairperson, ISF 83

**Convention Hotel  
Franklin Plaza**

Sponsored by  
**The International Institute of Forecasters**  
in collaboration with the Wharton School, U. of Pennsylvania



C I T Y        O F        P H I L A D E L P H I A

WILLIAM J. GREEN  
MAYOR

January 28, 1983

Mr. J. Scott Armstrong  
General Chairperson  
The Third International  
Symposium on Forecasting  
The Wharton School  
University of Pennsylvania  
Philadelphia, PA 19104

Dear Mr. Armstrong

On behalf of the Philadelphia City Government and the residents of Philadelphia, I welcome the delegates of the THIRD INTERNATIONAL SYMPOSIUM ON FORECASTING.

We are very honored to have such a diverse and prestigious group hold its convention in our fine city and especially when it is the first time that they have met in the United States.

Philadelphia is the birthplace of America. We are very proud of our City, particularly in the way that it gracefully blends the old with the new.

I am sure that Philadelphia will be a memorable experience for all of your attendees.

Sincerely,

*William J. Green*  
William J. Green  
Mayor

Registration

The registration desk is located on the Lower (Mezzanine) Level of the Franklin Plaza Hotel. Desk hours are:

Sunday, June 5, 1:00 pm - 10:00 pm  
Monday, June 6, 7:30 am - 6:00 pm  
Tuesday, June 7, 7:30 am - 6:00 pm  
Wednesday, June 8, 7:30 am - 2:00 pm

Conference aides will be available throughout the Symposium to provide assistance and to answer your questions.

Badges

Your ISF 83 badge serves as a pass for all program sessions, exhibits, and special events. Security personnel will be monitoring admissions so PLEASE WEAR YOUR BADGE AT ALL TIMES WHILE IN THE CONVENTION AREA.

Check-Out Regulations (Plans I and II)

Before leaving, all delegates registered under Plan I or Plan II (full or modified) must go to the checkout counter of the hotel where they are staying. You may request a late checkout time at your hotel.

Delegates are personally responsible for expenses not covered under Plan I or II and charged to their room. Meals taken at locations other than those designated are not covered.

Message Center

The Message Center is located near the registration area on the Lower (Mezzanine) Level. A bulletin board will be provided for personal messages.

Announcements or changes in program scheduling will be posted at the Message Center.

Public Telephones

Telephones are located on the Entrance Level, Lower (Mezzanine) Level, and Upper (Ballroom) Level of the Franklin Plaza (and noted on the map included on the inside front cover of this program).

Copying Services

Copying services can be purchased at the ISF 83 Office in Salon 7, Lower (Mezzanine) Level.

## ADMINISTRATIVE DETAILS

### International Institute of Forecasters (IIF)

Booth 54 in the Exhibit Hall is the center for information on IIF. Memberships, which include a subscription to the Journal of Forecasting, can be obtained here. Information on the Fourth International Symposium on Forecasting (ISF 84), which will be held in London on July 8-11, 1984, is also available.

### Additional Copies of Program Book

Additional copies of this Program Book are available at the ISF 83 Office for \$5.00. After the conference, copies may be purchased by writing to J. Scott Armstrong, Wharton School, U. of Pennsylvania, Phila., Pa. 19104. Include a check for \$7.50 payable to ISF 83 for the book plus postage and handling.

### Audiocassettes

Cassettes will be available for many of the keynote speeches, panels, and sessions. These tapes can be purchased in the lobby near the registration desk (Mezzanine Level) about  $\frac{1}{2}$  hour after the session ends. Proceeds from these sales help to offset the costs of the symposium and to contribute to other non-profit activities by the International Institute of Forecasters.

### Coffee Breaks

Coffee, tea, and soft drinks will be available in the Exhibit Hall (Pacific) and other locations at the mid-morning and mid-afternoon breaks on all three days of the symposium.

### Meals

The following meals are included for those registered under Plan I and II. (Bring your meal tickets.)

#### Breakfast: June 6, 7, and 8, 1983

Breakfast will be provided at your hotel in an assigned area from 7:00-8:30 am.

#### Lunch: June 6 and 7, 1983

Lunches will be held in the Dominion Ballroom at the Franklin Plaza Hotel at 11:30

#### REMEMBER TO BRING YOUR MEAL TICKETS!!

For those registered under Plan III or IV, lunch tickets may be purchased for \$20 at the registration desk (space permitting).

WELCOME TO PHILADELPHIA BLOCK PARTY

Sunday, June 5, from 8:00-10:00 pm  
at the  
FRANKLIN PLAZA HOTEL, Canadian and Pacific Halls  
(Admission by Badge Only)

All registrants and exhibitors are invited to attend the welcoming reception. The Philadelphia Block Party provides a glimpse of Philadelphia's diverse neighborhoods, its local foods, including soft pretzels, hoagies, beer and wine, its special street entertainment and a Mummers String Band. A fortune teller will help you forecast your future. The Exhibit Hall will be open at this time. The objectives of this session are to greet old friends and to make new ones. In particular, if you are a speaker on the program, try to meet your chairperson and the other speakers in your session.

UNIVERSITY MUSEUM COCKTAIL PARTY

Tuesday, June 7, from 6:00-8:00 pm  
at the  
University Museum, University of Pennsylvania  
33rd and Spruce Streets, Philadelphia  
(Admission by Badge Only)

The Wharton School of the University of Pennsylvania invites exhibitors and Plan I, II, and III registrants to a wine and cheese reception in the Museum's Chinese Rotunda and Upper Egyptian Gallery. The University Museum is one of the world's leading institutions for the study of ancient civilizations. Seven galleries will be open for you throughout the reception. Among the treasures is the world's second largest crystal ball.

Buses will pick you up outside the Franklin Plaza Hotel beginning at 5:30 and will take you back to the Franklin Plaza following the reception. The last bus will depart at 8:30 pm.

Day session registrants can purchase tickets for \$10.00 at the registration desk.

Guest tours, for those Plan II registrants who have signed up, will depart from the Franklin Plaza Hotel. Wear your badge. If space allows, extra guest tickets may be purchased at the registration desk. ISF 83 assumes no liability of any kind in connection with these tours.

Monday, June 6

Fairmount Park and Art Museum Tour: lunch included

Departs 9:30 am

Returns 12:30 pm for lunch  
(extra guest charge: \$15)

Tuesday, June 7

Day-in-the-Country Tour: Longwood Gardens and Brandywine River Museum, lunch included

Departs 9:30 am

Returns 5:00 pm  
(extra guest charge: \$30)

PHILADELPHIA

Philadelphia offers many things for you to do and to see. Preparations have been going on for 300 years since William Penn sailed up the Delaware River in 1682 and became the founder of the City of Philadelphia, the City of Brotherly Love. It was in Philadelphia that the Liberty Bell rang out in 1776 to proclaim America's liberty and freedom.

We urge you to take time to explore some of Philadelphia's many attractions, including its museums, theatre, professional baseball and basketball, ballet, music, restaurants, stores, and historic landmarks such as Independence Hall, the Liberty Bell Pavilion, First Bank of the United States, and Franklin Court. Write-ups of three self-guided walking tours are available at the registration desk (Historical Park Walking Tour, "Old City" Walking Tour, and Society Hill Walking Tour). Incidentally, it is also the home of the Wharton School, the oldest collegiate school of management in the U.S.A. and part of the University of Pennsylvania, founded by Benjamin Franklin.

The Philadelphia's Visitors Center, at 1525 John F. Kennedy Blvd. (Phone - 568-1976), is within easy walking distance of the hotels. It is open daily from 9-5 and provides many services including free maps, guide books, information on events around town, and information about special services to meet the needs of foreign visitors. For a daily listing of events in Philadelphia, call 568-7255.

Philadelphia is an exciting place to visit. Enjoy yourself!

#### ACKNOWLEDGMENTS

The ISF 83 Committee would like to thank the many people who helped. In particular, we thank ...

*Kay A. Armstrong*, for general organizational help (and those PERT charts!), for help in organizing the exhibitors program, for arranging the social program, for advice on communications and promotion, and for the many other details in acting as the ISF 83 business manager.

*Caroline Browne*, for her patience, understanding, help with word processing.

*William D. Busch*, Manager of Wharton Reprographics, for advice and for handling a year of "rush jobs" for duplication.

*Rocco Camilli and Mary Tragus*, of the U. of Pennsylvania Publications Office, for advice on the design of the brochures and of the program.

*Donald C. Carroll*, Dean of the Wharton School, for providing the wine and cheese party at the University Museum, and for providing support staff in many key areas.

*Joy Gomez and Franni Lundy*, of the Wharton School, handling the money that came and went.

*Tim Herron*, for photography in our brochure

*Thomson M. Kuhn*, of the Wharton School, for handling the audio-visual needs of the program.

*Cathy Lasowski*, for editorial assistance.

*Jocelyne Lessard, Michel Marcotte, Martine Vaillancourt, and Ginette Carrier*, from Université Laval, for assisting the Administrative Chairperson in designing and operating the registration information system.

*Mark Levenson*, of the Wharton News Office, for handling the publicity.

*Regina H. Loro*, for prompt and accurate typing service, as well as for helping to improve the program design, and reducing the number of errors made by the General Chairperson.

EXHIBITORS

EXHIBIT AREA: Franklin Plaza Hotel Pacific Hall  
(Admission by Badge Only)

EXHIBIT HOURS:	Sunday	8:00 pm - 10:00 pm
	Monday	9:30 am - 4:00 pm
	Tuesday	9:30 am - 4:00 pm
	Wednesday	9:30 am - 2:00 pm

EXHIBITORS (LISTED IN ALPHABETICAL ORDER)

*AMERICAN SOFTWARE, INC.*  
443 East Paces Ferry Road  
Atlanta, Georgia 30305  
(404) 261-4381

BOOTH 2

American Software provides proprietary software packages for sales forecasting, inventory management, manufacturing management, and purchasing and materials management. All of these systems can be delivered separately or integrated with one or more of the other systems. These systems are available in both batch and on-line versions. American Software's Sales Forecasting system includes three standard systems; Basic Forecasting, Item Forecasting, and Product Group and Item Forecasting. These systems may be classified as single level systems or multiple level systems. Our systems have been installed on IBM mainframes and plug compatible models.

*AT&T*  
295 North Maple Avenue  
Basking Ridge, New Jersey 07920  
(201) 221-7730

BOOTH 4

STATLIB is an evolving interactive system with a variety of forecasting tools. Widely used throughout the Bell System, it provides users with a powerful, flexible facility that can solve a wide range of problems. STATLIB is a system written by practitioners for practitioners.

The system can be used to analyze seasonality, detect trend, uncover relationships, create regression models, and generate forecasts with associated confidence limits. Some of the available techniques are X-11, SABL, Wiener Filter, ARIMA (Box-Jenkins) modeling, and regression routines including generalized least squares, robust, two-stage least squares and pooled (time-series) cross-sectional).

EXHIBITORS

*CHASE ECONOMETRICS/INTERACTIVE DATA*  
486 Totten Pond Road  
Waltham, Massachusetts 02154  
(617) 890-1234

BOOTHES 26 & 27

Chase Econometrics/Interactive Data Corporation, the leading supplier of Financial and Economic Data and Forecasts, will introduce micro-computer access to both financial and economic databases and menu-driven access to forecast models at the ISF. As part of its micro mainframe strategy, CE/IDC is using the micro computers to provide users with easier access to financial and economic data and with simplified access to a variety of mainframe applications. Two types of data access products will be featured: one designed for users familiar with "calc" products and a second designed for naive users.

CE/IDC will also have staff on hand to answer questions about the full range of data and services available.

*ELSEVIER SCIENCE PUBLISHING CO., INC.*  
52 Vanderbilt Avenue  
New York, New York 10017  
(212) 867-9040

BOOTH 11

A selection of North Holland and Elsevier books and journals in planning and forecasting will be shown at the Elsevier booth.

Featured will be Technological Forecasting and Social Change, the acclaimed international journal offering original research which emphasizes the interaction of technology with the social, behavioral, and environmental aspects of strategic planning. The diverse scope of the journal serves professionals in a variety of disciplines including corporate strategic planning, industrial and systems engineering, risk analysis, impact assessment, economics, policy analysis, and management. Comprehensive coverage, distinguished international contributors, and a multidisciplinary approach have made TFS a major worldwide forum for those who use technological forecasting and futures studies as planning tools in decision-making. (Sample copies available at the booth.)

**EXHIBITORS**

**EUROMETRICS RESEARCH ASSOCIATES, LTD.**  
55 rue des Belles Feuilles  
76016 Paris, France  
(1) 553-0874

**BOOTH 17**

The EZ Econometric Software System is designed to help economists build mathematical (econometric) models of the economy and to use those models for forecasting and analysis. The EZ System manages the two databases which are needed for this work: statistical data on the economy (like the inflation rate or the unemployment rate) and another file which describes the model that the economist is building (the model documentation file).

The EZ Econometric Software System has been adapted from mainframe computers to the Victor 9000 microcomputer. It is sold as a two diskette system with complete program documentation, an example model/database, and all supporting utilities. No computer experience is needed to operate EZ: The diskettes are simply inserted into the Victor and the machine is turned on. The display always indicates all of the possible choices at any point in time, and the user simply enters his selection by touching one key or by "pointing" on the screen. The Master Applications Control Program replaces the normal operating system.

EZ is available from Eurometrics Research Associates, Ltd., 2138 Biscayne Blvd., Miami, Florida, 33137.

**FROST & SULLIVAN, INC.**  
106 Fulton Street  
New York, N.Y. 10038  
(212) 233-1080

**BOOTH 18**

Frost & Sullivan publishes two to four hundred-page industry forecasts of European, American or World markets prepared by industrial consultants. Each report includes a forecast of market size by product, market share by company and by end use, and financial developments. The European and other non-American reports are organized by country. The reports analyze selected segments of the data processing, communications, plastics, food, pollution, instrumentation, medical, aerospace, oceanography, optics, paper, education, energy, chemical, consumer products, leisure time, financial services and transportation industries, among others.

Frost & Sullivan also forecasts political risks to multinational business in over 70 countries as the World Political Risk Forecast (WPRF) service, individual country reports and a monthly newsletter. These services are used by planners and finance executives in multinational corporations.

EXHIBITORS

GEMNET SOFTWARE CORPORATION  
2175 W. Stadium Blvd.  
Ann Arbor, Michigan 48103  
(313) 663-4333

BOOTHS 22 & 23

GemNet Software Corporation will be demonstrating FAME -- an innovative software system for the interactive solution of quantitative business problems.

FAME (Forecasting, Analysis, and Modeling Environment) is: • a fully integrated system providing advanced capabilities for time series and cross-sectional data management, financial and economic data analysis, forecasting, report-writing, graphics, modeling, and telecommunications. • an interactive analysis tool and a sophisticated programming language neatly fitted into a single package, allowing rapid construction of customized applications. • designed for your corporate timesharing system as well as the new generation of desktop computers, permitting fully distributed decision support processing. • built and supported by recognized experts in business analysis, computer science, statistics, and finance.

For further information, please call or write: Mr. Lawrence C Rafsky

GWILYM JENKINS AND PARTNERS, LTD.  
Lancaster, England  
Represented by:  
Northwest University Associates  
16045 NE 105th Court  
Redmond, Washington  
(206) 883-1613

BOOTH 9

Gwilym Jenkins and Partners is a consulting organization which offers services in business and economic forecasting areas based upon the Box-Jenkins approach. The modeling and forecasting techniques used by the company are those developed in part by Professor Gwilym Jenkins, the company's founder.

GJP has put together a comprehensive package which is unique in terms of quality and scope: 1. JENASYS software for univariate stochastic, transfer function, multivariate stochastic and multivariate transfer functions. 2. Education and Training for applications overview or "hands-on" experience. 3. Analytical Consulting Services.

Representatives (from Northwest University Associates) are at the exhibit to demonstrate and provide information concerning GJP's products and services.

EXHIBITORS

HEURIX COMPUTER PRODUCTS  
35 Lord William Penn Dr.  
Morristown, NJ 07960  
(201) 765-7159

BOOTH 24

4CaST<sup>TM</sup>/1 - Business Forecasting Systems for the IBM-PC: 4CaST<sup>TM</sup>/1 is a powerful forecasting tool with advanced features to satisfy the demanding forecast analyst, yet it is simple to use and accessible to anyone. 4CaST<sup>TM</sup>/1 replaces detailed statistical reports with superb color graphic and analyzing results of various forecasting techniques. 4CaST<sup>TM</sup>/1 reduces the time to prepare a forecast by as much as the factor of 10. Because it produces high quality forecasts easily and readily, 4CaST<sup>TM</sup>/1 gives you the flexibility to experiment and exercise business judgment to address specific problems.

INFORMETRICA LIMITED  
P.O. Box 828, Station B  
Ottawa, Canada K1P 5P9  
(613) 238-4831

BOOTH 25

INFORMETRICA AND THE FORECASTING SYSTEM MOSAIC: Since 1972, Informetrica Limited has served the interests of analysts and planners by providing data, forecasts, software programs, training and consulting services - a full range of information and research tools to support management information systems.

Informetrica's exhibit will provide a special focus on the forecasting system, MOSAIC. Informetrica has developed, modified and maintained a series of software packages with powerful, flexible program capabilities for database management, data exploration, forecasting, modelling, simulation and report generation. This software has evolved to continually support model development projects for the company and its clients. MOSAIC is key to these efforts and is now available for in-house installation on IBM 360/370 and the DEC VAX family of super mini-computers.

As a general-purpose forecasting system MOSAIC provides subject-matter specialists, a simple English-like MOSAIC language and powerful operators to effectively apply statistical, economic, market or financial analysis. Techniques include: Automatic Box-Jenkins Analysis, Seasonal Adjustment, Pattern-fitting, and Regression Analysis.

At Booth 11, talk to our software and forecasting specialists about MOSAIC applications suitable to your forecasting needs and decision making environment. They will be on hand to display MOSAIC's capabilities, review documentation and support services and provide company and product literature.

EXHIBITORS

HEURIX COMPUTER PRODUCTS  
35 Lord William Penn Dr.  
Morristown, NJ 07960  
(201) 765-7159

BOOTH 24

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EXHIBITORS

*INTERNATIONAL INSTITUTE OF FORECASTERS*  
CANADA - FRANCE - UK - USA

BOOTH 6

- Obtain information about ISF 84 in London and ISF 85 in Montreal
- Purchase an ISF 83 T-shirt. It makes a nice gift item.
- See the list of registrants at ISF 83
- Purchase copies of programs from ISF 81, ISF 82, or ISF 83.
- See sample copies of the Journal of Forecasting.
- Obtain information on the submission of papers to the Journal of Forecasting.
- Obtain information on the International Institute of Forecasters
- Join the International Institute of Forecasters

*LIFETIME LEARNING PUBLICATIONS*  
10 Davis Drive  
Belmont, California 94002  
(415) 595-2350

BOOTH 10

Lifetime Learning Publications is exhibiting Management Science books with an emphasis on forecasting. LLP publishes books in the areas of technology, science, and management to serve the information needs of professionals in fields which demand scientific, technical, and managerial sophistication.

*MERRILL LYNCH ECONOMICS, INC.*  
165 Broadway  
New York, New York 10080  
(212) 637-6219

BOOTH 1

Merrill Lynch Economics will exhibit its broad range of research publications covering the national macroeconomic scene, domestic financial markets, international economies of Europe, Japan, Canada and Latin America, and key U.S. industries. All publications are offered to clients as part of our standard consulting retainer service. The formats are weekly, monthly and quarterly, as appropriate to the area of study.

Our consulting approach is a fundamental element in the delivery of economic data and forecasts to the client's corporate planning process. Through active telephone and in-person access to a senior consulting economist, as well as our entire staff of senior macroeconomic and industry research economists, clients' changing needs are accommodated throughout their planning and senior management support functions. Our service is tailored to individual account needs, and is inherently flexible, so that a broad range of requests can be addressed within one general relationship.

Our wide range of published and consulting services is complemented by optional on-line access to our data bases and econometric models, through Merrill Lynch Timesharing.

EXHIBITORS

*PREDICTION SYSTEMS, INC.*  
P.O. Box 276  
Manasquan, New Jersey 08736  
(201) 223-4572

BOOTH 3

Prediction Systems, Inc. is an engineering based company that provides software to aid in the development of models for prediction, forecasting, and control. Applications include market demand, advertising, investment, process control, production planning, and inventory control.

Prediction Systems will demonstrate its software products -- the General Stochastic Analysis (GSA) and the General Stochastic Modeling (GSM) systems. These systems provide advanced software tools for stochastic analysis and modeling.

GSA is a comprehensive system for data management, statistical analysis, and plotting and reporting of large sets of vector time series. Statistical analysis capabilities include time variant distribution analysis, filtering, interpolation, smoothing, auto correlation, multivariate cross correlation, and spectral analysis.

GSM contains its own high level language compiler with a run time support system specific to stochastic modeling. Significant features include optimization algorithms for identification of nonlinear stochastic models containing multivariate driving forces, and adaptive bayesian estimators (e.g., Kalman filter) for estimating nonstationary parameters.

*PUBLISHERS' DISPLAY*

BOOTH 5

Numerous publishers have selected books to be displayed that will appeal to ISF 83 attendees. Browse through sample copies of relevant books and materials published by Lexington Books, Gale Research, Butterworth Scientific Ltd.'s Journal Division Futures, Williams Trend Indicators and others. Purchase forms will be available at the booth for you to order these publications.

*SAGE DATA, INC.*  
One Research Way  
Princeton, New Jersey 08540  
(609) 924-3000

BOOTH 8

SAGE DATA, Inc. is an economic information and computer software company providing historic data bases; on-line forecasts; analytical modeling and forecasting computer software, and consulting support to managers involved in economic analysis, corporate planning, and market research. SAGE DATA is affiliated with economic consulting firms, providing them with a sophisticated electronic delivery system for their forecasts and data bases.

SAGE DATA will exhibit its computer system; a powerful, elaborate but easy to use decision support software package. The SAGE System offers data bases, statistics, econometrics, modeling, forecasting, color graphics, and report generating capabilities.

EXHIBITORS

*SCIENTIFIC SYSTEMS INC.*  
54 Rindge Avenue Extension  
Cambridge, Massachusetts 02140  
(617) 611-6364

BOOTH 21

Scientific Systems is a seven year old research and development company, headquartered in Cambridge, Massachusetts. We specialize in statistical analyses, forecasting, and modern control system analysis.

We will be demonstrating the first of a new line of decision support products for the IBM Personal Computer and other micro-computers. The product, 4 CAST, is an interactive, semi-automative forecasting program based on state space principles. It will accommodate stationary or non-stationary, univariate or multivariate forecasting problems, in either the conventional or transfer function form. Forecasts are quick and easy to prepare, and are very accurate.

4 CAST is designed to be used in conjunction with a separate DBMS/Graphical system, for example 1-2-3. (1-2-3 is a trademark of Lotus Development Corporation of Cambridge Massachusetts.)

*STATISTICAL GRAPHICS CORPORATION*  
P.O. Box 1558  
Princeton, New Jersey 08540  
(609) 924-9374

BOOTH 12

Statistical Graphics Corporation, located in Princeton, New Jersey, specializes in the development of computer software for interactive data analysis and graphics. During February 1983, SGC announced STATGRAPHICS.PC, a new version of its APL interactive data analysis and statistical graphics system designed for the IBM Personal Computer. The system contains over 200 routines covering a broad range of statistical procedures, featuring 2 and 3-dimensional graphics, fullscreen procedure control, and an X-Y plotter interface. In addition to providing general support for the STATGRAPHICS system, SGC also conducts courses dealing with various applications of statistical methods and statistical computing. General consulting services are also provided, with an emphasis on the statistical design of experiments, forecasting and time series analysis, quality assurance, and interactive computer graphics.

EXHIBITORS

WHARTON ECONOMETRIC FORECASTING ASSOCIATES  
3624 Science Center  
Philadelphia, Pennsylvania 19104  
(215) 386-9000

BOOTH 15 & 16

Wharton Econometric Forecasting Associates is a leader in the field of economic consulting and econometric forecasting. Wharton provides regular forecasts and analyses of the U.S. and world economics as well as very specialized economic analysis services. Coverage of the U.S. economy is provided by the Quarterly, Long-term and Industry services. International services include the world economy, foreign exchange, agriculture and regions covering the Centrally Planned Economies, Middle East, Pacific Basin and Latin America. Wharton Econometrics delivers its forecasts and analyses through a range of mediums including regular publications, meetings, and on-site consultations. In addition, historical and forecast data are provided via timesharing, tape or machine-to-machine transfer.

JOHN WILEY & SONS, INC. PUBLISHERS  
605 Third Avenue  
New York, New York 10016  
(212) 867-9800

BOOTH 7

In its 176th year of business, John Wiley and Sons, Inc. remains an independent publisher of educational and professional books, reference works and journals covering the physical and life sciences, engineering, computer science, business, the social sciences, medicine and allied health, and law. We have recently launched a database publishing unit, and introduced computer software for computer-aided instruction and personal computers. Wiley's products are marketed worldwide through a diversified group of domestic divisions, international subsidiaries, foreign affiliates and overseas sales offices. Our display includes many books on forecasting as well as the Journal of Forecasting.

WORLD FUTURE SOCIETY  
4916 St. Elmo Avenue  
Bethesda, Maryland 20814-5089  
(301) 656-8274

BOOTH 14

The World Future Society is an international association of individuals and organizations seriously interested in the social and technological developments of the coming decades. Through its publications and meetings, the Society acts as an impartial, unbiased, independent forum and clearinghouse for trends, forecasts and ideas about the future. Its publications will be on display, and members of the Philadelphia chapter will be available to answer questions about the chapter and the Society. The Society's principal publication is THE FUTURIST.

## PROGRAM INTRODUCTION

Everything is listed in chronological order. The first page of each section presents the overview for that day. For events occurring at the same time, the keynote speech (if any) is listed in the program first, then the panel, then the sessions. Sessions are listed with Provincial rooms first, next the Salons, then the Seminar Rooms, and finally, the Parlors.

The papers will be presented in the order listed in each session. An addendum with last minute changes has been inserted in your folder. More recent information will be posted on the easel outside the meeting room.

No proceedings will be published for ISF 83. We anticipate, however, that many of the papers will appear in the Journal of Forecasting. Furthermore, we intend to provide a listing in the Journal of Forecasting of all papers submitted to the ISF 83 committee, along with the names and addresses of the authors.

Speakers were encouraged to bring at least 20 copies of their papers with them (more if they forecasted a high demand). Given that we expect over 1000 participants, please be selective in your requests for papers from the authors. Those who present papers have been asked to circulate sign-up sheets for those who would like copies sent to them. The authors' addresses are provided in the program so you can write for copies. In addition, duplicating services may be purchased at the ISF 83 Office in Salon 7.

You may be interested in presentations that occur simultaneously. To help with this problem, audio cassettes will be made where the overlap is most serious and where the speakers have consented to taping. In general, we tried to tape all sessions conducted on the Ballroom and Mezzanine Levels. These tapes can be purchased in the lobby (Mezzanine Level) about 30 minutes after the talk has ended.

We have asked the chairpersons and speakers to allow time for questions from the audience. We also encourage an informal atmosphere; the sessions should be enjoyable as well as pragmatic.

KEYNOTE SPEAKER

*Baruch Fischhoff*, Decision Research  
1201 Oak Street  
Eugene, Oregon 97401

Baruch Fischhoff is an experimental psychologist working on problems of judgment and decision making under conditions of uncertainty. He has a Ph.D. in psychology from the Hebrew University of Jerusalem. In recent years, he has served on National Research Council committees on Human Factors, Priority Mechanisms for Toxic Chemicals, and Survey Measure of Subjective Phenomena. Currently, he serves on the editorial boards of the Journal of Forecasting, the Journal of Personality and Social Psychology, Environment, and Organizational Behavior and Human Performance. He has co-authored a book entitled Acceptable Risk (Cambridge University Press, 1981), which critically analyzes policy-making methods for hazardous technology. In 1980, the American Psychological Association gave him the Distinguished Scientific Award for Early Career Contribution to Psychology.



"JUDGING FORECASTS AND  
FORECASTING JUDGMENTS"

However sophisticated they are technically, all forecasts depend upon the exercise of educated intuition, or judgment. It affects the decision to make explicit forecasts, the choice of forecasting models, the structuring of the problem, the assessment of key parameters, the sensitivity analyses that are conducted, the treatment of discrepancies with competing forecasts, and the confidence placed in the product. Furthermore, forecasters' attempts to look forward depend largely upon their judgment of past events, what periods provide useful data, how predictable have such processes been, what caused previous forecasting failures, and what constitutes a forecasting failure. Although subjective judgment can be subjected to scientific study, this talk will review what can be known with further study, and what are the implications of recognizing the role of judgment in forecasting.

SESSIONS ON MONDAY AT 10:00-11:30

<u>TITLE</u>	<u>CHAIRPERSON</u>	<u>PAGE</u>	<u>ROOM</u>
INPUT-OUTPUT PANEL	<i>Adams, F. Gerard</i> , U. of Pennsylvania, Philadelphia	25	DOMINION BALLROOM A
EXTRAPOLATION: COMPETITION AMONG METHODS I	<i>Pack, David J.</i> , Union Carbide, Oak Ridge, Tenn.	26	PROVINCIAL SOUTH
NEW PRODUCT FORECASTING	<i>More, Roger A.</i> , U. of Western Ontario, Canada	27	PROVINCIAL NORTH
TOURISM & AIR TRANSPORT	<i>BarOn, R.R.V.</i> , Ministry of Tourism, Jerusalem, Israel	28	SALON 1
BUDGET FORECASTING	<i>Griffin, Paul A.</i> , U. of California at Davis	29	SALON 2
SPORTS PREDICTION AND HUMAN PERFORMANCE	<i>Diech, James G.</i> , Rice University	30	SALON 3
USE OF MICROCOMPUTERS IN FORECASTING	<i>Hughes, G. David</i> , U. of North Carolina	31	SALON 4
FORECASTING FUTURE ENERGY TECHNOLOGIES	<i>Haines, George H.</i> , U. of Toronto	32	SALON 5
EVALUATION OF MACROECONOMIC FORECASTS & FORECASTERS	<i>Ormerod, Paul</i> , Henley Centre for Forecasting, London	33	SALON 6
FINANCIAL FORECASTING BY SECURITY ANALYSTS	<i>Brown, Lawrence D.</i> , SUNY Buffalo	34	SALON 9
FORECASTING BY THE MANIPULATION OF JUDGMENTAL INPUT	<i>McIntyre, Shelby H.</i> , U. of Santa Clara	35	SALON 10
INVENTORY CONTROL	<i>Bachman, Manfred</i> , U. of Dortmund, W. Germany	36	SEMINAR A
USE OF REGRESSION ANALYSIS IN FORECASTING	<i>Ketellapper, Ronald H.</i> , U. of Groningen, The Netherlands	37	SEMINAR B
MEDICAL CARE	<i>Eisenberg, John M.</i> , Hospital of the U. of Pennsylvania	38	SEMINAR C
IMPLEMENTATION IN FORECASTING	<i>Schultz, Randall L.</i> , U. of Texas at Dallas	39	PARLOR A
TIME SERIES APPLICATIONS	<i>Visser, Hans</i> , Dutch Electricity Supply Companies, The Netherlands	40	PARLOR B
FUTURES RESEARCH AND BUSINESS POLICY	<i>Nanus, Burt</i> , U. of Southern California	41	PARLOR C
TIME SERIES: TECHNICAL ISSUES	<i>de Gooijer, Jan</i> , U. of Amsterdam, The Netherlands	42	PARLOR D

INPUT-OUTPUT PANEL

This panel will discuss

"WHAT RESEARCH IN THE PAST DECADE HAS MOST IMPROVED  
OUR ABILITY TO FORECAST USING INPUT-OUTPUT ANALYSIS?"

and

"WHAT RESEARCH SHOULD BE DONE IN THE NEXT DECADE  
TO IMPROVE INPUT-OUTPUT FORECASTS?"

An opening statement lasting no more than 10 minutes from each panelist will be followed by 20 minutes of discussion among the panelists and 20 minutes of questions from the audience.

Panelists:

*Almon, Clopper*

Department of Economics, U. of Maryland, College Park, MD 20742

Clopper Almon is a professor of economics at the University of Maryland and director of its Interindustry Forecasting Project. With the aid of its INFORUM model, this group regularly produces integrated forecasts of many industries. Almon is also engaged in linking together interindustry models of a number of foreign countries.

*Courbis, Raymond P.*

G.A.M.A., Université de Paris-Nanterre, 2 Rue de Rouen, 92001 Nanterre, France

Raymond Courbis has been a professor of economics at the University of Paris-Nanterre since 1974. Prior to that, he was a professor at the University of Tours and Chargé de mission at the French Ministry of Finance. A specialist in macroeconomic theory and a model builder, he has been director, since 1972, of G.A.M.A. (Group for Applied Macroeconomic Analysis), a research centre that works on modeling and forecasting.

*Hoffman, Robert B.*

Structural Analysis Div., Statistics Canada, Coats Bldg., Tunney's Pasture, Ottawa, K1A 0T6, Canada

Robert Hoffman joined Statistics Canada as a member of the team responsible for designing and compiling the commodity-by-industry input-output tables for Canada. As Director of the Structural Analysis Division, he is responsible for research in systems modeling. The Division has implemented several input-output type models, including a price model, an inter-regional model, and an energy model. Current research is concerned with time structure, materials and energy flows, and the representation of technology.

*Kuroda, Masahiro*

Keio Economic Observatory, Keio University, Minato-ku, Tokyo, Japan

Professor Kuroda is a member of the Committee of Econometric Models for Japan's Economic Advisory Commission. His book, General Interdependence and Economic Policy, was published in 1981 by Kogakusha, Ltd.

*Kutscher, Ronald*

Office of Economic Growth, Bureau of Labor Statistics, U.S. Dept. of Labor, Washington, DC 20212

As Assistant Commissioner in the Bureau of Labor Statistics, Ronald Kutscher is responsible for medium-term projections of the U.S. Economy, covering potential output, composition of gross national product, industry structure of demand, input-output relationships, capital requirements, industry output, and productivity and employment by industry and occupation. In 1973, he won the American Statistical Association's prize for best economic forecast.

Chair: Adams, F. Gerard, Dept. of Economics, U. of Pennsylvania, Philadelphia, PA 19104

## EXTRAPOLATION COMPETITION AMONG METHODS - I\*

Chair: *Pack, David J.*, Union Carbide, Bldg 2029, P.O. Box X, Oak Ridge TN 37830

"A MODEL COMPARISON OF THE ARIMA MODELS OF THE MAKRIDAKIS COMPETITION"

*Lusk, Edward J.*, The Wharton School, U. of Pennsylvania, Philadelphia, PA 19104  
*Neves, Joao*, Catholic University, Lisboa, Portugal

A comparison of the ARIMA models developed in the Makridakis competition (Journal of Forecasting) for all 111 series is made with models developed independently by each author. Structural changes and outlier information were analyzed and summarized.

"WHY DIDN'T BOX-JENKINS WIN (AGAIN)?"

*Downing, Darryl J.*, Union Carbide, Bldg. 2029, P.O. Box X, Oak Ridge, TN 37830  
*Pack, David J.*, Union Carbide, Bldg. 2029, P.O. Box X, Oak Ridge, TN 37830

This paper focuses on the forecasting performance of the Box-Jenkins methodology applied to the 111 time series in the Makridakis competition. It considers the influence of the following factors: (1) time series length, (2) time series information (autocorrelation) content, (3) time series outliers, and (4) averaging results over time series.

"ANALYSIS OF THE FORECASTING ERRORS OF THE MAKRIDAKIS COMPETITION: A PRELIMINARY ANALYSIS"

*Makridakis, Spyros*, INSEAD, 77305 Fontainebleau, France  
*Lusk, Edward J.*, Wharton School, U. of Pennsylvania, Philadelphia, PA 19104  
*Neves, Joao*, Catholic University, Lisboa, Portugal

The forecasting errors from the 111 series of the Makridakis Competition were analyzed using principle components. Factors were developed from varimax rotations for the following partitions of the 111 Series: Macro (N=35) and Micro (N=68); Seasonal (N=60) and Non-seasonal (N=51); Yearly (N=20), Quarterly (N=23), Monthly (N=68); and for the series by one, four, six, eight, and 12 forecasts. Each of the methods is described by factors, the percentage of variance explained by that factor, the mean percent forecast error, and the corresponding standard deviation.

"AUTOMATIC BOX-JENKINS FORECASTING AND THE MAKRIDAKIS COMPETITION"

*Hill, Gareth*, Unilever Research, Port Sunlight, Mersey Side, England  
*Fildes, Robert*, Manchester Business School, Manchester M15 6PB, England

Hill and Woodworth proposed an algorithm suitable for identifying Box-Jenkins models automatically without reliance on the investigator. This paper first reviews the method. The method was then used on the 111 series analyzed by Andersen in the Makridakis forecasting competition. The results showed that the automatic method of Hill and Woodworth was comparable in accuracy to the full Box-Jenkins identification procedure.

\*See related session on Tuesday at 10:00-11:30

## FORECASTING FOR NEW PRODUCTS

Chair: More, Roger A., School of Business Admin., U. of Western Ontario, London N6A 3K7, Canada

"FORECASTING MODELS FOR NEW CONSUMER PACKAGED GOODS: A VALIDATION STUDY"

Katz, Gerald M., Management Decision Systems, Inc., 200 Fifth Ave., Waltham, MA 02254

In 1978, Silk and Urban proposed a model for pre-test-market evaluation of new consumer packaged goods. This model (named ASSESSOR) forecasts sales and/or market share for a new brand. Although such models have been widely used in the packaged goods industry, there is a paucity of data available for determining their accuracy. Many advertising claims have been made, but few have been substantiated. Between 1973 and 1980, over two hundred new products were evaluated with the ASSESSOR model. The purpose of this paper is to investigate this model's predictive accuracy and to examine the managerial implications of such a tool.

"THE APPLICATION OF DISCRIMINANT ANALYSIS TO THE PREDICTION OF SALES FORECAST UNCERTAINTY IN NEW PRODUCT SITUATIONS"

More, Roger A., School of Business Admin., U. of Western Ontario, London N6A 3K7, Canada

Managers' estimates of sales forecast uncertainty for a new product are critical to an effective risk analysis. This research utilized discriminant analysis to analyze sales forecast errors in past new-product ventures. Using the past ventures, a linear discriminant function is established from relevant market variables by which future ventures may be allocated to one of two populations depending on the probabilities that their sales forecast uncertainty will be low or high.

"ESTIMATING JUDGMENTAL DEMAND FUNCTIONS AND PREDICTING MARKET PENETRATION FOR INDUSTRIAL INNOVATIONS"

Scott, Jerome E., College of Business & Economics, U. of Delaware, Newark, DE 19711

Keiser, Stephen K., College of Business & Economics, U. of Delaware, Newark, DE 19711

Two practical methodologies are presented for forecasting market response to new industrial innovations where no history of usage is available. The first is a procedure for estimating judgmental demand functions. This procedure relies on modeling the judgment process of a carefully selected sample of adoption decision-makers. The second is a market penetration model which predicts the time to significant sales and subsequent annual market demand for a new concept. Results from a study investigating the potential for solar systems for mid-rise office buildings is used to illustrate both procedures.

"THE USE OF A PROBABILITY-BASED P.E.R.T. FORMULATION TO PREDICT DIFFUSION OF INNOVATIONS IN A SYSTEM"

Weinberg, Sanford B., College of Business & Administration, St. Joseph's U., Philadelphia, PA 19131

In the "high-tech" computer field, the need to correctly predict the extent and speed of the diffusion of innovations is particularly important. This paper uses a probability-based PERT system to model the diffusion of the innovation process, particularly as it relates to the spread of high technology developments.

## TOURISM AND AIR TRANSPORT

Chair: BarOn, R.R.V., Ministry of Tourism, 24 King George St., Jerusalem, Israel 91009

"THE IMPACT OF PERCEPTIONS, DEMOGRAPHICS AND EVENTS ON AMERICANS' EUROPEAN PLEASURE TRAVEL PLANS"  
*Berrol, Edward*, Ogilvy & Mather Partners, 380 Madison Ave., New York, NY 10017

Based on 1,000 personal interviews with Americans (replicating earlier European Travel Commission research), this study investigated the relative importance of cultural and "facilitating" factors in motivating travel to Europe and the selection of specific country destinations. It also assesses the role of: economic factors (e.g., the strength of the dollar, perceived cost of travel abroad, seasonal cost variations), background characteristics of the prospects (notably education, income and occupation), and attitudes and perceptions (towards travel agents, escorted tours, scheduled and charter airlines, etc.). These affect the likelihood of travelling to Europe and the specific ways of travelling.

"ESTABLISHING A MEASURE OF AIRLINE PREFERENCE FOR BUSINESS AND NON-BUSINESS TRAVELLERS"  
*Etherington, Lois D.*, Simon Fraser U., Burnaby, B.C., V5A 1S6, Canada  
*Var, Turgut*, Simon Fraser U., Burnaby, B.C., V5A 1S6, Canada

The paper re-examined passenger airline selection criteria using interviews of travel agents, airline managers, and a survey of domestic and international passengers at Vancouver International Airport. Using a specialized interview technique, and using travel agents as "expert" passenger surrogates, a weighting and ranking of airline selection criteria was derived -- one for business passengers and one for non-business passengers. The weightings derived were then used, together with "expert" opinions of six regularly scheduled airlines travelling from Hawaii to the mainland of Canada and the U.S., as an application of this methodology for measuring passenger airline preferences.

"THE ECONOMIC IMPACT OF CHARTER FLIGHTS ON TOURISM TO ISRAEL"  
*Haitovsky, Y.*, Hebrew University of Jerusalem, Israel  
*Salomon, I.*, Hebrew University of Jerusalem, Israel  
*Silman, L.A.*, Cambridge Systematics, 40 Schmaryahu Levin St., Jerusalem, 96665, Israel

In 1977, the Israel Government liberalized the regulations concerning charter flights to Israel with the intention of encouraging tourism to Israel. Since then, there has been much discussion as to whether tourism growth in the following years was due to reduced airfares produced by the extra competition, to additional market penetration caused by the existence of charter flights, or to natural growth which would have happened anyway. The paper describes pooled time-series cross-sectional models for total tourism by air to Israel and for tourism by scheduled air carriers to Israel. The models allow the evaluation of alternative policies regarding conditions for the authorization of charter flights.

"FORECASTING TOURISM BY MEANS OF TRAVEL SERIES OVER VARIOUS TIME SPANS UNDER SPECIFIED SCENARIOS"  
*BarOn, R.R.V.*, Ministry of Tourism, 24 King George St., Jerusalem, Israel 91009

Tourism series reflect the movements of millions of people -- by origin, destination, means of transport, dates, etc. Forecasting for National and Regional Tourism Administrations, transport, and tourism enterprises should take into account many economic parameters relating to these segments and also the effects of fashions, promotion, and unusual events on demand, supply and competitiveness. The specification of appropriate scenarios is illustrated, with automatic and Judgment Aided Models (JAM) for forecasting monthly and annual series. Trends can be monitored relative to these forecasts using seasonal analysis (e.g., X-11 ARIMA). The use of disaggregate models for individual choice is also discussed.

"HOW TO SATISFY THE POLICY MAKER? - TESTING FORECASTING ABILITY BY WAY OF A COMPUTER PROGRAM AND A SET OF USABILITY CRITERIA"  
*van Doorn, Jozef W.M.*, Dept. of Leisure Studies, Tilburg U., P.O. Box 90153, 5000 LE Tilburg, The Netherlands

With regard to the assessment of the usability of individual forecasting techniques, policymakers on the one hand, and researchers on the other (especially in standardized computer programs on forecasting), the researcher seems to prefer quality criteria like accuracy, simplicity, and costs. This is, however, in sharp contrast with findings in literature which reveals the existence of a complex set of criteria used by the policymaker (such as acceptability, quality, contextual and environmental criteria). As an example, the variety of the policymaker's criteria will be viewed against the rather narrow set of quality criteria used by the researcher. This will be done by examining the results of a computerized forecasting program on tourism flows into the Netherlands.

## BUDGET FORECASTING

Chair: *Griffin, Paul A.*, Graduate School of Admin., U. of California, Davis, CA 95616

"FORECASTING AND CAPITAL BUDGETING DECISIONS - EXPECTATIONS AND REALITY"

*McTavish, Ron*, Concordia U., Sir George Williams Campus, 1455 De Maisonneuve Blvd., West, Montreal, Quebec H3G 1MS, Canada

The evaluation by companies of significant capital expenditures on new projects (new plant, technological innovation) is usually seen as a matter of applying modern capital budgeting methodology based on a series of economic forecasts. Reality, however, has not always lived up to this expectation, judging from various examples of construction cost overruns, and the continued high new product failure rate. As a result, some companies, rather than awaiting authoritative forecasts, are adopting policies based on opportunism and developing strong internal resources, i.e., "making the future happen" not "guessing right." The paper elaborates on this issue, and highlights important implications for forecasters.

"STOCHASTIC BREAK-EVEN ANALYSIS: METHODOLOGY AND APPLICATION"

*Manning, Sharon H.*, Westinghouse R&D Center, 1310 Beulah Road, Pittsburgh, PA 15235

This paper discusses how econometric income-statement models can be used for a unique kind of break-even analysis. This analysis differs from traditional methods in three ways: (1) The model computes variable costs as non-linear function of constant-dollar sales so that scale effects are included; (2) The analysis is based on a forecasting model so that break-even charts can be plotted for any future year; (3) The model is computerized so that new curves can easily be generated for alternative input and product prices. An actual (disguised) application is shown.

"FORECASTING AND OPTIMALITY IN BUDGETARY DECISIONS OF NON-PROFIT ORGANIZATIONS - A CASE STUDY OF UNIVERSITY SPORTS"

*Hoyt, Ronald E.*, Faculty of Administration, U. of Ottawa, Ottawa, Ontario, Canada

The central issue examined in this paper is the application of independent measures of service outputs in public sector organizations. A linear programming approach is used to simulate the effects of alternative budgetary decisions on the physical development of participants in University Sports. A five year data base is used in an analysis of optimal allocation of four categories of resources: human, financial, physical facilities, and clientele.

"DIAGNOSING FLUCTUATIONS IN STATE TAX COLLECTIONS USING ARIMA MODELS"

*Peppers, Larry C.*, Dept. of Economics, Creighton U.,  
*Nazem, Sufi*, Dept. of Decision Sciences, U. of Nebraska at Omaha,

State tax revenue in Nebraska plummetted below forecast levels in 1982. The ensuing controversy has heightened interest in the development of short-term forecasting models capable of diagnosing current fluctuations and reassessing budgeted state tax collections. ARIMA models will be estimated for monthly tax collections in Nebraska over the 1970-82 time period. Actual and budgeted (projected) tax revenue fluctuations will be analyzed in order to develop an early-warning or diagnostic system for state revenue planners.

"A NEW ROLE OF FORECASTING IN STRATEGIC BUDGETING"

*Ishikawa, Akira*, Graduate School of Management, Rutgers U., 92 New Street, Newark, NJ 07102

A new role for forecasting in strategic budgeting will be presented. Strategic budgeting is defined as an integrative and synergetic endeavor of strategic planning and budgetary control. It should reflect upon management's beliefs and judgment. The meanings and implications of forecasting are examined by considering descriptivism versus normativism, internality versus externality, and continuous evolution versus discontinuous transition. Viewpoints of the producers and of the users of forecasts are considered.

## SPORTS PREDICTION AND HUMAN PERFORMANCE

Chair: *Disch, James G.*, Health and Physical Education Dept., Rice University, Houston, TX 77001

Session Overview: Prediction in sport and human performance is an exciting and broad area. Criterion measures vary from game or season performances to world records to individual potentials. Methods of analysis range from sophisticated mathematical modeling approaches (usually by non-physical educators) to conventional techniques of regression or discriminant analysis. The application of knowledge gained by sport predictions is exemplified by the Dallas Cowboys, who make extensive use of quantitative information to select and diagnose performance potential. This session was designed to present a variety of applications of prediction techniques for the analysis of sport and human performance.

"PREDICTION OF ATHLETIC SUCCESS FROM MOTOR ABILITY TEST ITEMS"

*McDavid, Robert F.*, Exercise Research Laboratory, Indiana State U Terre Haute, Indiana 47809

A data file of over 70,000 motor ability test scores for approximately 4,000 male athletes has been developed since 1962. Test items' validity and reliability have been established. Results of testing college football, basketball, baseball, volleyball and field hockey athletes verify the discriminatory value of the test battery and its accuracy in predicting success. A stepwise multiple regression analysis was used to determine which test item contributed the most to the criterion score and to formulate an equation for predicting a criterion score on one set of data. A discussion of a "Commonality of Ability" existing among athletes will be offered.

"PREDICTION OF BASKETBALL SKILL USING BIOMECHANICAL VARIABLES"

*Hudson, Jackie L.*, Health & Physical Education, Rice University, Houston, Texas 77001

College women ( $n=25$ ) from three distinct skill groups (international, intercollegiate, beginner) were filmed during the performance of the basketball one-handed free throw. Digitized coordinates of the body and ball were used to compute the biomechanical variables of angle and velocity of projection, wrist velocity, trunk inclination, height of release, and anterior-posterior stability. Additional variables were shooting accuracy, height, and weight. By employing multiple discriminant analysis, an equation was developed which allowed 96% of the subjects to be classified in the correct skill group. This equation may be useful in the future selection of elite basketball players.

"FORECASTING IN SPORT: ATHLETIC PERFORMANCE IN THE YEAR 2083"

*Schutz, Robert W.*, Dept. of Sport Science, U. of British Columbia Vancouver, B.C., Canada

For at least the last 50 years, athletes, coaches, sport scientists, and mathematicians have been attempting to predict ultimate performance in sport. The purpose of this study was to collate, compare and extend this work. Best yearly performances from 1874 to 1982 for all running events from the 100m to the marathon, and three field events (javelin, shot, discus), formed the data base for multiple non-linear regression analyses. Predicted 1982 performances, based on data up to 1960, were compared to actual 1982 performance, and predicted performances for the year 2083 were compared with present day world records.

## USE OF MICROCOMPUTERS IN FORECASTING

Chair: *Hughes, G. David*, Burlington Industries Professor of Business Administration, U. of North Carolina, Chapel Hill, NC 27514

"PROTOTYPING FORECASTS WITH A MICROCOMPUTER"

*Hughes, G. David*, Burlington Prof. of Business Admin., U of North Carolina, Chapel Hill, NC 27514

The advantages of developing prototype forecasting models with a microcomputer, VisiTrend/Plot, and the client at your side are discussed. Graphic capabilities and "disk slide shows" are illustrated. Working closely with the client revealed influences that may have been overlooked with routines that fit data automatically. Some of these influences include a leap year month with an extra week, representatives selling deals before they went into effect, the confounding of our introducing a new pack size with the competitor's product improvement, and the bad timing of deals. A "channel induced seasonality" was discovered during the development of a seasonal index.

"MICROCOMPUTER-BASED FORECASTING: CASE STUDIES FROM INDUSTRY & GOVERNMENT"

*Andriole, Stephen J.*, International Information Systems, 802 Woodward Rd., Marshall, VA 22115

In the 1970s, the US Department of Defense sponsored the development of a set of microcomputer-based forecasting aids grounded in Bayesian methodology, while others generated forecasts via empirical data and statistical operations. The paper will discuss how, where, and with what results these aids have been applied in government and industry. It will also suggest ways to improve future computer-based aids.

"PORTFOLIO THEORY AND ECONOMETRIC FORECASTING IN FINANCIAL MARKETS: EXPERIENCE WITH THREE SOFTWARE SYSTEMS IN DEVELOPMENT"

*Ghosh, Alo*, CDS Corporation, 3700 Science Center, Philadelphia, PA 19104

This paper describes a line of microcomputer-based forecasting software systems that combines concepts from financial and informational economics. Econometric, optimization, and simulation techniques were programmed with spreadsheet-like interfaces on microcomputers to enable financial executives to easily operate the software in areas as diverse as foreign exchange risk management (FERM), bank asset-liability management, and international portfolio asset management. The two basic principles underlying these systems are: (1) a combination of econometric, time-series, and Bayesian methods are used to derive, refine, and update composite forecasts of asset returns in several markets (e.g., spot, forward, future) to exploit more information; (2) single- and multi-period portfolio optimization techniques then exploit these forecasts and their covariance structures to suggest optimal investments while explicitly accounting for risk, transaction costs, taxes, and various institutional constraints. Simulation runs on the FERM system showed average net ex post returns on portfolios of nine currencies to be about 40% on reasonable risk postures. This system will be demonstrated on an IBM PC at the conference.

## FORECASTING FUTURE ENERGY TECHNOLOGIES

Chair: *Haines, George H., Jr. and Berkowitz, Michael*, Faculty of Management Studies,  
246 Bloor Street West, Toronto, Ontario, M5S 1V4, Canada

"USING PROBIT ANALYSIS TO FORECAST FUTURE ENERGY TECHNOLOGIES FOR HOME HEATING"

*Berkowitz, Michael*, Faculty of Management Studies, 246 Bloor Street West, Toronto, Ontario,  
M5S 1V4, Canada

*Haines, George H., Jr.*, Faculty of Management Studies, 246 Bloor Street West, Toronto, Ontario,  
M5S 1V4, Canada

This paper presents a profit analysis model that allows long run demand for a new product to be estimated prior to any significant sales history. The specific good group into which the proposed new product will be inserted is residential heating. The model is based on the concept that consumers react in their purchasing decision to the inherent package of characteristics they perceive in the commodity. The paper will discuss the possibility of inserting two different new products, heat pump and solar technology, simultaneously into the Canadian residential heating market. Survey data is used to obtain specific numerical estimates.

"USING THE ABSTRACT PRODUCT APPROACH TO FORECAST THE DEMAND FOR ELECTRIC CARS"

*Ratchford, Brian T.*, Operations Management, SUNY Buffalo, Buffalo, NY 14222

If brands can be modelled as bundles of attributes, it should be possible to explain brand choices and consequent market shares as a function of the characteristics and price of available alternatives. It should then be possible to forecast the demand for an altogether new bundle of characteristics by substituting its proposed price and characteristics into the estimated demand function. An attempt to use this approach in forecasting the demand for a new car type, electric cars, is presented. After developing regression relationships between relative market shares for car brands and their characteristics, forecasts of the demand for electric cars are presented. A somewhat detailed discussion of the strengths, limitations and feasibility of the approach is then presented.

"FORECASTING COMMERCIAL NUCLEAR REACTOR TECHNOLOGIES"

*Strauss, Hans*, Dept. of Economics, Laurentian U., Sudbury, Ontario, Canada

*Willauer, Edward*, Dept. of Economics, Laurentian U., Sudbury, Ontario, Canada

This paper provides a forecast of the nuclear fuel cycle used in commercial reactors. The most prevalent technology in place is the conventional fuel cycle (CUFC) which is a net uranium consumer. Future innovation would include the wide-spread usage of the advanced fuel cycle (AFC), including the thorium, uranium and mixed advanced breeder cycles, which are not net uranium consumers. Given that costs matter, the replacement of CUFC technology with AFC technology requires a high relative uranium price. Using standard econometric techniques, the price of uranium is forecasted under the assumption that CUFC remains the prevalent technology. The forecasted price is used to predict if there is any cost or profit incentive for the replacement of CUFC technology with AFC technology.

## EVALUATION OF MACROECONOMIC FORECASTS AND FORECASTERS

Chair: *Ormerod, Paul*, The Henley Centre for Forecasting, 2 Tudor St Blackfriars,  
London EC4Y OAA, England

"FORECASTING IN A BUSINESS ENVIRONMENT"  
*Ormerod, Paul*, The Henley Centre for Forecasting, 2 Tudor St., Blackfriars, London EC4Y OAA,  
England

The paper focuses on testing econometric models in order to establish the credibility of their results, before the client allows them to be used to construct forecasts. An analysis of such forecasts and a subsequent analysis of errors are also provided. In the UK, a substantial amount of forecasting activity is supported by grants from the public sector. The paper suggests that the testing and validation criteria demanded of forecasting models in a commercial environment is usually more rigorous than those applied elsewhere.

"A PERFORMANCE ANALYSIS OF UK MACROECONOMIC FORECASTING ORGANIZATIONS"  
*Bramson, Michael*, National Economic Development Office, Millbank Tower, Millbank,  
London SW1P 4QX, England  
*Mayes, David*, National Economic Development Office, Millbank Tower, Millbank,  
London SW1P 4QX, England

The paper analyzes the performance of a number of UK macroeconomic forecasting organizations; relating the errors in their forecasts of the principal macroeconomic variables to four characteristics: (a) which variable, (b) which year, (c) how far ahead, and (d) which organization. The main effects show quantitatively how performance depends on each of these, while the interactions show what combinations of factors lead to especially good, or poor, forecasts. The results are of value to forecast users who have to decide which organization to use and what confidence limits to place on forecasts. They are also of interest to organizations wishing to examine their own track record against their contemporaries.

"RANDOM CHARACTERISTICS OF FORECAST ERRORS"  
*Sankaran, S.*, Faculty of Administration, U. of Regina, Regina, Saskatchewan S4S 0A2, Canada

This paper studies the nature of forecast errors, with specific reference to published forecasts of the Canadian economy. It analyzes the randomness (or otherwise) of forecast errors. Where forecast errors were random, attempts were made to find the distributional fit.

"THE CANADIAN FORECASTING 'INDUSTRY'"  
*Daub, Mervin*, School of Business, Queen's Ontario, K7L 3N6, Canada

The role that expectations play in economic affairs has become a critical question in modern macro-economic theory. The researcher's extensive empirical interests in forecasting over the years leads him to believe that the process by which economic expectations are actually formed is little understood, if at all. While there are several possible explanations for this current state of affairs, one of the more important is that no empirical study of the structure of the forecasting industry has ever been carried out. As a result, the researcher is undertaking a classical, industrial-organization-oriented (i.e., à la Bain or Caves) study of the forecasting "industry" (in this case in Canada). The paper will report on the progress of the study to date.

"THE ACCURACY OF BLUE-CHIP SHORT-TERM MACROECONOMIC FORECASTS (1977-1982)"  
*Yermilov, A.P.*, Institute of Economics, Siberian Branch of Academy of Sciences, Acad. Lavrenti Ave 17, Novosibirsk - 90, 630090 USSR

Blue Chip Economic Indicators present the predictions of different forecasters, on a monthly basis, for several macro-variables for the next year. We analyzed the accuracy of predictions of the growth rates of real GNP, the GNP deflator, nominal GNP, levels of the 3-month treasury bill rate, and the unemployment rate. The results showed which years were more difficult to forecast and why they allowed for a comparison of the accuracy of different forecasting groups and individuals. The poor forecasting results for 1982, for almost everybody, deserve special attention and show, once more, that the problem of forecasting business cycle turning points has not been solved. A comparison of the forecasting accuracy of large econometric models, small models, and judgmental techniques did not show a definite advantage for any particular method.

## FORECASTING BY SECURITY ANALYSTS

Chair: *Brown, Lawrence D.*, School of Management, SUNY, Buffalo, NY 14214

"THE RELATIONSHIP BETWEEN INSIDERS' TRADING AND PREDICTIONS OF EARNINGS"

*Abdel-khalik, A. Rashad*, Faculty of Business, 432 Central Academic Bldg., The U. of Alberta, Edmonton, Alberta, Canada T6G 2G1

*Ajinkya, Bipin B.*, Accounting Research Center, School of Accounting, U. of Florida, Gainesville, FL 32611

*Smith, E. Dan*, Accounting Research Center, School of Accounting, U. of Florida, Gainesville, FL 32611

Earlier research indicated that predictions of earnings by corporate officials is impounded in security prices. This paper deals with the motivation of managers to disclose their predictions of earnings. One possible incentive! Managers time their trading as insiders such that they would earn abnormal returns. This issue was independently studied by Penman. Our study concentrated on formulating trading strategies by insiders with the benefit of the private (predisclosure) knowledge of the quality of the forecast signal. The strategy formulated: buy before, and sell after the disclosure of a favorable signal; and sell prior to, and buy subsequent to an unfavorable signal. Various combinations of these strategies were used. The results indicate that abnormal returns could be earned by following the insiders' purchasing activities coupled with favorable forecasts.

"ASSUMPTIONAL ANALYSIS OF FORECASTS: SOME NEW APPROACHES"

*Jensen, Robert E.*, Trinity University, 715 Stadium Drive, San Antonio, TX 78284

This study is an extension of cross-impact (XI) analysis which attempts to (i) improve upon XI methods by replacing mathematical composition and time adjustment with human judgment, and (ii) apply eigenvector scaling of main and interactive impacts of assumptions on forecasts. Expert judgments are elicited as paired comparisons in terms of odds ratios. These are then scaled via an eigenvector analysis into subjective probabilities of alternative combinations of scenarios and assumptions.

"PERSPECTIVES ON FORECASTING RESEARCH IN ACCOUNTING AND FINANCE"

*Brown, Lawrence D.*, SUNY at Buffalo, Buffalo, NY 14214

*Griffin, Paul A.*, U. of California, Davis, CA 95616

This paper offers perspectives on forecasting research in accounting and finance. It is maintained that many common areas of forecasting research exist. Yet, most research has focused upon a particular (Box-Jenkins) technique and a particular (reported earnings) variable, virtually neglecting numerous other relevant forecasting research topics. A special issue in the Journal of Forecasting will include papers that address several of these neglected research topics. Those eight papers constituting the special issue are classified into three categories: (1) univariate time-series modeling; (2) multivariate time-series modeling; and (3) comparison of experts' forecasts with those of statistical models. A summary of the papers is provided here and suggestions for future research are offered.

## FORECASTING BY THE MANIPULATION OF JUDGMENTAL INPUT

Chair: *McIntyre, Shelby H.*, School of Business & Admin., U. of Santa Clara, Santa Clara, CA 95053

"DECOMPOSITION IN FORECASTING: WHEN WILL IT WORK?"

*McIntyre, Shelby H.*, School of Business & Admin., U. of Santa Clara, Santa Clara, CA 95053

Several original studies are presented which clearly demonstrate that decomposition does, in some cases, decrease the accuracy of a forecast while, in other cases, it improves accuracy. A scheme is presented, and empirically tested, for assessing the probability that a given decomposition will improve the judge's direct forecast in a given situation.

"IMPLEMENTATION OF AN ADAPTIVE FORECASTING MODEL BASED ON LIMITED DATA AND ELICITED PREDICTIVE DISTRIBUTIONS"

*Laughlin, James E.*, Dept. of Psychology, U. of South Carolina, Columbia, SC 29208  
*Drane, Robert E.*, Oscar Meyer & Co., P.O. Box 7188, Madison, WI 53707

This paper describes the implementation of adaptive forecasting models derived from limited data and elicited expert opinion. The models developed forecasted the weekly retail sales of a major product line manufactured by a large consumer packaged goods company. Normal-Gamma conjugate prior densities were formed by bootstrapping the elicited predictive distributions of three expert judges. Posterior forecasting models were then obtained by combining individual and group prior distributions with a limited historical data base. The weight given priors in the posterior models was determined subjectively and empirically based on how well the elicited predictive medians fit corresponding design points in the data. The accuracy of data based, judgment based, and data + judgment based models was assessed in subsequently collected data.

"ON THE DOMINANCE OF CAUSAL REASONING OVER PROBABILITY JUDGMENTS: IMPLICATIONS FOR FORECAST ACCURACY"

*Locksley, Anne; Stangor, Charles; Hochstrasser, Marianne*, Dept. of Psychology, New York U.,  
6 Washington Place, New York, NY 10003

Data are presented which demonstrate that people often assess probabilities on the basis of causal theories about relationships among independent and dependent variables. These theories take the form of two general rules, one in which each independent variable is treated as a sufficient cause for an outcome and one in which each independent variable is treated as a necessary cause. Reliance on these rules to forecast outcomes can lead to significant violations of the laws of probability and increases the chances of error for intuitive in comparison to statistical forecasting. Implications for organizational and professional decision-making are discussed.

"JUDGMENTAL FORECASTING: DECISION AIDS FOR IMPROVED DECISION MAKING"

*Watkins, Paul R.*, School of Accounting, U. of Southern California, Los Angeles, CA 90089-1421

Human judgment is pervasive in forecasting and planning activities: from ad-hoc, intuitive forecasts to the selection of appropriate quantitative tools, to the selection of data, and to the interpretation of results. Yet cognitive psychologists who specialize in judgment and decision making have demonstrated empirically that many biases and "human" errors occur in judgmental activities. This paper evaluates decision aids for mitigating these judgmental biases. These include several multi-attribute modeling approaches, expert systems, decision support systems (DSS) and artificial intelligence (AI) aids. Empirical research was used to evaluate the comparative advantages of each of these decision aids. The result is a useful framework for practicing managers/analysts and researchers who wish to support their forecasting and planning decisions.

## FORECASTING FOR INVENTORY CONTROL

Chair: *Bachmann, Manfred*, Abt. Statistik, Universitat Dortmund, Postfach 50 05 00, 4600 Dortmund 50,  
West Germany

"FORECASTING: THE BASIS OF INVENTORY-POLICIES AND FINANCE PLANNING"

*Bachmann, Manfred*, Abt. Statistik, Universitat Dortmund, Postfach 50 05 00, 4600 Dortmund 50, W. Germany

Our aim is to create a Corporate Planning Model. The basis of such a model is the prediction of sales. Once a year, the sales-plan, the expenditure-plan, and the finance-plan are made on the basis of forecasts; if activities are intended the plan represents the aims of the enterprise. We try to reach these goals with the lowest costs. The monthly forecasts are used to determine "optimal" inventory-policies. The "rolling" forecast serves as a warning system if there are great differences between updated forecasts and plans.

"INTEGRATING INVENTORY CONTROL POLICIES WITHIN AN ADAPTIVE FORECASTING PENALTY APPROACH"

*Lefrancois, Pierre*, Département des Sciences Economiques et Administratives, Université du Québec,  
Chicoutimi, Québec, G7H 2B1, Canada

This paper illustrates how a simple penalty approach for setting pessimistic and optimistic forecasts with adaptive filtering forecasting methods can incorporate different inventory control policies. Examples are given for continuous and periodic review systems.

"REVISING AN INITIAL FORECAST OF DEMAND AS ORDERS ARE RECEIVED"

*D'Abadie, Catherine*, Materials Planning & Management, Western Electric, Gateway II,  
Newark, NJ 07102

As part of production planning, companies often must forecast what the demand for a product will be within a given season or time period. The forecast is usually made before the company receives any orders for the product. After ordering begins, however, the order input provides valuable information about what the total demand will be for the period. Several authors have proposed methods of using the accumulating orders together with the forecast of demand to produce revised forecasts that incorporate both sources of information. The revised forecasts are a valuable tool in decision-making. This paper discusses the use of one of these methods to improve forecast accuracy in a large manufacturing company. It also discusses improvements that we have made in the procedure.

"FORECASTING REPAIR PART DEMAND IN THE ARMY WHOLESALE SUPPLY SYSTEM"

*Gotwals, Edwin*, U.S. Army Inventory Research Office, 800 U.S. Custom House, 2nd & Chestnut Sts.,  
Philadelphia, PA 19106

This paper will present an overview of the problems encountered while trying to improve the forecast methods for the Army wholesale inventory management system. Both forecast models and evaluation procedures will be addressed.

"OPTIMAL LINEAR INVENTORY CONTROL AND GENERAL LINEAR FORECASTING: STATE SPACE ANALYSIS"

*Rosenberg, David*, School of Business Admin., Old Dominion U., Norfolk, VA 23508

State space techniques are used to study open and closed loop inventory control systems containing several arrangements of linear forecasting subsystems, with and without state variable feedback. The state space model of each control system is derived from a system flow graph. Each state space model is analyzed to determine stability and controllability characteristics, as well as the impulse response. The analysis shows that state variable feedback enhances the performance of the forecasting subsystem.

## USE OF REGRESSION ANALYSIS IN FORECASTING

Chair: *Ketellapper, Ronald H.*, Econometric Institute, U. of Groningen, P.O. Box 800,  
9700 AV Groningen, The Netherlands

**"FORECASTING WITH THE LINEAR REGRESSION MODEL WITH ERRORS OF OBSERVATION"**

*Ketellapper, Ronald H.*, Econometric Institute, P.O. Box 800, 9700 AV Groningen, The Netherlands

Ordinary Least Squares estimation of the parameters of a linear regression model with errors-of-observation leads to biased coefficient estimates. Hence, the OLS fitted model seems inappropriate for forecasting purposes under such circumstances. I investigated two alternative forecasting strategies. The first one took account of the autocorrelation structure of the regressors. The second one started from the assumption that the forecaster approximately knows the reliability of the observations. Attention was paid to the question under which conditions the usual OLS procedure should be abandoned in favor of either of the alternatives.

**"THE MSAE ESTIMATION CRITERION AND MEASURES OF FORECAST ACCURACY"**

*Weller, Barry R.*, The Behrend College of Pennsylvania State U., Erie, PA 16563  
*Wellington, J.F.*, The Behrend College of Pennsylvania State U., Erie, PA 16563

Recently there has been interest in the use of the minimization of the sum of absolute errors (MSAE) as an estimation criterion for various types of forecasting models. Concurrently, the body of literature related to MSAE estimation has expanded. However, this development has not included the treatment of the adequacy of the MSAE fit. Thus, the forecasting practitioner is without an important evaluative tool. In this paper, we propose and discuss a measure of the adequacy of the MSAE fit.

**"MULTIPEIOD PREDICTION FROM DYNAMIC MODELS WITH AUTOCORRELATED ERRORS CONDITIONAL ON FEEDBACK RULES FOR THE FUTURE POLICY VARIABLES"**

*Friedmann, Ralph*, U. of Bielefeld, Postfach 8640, Bielefeld 1, Germany

The multiperiod predictive accuracy depends on whether future policy variables are fixed without regard to future events or whether they respond to observations yet to be made. Assuming that future policy variables follow given feedback rules, I derive the asymptotic mean square prediction error for the h-period prediction of a linear dynamic simultaneous model with autocorrelated disturbances. In particular, I consider the prediction error conditional on the optimal control equations derived by Pagan.

**"A NEW WAY OF ADJUSTING SERIAL CORRELATION - A CASE OF  $R^2=1$ "**

*Hsieh, Hsih-chia*, Chung-Hua Institution for Economic Research, P.O. Box 36-306, Taipei, Taiwan

A review of forecasting models indicated that three stage least square methods and two stage least square methods tend to predict better than single equation methods and the full information maximum likelihood simultaneous equations. This occurs because econometric models frequently involve misspecification errors, measurement errors, simultaneity bias, and non-normality of residuals. In addition, the forecasting models need adjust themselves when there arise unexpected impacts of policy changes on the independent variables as well as dependent variables. Through a Monte Carlo simulation, I found that when the residuals are much smaller in magnitude than the structural variables, the adjustment of serial correlations cannot improve the regression coefficient estimates and forecasts. Secondly, a correct way of adjustments is to decompose the serial correlated residuals into two components: one is a deterministic component which is serially correlated; and the other is a white noise component which is independently and randomly distributed. Accuracy was improved by using this deterministic component in the forecasting model.

**"SYSTEMATIC INCORPORATION OF JUDGMENT INTO ECONOMETRIC FORECASTING PROCESS"**

*Jelisavcic, Gordana*, New York Telephone, Rm. 3423, 1095 Avenue of the Americas, New York, NY 10036

Econometric models using time series data often suffer from the problem of autocorrelated errors, which deteriorates their forecasting performance. Assuming the models are specified to include all currently available explanatory variables, autocorrelation might be caused by failure to include some essential but currently unavailable information. Due to well known difficulty to identify determinants of demand, this area of modelling appears suitable to help illustrate this problem. This paper offers a procedure which combines quantitative and semi-quantitative methods to utilize information contained in autocorrelated errors in order to improve forecasting performance of demand models in a systematic, reproducible manner.

## MEDICAL CARE APPLICATIONS

Chair: Eisenberg, John, General Medicine, Hospital of the U. of Pennsylvania, 3400 Spruce St., Philadelphia, PA 19104

Session Overview: The participants will describe forecasting methods that are being used in medical research. Predictive models that assist physicians in medical diagnosis will be reviewed, as will models that predict patients' outcome based on clinical factors. Each participant will describe his or her own research, including the prediction of urinary tract infections, the causes of lymph node enlargement, streptococcal throat infection, and coronary artery disease. The participants will discuss the applicability of these forecasting models for actual patient care.

"ACCURACY OF A CLINICAL DECISION RULE IN DIFFERENT POPULATIONS"

Wigton, Robert S.; Hoellerich, U.L.; Steinmann, W.C.; Holmes, J., Hospital of the U. of Pennsylvania, 3400 Spruce St., Philadelphia, PA 19104

A clinical decision rule derived in one patient population must be proved accurate in other settings. We tested the accuracy of a decision rule for the diagnosis of urinary tract infection derived from 505 patients at the University of Nebraska on 269 patients at the University of Pennsylvania (Penn) and 25 patients at the Philadelphia VA hospital (PVA). The rule predicted the correct diagnosis in 80-86% of cases at Penn and 100% of cases at PVA, thus validating the rule in a population other than the one from which it was derived.

"WHEN TO BIOPSY PERIPHERAL LYMPHADENOPATHY IN ADOLESCENTS"

Slap, Gail B.; Schwartz, J.S.; Brooks, J.S.J., Depts. of Medicine & Pathology, U. of Pennsylvania, Philadelphia, PA 19104

The objective of this study was to identify 9-25 year-old patients with peripheral lymphadenopathy who should be biopsied. The medical records of 123 patients who had biopsies were reviewed for 25 clinical variables. Of the 123 biopsies, 51 required treatment (Rx) and 72 did not. Stepwise discriminant analysis correctly classified 95% into the Rx or No Rx Group. The 6 variables associated with Rx Group at  $p<0.10$  were chosen as discriminators and the predictions were based on 3 of the 6. Prospective validation correctly classified 21 of 22 patients. We concluded that this simple function can help select young patients with peripheral lymphadenopathy for biopsy.

"VALIDATING FORECASTING MODELS IN MEDICINE"

Centor, Robert M., Medical College of Virginia, P.O. Box 102, Richmond, VA 23298

Recently, great interest has developed in using statistical models for forecasting medical events (e.g., throat culture results, asthma relapse, pulmonary angiography). Before models should gain widespread acceptance, we must prospectively validate them. Predictions can be either discrete (e.g., predicting asthma patients to relapse or not to relapse) or continuous (e.g., predicting the probability of a positive strep culture in patients with sore throats). Validation methods will be different for discrete and continuous models. I give examples of several types of validation. Data are presented from validation studies of both discrete and continuous models. Finally, standards for validating such studies are proposed.

"USE OF STATISTICAL REGRESSION MODELS IN MEDICAL PREDICTION PROBLEMS"

Harrell, Frank E., Jr., Duke University Medical Center, Durham, NC 27710

This paper presents examples of how regression models can be used in predicting the presence of a disease and in predicting the prognosis of a patient. The advantages of using regression models, as opposed to methods like stratification and Bayes' formula frequently used in medical studies, will be addressed. When regression models are used to develop predictions from multiple factors, especially when the disease or outcome is rare, predictions will not be accurate when assessed on a new series of patients. Methods for developing more stable and accurate regression models will be presented.

## IMPLEMENTATION IN FORECASTING

Chair: *Schultz, Randall L.*, School of Management and Administration, U. of Texas at Dallas, Richardson, TX 75080

"INTEGRATING FORECASTING AND STRATEGIC PLANNING"

*Capon, Noel*, Graduate School of Business, Columbia U., New York, NY 10027  
*Hulbert, James M.*, Graduate School of Business, Columbia U., New York, NY

Beginning with a distinction between strategic planning and other forms of planning, the paper analyzes the use of information in companies planning strategically versus those which are not. This contrast is used to build the case for developing strategic forecasting capability which focuses on a variety of environments, is proactive and interactive, and creates a need for different kinds of data bases and forecasting techniques.

"THE IMPLEMENTATION OF FORECASTING MODELS"

*Schultz, Randall L.*, School of Management and Administration, U. of Texas at Dallas, Richardson, TX 75080

Forecasting models can help managers make better decisions if they are used, a fact that motivates this study. Findings from research on the implementation of operations research/management science are generalized to include forecasting models. The similarity between forecasting and other models allows conclusions to be drawn about managing forecasting model implementation. Twelve key factors are identified and put into a framework for proactive management.

"MARKETING PLANNING AND GROUP DECISIONS: AN APPLICATION OF FUZZY SETS"

*Winter, Franz*, School of Marketing, U. of New South Wales, Sydney, N.S.W., 2033, Australia

The paper addresses the issue of integrating functionally differentiated organizational planning units through the use of a computer aided decision algorithm based on FUZZY SET THEORY. A role playing situation was created with a case study in executive seminars; participants taking the roles of vice presidents of marketing, sales, production, and finance. Each group used a desktop computer programmed with the algorithm during the decision process. Executives received a copy of the program and commitment to implement the algorithm in their organization was sought. The results of a follow-up questionnaire to 32 executives as well as details of the algorithm and its implementation are presented.

"MAKING FORECASTING SYSTEMS FOR ORGANIZATIONS EFFECTIVE: AN APPLICATION STUDY"

*Miller, Don M.*, School of Business, Virginia Commonwealth U., Richmond, VA 23284

Some of the recent forecasting literature focuses upon the process of forecasting in organizations. It emphasizes the importance of model building, tracking and updating, specifying a range of possible outcomes, and other aspects that enhance the usefulness of a forecasting process. Although these points are applicable to most organizations, it is important to recognize the particular needs of the organization for which the forecasting system is being developed. Characteristics such as the technical capabilities of analysts, rate of turnover of personnel, the technical sophistication of management, and the divergence of personal interests among stakeholders should affect decisions regarding the system design. A forecasting system developed at Xerox Corporation is described and used to illustrate these points. The system, originally developed to forecast average monthly copy volumes for approximately fifty copier models, was endorsed by both management and staff analysts. It has since been adapted to forecast monthly cash collections. Emphasis is placed upon those features that have contributed to gaining management acceptance.

MONDAY  
10:00-11:30

PARLOR

TIME SERIES APPLICATIONS

Chair: Visser, Hans, Joint Laboratories & Consulting Services, Dutch Electricity Supply Companies, Utrechtseweg 310, 6812 AR, Arnhem, The Netherlands

"FORECASTING THE WATERHEIGHTS ALONG THE DUTCH COAST"

Visser, Hans, Joint Laboratories & Consulting Services, Dutch Electricity Supply Companies, Utrechtseweg 310, 6812 AR, Arnhem, The Netherlands

Two time series methods were applied to waterlevel data along the Dutch coast: Fourier analysis and ARIMA-modelling. The combination of these methods yielded good results. The predictions were based on one series of observations, taken 22 km offshore, and are valid for locations in the same region. Waterlevels can be predicted  $7\frac{1}{2}$  hours in advance, with an average accuracy of 5 cm (under conditions with moderate windspeeds). The tidal components in the time series were separated using discrete Fourier analysis. Subsequently, a new time series was generated and subtracted from the observations. The new series contained only non-harmonic components. These were analyzed in relation to windspeed using ARIMA-models. Predictions were made separately for the tidal components, using the Fourier method, and the non-harmonic component, using the ARIMA-model. The predicted waterlevel is the sum of these two.

"A NEW APPROACH TO RESOLVING THE MISSING MONEY CONTROVERSY"

Triantitis, John E., AT&T Long Lines, 201 Littleton Rd., Morris Plains, NJ 07950  
Simos, Evangelos O., Whittemore School of Business & Economics, U. of New Hampshire  
Durham, NH 03824

Static and dynamic out-of-sample simulations of traditional OLS-logarithmic demand for money equations indicate a breakdown of forecasted short-run real cash balances over the post 1974 period. In this study, optimum Box-Cox transformations were found, and static and dynamic forecasts were developed. Similar forecasts were derived from a varying parameter regression (VPR) model, and then static and dynamic forecasts from a VPR model, using the optimum Box-Cox transformation, were obtained and compared with the OLS, OLS-Box-Cox, and VPR results. The study shows that the missing money puzzle was resolved when appropriate transformations and estimation technique were used.

"FORECASTING ADVERTISING LINES FOR SPECIAL APPOINTMENTS: TIME SERIES ANALYSIS VERSUS ECONOMETRIC MODELS"

Madsen, Henning, Dept. of Applied Statistics, The Aarhus School of Economics, Fuglesangs Allé 4,  
DK-8210 Aarhus V, Denmark

This paper discusses the application of time series models in contrast to econometric models as the basis for forecasting in corporate models. I examined the advantages and disadvantages of the econometric approach, the simple extension of the econometric model by including models for the error structure, the transfer function approach, and the Bayesian approach known as dynamic linear models. To illustrate the various methods, an example is presented for forecasting advertising lines for special appointments from a Danish newspaper.

"USE OF A GENERALIZED TRANSFORMATION IN FORECASTING FROM AN ECONOMETRIC MODEL FOR INTERNATIONAL TELECOMMUNICATIONS DEMAND"

Schultz, William R., AT&T Long Lines, 201 Littleton Rd., Morris Plains, NJ 07950

A demand forecasting model of the international telecommunications market is specified and estimated using quarterly data from 1973 through 1982. The Box-Cox transformation procedure was used to select a generalized functional form in the estimation of the demand model. Results suggested that transformations other than the log-linear choice were preferred for estimation, based on the Box-Cox maximum likelihood criteria. Also, forecast tracking performance can be substantially affected for alternative transformations based on Thiel's U statistics for results on ex post forecasts. Alternative criteria were developed and compared to select an optimal ex ante forecast from different transformations given information from the model estimation and ex post forecast.

MONDAY  
10:00-11

PARLOR (

FUTURES RESEARCH AND BUSINESS DAY

Chair: *Nanus, Burt*, Center for Futures Research Graduate School of Business Administration  
Southern California, Los Angeles, CA 90089

Session Overview: Futures research methods range from relatively simple approaches such as QUEST (Quick Environmental Scanning Technique) to very sophisticated computer modeling approaches such as interactive cross-impact simulation. The INTERAX model will be described and its practical applications to both econometric forecasting and corporate modeling will be explored in this session.

"FUTURES RESEARCH AND POLICY RESEARCH"

*Nanus, Burt*, Center for Futures Research Graduate Business Administration  
U. of Southern California, Los Angeles CA 90089

Futures research is a new discipline concerned with bringing anticipations of the longer-range future to bear on current decisions. It incorporates traditional long-range forecasting methods, as well as some new varieties, but not for the purposes of prediction. Rather, the intent is to understand possible futures, the probabilities associated with them, and the desirability of taking actions to make some of them more likely than others. Three methodologies developed at USC's Center for Futures Research are discussed in this paper -- QUEST (Quick Environmental Scanning Techniques), Emerging Issues Analysis, and INTERAX.

"INTERAX-INTERACTIVE ANALYSIS FOR STRATEGIC PLANNING"

*Enzer, Selwyn*, Center for Futures Research, U. of Southern California, Los Angeles, CA 90089

Many future changes are at least, in part, inherently unpredictable. When this is the case, forecasting is limited to estimating the probability of these changes. A responsible planning posture for coping with uncertainty is to develop "robust" strategies -- strategies that permit management to perform acceptably well over a wide range of foreseeable outcomes. This paper outlines a procedure for developing and testing robust strategies consisting of man-machine simulations for generating alternative scenarios and for evaluating their impact on long-term corporate performance. Scenarios in which the results are unacceptable are the focus of detailed analyses. These analyses help the planner make the strategy more robust, develop contingency plans, and identify key monitoring signals.

"CORPORATE MODELING AND FUTURES RESEARCH"

*Leschinsky, David*, Interactive Data Corp One Wilshire Blvd Suite 1000, Los Angeles

Corporate modeling is widely used for evaluating near-term performance of alternative policies, especially those concerned with financial options. However, the use of corporate modeling for long-range strategic planning is currently minimal. One reason for this is that the financial focus of most corporate models is not a high priority facing the strategic planner. Another reason is the inability of most corporate models to reflect all of the events that could affect the external environment. This paper addresses these difficulties and describes how corporate models can be combined with futures research models to generate alternative scenarios in a way that permits the development and testing of alternative strategic policies. This facilitates the development of more robust strategies and makes the implications of strategic change more relevant to human resource needs, new product development, acquisitions, capital equipment needs and R&D.

"ENVIRONMENTAL FORECASTING FOR R&D PLANNING"

*Maxwell, Russell C.*, Gulf Research & Development P.O. Box 20, Pittsburgh, PA 5230

The ability to creatively envision the technological response to shifts in the external environment can be enhanced by the consideration of interactive effects of numerous cross-impacting events. The INTERAX simulation program generates scenarios with the observation of precursor sequences and pressures that influence policy shifts. GR&DC is doing studies to adapt this futures analysis methodology to the assessment of specific technological areas in the context of broad-scale external environmental change. This presentation covers the problems and results of early attempts to use the INTERAX approach for technical R&D planning.

## TIME SERIES SOME TECHNICAL ISSUES

Chair: *de Gooijer, Jan G.*, U. of Amsterdam, Jodenbreestraat 23, 1011 NH Amsterdam-C, Holland

**"SMOOTHNESS PRIORS VERSUS BOX-JENKINS METHODS FOR PREDICTION OF TIME SERIES"**

*Gersch, Will*, U.S. Bureau of the Census 3-3524, Washington, DC 20233

*Kitagawa, Genshiro*, Institute for Statistical Mathematics, 4-6-7 Minami-Azabu, Minato Ku, Tokyo, Japan 106

The modeling of time series with trends and seasonalities is conventionally done with innovations type-optimum one-step-ahead prediction models. Increasing horizon predictions from such models are achieved by successive concatenation of one-step-ahead predictions. Our smoothness priors-maximization of the predictive distribution modeling of such data yields different models for one-step-ahead and k-step-ahead predictions. The increasing horizon prediction performance of optimum k-step-ahead prediction models can be superior to that of one-step-ahead prediction models. The increasing horizon prediction performance of the smoothness priors and Box-Jenkins modeling methods is contrasted and explained.

**"EMPIRICAL BAYES FORECASTING"**

*Morris, Carl*, Dept. of Mathematics, U. of Texas at Austin, Austin, TX 78712

*Kostal, Hubert*, Dept. of Mathematics, U. of Texas at Austin, Austin, TX 78712

Parametric empirical Bayes methods were developed for forecasting problems involving multiple time series. The ensemble information from related time (or spatial) series provided improved individual forecasts. We compared proposed empirical Bayes estimators with standard time series estimators, both theoretically and with real data. One main application involves predicting crop yields using digitalized imagery data, wherein series of measurement vectors were obtained by satellite.

**"TRANSFER FUNCTION MODELLING: A COMPARISON OF TWO PREWHITENING APPROACHES"**

*Cheung, Hym K.*, Forecasting Research, Transport Canada, Place de Ville, Ottawa, Ontario, K1A 0N5, Canada

During transfer function modelling, the output series is usually prewhitened by applying to it the model developed for the input series. Alternatively, the output series can be prewhitened by developing for it a separate univariate model. Using air passenger travel data, models were developed using both prewhitening approaches. The advantages and disadvantages of each approach are discussed and the forecasting performance of the models was compared.

**'ESTIMATION OF PARAMETERS IN MAKEHAM'S SURVIVAL FUNCTION"**

*Patel, I.D.*, Dept. of Statistics, Gujarat U., Ahmedabad 380 009, India

Given a force of mortality function  $u(t) = \delta + \beta e^{\alpha t}$ , the Makeham's survival function can be given by

$$S = F(t) = e^{-\delta t - \frac{\beta}{2} (e^{\alpha t} - 1)}, \quad t \geq 0$$

This provides a good fit to observed mortalities in the situation where Gompertz survival function fails. Some of the statistical properties of the Makeham's survival function are investigated. The parameters  $\delta$ ,  $\alpha$  and  $\beta$  were estimated on the basis of Cohort life data using a computer method.

**"AN ADAPTIVE SEASONAL ADJUSTMENT PROCEDURE: SOME EMPIRICAL RESULTS"**

*Courchesne, Camille*, Bureau de la Statistique du Québec, 117 Rue Saint-André, Québec, G1K 3Y3, Canada

*de Fontenay, Alain*, Dept. of Communications, Government of Canada, 300 Slater, Ottawa, K1A 0C8, Canada

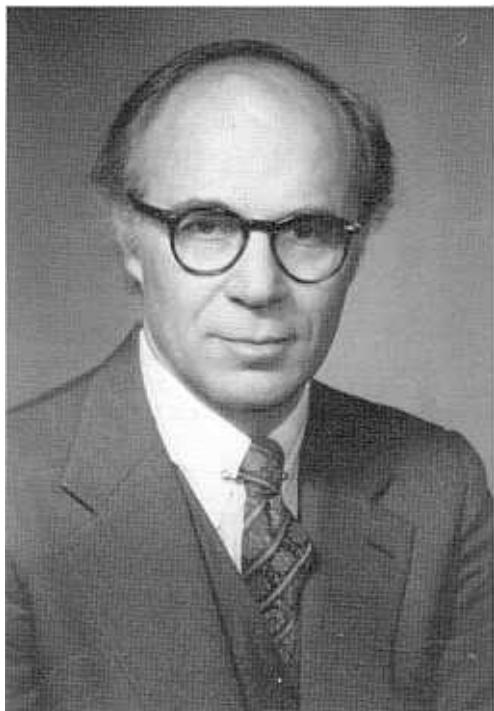
*Thibodeau, André*, Bureau de la Statistique du Québec, 117 Rue Saint-André, Québec, G1K 3Y3, Canada

In a recent paper, the authors presented the Seasonal Smoothest Adaptive Model (SSAM) with the Theil and Wage (TW) approach, which introduced the seasonal at the level of the signal. The TW-SSAM class is shown to be covariance equivalent to a subclass of the IMA class, called IMAD for Integrated Moving Average Decomposable. This current paper gives, without proof, the main results obtained by the authors. Following the description of the estimation algorithm for the TW-SSAM, empirical results are presented. Labor force survey data and artificial series are used to present and evaluate the main features of the proposed model.

KEYNOTE SPEAKER

*Lawrence R. Klein*, Department of Economics  
University of Pennsylvania  
Philadelphia, PA 19104

Lawrence R. Klein is the Benjamin Franklin Professor of Economics and Finance and the Chairman of the Professional Board of Wharton EFA, Inc. Professor Klein pioneered the development of econometric forecasting models in the United States and abroad. He is a principal investigator for project LINK, which is the first large scale integrated system of models for many countries. During the 1976 Presidential campaign, he was the principal economic advisor to Jimmy Carter and remained as an informal advisor during his administration. Professor Klein is a fellow of the American Academy of Arts and Sciences, a member of the American Philosophical Society, and a member of the National Academy of Sciences. He was the recipient of the President's Medal of the University of Pennsylvania and the Alfred Nobel Memorial Award in Economic Science for 1980.



"THE IMPORTANCE OF THE FORECAST IN  
THE IMPLEMENTATION OF ECONOMIC POLICY"

Careful forecasts, as accurate as possible, are central to the successful implementation of policy. There are fundamental reasons why policy makers cannot "play by ear," adjusting policy quickly to each unexpected deviation in economic outcomes. Specific incidents will be described where economic policy went awry because of faulty forecasts. The policy process will be described in detail to show precisely where the forecast enters. Forecasting as a validation tool for establishing credibility in policy formation will be analyzed and discussed. Some estimated measure of forecast accuracy will be presented, together with commentary on the necessary degrees of precision for successful implementation of policy.

Chair: *J. Scott Armstrong*, Wharton School, U. of Pennsylvania, Philadelphia, PA

Guest of Honor: U.S. Congressman *Bob Edgar*, Chairman of the  
Congressional CLEARINGHOUSE ON THE FUTURE

Introduction of Professor Klein by *Spyros Makridakis*, INSEAD, Fontainebleau, France

SESSIONS ON MONDAY AT 2:00-3:30CHAIRPERSON

JUDGMENTAL FORECASTING (PANEL)	<i>Armstrong, J. Scott</i> , The Wharton School, U. of Pennsylvania	45	DOMINION BALLROOM A
FORECASTING FOR STRATEGIC PLANNING	<i>Beck, Peter W.</i> , Shell UK, London	46	PROVINCIAL SOUTH
ECONOMETRIC MODELS	<i>Adams, F. Gerard</i> , U. of Pennsylvania, Philadelphia	47	PROVINCIAL NORTH
ENERGY FORECASTING	<i>Dosanni, Nazir</i> , CONSAD Research Corp., Vienna, Virginia	48	SALON 1
EXPONENTIAL SMOOTHING	<i>Gardner, Everette</i> , U.S. Atlantic Fleet Headquarters, Norfolk, VA	49	SALON 2
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EXTRAPOLATION: ADAPTIVE FORECASTING	<i>Carbone, Robert</i> , U. of Laval, Quebec	51	SALON 4
HEALTH CARE FORECASTING	<i>Chacko, George K.</i> , U. of Southern California	52	SALON 5
FINANCIAL FORECASTING: RECENT DEVELOPMENTS	<i>Griffin, Paul A.</i> , U. of California at Davis	53	SALON 6
TRANSPORTATION FORECASTING: I	<i>Jessop, Alan</i> , Polytechnic of Central London	54	SALON 9
EVALUATION OF COMPUTER MODELS & DATA BASES	<i>Mahmoud, Essam</i> , Concordia U., Montreal	55	SALON 10
MARKET FORECASTS	<i>Hallett, A.J. Hughes</i> , Erasmus U., Rotterdam	56	SEMINAR A
EVALUATIONS OF ALTERNATIVE EXTRAPOLATION TECHNIQUES	<i>Dalrymple, Douglas J.</i> , Indiana U., Bloomington	57	SEMINAR B
REGRESSION MODEL SELECTION FOR FORECASTING	<i>Askin, Ronald G.</i> , U. of Iowa, Iowa City	58	SEMINAR C
SOCIOLOGY	<i>Henshel, Richard L.</i> , U. of Western Ontario, London, Canada	59	SEMINAR D
USES AND ABUSES OF FORECASTING	<i>Solem, Erik</i> , Dept. of National Defense, Ottawa	60	PARLOR A
ASPECTS OF FORECASTING USING ARIMA MODELS	<i>Hillmer, Steven</i> , U. of Kansas, Lawrence	61	PARLOR B
REGIONAL SCIENCE I	<i>Gorr, Wilpen L.</i> , Ohio State U. Columbus	62	PARLOR C
ESTIMATING UNCERTAINTY	<i>Calzolari, Giorgio</i> , IBM, Pisa, Italy	63	PARLOR D

DOMINION BALLROOM A

JUDGMENTAL FORECASTING PANEL

This panel will discuss

"WHAT RESEARCH IN THE PAST DECADE HAS MOST IMPROVED OUR  
ABILITY TO FORECAST USING JUDGMENTAL FORECASTING?"

'WHAT RESEARCH SHOULD BE DONE IN THE NEXT DECADE  
TO IMPROVE JUDGMENTAL FORECASTING?"

An opening statement lasting more than 10 minutes from each  
panelist will be followed by minutes of discussion among  
the panelists and 20 minutes questions from the audience.

Panelists:

*Armstrong, J. Scott*  
The Wharton School      U. of Pennsylvania, Philadelphia 'A 19104

Scott Armstrong, Ph.D. from M.I.T., is an Editor for the Journal of Forecasting and a Contributing Editor for Interfaces. He has taught at Wharton (since 1968), the Stockholm School of Economics, the University of Hawaii, and IMEDE (Switzerland). He has published on applied statistics, survey research, social responsibility in management, educational methods, scientific methodology, strategic planning, and forecasting. Among his publications is Long-Range Forecasting: From Crystal Ball to Computer.

*Dreman, David*  
343 30th St. (Apt. 21J    New York, NY 10016

David Dreman is president of Dreman Associates, a New York-based investment management firm. He was formerly a consultant to Rauscher, Pierce, Refsnes, a national brokerage house; a senior investment officer for J. & W. Seligman, an investment advisory and mutual fund organization; and a senior editor/analyst for the Value Line Investment Survey. He is the author of the critically acclaimed Psychology and the Stock Market and of Contrarian Investment Strategy.

*Fischer, Gregory W.*  
Dept. of Social Science College of Humanities, Carnegie-Mellon U   Pittsburgh, PA 15213

Gregory Fischer's primary theoretical interests are in behavioral theories of inference, prediction, and decision making. His current applied interests include: military threat assessment, decision analysis of regulatory policies, and the development of computer-based aids for forecasting and decision making.

*Fischhoff, Baruch*  
Decision Research, 1201 Oak Street, Eugene, Oregon 97401

Baruch Fischhoff (Ph.D. from the Hebrew University of Jerusalem) serves on the editorial boards of the Journal of Forecasting, Journal of Personality and Social Psychology, Environment and Organizational Behavior and Human Performance. In 1980, he received the Distinguished Scientific Award for Early Career Contribution to Psychology from the American Psychological Association. He recently co-authored a book, Acceptable Risk.

Chair: *Armstrong, J. Scott*, The Wharton School U. of Pennsylvania, Philadelphia, PA 19104

PROVINCIAL SOUTH

FORECASTING FOR STRATEGIC PLANNING I\*

Chair: Beck, Peter W., Shell UK, Shell-Mex House, Strand, London, WC2R 0DV, England

"FORECASTS, MODELS - THE OPIATE OF DECISION MAKERS?"

Beck, Peter W., Shell UK, Shell-Mex House, Strand, London, WC2R 0DV, England

In our complex and uncertain world, models and forecasts tend to be used by decision makers as a substitute for judgment. Models can never mirror reality; decision makers who use them as if they did, opt out of the real world, just as do drug addicts. Numerical analyses, however sophisticated, are by themselves quite inadequate bases for policy decisions. Nevertheless, models and forecasts must have major roles in the decision making process. They should be necessary elements to stimulate debate. Good decisions are more likely to be taken by those who have well informed judgment. It is up to planners to ensure that decision makers are provided with the type of information necessary for such judgment. This mode of working implies a radical change in the development and use of models and in the behavior of the decision makers.

"IDENTIFICATION OF ENVIRONMENTAL PROBLEMS WHEN SIGNALS ARE WEAK OR NON-EXISTENT"

Milutinovich, Jugoslav S., School of Business Administration, Temple U., Philadelphia, PA 19122  
Mankelewicz, John M., Municipal Environmental Associates, Inc., Finore Bldg., Springhouse, PA 19477

Lack of strategic information about future environmental constraints and opportunities may result in great difficulties for planning future organizational policies and strategies. Unfortunately, in many instances there is either no information or very little information (weak signal) in the past or present environments that may be used to forecast future environmental conditions. Under such circumstances the classical forecasting approaches are of little value to organizational planners. This paper reviews the literature and presents a model of executive future problem identification. Further, it presents different methodologies for environmental problem identification when the signals are either weak (eight methods) or non-existent (six methods).

"MICROECONOMICS AND STRATEGIC PLANNING"

Webster, George, St. Joseph's U., 5600 City Line Ave., Philadelphia, PA 19131

While macroeconomists have made executives aware of the need to incorporate macroeconomic information in the planning process, microeconomists have not been successful in demonstrating the usefulness of "price theory" in the planning process. A parallel exists between microeconomics and strategic planning. It is the function of the planner to achieve long-term objectives, subject to a given amount of information. In microeconomics, an objective function is maximized, subject to some constraints. Planning models can be constructed that are as precise as microeconomic models.

"THE ROLE OF ENVIRONMENTAL FORECASTING/ASSESSMENT IN FORMAL CORPORATE PLANNING PROCESSES -  
AN INTERNATIONAL STUDY OF CORPORATE PRACTICE"

Klein, Harold E., School of Business Administration, Temple U., Philadelphia, PA 19122  
Linneman, Robert E., School of Business Administration, Temple U., Philadelphia, PA 19122

Survey data collected from 500 of the largest corporations world-wide indicate a strong and increasing commitment to the environmental assessment (EA) task. This was shown by the extent of EA task formalization in planning processes, the establishment of EA organizational units, and the wide-spread, but selective adoption of conjectural forecasting approaches, notably multiple scenario analysis. EA activity is most pronounced where "strategic" planning is a distinctly identified task and where companies find themselves in rapidly changing environmental situations. Corporate EA practices tend to be remarkably similar among industrials and non-industrials for both U.S. and foreign corporations.

"TECHNOLOGICAL ASSETS MANAGEMENT AND TF"

Bnaya, David, ICTAF, Tel-Aviv U., Ramat-Aviv, Tel-Aviv, Israel 69978

Technology is often a substantial part of the assets of a firm. There is a need to manage these assets, but this is quite a task regarding the duality of technology (process and product), the rate of innovation and obsolescence, and the fact that technology is an intangible asset. The objectives of Technological Assets Management (T.A.M.) are the maintenance and development of the technological infrastructure of the firm. This includes: (1) maximizing return on technology in inventory, (2) assuring the matching between market needs of technology and the firm's technology inventory, (3) assuring technological "lead" of a product, (4) planned replacement of old technology with new one, and (5) building a technological infrastructure by buying new technology and by internal R & D. TF is an indispensable tool for T.A.M.; nevertheless the use of TF in management decision making is rare. The objective of this paper is to present a framework for Technological Assets Management and to discuss ways for integration of TF input in the process.

PROVINCIAL NORTH

ECONOMETRIC MODELS

Chair: *Adame, F. Gerard*, Dept. of Economics, U. of Pennsylvania, Philadelphia, PA 19104

"EVALUATING ACCURACY OF OFFICIAL AND NON-OFFICIAL FORECASTS FOR THE FRENCH ECONOMY"

*Courbis, Raymond*, Group for Applied Macroeconomic Analysis, U. of Paris-Nanterre, 2 Rue de Rouen, 92001 Nanterre, France

Official and non-official forecasts for the French economy have been made for thirty years. This paper appraised the accuracy of these official and non-official forecasts. A comparison of the accuracy of the official forecasts for the 1950s, 1960s and 1970s reveals a systematic bias, in particular, for external trade and inflation. The 1975 recession had not been anticipated and the 1981-82 recession had also been under-evaluated, but lower. For the non-official forecasts, the mean absolute error in the 1970s is in general lower than for the official ones. Errors are the largest for investments and external trade. The 1975 and 1980-82 recessions have also been under-evaluated, but progress has been made for the 1980-82 recession.

"PREDICTION AND SPECIFICATION TESTS BASED ON STOCHASTIC SIMULATIONS OF A NONLINEAR DYNAMIC ECONOMETRIC MODEL"

*Mariano, Roberto S.*, Dept. of Economics, U. of Pennsylvania, Philadelphia, PA 19104  
*Brown, Bryan W.*, Dept. of Economics, Princeton U., Princeton, NJ 08540

Most econometric models from which economic predictions are obtained are nonlinear as well as dynamic. In this paper, we analyze the large-sample behavior of alternative one-period and multi-period predictors in a nonlinear dynamic system. We show that the commonly used deterministic predictor is, in general, asymptotically biased for prediction as well as for estimation of means. We consider alternative procedures that avoid this bias; namely, Monte-Carlo based and residual-based stochastic simulations. In addition to correcting for bias, these two stochastic predictors also provide estimates of higher order moments and probability distributions of endogenous variables. The Monte-Carlo predictor has been used by practitioners but only to a limited extent. The residual-based simulation, which uses sample-period residuals as proxies for disturbance terms, is a new procedure which we propose in order to reduce the computational burden and sensitivity to distributional assumptions inherent in Monte-Carlo. Asymptotic bias and mean squared prediction errors are calculated for these various predictors. A numerical illustration is provided within the context of a moderately size model. The use of Monte-Carlo and residual-based model simulations in the construction of prediction regions and specification error tests is also discussed.

"A MONTHLY GNP MODEL"

*Savacool, John*, Chase Econometrics, 150 Monument Rd., Bala Cynwyd, PA 19004

Since the Department of Commerce first released historical data for consumption expenditures at a monthly frequency, there have been few systematic attempts to exploit the fact that approximately 65% of GNP is now available on a monthly basis. Given the problems macroeconomic forecasters have encountered with near-term forecasts over the last three years, a more structured approach to analyzing monthly data seems desirable. This paper explains how the remaining components of GNP were constructed on a monthly basis and discusses the problems attendant to this process. Following the section on interpolation of the data, the specifications of a small monthly model are presented along with postsample simulation and forecasting results. The final section contains a forecast for the first three months of 1983 and some observations on the benefits obtained by modeling GNP on a monthly basis.

## ENERGY FORECASTING

Chair: Dossani, Nazir, CONSAD Research Corp., 8150 Leesburg Pike, Vienna, VA 22180

"AN EVALUATION OF THE DRI QUARTERLY MACROECONOMIC MODEL'S RESPONSE TO ENERGY AND ENVIRONMENTAL COST SHOCKS"

Dossani, Nazir, CONSAD Research Corp., 8150 Leesburg Pike, Vienna, VA 22180

Santini, Danilo J., Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439

During the 1970s two major energy price shocks occurred. Each was accompanied by cost shocks from combined effects of safety and environmental regulation and by reductions in the rate of growth of the money supply. Each was followed by a recession. A third energy price shock and the contraction of monetary growth occurred when President Reagan took office and another recession followed. I used the DRI macromodel to evaluate the impact of environmental regulations over the 1982-1987 period, using different assumptions about energy price shocks and money supply growth. The simulation results are evaluated in light of the historical evidence of the 1970s.

"POWER PLANNING IN THE PACIFIC NORTHWEST"

Morlan, Terry H., Northwest Power Planning Council, 700 S.W. Taylor St., Portland, OR 97205  
Corum, Kenton R., Northwest Power Planning Council, 700 S.W. Taylor St., Portland, OR 97205

Established in 1981, the Northwest Power Planning Council was formed to plan for meeting the electricity needs of the Pacific Northwest for the rest of the century. Their planning deals with several unique features of the region, including substantial weather-related variation in energy available from its dominant hydroelectric resources, a congressional mandate to treat conservation as the preferred resource for meeting future needs, and the nation's widest disparity between average cost and marginal cost of electricity. This paper describes key elements of the planning methodology and its application for the development of the Pacific Northwest Power Plan.

"IMPORTANCE AND JUSTIFICATION OF FILTERING IN FORECASTING ECONOMIC TIME SERIES"

Nadeau, Serge, Carnegie-Mellon U., Pittsburgh, PA 15213  
Longini, Richard L., Carnegie-Mellon U., Pittsburgh, PA 15213

Rather than assuming that transitory components are random, we propose a forecast functional definition. The transitory components are zero mean and have autocorrelations that are insignificant for a time offset commensurate with the forecast period. We show theoretically that forecasting accuracy can be improved if the magnitude of the transitory components is reduced, by the use of filters, prior to the estimation of a specific model. We found that suitably filtered series produce improved forecasts of the U.S. electric energy demand.

"STATE FORECASTING FOR REAL-TIME MONITORING OF ELECTRIC POWER SYSTEMS"

Filho, M.B. Do Coutto, Dept. de Eng. Elétrica, PUC/RJ, C.Postal 38063, Rio de Janeiro, Brazil  
da Silva, A.M. Leite, Dept. de Eng. Elétrica, PUC/RJ, C.Postal 38063, Rio de Janeiro, Brazil  
Queiroz, J.F., Programa de Eng. Elétrica, COPPE/UFRJ, C.Postal 68505, Rio de Janeiro, Brazil

Due to the dynamic nature of system loads, the state vector of a power system varies with time. The dynamic state estimation approach consists of predicting the state vector based on past estimations, followed by a filtering process when a new set of measurements is available. This paper presents a new algorithm for forecasting and filtering the state vector using exponential smoothing and least-squares estimation techniques. Numerical results showing the performance of the proposed dynamic estimator under different operational conditions are presented and discussed.

"FORECASTING IN A STATISTICAL ENVIRONMENT - AN APPROACH FOR ENERGY DEMAND FORECASTS"

Sheel, Satya, Dept. of Electrical Engineering, M.N.R. Engineering College, Allahabad 211004, India  
Biswas, K.K., Dept. of Electrical Engineering, Indian Institute of Technology, Delhi,  
New Delhi, 110 010, India  
Sinha, A.K., Dept. of Electrical Engineering, Indian Institute of Technology, Delhi,  
New Delhi, 110 010, India

Power utilities have been using energy demand forecasting for technical as well as economic planning. This paper deals with the development of a self-tuning approach for a short term operational forecasting of energy demand. The self-tuning approach assumes minimum a priori knowledge about the system. The modelling of system is avoided; instead a predictor structure is directly considered whose parameters are estimated adaptively to yield predictions in one step. In modified form, the model is capable of handling stochastic periodic data as commonly occur in energy demand values. The algorithm is short and fast, requiring only a few steps. It is implementable on a mini/micro computer. A case study is presented for illustration.

MONDAY  
2:00-3:30

SALON 2

EXPONENTIAL SMOOTHING

Chair: *Gardner, Everette S.*, U.S. Atlantic Fleet Headquarters, Norfolk, Virginia 23511

"TRACKING THE EXPONENTIAL SMOOTHING MODEL"

*Gardner, Everette S.*, U.S. Atlantic Fleet Headquarters, Norfolk, Virginia 23511

Gardner (1983) recommended the simple cumulative sum (cusum) of errors as a tracking signal for exponential smoothing. This paper compares the simple cusum to the sophisticated parabolic mask tracking system developed by Brown (1982). Extensive simulation results show that the simple cusum should be preferred by most users. The parabolic mask is relatively insensitive to small changes in the time series. The performance of the parabolic mask also deteriorates as the smoothing parameter is increased, particularly when the linear (double smoothing) model is used.

"DETERMINING FORECAST ACCURACY OF EXPONENTIAL SMOOTHING MODELS"

*Brandon, Charles*, Crummer Graduate School of Business, Rollins College, Winter Park, FLA 32782  
*Jarrett, Jeffrey*, Dept. of Management Science, U. of Rhode Island, Kingston, RI 02881  
*Khumwala, Saleha B.*, Dept. of Accounting and Taxation, U. of Houston, Houston, TX 77004

Although recent years has seen great advancements in both the development of forecasting methodologies and the use of these methodologies, there has not been an attempt to identify variables covariant with forecast accuracy. In this study, variables having a strong association with forecast accuracy will be identified. The model selected to do this is a multivariate regression using explanatory variables categorized as firm factors, industry factors and economy-wide factors.

"COMPUTING THE VARIANCE OF THE FORECAST ERROR FOR THE ADDITIVE HOLT-WINTERS SEASONAL MODEL"

*Sweet, Arnold L.*, Purdue University, West Lafayette, Indiana 47907

Using the method of generating functions, equations are derived for the variance of the forecast error for the one-step-ahead and many-step-ahead forecast, when the forecasts are generated using the Holt-Winters additive seasonal model. A computational algorithm is presented. Using the algorithm, the problem of finding the range of values for the smoothing constants and period for which the variances are finite is discussed. Some tables of numerical results are shown.

MONDAY  
2:00-3:30

SALON 3

FORECASTING WITH INPUT-OUTPUT ANALYSIS

Chair: *Cook, Larry H.*, Centre of Policy Studies, Monash U., Melbourne, Australia, 3168

"FORECASTING ABILITY OF LEONTIEF-TYPE AND WALRASIAN-TYPE INPUT-OUTPUT MODELS: NORWAY, 1949-61"

*Cook, Larry H.*, Centre of Policy Studies, Manash U., Melbourne, Australia, 3168

In spite of the increasingly widespread usage of price-responsive computable general equilibrium models over the past few years, there has been little attempt to test whether they can track actual movements in an economy over time. This paper uses a Norwegian input-output data base, which is unequalled for any other country, to test the ex-post forecasting ability of two typical price-responsive Walrasian-type models (one assuming perfect substitutability between domestically-produced and imported goods in the same input-output category, and the other imperfect substitutability) and a typical Leontief-type input-output model.

"ESTIMATING TECHNOLOGICAL COEFFICIENTS BY HIERARCHICAL MEASUREMENT"

*Bahmani, Nick*, Quantitative Methods Dept., Montclair State College, Upper Montclair, NJ 07043  
*Khorrami, Allen*, Quantitative Methods Dept., Montclair State College, Upper Montclair, NJ 07043  
*Chen, Ed*, Quantitative Methods Dept., Montclair State College, Upper Montclair, NJ 07043

In this paper, we present a new, system oriented, method for estimating the input coefficients derived from an input-output table of a given economy. The method is based on pairwise comparisons among the sectors of the economy to rank them according to their priority on a ratio scale. The estimates turn out to be very close to what is obtained by traditional methods, but a major advantage is that it generally does not require extensive detail to capture the significant relations among the sectors.

"SYNTHESIZING THE LEONTIEF AND KEYNESIAN APPROACHES: AN EXAMPLE"

*Simunek, Vladimir J.*, Dept. of Economics, Kent State U., Kent, OH 44242

The paper discusses one of the possible ways to interrelate the Leontief input-output subsystem with the Keynesian subsystem of flows of income into a closed-loop system. Two types of markets that provide such interrelationship are considered: 1) Markets for final commodities where Leontief final output and Keynesian final expenditures represent the respective supply and demand sides, and 2) Markets for services of factors where the Leontief value added and the Keynesian primary incomes represent the respective demand and supply sides. Examples of quarterly forecasts with an econometric model containing the 83 by 83 interindustry matrices in constant and current dollars are included.

## EXTRAPOLATION: ADAPTIVE FORECASTING

Chair: *Carbone, Robert, FSA, Université Laval, Québec, G1T 1X4, Canada*

"THE FUTURE OF ADAPTIVE FORECASTING METHODS"

*Carbone, Robert, FSA, Université Laval, Québec, G1T 1X4, Canada*

*Lewandowski, Rudolf, Marketing Systems, Postfach 230109, D-4300 Essen 1, West Germany*

*Makridakis, Spyros, INSEAD, 77305 Fontainebleau, France*

Different meanings have been assigned to the concept of Adaptive Forecasting. This paper reviews and compares in a non-technical way how these meanings have been applied to univariate and multivariate forecasting. From this analysis, an attempt is made to evaluate the usefulness of the concept and identify what future directions should be followed.

"A COMPARISON OF DIFFERENT FORECASTING METHODS AND ITS STATISTICAL EVALUATION"

*Schwarze, Jochen, Abteilung Statistik und Operations Research des Instituts für*

*Wirtschaftswissenschaften der Technischen Universität, Postfach 3329, D-3300 Braunschweig,  
Federal Republic of Germany*

The working group, "Forecasting Methods" of the Deutsche Gesellschaft für Operations Research (German OR Society), has compared 12 different types of forecasting methods using 15 empirical time series. The methods applied are: Modifications of exponential smoothing, adaptive filtering, Kalman-filters, linear-recursive functions, and ARIMA-models (Box and Jenkins). For this comparison, different forecast errors and criteria were determined to analyze forecast accuracy. The errors computed have been analyzed by cluster-analysis, analysis of variance, and with simple methods of correlation analysis. The paper will give a short overview of the comparison and the main results.

"A FRAMEWORK FOR VARIABLE PARAMETER REGRESSION MODELLING"

*Machak, J.A., School of Business Administration, U. of Michigan, Ann Arbor, MI 48109*

*Spivey, W.A., School of Business Administration, U. of Michigan, Ann Arbor, MI 48109*

Variable parameter regression models provide a natural and useful extension of fixed coefficient linear regression models. However, the specification of the stochastic process assumed to be generating coefficients in these models is often ad hoc. In this paper, we present a general model framework that includes, as special cases, many of the models previously appearing in the literature, as well as new ones developed by the authors. Maximum likelihood estimation techniques are introduced which allow one to choose a model from this class in a more robust fashion than has been previously possible.

"STOCHASTIC PROCESS MODELING IN A VARIABLE PARAMETER FRAMEWORK"

*Ruth, William L., Management Science Dept., College of Business Admin., Northeastern U.,*

*360 Huntington Ave., Boston, MA 02115*

A common assumption with time series modeling is that the parameters of the process remain unchanged as the series realization grows. This paper examines the case in which the parameters of a stochastic process type time series model are allowed to vary systematically within a given realization. Specifically, a model is developed that explicitly considers the structure of parametric drift within a given stochastic process. It is shown that models of this type are easily developed and add an element of enhanced precision to the predictive performance of time series forecasts.

MONDAY  
2:00-3:30

SALON 5

HEALTH CARE FORECASTING

Chair: Chacko, George K., Professor of Systems Science, University of Southern California Institute of Safety and Systems Management - East, 6809 Barr Road, Bethesda, Maryland 20816

Session Overview: For one of the major sectors of the U.S. economy, health care is conspicuous for its lack of use of forecasts in planning and performing its mission. Three papers in the session present empirical instances of health care forecasting in which two or more forecasting methodologies were applied to the same database to make the forecasts and the forecasts were then compared with actuals. Two of these papers deal with cost and physical consequences and one deals with demand and supply forecasts. A fourth paper synthesizes several methodologies to yield scenarios for health management of the future.

"FORECASTING FOR HEALTH MANAGEMENT OF THE FUTURE"

Mitchell, Ferd, School of Medicine, U. of California at Davis, Sacramento, CA 95817  
Cloner, Alexander, School of Public Adm., U. of Southern California, Sacramento, CA 95814  
Coile, Russell, Western Center for Health Planning, 703 Market St., San Francisco, CA 9410

Effective health management of the future will depend on coalignment between the dominant paradigm (or paradigms) that provide the framework for care and services and the management methods and insights that are employed. This paper forecasts the future health care setting as a composite mix of "ideal type" scenarios; reality is a dynamic, interactive synthesis among these scenarios. The impact of this new setting on effective management methods is then explored within the framework of contemporary organizational theory. The implications for training programs and program development are explored within this context.

"FORECASTING END-STAGE RENAL DISEASE COST CONSEQUENCES"

Leonard, Michael S., Dept. of Industrial Engineering, U. of Missouri-Columbia, MO 65211  
Goldman, Jay, Dept. of Industrial Engineering, U. of Missouri-Columbia, MO 65211

To make decisions regarding the effectiveness of alternative strategies for containing the costs of care for end-stage renal disease (ESRD) patients, an evaluation of the impact of each alternative needs to be conducted. A major part of this evaluation is a forecast of the cost implications of each alternative proposed. This paper presents a methodology to evaluate the cost containment consequences of alternative proposals. A part of the methodology development process was the development, testing and analysis of five alternative forecasting models to predicted ESRD patient flows. The performance of the total cost containment proposal evaluation methodology was examined using data from three cost containment proposals that had been funded within the state of Missouri.

"MARKOV CHAINS FOR PREDICTION: APPLICATIONS TO HEALTH-RELATED PHENOMENA"

Schoenfelder, John, Burroughs Wellcome Co., 3030 Cornwallis Rd., Research Triangle Park, NC 27709  
Shachtman, Richard H., Dept. of Biostatistics, U. of North Carolina, Chapel Hill, NC 27514

Because of their inherent capacity for extended mathematical development, Markov chains are often viewed as too sophisticated for frequent use as an inferential tool. In fact, only recently have researchers begun to use Markov chains as more than descriptive models. This paper presents these familiar stochastic processes in an intuitive setting and demonstrates how they may be used for statistical inference. Applications utilize existing Markov chains employed in various inferential settings, in particular the area of prediction, to consequences of induced abortion and patients with hospital-acquired infections.

"THE RECORD OF FORECASTS OF SUPPLY AND DEMAND IN ANESTHESIA SERVICES"

Reisman, Arnold, Dept. of Operations Research, Case Western Reserve U., Cleveland, Ohio 44106  
Dean, Burton V., Dept. of Operations Research, Case Western Reserve U., Cleveland, Ohio 44106

At the beginning of the 1970s, the authors were involved in generating ten-year forecasts for the demand and supply of anesthesiologists and auxiliary personnel in the Greater Cleveland area. Several regression models were used to forecast supply based on population, number of physicians, and the income per capita. The demand models were based on population, age, and sex distribution projections, and historical data regarding operative and obstetrical procedures. The results of these "objective" models were then compared to forecasts under uncertainty generated by a panel of experts using the Delphi Method. Alternative states of health care delivery were investigated and implications for future anesthesiologist manpower requirements detailed. This paper compares the accuracy of each of the forecasting modes with outcome data.

SALON 6

FINANCIAL FORECASTING: RECENT DEVELOPMENTS

Chair: *Griffin, Paul A.*, Graduate School of Administration, U. of California, Davis, CA 95616

"THE IMPACT OF INTERVENING EVENTS ON CORPORATE EARNINGS"

*Hopwood, William S.*, Dept. of Accountancy, U. of Illinois, Urbana, IL 61820  
*McKeown, James C.*, Dept. of Accountancy, U. of Illinois, Urbana, IL 61820

This study deals with the impact of strikes and other intervening events on corporate earnings per share. It is shown that such interruptions in the time series can add considerable confusion to the model identification process. A proposed technique for dealing with this problem is discussed and applied to several series.

"AN EMPIRICAL COMPARISON OF THE EXTANT FINANCIAL DISTRESS PREDICTION MODELS"

*Zmijewski, Mark E.*, School of Management, SUNY at Buffalo, Buffalo, NY 14214

This study empirically examined 13 alternative bankruptcy prediction models which were formulated from eleven seminal financial distress studies. Three types of models were examined: those based primarily on financial statement data, those based on stock return data, and those based on liquidity statistics. The results indicated that most of the models predicted bankruptcy significantly better than the naive model -- predicting all firms as nonbankrupt -- when there existed asymmetric incorrect prediction costs. The models based primarily on financial statement derived relationships were the best predictors. The results also indicated that most of the alternative bankruptcy probability measures were significantly correlated with each other, with the exception of the model that utilized financial ratio standard deviations as predictors.

"RESEARCH ON FASB STATEMENT NO. 33: IMPLICATIONS FOR FORECASTING"

*Freeman, Robert N.*, Financial Accounting Standards Board, High Ridge Park, Stamford, CT 06905  
*Griffin, Paul A.*, Graduate School of Administration, U. of California, Davis, CA 95616

This paper critically analyzes the recent research on the usefulness to investors and creditors of information on the effects of changing prices on a firm's income and net assets -- as required by the Financial Accounting Standards Board's ruling number 33, "Financial Reporting and Changing Prices." While the research thus far is subject to the usual kinds of methodological caveats, the hypothesis that Statement 33 information is helpful in predicting enterprise cash flows or other economic phenomena is not generally supported.

TRANSPORTATION FORECASTING - I\*

Chair: Jessop, Alan, Transport Studies Group, Polytechnic of Central London, 35 Marylebone Rd.,  
London NWJ 5LS, England

"FORECASTING FOR HIGHWAY PLANNING AND DESIGN IN THE UK"

Jessop, Alan, Transport Studies Group, Polytechnic of Central London, 35 Marylebone Rd.,  
London NWJ 5LS, England

Following the publication in 1977 of a report critical of then current methods of forecasting traffic for highway design purposes, considerable interest was shown in the question of how to make useful forecasts. At first, interest centered on problems of making probabilistic forecasts, rather than point or range estimates, and on the incorporation of judgmental estimates of factors (such as GDP growth). Recently, attention has turned towards the problems of making decisions using such probabilistic information, particularly the impact on the highway engineer's design standards approach. The lessons that have been learned will be reviewed and likely future developments described.

"ASSESSING FORECASTING METHODS FOR TRANSPORT POLICY AND PLANNING DECISIONS"

Khan, Ata M., Dept. of Civil Engineering, Carleton U., Ottawa, K1S 5B6, Canada

A systematic framework and associated methodology now exist to support transport policy and planning decisions. However, a critical difficulty that remains is that, frequently, much reliance is placed upon answers, without much regard to their accuracy. This paper assesses forecasting methods for transport policy and planning decisions. Forecasting elements in methodology used for typical transport decision -- making contexts are described, and sources of uncertainties are identified. Examples of methodological deficiencies in actual decision cases are discussed. Finally, improvements to forecasting methodology and the role of refined (additional) information are described.

"AN OPERATING SYSTEM FOR FORECASTING PROJECT COST AT COMPLETION"

Anbari, Frank T., National Railroad Passenger Corp., (Amtrak), Operations & Maintenance  
Transportation East, 1617 John F. Kennedy Blvd., Philadelphia, PA 19103

The Northeast Corridor Improvement Project (NECIP), a program to upgrade railroad passenger service between Washington and Boston, requires improvements in various disciplines of railroad work. The Project Decision Support System (PDSS) presents a timely, simple, specific and action-oriented status of project performance and vision of the future. This is accomplished by integrating the Performance Index concept with forecasting techniques to estimate the cost at completion of various tasks, disciplines, and the entire project. Judgment is applied to the results, and the project manager approves or modifies the proposed actions to rectify problem areas.

"THE APPLICATION OF REGRESSION ANALYSIS TO DEVELOP COMMODITY FLOW FORECASTS ON THE LOWER MISSISSIPPI RIVER"

Martin, John C., Booz, Allen and Hamilton, 4330 East West Highway, Bethesda, MD 20814

In order to evaluate the feasibility of deepening the Lower Mississippi River, an estimate of future bulk cargo tonnage levels on the Lower Mississippi River was required, as was an estimate of the tonnage of bulk cargo that could be diverted from other U.S. seaports to Mississippi River seaports as the result of lower shipping costs due to the use of deeper draft ocean vessels. The paper describes the use of regression analysis to estimate baseline flows of export grain and coal from Lower Mississippi River ports. In addition, the development of port market share elasticities are described. These elasticities are then used to estimate the additional tonnage of coal and grains that could be diverted from other U.S. ports to Lower Mississippi River ports as a result of lower shipping costs due to the use of deeper draft vessels.

\*See related session on Wednesday at 12:00-1:30 PM

## EVALUATION OF COMPUTER MODELS AND DATA BASES

Chair: *Mahmoud, Essam*, Dept. of Quantitative Methods, Concordia U., Montreal, Quebec, H3G 1M8, Canada

"AN EVALUATION OF SELECTED COMPUTER PACKAGES"

*Mahmoud, Essam*, Dept. of Quantitative Methods, Concordia U., Montreal, Quebec, H3G 1M8, Canada

Forecasting specialists and business managers face the decision of buying or renting one or more of the many computer packages now available for forecasting. Examples of packages are: SIBYL/RUNNER, FORSYS-MAVIS, FLEXICAST, SIFT, APE, SABL, T-Series, SAS and SARAS. The uncertainty of the selection decision can be reduced if evaluations of these packages are accessible. This paper proposes a systematic approach for evaluating computer packages. The approach is discussed in detail for a variety of packages. The results of an empirical test of the approach for selected packages are presented.

"A SURVEY OF COMPUTER PROGRAMS FOR FORECASTING"

*Chen, Ed*, Dept. of Finance & Quantitative Methods, Montclair State College, Upper Montclair, NJ 07043

*Bahmani, Nick*, Dept. of Finance & Quantitative Methods, Montclair State College, Upper Montclair, NJ 07043

Forecasting programs, packaged or non-packaged, that are currently being used by industry and other organizations are evaluated and compared. These programs or packages are assessed in terms of their capabilities of handling various forecasting techniques, machine dependency (main frame, mini or micro), source language used, programming efficiency, input/output formatting, documentation, and costs. The purpose is to assist potential users to select the right program or package to meet their needs.

"FORECASTING AND THE DATA BASE: AN ANALYSIS OF DATA BASES FOR INTERNATIONAL BUSINESS"

*Rice, Gillian*, Dept. of Quantitative Methods, Concordia U., Montreal, Quebec, H3G 1M8, Canada

*Mahmoud, Essam*, Dept. of Quantitative Methods, Concordia U., Montreal, Quebec, H3G 1M8, Canada

A major consideration in the selection of a forecasting method for a specific situation is the type of pattern in the data. Before the data pattern is identified, the forecaster must recognize the dependence of any forecasting method upon the accompanying reliable data base. This issue is discussed in the paper with reference to forecasting for international business decision-making. In addition, an extensive list of international business data sources is presented with their appropriate applications in the area of forecasting. Selected data sources are also evaluated in more depth in terms of their reliability, coverage, time periods and forecasting application.

## MARKET FORECASTS

Chair: *Hallett, A.J. Hughes, Erasmus U., Postbus 1738, Rotterdam 3000 DR, The Netherlands*

"FORECASTING OF THE GERMAN STOCK MARKET WITH A MODIFIED BOX-JENKINS MODEL AND A MULTIPLE REGRESSION MODEL"

*Hansmann, Karl-Werner, Hochschule der Bundeswehr Hamburg, Postfach 700822, D-2000 Hamburg 70,  
Germany*

A computer implemented model was developed to forecast the future movements of prices in the German stock market. The forecasting system was founded on weighted multiple regression analysis with exponentially decreasing weights and macroeconomic time series as independent variables. The model was completed by a modified Box-Jenkins-Algorithm (including adaptive filtering) to forecast the independent variables and the autocorrelated residuals of the dependent variable. The forecasting system was numerically tested over a period of five years.

"MARKET PARTICIPANTS' FORECASTS OF COMMON STOCK RETURNS"

*Bart, John T., School of Admin. Studies, Brock U., St. Catharines, Ontario L2S 3A1, Canada*

This paper reports on the measurement and methodological issues involved in eliciting forecasts of expected returns from transactors in, and owners of, common stocks. Market participants' forecasts of return are widely acknowledged as the basis for decisions to buy, sell or hold shares. Despite the prominence of the *ex ante* return construct in capital markets theory, the virtual absence of forecasted return data in empirical research attests to the obstacles in obtaining these data from market participants. The present paper addresses this absence in the forecasting literature by reporting on the resolution of the empirical issues encountered in a survey of the capital-gain and dividend-income forecasts of over 800 owners of three of Canada's most widely-held and actively-traded common stocks. Two sets of issues are involved: 1) Issues bearing on the design and validation of a measuring device(s) to elicit unbiased, multi-outcome, capital-gain and dividend-income forecasts from various types of market participants; 2) Issues bearing on identifying and surveying scientific samples of transactors in, and owners of, common stocks on a timely basis. The paper concludes with a state-of-the-art assessment of empirical research involving the elicitation of forecasted return data from market participants.

"FORECASTS IN STABILIZATION POLICY AND THE INFORMATION INFEASIBILITY PROBLEM"

*Hallett, A.J. Hughes, Erasmus U., Postbus 1738, Rotterdam 3000 DR, The Netherlands*

The scope for stabilizing market prices or incomes, whether for international commodity stabilization agreements or for regulating markets in a rational economy, remains a contentious issue. Empirical studies designed to resolve this issue invariably take the ideal stabilization level as given, usually the historical trend of the stabilization period. But the ideal level cannot be known in advance of events in the market, and decision rules assuming such knowledge are informationally infeasible and illegitimate forecasts. This paper examines the impact of imposing information feasibility and evaluates four different methods of forecasting an ideal level jointly with the stabilization rule, using a model of the world copper industry.

SEMINAR B

MONDAY  
2:00-3:30

EVALUATIONS OF ALTERNATIVE EXTRAPOLATION TECHNIQUES

Chair: *Dalrymple, Douglas J.*, Graduate School of Business, Indiana U., Bloomington, IN 47401

"SELECTING PARAMETERS FOR TIME SERIES FORECASTING TECHNIQUES"

*Dalrymple, Douglas J.*, Graduate School of Business, Indiana U., Bloomington, IN 47401  
*King, Barry E.*, Academic Faculty of Management Science, Ohio State U., Columbus, OH 43210

This study examines the forecasting errors associated with time series parameter estimates for four forecasting techniques used in three different modes of forecasting. The data used to examine the forecasting performances are from a well-publicized set of 1001 time series. Results show that searching for ideal parameters often produces smaller forecasting errors.

"ON THE USE OF MULTIPLE MODELS FOR MULTI-PERIOD FORECASTING"

*Findley, David F.*, Bureau of the Census, Rm. 3524, FB-3, U.S. Dept. of Commerce, Washington, DC, 20233

This paper advances simple theoretical arguments for selecting and estimating a different linear forecasting model for each prediction period  $m$  for which a forecast is desired. For these arguments, it is assumed that the series being forecast is covariance stationary and is not perfectly modeled by the one-period-ahead forecasting model which is fit to it. Two examples are given using well-known series which illustrate one possible implementation of a multi-model forecasting procedure for autoregressive forecasting.

"FORECASTING FLEXIBLE WORK FORCE DEMAND LEVELS"

*Yost, Nada R.*, Academic Faculty of Management Science, Ohio State U., Columbus, OH 43210  
*King, Barry E.*, Academic Faculty of Management Science, Ohio State U., Columbus, OH 43210

This paper describes an effort to forecast and schedule flexi-force warehouseman in the public warehousing environment. The problem is characterized by highly variable demand within a short planning horizon. It is a controllable operation that is dominated by labor expense, but can only be buffered with extra labor forces. Customers expect same day service and routinely make requests for service after the time when the following day's labor force needs to have been decided. Acceptable day-to-day forecasts were the goals of this project. The best performing technique uses multiplicative indexes applied against a base using Bayesian estimates of the probability that the supplied index will be the correct one for the following day.

## REGRESSION MODEL SELECTION FOR FORECASTING

Chair: *Askin, Ronald G.*, Division of Systems Engineering      U. of Iowa, Iowa City, IA 52242

**"TRIMMED REGRESSION QUANTILES AND RELATED PROCEDURES"**

*Narula, S.C.*, School of Management, Rensselaer Polytechnic Institute, Troy, NY 12181  
*Wellington, J.F.*, Behrend College, The Pennsylvania State University, Erie, PA 16563

The minimization of the sum of absolute errors (MSAE) is an alternative to least squares for estimation of the unknown constants in the linear regression model. In recent literature, the MSAE principle is shown to be a special case of "regression quantiles." We discuss estimators that result from a trimming procedure using regression quantiles and subsequent fitting based upon the MSAE principle. The results of a prediction experiment are reported.

**"THE COMPLEMENTARY USE OF REGRESSION DIAGNOSTICS AND ROBUST ESTIMATORS"**

*Gibbons, Diane I.*, Mathematics Dept., General Motors Research Laboratories, Warren, MI 48090  
*Gunst, Richard F.*, Dept. of Statistics, Southern Methodist U., Dallas, TX 75275  
*McDonald, Gary C.*, Mathematics Dept., General Motors Research Laboratories, Warren, MI 48090

Regression modeling for prediction or forecasting purposes is critically dependent on the quality of the data used to estimate the model parameters. Extreme response or predictor-variable values can distort least squares estimates and cause predictions to be imprecise. Robust alternatives to least squares are less sensitive to extreme observations and can provide more precise predictions. In this article, diagnostic displays are used to identify extreme observations and to assess the sensitivity of least squares parameter estimates and predictions to the inclusion of these observations in a data set. The displays are shown to aid in the interpretation of weights that robust estimators assign to influential observations.

**"EVALUATION OF THE EXTRAPOLATION ABILITY OF BIASED ESTIMATION PREDICTIVE EQUATIONS"**

*Friedman, David*, School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA 30332

The predictive performance of a regression model has been found to be, on occasion, adversely affected by both multicollinearity and high influence data points. Although biased estimation procedures have been proposed as an alternative to least squares, there has been little analysis of the predictive ability of the resulting equations. Nor has extensive work been done on the detection of influential points in the resulting models. This paper discusses the predictive performance of various biased estimators, together with methods to detect high leverage points, outliers, and extrapolation points in the resulting models.

**"SELECTING A RIDGE-TYPE REGRESSION MODEL FOR FORECASTING"**

*Askin, Ronald G.*, Division of Systems Engineering, U. of Iowa, Iowa City, IA 52242  
*Montgomery, Douglas C.*, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA 30332

Biased estimation of regression model parameters has received considerable attention in the past decade. In this paper we discuss procedures that have been developed to guarantee expected forecasting improvements with respect to least squares. In addition, we look at several indicator statistics that can be used in practice for determining if, for a specific data set, biased parameter estimates will produce better forecasts than least squares.

SEMINAR D

SOCIOLOGY

Chair: *Henshel, Richard L.*, Dept. of Sociology, U. of Western Ontario, London, N6A 5C2, Canada

"SOCIOECONOMIC RAMIFICATIONS OF CHANGING COHORT SIZE: AN ANALYSIS AND FORECAST OF US POSTWAR SUICIDE RATES BY AGE AND SEX"

*Ahlburg, Dennis A.*, Industrial Relations Center, U. of Minnesota, Minneapolis, MN 55455  
*Schapiro, Morton Owen*, Dept. of Economics, Williams College, Williamstown, MA 01267

This paper presents a relative cohort size model of suicide. The model states that as relative cohort size (the ratio of younger to older workers) rises, income and income aspirations diverge for the young. One extreme reaction to this disequilibrium is suicide. The model explained the variation in age and sex-specific suicide rates for the U.S. over the period 1948 to 1976. It identified the direct effect of changes in cohort size on suicide rates, as well as the indirect effect operating through other demographic variables. For the future, the model predicts that the suicide rates for males above 45 years of age will rise and those for all other groups will decline. For most groups, this is a reversal of recent movements in suicide rates.

"FORECASTING AGGREGATE AND DISTRIBUTIONAL OUTCOMES FOR HETEROGENEOUSLY BEHAVING POPULATIONS"

*Caldwell, Steven*, Dept. of Sociology, Cornell U., Ithaca, NY 14850

Common sense and a growing body of empirical evidence testify that individuals, families, firms, local governments and other actors typically do not respond identically to similar interventions. Consequently, the aggregate response to some intervention by populations of such actors typically depends on the composition of the population as well as its size. Aggregate forecasting models are limited in the degree to which heterogeneity can be captured and, thus, are subject to severe aggregation biases. Sample-based microanalytic models, in contrast, are designed to represent heterogeneity and, hence, overcome aggregation biases. This paper reviews the specification, testing and estimation issues at stake in comparing macro to micro forecasting strategies. Based on the empirical evidence for particular demographic and economic behaviors, the paper attempts to specify the trade-offs in choosing macro vs micro forecasting strategies.

"COMPONENTS OF BEHAVIOR IN LONG RANGE FORECASTS - THE PROBLEM OF CULTURAL CHANGE"

*Mackensen, Rainer*, Institute of Sociology, Technical University Berlin, Dovestra. 1/714,  
D-1000 Berlin 10, West Germany

Long range forecasts often use behavioral hypotheses resting on static sociostructural models. Observations during the last twenty years suggested cultural change in functions representing social behavior. Understanding the patterns of cultural change can lead to formulation of metaempirical functions and parameters governing change in behavioral functions. Two examples in forecasting are discussed. They are the consequences of diminishing population, and the effect of traffic systems in West Germany. These demonstrate problems and applied procedures. Dimensions of behavioral patterns change and types of possible cultural development in modern society are suggested for further empirical clarification and long-range social forecasting.

## USES AND ABUSES OF FORECASTING

Chair: *Solem, Erik, ORAE, Dept. of National Defense, Ottawa 1, Ontario K1A 0K2, Canada*

"TENSION BETWEEN THE POLICY AND RATIONAL USE OF FORECASTS: THE CASE OF AIR QUALITY PLANNING"

*Dennis, Robin L., National Center for Atmospheric Research, P.O. Box 3000, Boulder, CO 80307*

Two cases of choice between two forecasts are examined. The first is the choice within a bureaucracy between two models to forecast future emissions of motor vehicles. The second is multiple agency use of an agency's forecasts when goals are injected into the official forecast. In each case, one forecast is congruent with the facts, the other one is not. The different forecasts lead to different decisions, and choosing the congruent forecast has political costs. The resulting tension between a policy and a "rational" choice of a forecast introduces additional uncertainty into the information base, degrading our ability to understand problems and undercutting our ability to plan ahead.

"THE NOT SO NOBLE ART OF FORECASTING PUBLIC ACCEPTANCE OF NUCLEAR DEFENSE AND NUCLEAR POWER TECHNOLOGIES"

*Nielsen, Sigurd O., Symplexor Consultants, Holte, Denmark 2840*

Nuclear technologies promise "more bang (deterrence) for the buck" and "unlimited" energy plus the risk of destruction. Forecasting public acceptance of nuclear power reactors or nuclear weapon systems is asking how the public will weigh benefits against corresponding major hazards. Without sufficient disclosure of the broad design principles used and of the context in which the nuclear technology is going to operate, public attitudes towards it tend to become unstable when challenged. Convincing forecasting must, therefore, be based on extensive public technology assessments that stress context, consideration of alternatives, minimization of risk, and long-term projections. Nuclear missile deployment, power reactor operation, and high-level waste management illustrate where progress in forecasting is needed and how it may be accomplished.

"SOCIAL FORECASTING AND THE EFFECTS ON THE ACT OF FORECASTING"

*Masini, Eleonora, World Futures Studies Federation, Casella Postale 6203, Roma-Prati, Italy*

Social forecasting is a basically normative endeavor whether at the explorative or clearly accepted normative level. As such, social forecasting brings to the forefront ethical aspects related to the responsibility of the researchers' activity not only in terms of the choices expressed for the future, but also in terms of changing the socio-cultural environment in which the activities are developing. This specific aspect has an ambivalent importance: on one side, it brings to the acknowledgement capability of change of whoever and whatever is involved opening up alternatives; at the same time, it must acknowledge the force of change that is taking place by the act of forecasting. Groups and people involved in social forecasting must recognize this ambivalence.

"FORESIGHT AND FORECASTING"

*Smith, Ethan T., College of Architecture and Urban Studies, Virginia Tech, Blacksburg, VA 24061*

The developing topic of national foresight is one which, while related to forecasting, significantly extends the boundaries of method available. For example, forecasts may be extrapolations of trends, complex models, or expert judgment. In some sense, forecasts attempt to predict the future, or at least the future state of a system. By contrast, foresight tends to focus on understanding the underlying nature of a system. It can include preparing for possible contingencies and their implications, and setting up institutions to deal with many possible futures. Forecasting then becomes one tool that is used to support national foresight capability.

MONDAY  
2:00-3:30

PARLOR B

ASPECTS OF FORECASTING USING ARIMA MODELS

Chair: *Hillmer, Steven*, School of Business, U. of Kansas, Lawrence, Kansas 66045

"TIME SERIES AND SAMPLE SURVEYS"

*Abraham, Bovas*, U. of Waterloo, Waterloo, Ontario, Canada N22 3G1

Most of the important surveys are repeated at regular time intervals. The labour force survey in Canada is an example. In such situations, it is reasonable to consider the characteristic of interest, say  $\mu_t$ , to be slowly changing over time, and to model  $\mu_t$  using time series techniques. Thus, for estimating  $\mu_t$ , the information from previous surveys at time  $t-1, t-2, \dots$  could be used together with that from the current survey. Some previous attempts have been made in this regard. In this paper, we consider general models capturing seasonality and bivariate or multivariate models in which two or more characteristics are under consideration. The implications on the survey designs are also investigated.

"MODELING THE ADVERTISING - SALES RELATIONSHIP THROUGH USE OF MULTIPLE TIME SERIES TECHNIQUES"

*Heyse, Joseph F.*, Merck, Sharp, and Dohme, Research Labs. W-3, West Point, PA 19486

*Wei, William W.S.*, School of Business Administration, Temple University, Philadelphia, PA 19122

When time series data is available for both advertising and sales, it may be worthwhile to model the two series jointly. Such an analysis may contribute to our understanding of the dynamic relationship among the series and may improve the accuracy of forecasts. Multiple time series techniques are applied to the well-known Lydia Pinkham data to illustrate their use in modeling an advertising-sales relationship. In analyzing the Lydia Pinkham data, the need for a joint time series model is established, a bivariate model is identified, estimated and checked. Its forecasting properties are discussed and compared to other time series and econometric approaches.

"DISTRIBUTION-FREE PROBABILITY LIMITS FOR TIME SERIES FORECASTS"

*Cogger, Kenneth O.*, School of Business, U. of Kansas, Lawrence, Kansas 66045

Parameters and forecast probability limits are estimated directly for autoregressive time series generated with Gaussian, Laplace, and Cauchy white noise sequences. The technique employed is the weighted least absolute value. Monte Carlo simulations suggest that relevant sampling distributions are normal, that parameter estimates are consistent, and that forecast probability limits are distribution-free. Given the wide range of variability in these three white noise series, and the implausibility of a rigidly maintained Gaussian hypothesis, this technique appears useful in establishing credible probability limits when the generating sequence is not Gaussian.

REGIONAL SCIENCE I\*

Chair: *Gorr, Wilpen L.*, School of Public Admin., The Ohio State University, Columbus, Ohio 43210

"ECONOMETRIC MODELLING OF A SMALL REGIONAL ECONOMY"

*Morgan, James N.*, College of Business Admin., Northern Arizona University, Flagstaff, AZ 86011

This paper describes an econometric model developed for use in forecasting general economic conditions in a five county region of Northern Arizona. The region is geographically large, but encompasses a population of only 300,000 with no single community having a population in excess of 40,000. The modelling procedure used attempts to restrict linkages to the national economy, so that only highly aggregated national variables are needed as inputs to forecasts using the model. The paper argues that this structure provides accuracy to models with more detailed national structure, that it provides more flexibility, that it allows the impact of national policy measures upon the regional economy to be seen more clearly, and that it saves the cost of subscribing to a large scale national model.

"REGIONAL FORECASTING WITH VECTOR AUTOREGRESSION: THE CASE OF NEW YORK STATE"

*Kinal, Terrence W.*, Dept. of Economics, SUNY, 1400 Washington Ave., Albany, NY 12222

*Ratner, Jonathan B.*, Dept. of Economics, SUNY, 1400 Washington Ave., Albany, NY 12222

The usefulness of the vector autoregression approach to forecasting in a regional context was explored. Vector autoregression (VAR) was contrasted with other time series forecasting methods and with using structural econometric models for forecasting. A VAR model of New York State was constructed. The accuracy of the predictions from this model relative to the other forecasting alternatives indicated that, as a benchmark for structural econometric forecasts and as a forecasting tool in its own right, VAR is a promising approach for state and regional forecasting.

"REGIONAL FORECASTING PERFORMANCE"

*Renfro, Charles G.*, Chase Econometrics, 150 Monument Rd., Bala Cynwyd, PA 19004

During the period from 1973 through 1981, a model of the economy of the state of Kentucky was used to produce forecasts based upon a set of national forecasts. This paper evaluated the forecast record of the Kentucky model over the period from 1974 through 1980. In addition to presenting the evaluated forecast record in terms of Root Mean Square Error and other statistics, the paper explored the characteristics of the forecasts: in the case of a regional or other satellite model to a national econometric model, some of the forecast error is ascribable to sources such as the national model forecasts or data revisions (or at least the absence of final revisions at the time each forecast was made). It is useful to evaluate the types of variables predicted with the greatest precision and those predicted at various levels of less precision. In general, there has been little evaluation done of forecasting performance for satellite models, or more specifically, regional models.

"SMOOTHING APPROACHES TO SPATIAL FORECASTING"

*Foster, Stuart A.*, Department of Geography, The Ohio State University, Columbus, Ohio 43210  
*Gorr, Wilpen L.*, School of Public Admin., The Ohio State University, Columbus, Ohio 43210

This paper extends smoothing time series techniques, such as Brown smoothing, the adaptive estimation procedure, and generalized adaptive filtering, to the spatial domain. While these techniques have been used to process data points recursively, as ordered by time, we show that they can be easily extended to simultaneously process data points. Hence they are applicable to spatial data where no natural ordering of data points exists. We present a regional science application to illustrate spatial smoothing.

\*See related session on Tuesday at 2:00-3:30

SESSIONS ON MONDAY AT 4:00-5:30

<u>TITLE</u>	<u>CHAIRPERSON</u>		
KEYNOTE SPEECH BY HILLEL J. EINHORN	<i>Armstrong, J. Scott</i> , The Wharton School, U. of Pennsylvania	65	DOMINION BALLROOM D
FORECASTING FOR STRATEGIC PLANNING	<i>Makridakis, Spyros</i> , INSEAD, Fontainebleau, France	66	PROVINCIAL SOUTH
ASSESSMENT OF UNCERTAINTY IN ECONOMIC FORECASTS	<i>McNees, Stephen K.</i> , Council of Economic Advisors, Washington, DC	67	PROVINCIAL NORTH
MENTAL HEALTH SERVICE SYSTEMS	<i>Wooldridge, Ronald J.</i> , New York Office of Mental Health, Albany	68	SALON 1
STATE SPACE APPLICATIONS	<i>Brownlow, James</i> , U. of Southern California, Los Angeles	69	SALON 2
FORECASTING FOR FINANCIAL MARKETS	<i>Fisher, Jeffrey</i> , Bank of Israel, Jerusalem	70	SALON 3
SEASONAL ADJUSTMENTS	<i>Dagum, Estela</i> , Statistics Canada, Ottawa	71	SALON 4
DEMOGRAPHIC/ECONOMIC FORECASTING	<i>Ahlburg, Dennis A.</i> , U. of Minnesota, Minneapolis	72	SALON 5
BUSINESS CYCLES	<i>Caton, Christopher</i> , DRI, Lexington, Massachusetts	73	SALON 6
FORECASTING FOR UTILITIES	<i>Olley, Robert E.</i> , U. of Saskatchewan, Saskatoon, Canada	74	SALON 9
TECHNIQUES TO IMPROVE THE ACCURACY OF EXTRAPOLATION METHODS	<i>Spivey, W. Allen</i> , U. of Michigan, Ann Arbor	75	SALON 10

FORECASTING FOR STRATEGIC PLANNING PANEL

This panel will discuss:

"WHAT RESEARCH IN THE PAST DECADE HAS MOST IMPROVED OUR  
ABILITY TO DO FORECASTING FOR STRATEGIC PLANNING?"

and

"WHAT RESEARCH SHOULD BE DONE IN THE NEXT DECADE  
TO IMPROVE FORECASTING FOR STRATEGIC PLANNING?"

An opening statement lasting no more than 10 minutes from each panelist will be followed by 20 minutes of discussion among the panelists and 20 minutes of questions from the audience.

Panelists:

*Makridakis, Spyros*  
INSEAD, 77305 Fontainebleau, France

Spyros Makridakis has been on the faculty at INSEAD since 1970. He received his Ph.D. degree from New York U. He was a visitor at Stanford U., M.I.T., and Harvard U. He is the founding and chief editor of the Journal of Forecasting.

*McLaughlin, Robert L.*  
Micrometrics, Inc., Cheshire, CT 06410

Robert L. McLaughlin, publisher of the forecaster's newsletter Turning Points since 1969, is forecasting instructor for Control Data's Management Institute. A graduate of Notre Dame and Syracuse University, he held research positions in General Electric and Scovill (where in his last assignment he was researcher to Malcolm Baldrige, Secretary of Commerce in the Reagan Administration).

*McNulty, Robert E.*  
American Bell, 100 Southgate Parkway, Morristown, NJ 07960

Robert McNulty joined AT&T's Marketing Department in 1974. He was promoted to Illinois Bell as Assistant Vice President for Marketing in 1976 and returned to AT&T in September 1978 as Assistant Vice President Business Marketing Development. In September 1981, he assumed responsibility as Assistant Vice President Integrated Planning and Analyses. Effective January 1, 1983, he became the Vice President Corporate Planning Analysis and Operations for American Bell.

*Schoeffler, Sidney*  
The Strategic Planning Institute, 955 Massachusetts Ave., Cambridge, MA 02139

Sidney Schoeffler, Managing Director of The Strategic Planning Institute, received a Ph.D. from the New School for Social Research in 1952. He has taught at the U. of Massachusetts, the Harvard Business School and, currently, at the U. of Massachusetts. He is the author of The Failures of Economics: A Diagnostic Study and of many papers on business strategy.

*Tanguay, Louis A.*  
Bell Canada, 800 Place Victoria, Montreal H4Z 1A2, Canada

Louis Tanguay joined Bell Canada as a technician in 1957 and has held positions of steadily increasing and diversified responsibilities in various departments. He has been negotiator for Bell Canada, General Manager - Island of Montreal, and a vice president of Revenue Estimates, Personnel, and Corporate Performance. He was President of the Organizing Committee of the Quebec Winter Games (1983).

Chair: *Makridakis, Spyros*, INSEAD, 77305 Fontainebleau, France

**"ASSESSMENT OF UNCERTAINTY IN ECONOMIC FORECASTS"**

Chair: McNees, Stephen K., Council of Economic Advisers, Washington, DC 20500

**"CONTINGENT CONFIDENCE INTERVALS: THE ART OF PORTRAYING POLICY OPTIONS"**

von zur Muehlen P., Div. of Research and Statistics, Federal Reserve Board, Washington, DC 20551  
Tinsley, P.A., Div. of Research and Statistics, Federal Reserve Board, Washington, DC 20551

This paper provides an overview of recent work on estimating the ranges of uncertainty of staff macroeconomic forecasts. Topics include: (1) the use of forecast uncertainty as a criterion in the selection of policy strategies, (2) characterizations of anticipated policy responses to future unplanned outcomes, and (3) the transmission of uncertainty under alternative policy procedures.

**"THE INDEX OF LEADING SERIES AS QUANTITATIVE PREDICTORS: AN EVALUATION"**

O'Brien, M.J., 1926 N. Powhatan St., Arlington, VA 22205  
Stekler, Herman O., National Defense U., Washington, DC 20319

This paper examined the accuracy of the Index of Leading Series (ILS) in predicting quantitative movements of the Federal Reserve Index of Production. A number of approaches were examined, but the study was primarily based on a time series (transfer function) approach. The results obtained from these specifications were then compared with the predictions of an ARIMA model (using only the FRB Index). The comparison involved within sample and post sample forecasts and focused on both the magnitude of the errors and the timing associated with cyclical turns. Finally, the paper examined the stability of the model in the face of data revisions and the availability of additional observations.

**"THE ACCURACY OF INDIVIDUAL AND GROUP FORECASTS FROM BUSINESS OUTLOOK SURVEYS"**

Zarnowitz, Victor, Graduate School of Business, U. of Chicago, Chicago, IL 60637

This paper reports on a comprehensive study of the distributions of summary measures of error for a large and diversified collection of quarterly multiperiod predictions. The data cover more than 70 individuals professionally engaged in forecasting the course of the U.S. economy. Combining corresponding predictions from different sources can result in significant gains; thus, the group mean forecasts are on the average over time more accurate than most of the corresponding sets of individual forecasts. But we also demonstrate a moderate degree of consistency in the relative performance of a sufficient number of the survey members.

**"FORECASTING AND CONDITIONAL PROJECTIONS WITH REALISTIC PRIOR DISTRIBUTIONS"**

Doan, Thomas A., Dept. of Economics, Northwestern U., Evanston, IL 60201  
Litterman, Robert, Federal Reserve Bank of Minneapolis, Minneapolis, MN 55480  
Sims, Christopher, Dept. of Economics, U. of Minnesota, Minneapolis, MN 55455

This paper explains how to forecast and to make conditional projections of economic time series using vector autoregression. Our analysis is Bayesian in spirit. We aim at a prior distribution that is informative but also conventional and objective, in the sense that it is easily standardized and reproduced by other researchers.

## MENTAL HEALTH SERVICE SYSTEMS

Chair: *Wooldridge, Ronald J.*, New York State Office of Mental Health, 44 Holland Ave., Albany, NY 12229

"FORECASTING PERFORMANCE OF MENTAL HEALTH SERVICE SYSTEMS"

PART I: *Leff, H. Stephen*, Laboratory for the Study of Community Support Systems, 52 Beacon Street, Somerville, MA 02143

This presentation describes a multi-period linear programming model that is being tested by several State Mental Health agencies as a tool for predicting the effects of resource reallocations. The model was designed for application to a complete service system comprised of a full range of complementary programs. This presentation will center on the adaptations required during implementation of the model in a variety of settings.

PART II: *Mandersheid, Ronald*, Survey & Reports Branch, Biometry & Epidemiology, Room 18C17 - Parklawn Bldg., 5600 Fishers Lane, Rockville, MD 20857

This presentation provides an overview of forecasting activities sponsored by the National Institute of Mental Health through its program for Service System Research. Priorities for future research will be explained and guidelines will be provided on making application for a grant through the program.

PART III: *Wooldridge, Ronald J.*, Forecasting & Modeling, NYS Office of Mental Health, 44 Holland Ave., Albany, NY 12229

This presentation shows how life table analysis, queuing theory, and Box-Jenkins techniques have been unified in application to the problem of predicting inpatient census in New York State Psychiatric Centers. This presentation will feature a demonstration of dynamic display computer graphics as a complement to the more conventional algebraic methods of analysis.

## STATE SPACE APPLICATIONS

Chair: *Brownlow, James*, Dept. of Systems Science, U. of Southern California, Los Angeles, CA 90007

"A STATE SPACE, DISCRETE TIME APPROACH TO FORECASTING NATIONAL FOOTBALL LEAGUE GAMES"  
*Brownlow, James*, Dept. of Systems Science, U. of Southern California, Los Angeles, CA 90007

A State Space Model was used to predict the outcomes of the National Football League games. The underlying model for forecasting point spreads was based on a state vector of team performance and home-field advantage values for the 28 professional teams. The multivariate forecast procedure used a discrete-time Kalman Filter to update estimates of the State Vector and to provide variance/covariance information for estimating probabilities associated with forecast outcomes of the games. The development of the model, as well as forecast results for the 1981 season, are presented.

"SALES FORECASTING ACCURACY OF BOX-JENKINS VERSUS STATE SPACE MODELS FOR THE SALES/ADVERTISING RELATIONSHIP"

*Petto, Anthony C.*, Marketing Dept., DePaul U., 25 E. Jackson St., Chicago, IL 60604

Using one of the oldest sales/advertising time series (Lydia Pinkhams Company sales) relationship, this paper analyzes the relative forecast accuracy of Box-Jenkins models with univariate and multivariate state space models. Analysis of monthly and yearly sales data showed that, although state space models are more efficient to optimize, they did not perform as accurately as the best of the Box-Jenkins models. Multivariate state space models, which included advertising and income as independent variables, were more accurate than univariate state space models. Results are compared with Palda's 1964 econometric results for this series.

"A STATISTICAL COMPARISON OF SEVERAL TECHNIQUES FOR FORECASTING INFLATION"

*Taylor, Lawrence W., Jr.*, Investment Analysis Co., 139 Milstead Rd., Newport News, VA 23606

An evaluation is made of several techniques of forecasting inflation. Both statistical assessments and comparisons of actual and forecast price changes are used. The forecasting techniques studied for a ten-year period ranged in complexity from simplistic to major econometric model of the United States. All of the techniques that were compatible with the State Space format were evaluated using statistical estimation of their forecast error as a function of the forecast horizon.

"OUT-OF-SAMPLE FORECASTING PERFORMANCE OF CERTAIN MULTIPLE TIME SERIES MODELS"

*Narayan, Jack Y.*, Dept. of Mathematics, S.U.N.Y. College at Oswego, Oswego, NY 13126  
*Akeu, Celal*, School of Management, Syracuse U., Syracuse, NY 13210

Recently, numerous studies have appeared in the area of causality testing in economics. In many of these studies, the identification of the causal relationships was based on one-step-ahead ex post forecasts. Model selection based only on goodness of fit has justly been criticized by forecasters. In this study, an evaluation of the forecasting performance of certain multiple time series models for a number of macroeconomic series is presented. Recently developed statistical tests are applied to check for significant difference between the out-of-sample forecasts from multivariate models and those from corresponding univariate models. The state space methodology is utilized.

## FORECASTING FOR FINANCIAL MARKETS

Chair: Fisher, Jeffrey, Economics Dept., Bank of Israel, P.O. Box 780, Jerusalem, Israel

"DEVELOPMENT OF AN INTEREST RATE FORECASTING SYSTEM"

Brush, John S., Columbine Capital Services, 450 Holly Sugar Bldg., Colorado Springs, CO 80903

The U.S. Government security forecasting system offers users a choice of three interest rate forecasting approaches: Box-Jenkins, multivariate/econometric; and interactive. These provide forecasts out to six month horizons for maturities ranging from overnight to thirty years. This paper discusses the generation of the forecasting equations from a core of base equations selected as optimal at the boundary points of the time horizon/maturity space. I examine the compromises necessary to meet the requirements for use of a system by financial managers not well versed in economics, mathematics, or computer technology.

"SOME DAY-TO-DAY FORECASTS OF THE 1982-83 'BULL' MARKET"

Pourian, Heydar, Dept. of Economics, U. of Missouri, St. Louis, MO 63121

This paper reports on a variety of models and methods employed in generating daily forecasts of the Dow Jones Industrial Average based on the data from August 16, 1982 to March 14, 1983. Among the 55 methods tested, the following are discussed: A) Four Regressions based on the stock-market indicators ("internal" forecasts), B) Four Regressions based on non-stock indicators ("external" forecasts), namely, interest rates, money supply, and one "news" variable, C) Two Regressions based on A and B above ("mixed" forecasts), D) 15 ARMA and ARIMA models, E) Two Ridge Regressions, F) Two Simultaneous-Equation models. A comparison was made among these models and methods using day-to-day minimum absolute error.

"SECURITY ANALYSTS' EXPECTATIONS AND SHARE PRICES"

Guerard, John B., Jr., Dept. of Management, Finance & Marketing, Lehigh U., Bethlehem, PA 18015  
Beidleman, Carl R., Dept. of Management, Finance & Marketing, Lehigh U., Bethlehem, PA 18015

The purpose of this study was to test the hypotheses that security analysts earnings per share forecasts, collected and published in the Standard and Poor's EPS Forecaster, are more accurate than univariate and bivariate time series forecasting models. Moreover, this paper tested whether a linear combination of these forecasts outperformed the analysts' forecasts. Tests were produced to examine the excess returns generated by the securities forecasted to achieve the highest future growth in earnings; such forecasts should be incorporated into the share prices.

## **SEASONAL ADJUSTMENTS**

Chair: Dagum, Estela B., Seasonal & Time Series Adjustment Section, Statistics Canada, 2011, Ottawa, Ontario K1A 0T6, Canada

"ARIMA FORECASTING OF SEASONALLY ADJUSTED VERSUS UNADJUSTED DATA"  
Cholette, Pierre A., Statistics Canada, 25 Station A, Ottawa, Ontario K1A 0T6 Canada

This paper first compares the forecasting errors recorded when an autoregressive integrated moving average (ARIMA) model of Box-Jenkins is fitted to seasonally unadjusted series on the one hand and to seasonally adjusted series on the other hand. The errors were not systematically lower with seasonally unadjusted data. However, it is definitely easier to identify and fit models to unadjusted than to adjusted series. It was also found that seasonally adjusting the unadjusted series which had been extended by one year of unadjusted ARIMA forecasts generally yielded lower forecasting errors than directly forecasting the seasonally adjusted series.

## "ON CHOOSING A SEASONAL MODEL FOR OPTIMAL FORECAST ACCURACY"

*Longbotham, C. Roger*, College of Business Administration  
Denver, CO 80208

Denver University Park,

Most seasonal time series methods treat seasonality as if it were entirely stochastic or deterministic even though many seasonal time series have some combination of stochastic and deterministic seasonality. Recently, several authors have suggested combining deterministic and stochastic seasonal models when appropriate. The present study documents the forecast accuracy of three seasonal models: deterministic, stochastic and a combined deterministic and stochastic model for different levels of stochastic and deterministic seasonality and for different forecast horizons. Each of the three methods proves to be the most accurate under certain conditions.

## "ON NEW PROCEDURES IN THE ANALYSIS AND SEASONAL ADJUSTMENT OF TIME SERIES"

*Stier, W.*, Hochschule St. Gallen, Bodanstrasse 1, CH-9000 St. Gallen, Switzerland

It is shown that the old problem of decomposition and seasonal adjustment of time series can be solved in an optimal manner by newly developed methods. These consist essentially of digital filters that have two important and practical properties: exact amplitude functions, and zero-phases over the whole frequency-band. Thus, multiple notch or bandstop filters can be provided for seasonal adjustment, low-pass filters for "high-frequency-adjustment," high-pass filters for analysing seasonal movements, or band-pass filters for isolating the business-cycle component.

## "UNOBSERVED-COMPONENTS MODELS FOR SEASONAL ADJUSTMENT FILTERS"

Burridge, Peter, Dept. of Economics, U. of Warwick, Coventry CV4 6AL, England  
Wallis, Kenneth F., Dept. of Economics, U. of Warwick, Coventry CV4 6AL, England

Time series models are presented for which the seasonal component estimates delivered by the widely-used Census X-11 program closely approximate the linear least squares signal extraction solution. Models of the kind implied by our decomposition are frequently observed in applied time series analysis, and so an explanation of the well-known robustness of the X-11 procedure can be given. Earlier work in this area, by Cleveland and Tiao, is extended by consideration of a wider class of models, and by examination of both asymmetric and symmetric linear filters.

## "ADAPTIVE FORECASTING AND SEASONAL ADJUSTMENT WITH AEP FILTERING"

*Bilongo, Robert, FSA, Université Laval, Québec, G1T 1X4, Canada  
Carbone, Robert, FSA, Université Laval, Québec, G1T 1X4, Canada*

In recent years, several approaches have been proposed for deseasonalizing time series data. The most well-known are BAYSEA (Akaike and Ishiguro), SIGEX (Burman), Xll-ARIMA (Dagum), and SABL (Cleveland). This paper makes empirical comparisons of these approaches to DESAEP (Deseasonalized AEP, a new adaptive modeling structure that combines adaptive forecasting with seasonal adjustment. The comparison criteria center on result consistency between methods, forecasting performance, and the magnitude of revisions in seasonal factors.

## SALON 5

### DEMOGRAPHIC/ECONOMIC FORECASTING

Chair: Ahlburg, Dennis A., Industrial Relations Center, U. of Minnesota, Minneapolis, Minn. 55455

#### "LABOR MARKET FORECASTS AND PUBLIC POLICY"

Olson, Lawrence, SAGE Associates, 1875 I St. NW, Washington, D.C. 20006

Three revolutionary forces will soon combine to transform American labor markets: a shift from rapid to slow growth in the labor force, a Second Industrial Revolution in technology, and a quantum leap in international economic interdependence. Together, these forces will lead to serious shortages in skilled and educated American labor within five years, and the entire adult labor force will need to be retrained. Public policy should focus on education (especially technical education), training, and opening up world markets. Industry should focus on training and retention, while aggressively pursuing automation and international sourcing.

#### "FORECASTING COUNTY AND STATE DEMOGRAPHIC CHANGE"

Greene, Geoffrey, Wharton EFA, 3624 Market St., Phila., PA 19104

The paper describes methodology developed by Wharton Econometric Forecasting Associates for econometrically-driven projections of population, households and other demographic data at the county and state level. The first step is the estimation of a disaggregated historical demographic database using aggregate time-series and decennial Census data. These data are used in conjunction with economic data to build an econometric simulation model which is used for forecasting. The key to the methodology is a flexible, dynamically controllable variant of the "cohort-component" demographic projection algorithm which is used in both the estimation and forecasting steps.

#### "A CRITICAL EVALUATION OF TWO FORECASTING MODELS OF U.S. FERTILITY"

Ahlburg, Dennis A., Industrial Relations Center, U. of Minnesota, Minneapolis, Minn. 55455  
Schapiro, Morton Owen, Dept. of Economics, Williams College, Williamstown, MA 02167

There are two major economic models of fertility, one derived from the new household economics of Becker and the other from the relative income model of Easterlin. The former predicts U.S. fertility to fall to even lower levels than are currently being experienced, and the latter predicts fertility to rise over the next two decades. This paper systematically evaluates each model and compares ex-post forecast accuracy in an effort to reduce uncertainty about the future course of fertility in the U.S.

#### "POPULATION PROJECTIONS: A STATE GOVERNMENT VIEW"

Gillaspy, Thomas, Minnesota State Demography Unit, Capitol Square Bldg., 555 Cedar, St. Paul, Minn. 55101

McMurry, Martha, Minnesota State Demography Unit, Capitol Square Bldg., 555 Cedar, St. Paul, Minn. 55101

The Minnesota State Demography Unit is required to produce population projections which must be used for official state purposes. The projections are also widely used by other groups and individuals. The large number of users and the official nature of the projections create a number of constraints. First, since there is only one "official" set of projections, the tendency is to adopt a set of conservative assumptions that will be easy to explain. Second, since there is such a diverse group of users, and since all potential users are not known in advance, the projections do not always provide the specific information that people want. Third, projections can become a self-fulfilling (or self-denying) prophecy when they are used as a basis for planning and decision-making.

SALON 6

BUSINESS CYCLES

Chair: Caton, Christopher, Data Resources Inc., 29 Hartwell Ave., Lexington, MA 02173

"THE LONG WAVE - GOODBYE TO GROWTH?"

Caton, Christopher; Eckstein, Otto; Probyn, Christopher, Data Resources, Inc., 29 Hartwell Ave., Lexington, MA 02173

The 1970s were not happy years. After the strong growth and low inflation of the 1960s, the world was suddenly beset by cyclical turbulence, the return of inflation, disappointing productivity growth, high unemployment and, of course, the two OPEC episodes of 1973-74 and 1979. Writing in the mid-1920s, a Russian economist, Nikolai Kondratieff, described the existence of long cycles, with a periodicity of close to 50 years. Economic deterioration arrived right on time almost half a century after the beginning of the Great Depression. Was Kondratieff right? If so, how long will the downswing last? This study does not answer the first question. Rather, it draws implications for the U.S. economy through to 1995, if the economy follows Kondratieff's theory. The results are not pleasant for corporate planners.

"A DISCUSSION OF THE INDICATORS USED IN DEVELOPING AN EARLY AND ACCURATE JUDGMENTAL PREDICTION OF WEAK RECOVERY OR DEPRESSION"

Santini, Danilo J., Argonne National Laboratory, 9700 South Cass Ave., Argonne, IL 60439

Research supporting the March, 1982 prediction that events and federal policy indicated either a "weak recovery or a decline into depression level unemployment and national output" is summarized. Characteristics of the three major U.S. depressions since 1830 were compared to those of recessions since 1900 to arrive at this correct judgmental forecast. Depression indicators include characteristic changes in agricultural, transportation, energy, environmental, and monetary subject areas. Based on the recent behavior of these indicators, the 1982 "recession" was judged to be the initial stage of a depression, albeit one more similar in magnitude to the depression of the 1890s than the Great Depression.

"PREDICTION OF ECONOMIC RECOVERY AND AN OPTIMUM ECONOMIC POLICY"

Kao, Stephen S.T., Center for Rating the Presidents, 30 Illinois Ave., Racine, WI 53405

Many criticize Reaganomics, but few have a positive replacement. Based on 59-year statistics, this study has formulated an Optimum Ratio of high income to low income of 2.5. At this ratio, inflation would be 1.5%, and unemployment would be 4.4%. Experts, private and government, have forecasted that economic recovery would come in the winter of 1981, spring, summer, fall, and winter of other future years. This study shows that economic recovery will not be forthcoming until the unemployment rate has been reduced. A 1.6% reduction in unemployment is needed to stimulate a 1% economic recovery.

"BUSINESS CYCLE ANALYSIS AND FORECASTING WITH STATE SPACE MODELS OF CONTROL THEORY"

Vishwakarma, Keshav P., School of Economics, La Trobe U., Melbourne (Bundoora), Victoria, Australia 3083

Business cycles are considered to be an important aspect of economic activity. Certainly, any fluctuations in the economic activity have immense implications for management, both at the macro and the micro (individual firm) levels. This paper demonstrates the use of stochastic control theory for the identification and forecasting of business cycles. The emphasis is on practical applications. Several economic indicators are employed for illustration. These include industrial production, housing construction, and interest rates. A computer program called CIFS (Cycles Identification and Forecasting Software) has been developed by the author for the calculations.

MONDAY  
4:00-5:30

SALON 9

FORECASTING FOR PUBLIC UTILITIES

Chair: *Olley, Robert E., Dept. of Economics & Political Science, U. of Saskatchewan, Saskatoon, S7N 0W0, Canada*

Session Overview: This session is concerned with the development of conceptual underpinnings required in forecasting in utilities, and in the application of those tools to illustrative case examples. Emphasis is on understanding the underlying theoretical relationships and how they may increase the range and usefulness of forecasting in several applied areas.

"SOME PHILOSOPHICAL ISSUES IN THE PRACTICE OF FORECASTING"

*Falchi, Paul, Marketing, B.C. Tel, 1206 Island Park Walk, Vancouver, BC, V6H 3T4, Canada*  
*Toman, Allen, Coopers & Lybrand, Washington, DC*

The purpose of this paper is to examine various important concepts (explanation, cause, understanding and uncertainty) as methodological and practical issues in forecasting. An analytical approach can induce clarity (by examining the range of meanings and criteria for adequacy) and, also, provide practical assistance in sorting out the purposes/motivations related to the utilization of forecasts. Finally, our effort will draw upon existing work by Zellner (causality), Einhorn and Hogarth (diagnosis/causal thinking), Hogarth and Makridakis (psychological limits) and Jenkins (discovery and parsimony).

"INTER-FIRM PRODUCTIVITY GAIN COMPARISON IN THE CANADIAN TELECOMMUNICATIONS INDUSTRY"

*Olley, Robert E., Dept. of Economics & Political Science, U. of Saskatchewan, Saskatoon, S7N 0W0, Canada*  
*Kiss, Frank and Lefebvre, B.J., Bell Canada, 25 Eddy, 5th Floor, Hull, Quebec, J8Y 6MY, Canada*

The paper offers a method to explain observed differences in the productivity gains of firms. Productivity gain differences are attributed to inter-firm differences in (1) output growth rates, (2) product mixes, (3) technological improvements and (4) other factors. The required structural information on production technologies is delivered by a cost model of the firms to be compared. Certain technological similarities are assumed to exist, but a wide range of differences in production characteristics can be explicitly considered. Data on telecommunications firms are used to illustrate the strengths and weaknesses of the proposed analysis of inter-firm productivity gain differences.

TECHNIQUES TO IMPROVE THE ACCURACY OF EXTRAPOLATION METHODS

Chair: Spivey, W. Allen, Graduate School of Business Admin., U. of Michigan, Ann Arbor, MI 48109

"MISSING DATA IN TIME SERIES: FORECASTING WITHOUT INTERPOLATION"

Wright, D., Faculty of Administration, Ottawa U., 135 Wilbrod St., Ottawa K1N 9B5, Canada

Time series often contain gaps caused by the unavailability of certain data points or by the removal of outliers. This paper provides sequential procedures specifically designed to cope with missing data points as alternatives to the use of interpolation. Numerical examples are given for the forecasting behavior of these procedures and their sensitivity to initial and other conditions are explored. The choice of a method appropriate to a given type of data is described in order to improve forecasting accuracy and to reduce computational requirements.

"MONITORING AND ADJUSTING FORECASTS IN THE PRESENCE OF ADDITIVE OUTLIERS"

Hillmer, Steven, School of Business, U. of Kansas, Lawrence, KS 66045

The effect of additive outliers upon the accuracy of forecasts derived from extrapolative methods was investigated. It is demonstrated that outliers affect not only the accuracy of the forecasts at the time of occurrence, but also subsequent forecasts. Methods to adjust for additive outliers are discussed. The results of the paper are illustrated with an example.

"MINIMAL INTERVENTION MULTIPLE TIME SERIES FORECASTING MODELS"

Machak, J.A., Graduate School of Business Admin., U. of Michigan, Ann Arbor, MI 48109

Spivey, W. Allen, Graduate School of Business Admin., U. of Michigan, Ann Arbor, MI 48109

A class of multiple time series models useful in automated or minimal intervention industrial forecasting systems is analyzed. These models offer an alternative to simple exponential smoothing and Trigg and Leach type adaptive models, which treat time series as unrelated and thus cannot explicitly accommodate interrelationships that may exist between two or more series. Estimators of model parameters are provided, eliminating the need for ad hoc estimates of parameter values, a feature of many simple exponential smoothing models. Forecasting performance of the multiple models is compared with that of univariate models using automobile sales and inventory data.

"UNBIASEDNESS OF PREDICTIONS FROM ESTIMATED VECTOR AUTOREGRESSIONS"

Dufour, Jean-Marie, Faculté des Sciences Économiques, Université de Montréal, Place Anatole-France, 31047 Toulouse, France

Forecasts from a univariate autoregression estimated by OLS can be shown to be unbiased for any autoregressive process, irrespective of whether the autoregressive model fitted has the correct order. This result requires only symmetry of the distribution of the innovations. In this paper, I prove a similar result for vector autoregressions and describe a wide class of multivariate stochastic processes (which include multivariate Gaussian stationary processes) for which unbiasedness of predictions holds: if a vector autoregression of arbitrary finite order is fitted to a process in this class, the fitted model will generate unbiased forecasts.

KEYNOTE SPEAKER

*Robert G. Brown, Materials Management Systems, Inc.*  
P.O. Box 332  
Norwich, Vermont 05055

Robert Brown is president of Materials Management Systems, Inc. For more than 35 years he has specialized in statistical forecasting for inventory control. He has worked in operations research with Arthur D. Little, IBM, Curtiss Wright, the U.S. Navy and Air Force, and has been a visiting professor of operations research, mathematics, and production management at Yale, Northeastern, Dartmouth, Boston, and Lehigh Universities. He has contributed nearly 200 professional publications on statistical forecasting and scientific inventory management. Among his books are: Statistical Forecasting for Inventory Control (1959), Smoothing, Forecasting and Prediction (1963), Management Decisions for Production Operations (1971), Materials Management Systems (1977), and Advanced Service Parts Inventory Control (1981).

"OPERATIONS FORECASTING:  
FINDING THE PROBLEMS"

It may be a waste of critically short research resources to try to solve all the problems that can be stated in forecasting. My interest is primarily in short-term, detailed, forecasts for inventory management. An investment in a little extra safety stock may be much cheaper than the effort to find, and implement, an elegant solution which would make the forecast marginally more accurate. This paper identifies a few problems about which apparently very little is known, and where even an approximate solution could be of enormous value to industry.

Chair: *Robert Carbone, FSA, U. of Laval, Quebec, Canada*

KEYNOTE SPEAKER

*Robert L. Winkler, Graduate School of Business  
Indiana University  
Bloomington, Indiana 47405*

Robert L. Winkler is Distinguished Professor of Quantitative Business Analysis at Indiana University. He received a B.S. from the University of Illinois and a Ph.D. from the University of Chicago. He has held visiting positions at the University of Washington, the International Institute for Applied Systems Analysis, Stanford University, and INSEAD. He is the author of numerous research articles and books. His primary research interests involve probability forecasting, combining forecasts, Bayesian inference, decision analysis, and risk assessment. He is Departmental Editor for *Decision Analysis for Management Science* and serves as Associate Editor for the Journal of Forecasting and several other journals.

**"COMBINING FORECASTS"**

Aggregating information by combining forecasts from two or more forecasting methods is an alternative to using just a single method. Theoretical models and empirical results indicate that the combination of forecasts improves forecasting accuracy and also reduces the variability of forecasting errors and hence the risk associated with the choice of forecasting methods. Combining forecasts might be compared with portfolio analysis, in which a portfolio of securities is purchased instead of just a single security in order to diversify away some of the risk. Since the identification of a "true" model of the data-generating process or a single "best" forecasting method is difficult at best, combining forecasts is a reasonable practical alternative.

Chair: *J. Scott Armstrong, Wharton School, U. of Pennsylvania, Philadelphia, PA*

## SESSIONS ON TUESDAY AT 10:00-11:30

<u>TITLE</u>	<u>CHAIRPERSON</u>	<u>PAGE</u>	<u>ROOM</u>
ECONOMETRIC METHODS (PANEL)	<i>McNees, Stephen K.</i> , Council of Economic Advisors, Washington, DC	79	DOMINION BALLROOM D
EXTRAPOLATION: COMPETITION AMONG METHODS II	<i>Hibon, Michele</i> , INSEAD, Fontainebleau, France	80	PROVINCIAL SOUTH
JUDGMENTAL METHODS	<i>Fischer, Gregory W.</i> , Carnegie-Mellon U., Pittsburgh	81	PROVINCIAL NORTH
FORECASTING FOR HEALTH CARE INSTITUTIONS	<i>Tyson, Karen W.</i> , Georgetown U., Washington, D.C.	82	SALON 1
BUSINESS OPPORTUNITY ANALYSIS	<i>Talbott, Robert</i> , American Bell, Morristown, New Jersey	83	SALON 2
ELECTRIC UTILITY FORECASTING	<i>Williams, Larry J.</i> , EPRI, Menlo Park, California	84	SALON 3
COMMUNICATION OF FORECASTS	<i>Reyna, Valerie</i> , U. of Texas at Dallas	85	SALON 4
ORGANIZATIONAL EXPERIENCE WITH FORECASTING: SURVEYS	<i>Mentzer, John T.</i> , Virginia Polytechnic Institute, Blacksburg	86	SALON 5
FINANCIAL FORECASTING FOR FIRMS	<i>Brown, Lawrence D.</i> , SUNY Buffalo	87	SALON 6
EVALUATION OF MODEL USE IN POLICYMAKING	<i>King, John L.</i> , U. of California, Irvine	88	SALON 9
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FOREIGN EXCHANGE RATES	<i>Walldin, Knut-Erik</i> , Bromma, Sweden	90	SEMINAR A
TECHNOLOGICAL FORECASTING: DIFFUSION OF TECHNOLOGY	<i>Baal-Sohem, Jacob</i> , Tel-Aviv University	91	SEMINAR B
TELECOMMUNICATION SERVICE DEMAND	<i>Gilstein, Zachary</i> , Bell Laboratories, Holmdel, New Jersey	92	SEMINAR C
FORECASTING IN LESSER DEVELOPED COUNTRIES	<i>Karasek, Mirek</i> , Arabian Data Systems, Jeddah	93	SEMINAR D
COMPOSITE FORECASTING	<i>Bunn, Derek W.</i> , Oxford, England	94	PARLOR A
MARKETING: QUANTITATIVE APPROACHES	<i>Bassin, William M.</i> , Sage Data, Princeton, New Jersey	95	PARLOR B
BIOPOLITICS: PROSPECTS FOR HOMO SAPIENS	<i>Kort, Fred</i> , U. of Connecticut, Storrs	96	PARLOR C
ROBUST PROCEDURES IN TIME SERIES ANALYSIS	<i>Nyquist, Hans</i> , U. of Umea, Sweden	97	PARLOR D

ECONOMETRIC METHODS PANEL

This panel will discuss:

"WHAT RESEARCH IN THE PAST DECADE HAS MOST IMPROVED  
OUR ABILITY TO FORECAST USING ECONOMETRIC METHODS?"

and

"WHAT RESEARCH SHOULD BE DONE IN THE NEXT DECADE  
TO IMPROVE FORECASTS FROM ECONOMETRIC METHODS?"

An opening statement lasting no more than 10 minutes from each panelist will be followed by 20 minutes of discussion among the panelists and 20 minutes of questions from the audience.

Panelists:

*Adams, F. Gerard*

Dept. of Economics, U. of Pennsylvania, Philadelphia, PA 19104

F. Gerard Adams is Director of the Economics Research Unit at the University of Pennsylvania. His research interests focus on the extension of econometric modeling from the model of the nation to models of commodity markets, regions, firms, industries, and international economic interactions. He has also been active in regional modeling and is co-editor of a book, Modeling the Multiregional Economy.

*Cole, Rosanne*

IBM Corporation, Old Orchard Road, Armonk, NY 10504

Rosanne Cole is manager of economic research and forecasting at the International Business Machines Corporation. Formerly she served on the staff of the National Bureau of Economic Research. Her work involves using econometric models in business planning and forecasting, and she has made detailed studies of errors in macroeconomic data and their effects on forecasts. She received a Ph.D. in economics from Columbia University.

*Eckstein, Otto*

Data Resources Inc., 29 Hartwell Ave., Lexington, MA 02173

Otto Eckstein is Chairman of Data Resources, Inc., the country's largest economic forecasting and consulting firm. He is also Paul M. Warburg Professor of Economics at Harvard University. From 1964-1966 he served as a member of President Johnson's Council of Economic Advisers. He is the author of various books, including The Great Recession (1978), Core Inflation (1981), and most recently, The Data Resources Model of the U.S. Economy. He holds the Ph.D. from Harvard (1955) and honorary degrees from Princeton and from the Free University of Brussels, Belgium.

*Fair, Ray*

Dept. of Economics, Yale University, New Haven, CT 06520

Ray Fair received his Ph.D. from M.I.T. in 1968. He has taught at Princeton and M.I.T. prior to coming to Yale. He has published on macroeconomics, international economics and econometric techniques. Among his publications are his book, A Short-Run Forecasting Model of the United States Economy and Specification, Estimation and Analysis of Macroeconomic Models (forthcoming). He is an Associate Editor for the Journal of Economic Dynamics and Control and the Review of Economics and Statistics.

*Hendry, David F.*

Nuffield College, Oxford University, Oxford, England

David F. Hendry took an M.Sc. and Ph.D. at the London School of Economics, remaining at the School as lecturer, reader, then professor till 1981. He has been econometrics editor of The Review of Economic Studies and The Economic Journal, and an associate editor of Econometrica. He has published on econometric theory, method, applications and Monte Carlo simulation in a number of journals.

*McNees, Stephen K.*

Council of Economic Advisers, Room 325 Old Executive Office Bldg., Washington, DC 20500

Stephen McNees is currently serving as Senior Staff economist for macroeconomic policy at the Council of Economic Advisers while on leave of absence from the Federal Reserve Bank of Boston where he is a Vice President and economist. His responsibilities at the Bank include briefing the President and the Board of Directors of the Bank on the economy and economic policy. His major research interest has been on the evaluation of economic forecasts and assessing the role of macroeconomic models. He is an associate editor of the Journal of Forecasting.

PROVINCIAL SOUTH

EXTRAPOLATION: COMPETITION AMONG METHODS\* - II

Chair: *Hibon, Michele, INSEAD, 77305 Fontainebleau, France*

"THE ACCURACY OF EXTRAPOLATIVE METHODS"

*Makridakis, Spyros, INSEAD, 77305 Fontainebleau, France*  
*Hibon, Michele, INSEAD, 77305 Fontainebleau, France*

Forecasting accuracy is a major criterion used for selecting appropriate forecasting methods. This paper attempts to quantify the various components determining forecasting accuracy. The objective of the research described is to estimate the expected accuracy of a given method, for some specific data series without having to run the method first. The theoretical advantages of such an approach can be considerable in terms of time and effort saved. In order to estimate forecasting accuracies, a multiple regression approach was used which expressed forecasting accuracy (both for the model fitting and the post sample data) as a function of several factors affecting accuracy. The data needed for developing the regression equations came from a forecasting competition in which experts in various fields forecasted up to 1001 series. The regression equations found shed considerable light on the factors affecting forecasting accuracy and the comparative advantages/limitations of various time series methods.

"ACCURACY OF ALTERNATIVE EXTRAPOLATION MODELS: THE VALUE OF TECHNICAL EXPERTISE AND HUMAN JUDGMENT"

*Carbone, Robert, Faculté des sciences de l'administration, Université Laval, Québec, G1K 7P4, Canada*  
*Gorr, Wilpen L., School of Public Administration, Ohio State U., Columbus, OH 43210*

The M-competition examined the performance of over 20 univariate forecasting methods executed objectively (in most cases, automatically) by experts in each method. Overall, simple approaches were found to perform as well, if not better, than sophisticated methods. Would the results differ if the methods had been applied subjectively by persons with little training? Would straightforward qualitative extrapolation produce similar performances? Is there any benefit in using quantitative extrapolation methods? This paper reports results of a controlled experiment undertaken at Ohio State and Laval University which provided answers to the above questions. The answers in some cases are most surprising.

"FORECASTING IN THE FOOD PROCESSING INDUSTRY"

*Koehler, Anne B., Dept. of Production & Decision Sciences, Miami U., Oxford, OH 45056*

This paper examined time series data at the stockkeeping unit level for consumer products in the food processing industry. Three mid-west food processing companies provided data for this study which was motivated by the Makridakis forecasting competition. The results of that competition indicated that, for micro data with monthly observations, simple forecasting techniques did well. The approach in the present paper is to use the Box-Jenkins methodology to determine whether or not simple models are indicated by model fitting. Simple models do seem to be suggested by this procedure. The best models found for each time series, with the most recent twelve months withheld, were then compared by forecasting the last twelve months.

"AN EVALUATION METHOD FOR SHORT-TERM FORECASTING TECHNIQUES"

*Mahmoud, Essam, Dept. of Quantitative Methods, Concordia U., Montreal, Quebec, H3G 1M8, Canada*  
*Pegels, Carl, Management Science & Systems Dept., SUNY, Buffalo, NY 14214*

We evaluated thirteen short-term forecasting techniques using fourteen sets of actual sales data to determine whether there were certain forecasting techniques that performed more consistently than others. The study developed an approach to evaluate each forecasting method based on a variety of forecast accuracy measures.

\*See related session on Monday at 10:00-11:30

## FORECASTING FOR HEALTH CARE INSTITUTIONS

Chair: *Tyson, Karen W.*, Center for Health Policy Studies, Georgetown U., Washington, DC 20007

"AN ERA OF UNCERTAINTY FOR HEALTH CARE INSTITUTIONS"

*Tyson, Karen W.*, Center for Health Policy Studies, Georgetown U., Washington, DC 20007  
*Merrill, Jeffrey*, Center for Health Policy Studies, Georgetown U., Washington, DC 20007

The study used forecasts of macroeconomic variables, national health expenditures, prices, and other health care variables to forecast the health care services environment for the next three years. While health care is one of the fastest-growing sectors of the U.S. economy, the next three years will be a time of great structural change. Access to capital, for example, will be a critical variable in institutional planning. The role of the business cycle and of public policy in shaping the structural change in health care is discussed.

"A MULTINOMIAL LOGIT MODEL FOR HOSPITAL UTILIZATION MARKET SHARE"

*Cohen, Morris A.*, Dept. of Decision Sciences, The Wharton School, U. of Pennsylvania, Philadelphia, PA 19104  
*Lee, Hau Leung*, Dept. of Decision Sciences, The Wharton School, U. of Pennsylvania, Philadelphia, PA 19104

Effective regional planning and hospital management require solid understanding of the patient pool. Models are needed to explain both current utilization patterns and to predict hospital market share. This paper develops a multinomial logit model for hospital market share using a statewide patient data base. The paper addresses issues concerned with the choice of the appropriate estimation method, treatment of zero observations, and evaluation of model performance. The multinomial logit performs well in explaining patient hospital utilization. The model also give rise to policy implications associated with the hospital utilization patterns for population subgroups and for different hospital services.

"FORECASTING PATIENT FLOW WITH ECONOMETRIC MODELS"

*Koshal, Rajinder K.; Koshal, Manjulika; Nandola, Kahandas*, Ohio U., Athens, OH 45701  
*Rau, William A.*, Mercy Hospital, Portsmouth, OH 45662

During the past several decades, the hospital industry has experienced rapid increases in hospital costs, the inception of Medicare and Medicaid, capital expenditure review processes, health planning activities and similar shifts in the health care environment. This project constructed and estimated a function that was able to explain variations in the number of emergency room visits through physical environment variables. Based on 1724 daily observations, the most important variables in explaining these variations were past history, temperature, wind, and day of the week. The estimated model performed well in predicting the turning points in the number of emergency room visits.

"A PATH ANALYTIC APPROACH TO THE PREDICTION OF TURNOVER AMONG HOSPITAL NURSES"

*Parasuraman, Saroj*, Wayne State U., School of Business Admin., Detroit, MI 48202

Data gathered from 307 staff nurses in a large hospital were used to test an integrated model of turnover. These data incorporated demographic, job situation, attitudinal variables, and behavioral intentions as predictors of voluntary turnover. The technique of path analysis was applied in assessing the predictive utility of the variables included in the model, as well as the tenability of the posited causal links among the system variables. The results confirmed the model's prediction of "intention to resign" being the most proximal determinant of the actual turnover of nurses. This was followed by felt-stress, job satisfaction, and organizational commitment. Job scope, leadership attention, age, and level are found to be more distal determinants of voluntary turnover, influencing it only indirectly through the three attitudinal variables. Results are discussed in light of recent findings in other multivariate studies of turnover.

TUESDAY  
10:00-11:30

SALON 2

BUSINESS OPPORTUNITY ANALYSIS

Chair: *Talbott, Robert*, American Bell, 100 Southgate Parkway, Morristown, NJ 07960

Panel: "THE IMPACT OF THE FUNCTIONAL VIEWPOINT ON DECISION CRITERIA"

OR

"WHO WILL BELIEVE YOUR FORECAST AND WHY?"

This panel will examine in real time a business opportunity decision from the differing viewpoints of those involved in the decision and its consequences. These viewpoints can be addressed through the following questions:

What does a product manager want from a forecast?

What does the CEO want from a forecast?

What does the sales manager want from a forecast?

What does the manufacturer want from a forecast?

What does the corporate strategist want from a forecast?

Which inputs and assumptions and what impacts do each of the above people consider most critical (e.g., market, cost, competitors price, volume, credibility, risk appraisal)?

The product that will be the basis of the discussion is videotext.

Participants will include:

*Berents, Kenneth T.*, Securities Analyst, Alex Brown & Sons, P.O. Box 515, Baltimore, MD 21203

*Selin, Clarence*, Director-Strategic Planning & Terminal Products, American Bell, 5 Woodhollow Rd., Room 2A57, Parsippany, NJ 07054

## ELECTRIC UTILITY FORECASTING

*Williams, Larry J.*, Electric Power Research Institute/Strategic Investments Group,  
12 Sneedner Court, Menlo Park, CA 94025

**"SHORT-TERM SALES FORECASTING USING A MULTIVARIATE DATA BASED METHOD"**

*Williams, Larry J.*, Electric Power Research Institute/Strategic Investments Group,  
12 Sneedner Court, Menlo Park, CA 94025

A variation of the vector autoregression (VAR) method developed at the Federal Reserve Bank of Minneapolis was used to model and forecast monthly kilowatt hours sales to residential customers in Missouri. Other variables included personal income, average electricity price, appliance saturation, number of customers, winter heating degree days, and summer cooling degree days. Our approach to the VAR method developed a cubic spline distributed lag data transformation matrix prior to using the Litterman/Sims Bayesian procedure. This variation reduced the number of parameters that had to be estimated prior to application of the Bayesian procedure. This should improve efficiency since "profligate parameterization" is a serious problem with the unmodified (non-Bayesian) VAR method.

**"A COMPARISON OF MULTIVARIATE TIME SERIES METHODS FOR UTILITY MONTHLY SALES FORECASTING"**

PART I: *Goodrich, Robert and Mehra, Raman K.*, Scientific Systems, Inc., 54 Rindge Ave. Ext.,  
Cambridge, MA 02140  
II: *Engle, Robert F. and Granger, C.W.J.*, Quantitative Economic Research Inc. (QUERI),  
6095 Tamlyn St., San Diego, CA 92122

This paper presents a comparison of several multivariate statistical methods for short term (1-36 month) forecasts of electric power sales. The methods include structural techniques such as dynamic regression, state space with theoretical structural constraints, autoregressive conditional heteroscedasticity (ARCH); adaptive methods such as adaptive state space, time varying regression, multiple Kalman filters, and exponential smoothing; and purely data based methods such as state space via canonical correlation. Models estimated on a fit subset of the data were compared on a test set not involved in the parameter estimation. Evaluation criteria include one-month, twelve-month, and thirty-six month forecast errors, as well as discounted and undiscounted sums of errors. Error estimators include both the root mean square and root median square.

## COMMUNICATION OF FORECASTS

Chair: *Reyna, Valerie F.*, Psychology Dept., GR 41, U. of Texas at Dallas, Box 688, Richardson, TX 75080

**"THE ORGANIZATION OF BELIEF: CLAIMS AND CREDIBILITY"**

*Reyna, Valerie F.*, Psychology Dept., GR 41, U. of Texas at Dallas, Box 688, Richardson, TX 75080

This research focuses on the believability of claims, especially their impact on decision makers who must rely on these sources (e.g., forecasters). Experiments eliciting choices, decision times, and believability ratings examined the following factors: a claim's content, a source's domain, expertise, confidence, and credibility. High credibility and expertise augmented believability, but surprisingly, "objective" sources (e.g., scientists) were no more impressive than "subjective" sources (e.g., pastors). Further, objective content (e.g., scientific observations) was not more believable than subjective content (e.g., morality judgments). Content interacted with confidence such that, paradoxically, a source expressing less confidence could be more believable than a source expressing greater confidence.

**"THE PSYCHOLOGY OF SUNK COST"**

*Arkes, Hal R.*, Dept. of Psychology, Ohio U., Athens, OH 45701

*Hackett, Catherine*, Dept. of Psychology, Ohio U., Athens, OH 45701

According to economic theory, choices should be based on the costs and benefits that are expected to arise as a result of choosing each option. Sunk costs should not influence current choices. However, we report several experiments which strongly suggest that sunk costs exert a powerful influence on current choices. We identify two of the factors which may contribute to this influence: one's desire not to appear wasteful and the heightened probability of success assigned to a project once it has accrued a sunk cost.

**"FORECASTING AS INFORMATION PROCESSING AND COMMUNICATION"**

*Eerola, Annele*, Institute of Mathematics, Helsinki U. of Technology, Otakaari 1M, 12150 ESPOO 15, Finland

The paper presents ideas from an ongoing research project on forest product market forecasting. In the research, forecasts are examined as pieces of information. Correspondingly, the generation and use of forecasts are seen as information processing where communication between people, and between people and computers plays an essential role. Among the factors affecting the "success" of forecasting are the information processing abilities of the participants, comprehensibility of the messages, and attractiveness and credibility of the communication channels and media used. These factors are examined in the paper on the basis of previous research on communication and information processing. Sound communication systems for forecasting are seen to be contingent on the organization and situation. Preliminary results of the ongoing research on forest product market forecasting are reviewed and suggestions are made for constructing a proper communication system for the specific case.

TUESDAY  
10:00-11:30

SALON 5

ORGANIZATIONAL EXPERIENCE WITH FORECASTING TECHNIQUES: SURVEYS

Chair: *Mentzer, John T.*, Dept. of Marketing, Virginia Polytechnic Institute, Blacksburg, VA 24061

Session Overview: Different corporations have tried various forecasting techniques with varying degrees of success. This session presents papers that have investigated the usage and satisfaction of corporations with forecasting techniques.

"FAMILIARITY, APPLICATION, AND PERFORMANCE OF SALES FORECASTING TECHNIQUES"

*Mentzer, John T.*, Dept. of Marketing, Virginia Polytechnic Institute, Blacksburg, VA 24061

*Cox, James E. Jr.*, Dept. of Marketing, Virginia Polytechnic Institute, Blacksburg, VA 24061

This article presents the results of a survey to determine the degree of familiarity and usage, accuracy obtained, and evaluation of different forecasting techniques. It was found that regression analysis, subjective techniques, exponential smoothing, and moving average were well known and utilized for specific situations. Accuracy was relatively high for aggregate short range forecasts, but decreased for longer range and product level forecasts.

"PRIOR KNOWLEDGE AND THE FORECASTING COMPETITION"

*Fildes, Robert*, Manchester Business School, Manchester, England M15 6PB

*Lusk, Edward J.*, Wharton School, University of Pennsylvania, Philadelphia, PA 19104

We present the results of a survey of forecasting practitioners in the US and UK. The survey asked about the familiarity and accuracy of the following methods: Naive, Moving Average Decomposition, Single Exponential Smoothing, Holt-Winters, Bayesian, Box-Jenkins, Trend Curves, and Adaptive Smoothing. Opinions on accuracy measures were requested for two different horizons for each of three forecasting problems. The results, similar for both the US and UK respondents, were that the practitioners were relatively familiar with all of the techniques except for Holt-Winters and Bayesian. For short horizons, Box-Jenkins was perceived as most accurate, and trend curves were perceived as most accurate for longer forecasting horizons. These survey results are contrasted with the results from an empirical study on accuracy by Makridakis.

"FORECASTING APPLICATIONS IN SOUTH AFRICA: THE DEVELOPMENT, PRACTICE AND IMPACT OF FORECASTING IN BUSINESS AND GOVERNMENT"

*Spies, Phillip H.*, Unit for Futures Research, University Private Bag 5050, 76 Stellenbosch, South Africa

This paper presents the results of a literature study of the recent history of forecasting in South Africa as well as the results of a survey of current forecasting applications in business and government. Forecasting practices in twenty-five major South African corporations were surveyed and evaluated in terms of the purpose of the forecasts, methodology, forecasting horizons and impact on decision making. A similar survey of government institutions and research institutions evaluated current directions in forecasting methodology in South Africa. Specific examples of forecasts are provided to illustrate methodologies and applications in South Africa. Also, the relative importance and role of short, medium and long-term forecasting in planning are reviewed against the background of current decision making needs.

SALON 6

FINANCIAL FORECASTING FOR FIRMS

Chair: *Brown, Lawrence D.*, School of Management, SUNY, Buffalo, NY 14214

"CORPORATE PROFITABILITY: DETERMINANTS AND FORECASTS"

*Foote, Paul Sheldon*, School of Economics & Management, Oakland U., Rochester, MI 48063

The public disclosure of forecasted income statements has been hindered by the lack of detailed, generally accepted forecasting standards. Managers, accountants, auditors, and regulators have lacked detailed benchmarks for the evaluation of the reliability of the forecasting process of firms. Six income statement models were estimated for 1,674 firms using ordinary least squares, unrestricted reduced form, two-stage least squares, and two-stage least squares derived reduced form. All models included forecasts for sales; cost of goods sold; gross margin; selling, general, and administrative expenses; and operating income. Some models included distributed lag specifications and forecasts of advertising and R & D.

"AN EVALUATION OF THE PREDICTIVE PROPERTIES OF THE STATEMENTS ON CHANGES IN FINANCIAL POSITION"

*Rue, Joseph*, School of Management, Syracuse U., 116 College Place, Syracuse, NY 13210

*Ismail, Badr E.*, School of Management, Syracuse U., 116 College Place, Syracuse, NY 13210

Financial statement users need to assess firms' future cash generating ability. Unfortunately, this process is made difficult given the data contained in audited statements. This paper explores approaches that might be used in preparing the statement of changes in a financial position statement to allow users to clearly see firms' internal cash generating ability. In doing so, I emphasize identifying variables that are critical in predicting the firms' ability to generate sufficient cash flows to satisfy the requirements for dividends, interest, repayment of debt, and asset replacement. This is particularly important given recent attempts by the FASB to develop a reporting framework oriented toward cash flow.

"GENERAL PRICE LEVEL ADJUSTMENTS (GPLA) FOR INFLATION ACCOUNTING AND STATEMENT OF FINANCIAL ACCOUNTING STANDARDS (SFAS) NUMBER 33: AN EMPIRICAL STUDY OF THE MEAN SQUARED ERROR (MSE) OF UNIVARIATE TIME SERIES FORECASTING"

*Espahbodi, Reza*, Dept. of Accounting, Florida International U., Miami, FL 33199

*Rushinek, Avi*, Dept. of Accounting, U. of Miami, P.O. Box 248031, Coral Gables, FL 33124

*Rushinek, Sara F.*, Dept. of Management Science, U. of Miami, P.O. Box 248031, Coral Gables, FL 33124

Among the recent trends in accounting is the notion that the primary objective of accounting is to provide information to help the interested parties in making predictions. The objective of this paper is to investigate the relative predictive ability of general price level adjusted historical cost (GPLA), replacement cost (RC), and general price level adjusted replacement cost (GPLA-RC) versus the traditional historical cost data. It is found that, for the same prediction model, historical cost is the best predictor of itself, with GPLA being a somewhat less effective predictor. RC, with one exception, is always the inferior model.

"MEASURING AND MANAGING BANK RISK: SOME RECENT HISTORY"

*Korobow, Leon*, Federal Reserve Bank of New York, New York, NY 10045

This paper discusses an approach by which a bank's risk exposure can be appraised from specific aspects of its reported balance sheet and income statement. Key statistical measures, based on reported data, are employed to evaluate a bank's risk exposure and to suggest possible remedies to reduce excessive risk. The statistical procedure generates a financial profile of each bank's risk exposure. Banks can be ranked according to their risk profile and, using historical experience, the probability of severe financial weakness can be forecasted.

TUESDAY  
10:00-11:30

SALON 9

EVALUATION OF MODEL USE IN POLICYMAKING

Chair: *King, John L.*, Public Policy Research Organization, U. of California, Irvine, CA 92717

"FISCAL IMPACT BUDGETING MODELS IN LOCAL LAND USE PLANNING"

*Kraemer, Kenneth L.*, Public Policy Research Organization, U. of California, Irvine, CA 92717

This paper examines the use of fiscal impact budgeting models in the land use planning processes of a set of U.S. local governments. Primary focus of the paper is on the role of the models in shaping the nature of the political debates surrounding land use decisions, especially in the establishment of agreements among various interests as to how the policymaking process would be carried out.

"USE OF MODEL-BASED FORECASTS IN U.S. WELFARE POLICYMAKING"

*Fallows, Susan E.*, Massachusetts Energy Facilities Siting Council, 100 Cambridge Street, Boston, MA 02202

Discusses use of the TRIM and MATH microanalytic simulation models in the making of income transfer policies in U.S. federal agencies (e.g., HHS, DOA, DOL, OMB, and CBO). The primary focus of the talk is on the role of the models as instruments in the policymaking process, both as scientific tools for simulating and forecasting to determine appropriate policy options, and as "weapons" in the partisan and agency political debates over the course and form of U.S. welfare policy.

"IDEOLOGY AND MODEL USE IN U.S. NATIONAL ECONOMIC POLICYMAKING"

*King, John L.*, Public Policy Research Organization, U. of California, Irvine, CA 92717

Examines two ideological "forces" that shape the uses of macroeconometric models in making of U.S. national fiscal policy. Using data collected during the transition from the Carter to the Reagan administrations, the paper identifies both a "managerial" ideology and a "political/economic" ideology, each of which plays a different role in shaping how models are used and the effects they have on the economic policymaking process.

"ASSESSING GERMAN AND U.S. EXPERIENCES IN MODEL USE FOR NATIONAL POLICYMAKING"

*Dickhoven, Siegfried*, Gesellschaft für Mathematick und Datenverarbeitung, Schloss Birlinghoven D-5205 St. Augustin 1, West Germany

Presents the results of an international comparative study of the use of planning models in the U.S. and Germany, focusing on the similarities and differences in uses and outcomes of modeling. Special attention is given to the potential of transferability of U.S. modeling experiences and successes to the German government context.

"PUBLIC SECTOR USE OF MODELING TECHNOLOGY FOR FORECASTING: A PRIVATE-SECTOR PERSPECTIVE"

*Galbraith, Craig*, Graduate School of Management, U. of California, Irvine, CA 92717  
*Merrill, Greg*, School of Business Administration, U. of San Diego, San Diego, CA 92110

Examines the findings of the studies of model use in public agencies presented in the four papers above, and applies knowledge about private-sector experiences with model use to determine significant similarities and differences in the experiences.

SALON 10

FORECASTING FOR MANAGEMENT OF OPERATIONS

Chair: *Flowers, A. Dale*, Dept. of Operations Research, Weatherhead School of Management, Case Western Reserve U., Cleveland, Ohio 44106

Session Overview: Following the "pragmatic research" conference theme, this session includes papers that report research results with pragmatic implications and a paper posing additional questions for future research. The paper by King and Ritzman assesses the importance of forecast error for operations in complex manufacturing environments. The paper by Flowers presents improved results for the adaptive smoothing forecasting system in an international forecasting competition. The presentation by Muir points to remaining problems requiring pragmatic solutions in the future.

"A SIMULATION STUDY ON THE IMPACT OF FORECAST ACCURACY IN MANUFACTURING OPERATIONS"

*King, Barry E.*, Faculty of Management Sciences, Ohio State U., Columbus, Ohio 43210  
*Ritzman, Larry P.*, Faculty of Management Sciences, Ohio State U., Columbus, Ohio 43210

A common assumption is that reducing forecast errors pays big dividends for manufacturing operations. This study analyzed how much errors really impact inventory, productivity and customer service. It used simulated manufacturing plants with several bill-of-material levels, many work stations, a mix of specials and standards, and a materials requirements planning system. The simulations captured disturbances normally present, such as inaccurate records, yield losses, and equipment failures. Realistic experimental settings were obtained from a panel of manufacturing managers. Results show that the importance of forecast errors depends on management's lot sizing and buffering strategies.

"SOME EMPIRICAL RESULTS FOR AN ADAPTIVE SMOOTHING FORECASTING SYSTEM"

*Flowers, A. Dale; Chandawarkar, A.; Collens, J. Jr.; Gallo, J.; Schulze, M.; Shivakumar, J.; Spang, M.; Steinhoff, J.; Tamaskar, M.*, Case Western Reserve U., Cleveland, Ohio 44106

The results of the international forecasting competition reported at the 1981 Quebec City meeting indicated that adaptive exponential smoothing methods did poorly as compared to other robust procedures for the 1001 time series tested. In this research, we constrained the adaptive smoothing constant values and combined adaptive smoothing with automatic model selection procedures for Winters' models. This substantially improved the adaptive smoothing results. These findings are especially important to practitioners needing the greater responsiveness of these methods for turbulent forecasting environments.

"PROBLEMS IN SALES FORECASTING NEEDING PRAGMATIC SOLUTIONS"

*Muir, James*, American Software, 443 East Paces Ferry Rd., Atlanta, GA 30305

This paper addresses those areas of Sales Forecasting which happen before, during, and after application of the formulas, which need pragmatic solutions in order to insure success of the system. The following topics are examined: Selection of technique; tracking forecasts; when and how to modify forecasts; the use of demand filtering; the source of parameters; and whether results can be improved. Most companies do not have many operations research analysts available to provide solutions to forecasting problems. Our challenge is to develop straightforward pragmatic solutions in order to ensure each company's forecasting system is achieving the best results.

## FOREIGN EXCHANGE RATES

Chair: *Walldin, Knut-Erik*, Box 3071, 161 03 Bromma, Sweden

"FORECASTS OF A CENTRAL BANK'S FOREIGN EXCHANGE TRANSACTIONS"

*Hjeldnes, Jostein*, Oslo, Norway

*Walldin, Knut-Erik*, Box 2071, 161 03 Bromma, Sweden

In 1976 a computer based liquidity forecasting and planning system was evolved for Norway's largest commercial bank. The bank liquidity is influenced by the central bank's foreign exchange transactions. These transactions have, until recently, been treated as an external factor in the forecasting system. In this paper, we describe a forecasting system for the central bank's foreign transactions, thereby turning the external factor into an internal one. The system is based on an analysis of daily statistics from the period May 1980 - December 1982.

"THE POUND \$ EXCHANGE-RATE AND THE 'NEWS'"

*Copeland, Laurence S.*, U. of Manchester Institute of Technology, P.O. Box 88, Manchester M60 1QD, England

The "news" approach to exchange-rate modelling involves concentrating on the unexpected component of the explanatory variables, on the grounds that all anticipated changes are incorporated into the dependent variable when agents first form their expectations. Since the interest-rate is also an asset price (approximately), the same efficient market strictures apply to it, even as an explanatory variable. In this paper, time-series and econometric methodology are combined to derive a relationship between the UK Pound/US \$ exchange-rate and the unexpected interest-rate differential over the period since 1973.

"AN ECONOMETRIC EXCHANGE RATE MODEL CONTAINING RATIONAL EXPECTATIONS AND USING SEASONAL ADJUSTED TIME SERIES"

*Schips, B.*, Forschungsstelle für Ökonometrie, Hochschule St. Gallen, Bodanstr. 1, CH-9000 St. Gallen, Switzerland

The structural model presented contains the exchange rates, the price levels, the money supplies, and the retail sales as endogenous variables. The model is estimated with monthly data for the period of November 1975 to July 1981, using a fixpoint estimator (which is especially developed for models containing rational expectations). The structure of the model, with its ex-post- and "k-step-ahead"-predictions, is presented. The predictive power of the model on the spot rate is better than the forward market.

## TECHNOLOGICAL FORECASTING: DIFFUSION OF TECHNOLOGY

Chair: *Baal-Schem, Jacob*, Interdisciplinary Center for Technological Analysis & Forecasting,  
Tel-Aviv University, Ramat-Aviv, Tel-Aviv, Israel 69978

## "FORECASTING THE DIFFUSION OF HOME INFORMATION SYSTEMS"

*Baal-Schem, Jacob*, ICTAF, Tel-Aviv U., Ramat-Aviv, Tel-Aviv, Israel 69978

Home Information Systems are the outcome of innovations based upon the interweaving of dramatic developments in micro-computer technology with great achievements in telecommunications. By combining computing and communication technologies in integrated systems, a great variety of services can be provided to many users, in environments chosen by the user. The emerging of the "Electronic Cottage," through the use of Home Information Systems, will fundamentally change the way people shop, bank, work and communicate. Widespread implementation of these systems will impact on many aspects of daily life. The acceptance of these systems is based upon economic as well as societal assumptions. This paper reviews forecasts on the diffusion of Home Information Systems and analyzes the methods of these forecasts. Emerging factors in the diffusion of Home Information Systems are examined and their impact on the outcome of the forecasts is discussed.

## "TECHNOLOGICAL FORECASTING AND THE TRADE IN TECHNOLOGY"

*Raz, B.*, ICTAF, Tel-Aviv U., Ramat-Aviv, Tel-Aviv, Israel 69978

This paper tackles the problems of: (a) how to determine the risks of obsolescence of a technology that is considered for purchase, and (b) how to choose a source of a desired technology. In the first case the issue of transfer-time is considered within the formalism of logistic curves and their extrapolation. For the second problem, the paper invokes the approaches of "Fair Pricing of Technology" and of "Maximization of Utility."

## "TECHNOLOGICAL FORECASTING USING TRADEOFF SURFACES"

*Martino, Joseph P.*, Research Institute, U. of Dayton, Dayton, OH

For many technologies, the State of the Art (SOA) is defined by multiple parameters. Because of the trade-offs possible, no one parameter can completely define the SOA of the technology (e.g., in aircraft design, range, payload, and maximum allowable acceleration can be traded against one another). In some cases, there is a known analytical relationship among the parameters (e.g., the gain-bandwidth product in electronic amplifiers). In most cases, however, the parameters are not related analytically. The tradeoffs at a given SOA can be determined empirically, by examining designs that represent different manifestations of the same SOA. Prior investigators have attempted to fit surfaces to these empirical values to define the SOA. I utilized a modification of Dodson's procedure. Alternative means were then used to project future tradeoff surfaces, in order to forecast the future technology.

SEMINAR C

TUESDAY  
10:00-11:30

TELECOMMUNICATION SERVICE DEMAND

Chair: *Gilstein, C. Zachary*, Bell Laboratories, Crawfords Corner Rd., Holmdel, NJ 07733

"ALTERNATIVES TO SEEMINGLY UNRELATED REGRESSION AND POOLING IN DISAGGREGATED MODELS"

*Stephan, Scott W.*, Long Lines Business Research, Rm. N-380, 340 Mt. Kemble Ave., Morristown, NJ 07960

Analysts frequently must choose between two classes of estimation techniques in the estimation of multi-equation (disaggregate) models. The first class is essentially the estimation of each separate equation or jointly by seemingly unrelated regression (SUR). The second class represents the "pooling" of the data from all equations. Long Lines Business Research has sponsored research concerning random parameter alternatives to the above approaches. The presentation will summarize the main theoretical and practical implications of random parameter specifications in the context of multi-equation (disaggregated) models.

"THE BAYESIAN APPROACH TO TELETRAFFIC USAGE FORECASTING"

*Lee, Tony T.*, Bell Laboratories, Crawfords Corner Rd., Holmdel, NJ 07733

This paper presents a discussion of a Bayesian approach to forecasting and its application to teletraffic usage. This approach directly confronts the occurrences of outliers, step or slope changes in the usage per main station (CCS/M) time series. This procedure allows for inclusion of model uncertainty in the forecast. Initial results of using monthly field data show that for series with "regular" seasonality, the empirical distribution of forecasting errors is better for the Bayesian approach when compared with random walk (a viable candidate for CCS/M forecasting) applied to annual data. For series whose seasonality is irregular, as data with no structure, a simpler approach (such as AR(1) or random walk) may be more appropriate.

"DEMAND FORECAST IN NIPPON TELEGRAPH AND TELEPHONE PUBLIC CORPORATION (JAPAN)"

*Kawaguchi, Toyoaki*, Market Research Section, Nippon Telegraph & Telephone Public Corporation, 1-1-6 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100, Japan

This paper reviews the general environment surrounding demand forecasting in NTT. It presents the present situation and the forecasting methods used for existing services in NTT. Forecasting methods for new services are of particular concern. Customers' needs have become more sophisticated, especially after the equilibrium of demand and supply of telephones in 1977. In order to cope with the various needs of customers, NTT is selling many kinds of new services. The paper describes the INS (Information Network System), a sophisticated telecommunication system utilizing the digital and optical-fiber technologies. Construction of INS is a major project in NTT.

"FORECASTING SPECIAL TELECOMMUNICATIONS SERVICES"

*Miller, Pat*, Bell Laboratories, Crawfords Corner Rd., Holmdel, NJ 07733

{Abstract not available at time of publication}

## FORECASTING IN LESSER DEVELOPED COUNTRIES

Chair: Karasek, Mirek, Arabian Data Systems, P.O. Box 7610, Jeddah, Saudi Arabia

"DEVELOPING EFFECTIVE FORECASTING TECHNIQUES FOR PUBLIC ENTERPRISE POLICY DECISIONS IN NIGERIA"  
Airhunmwunde, Amaruegbeku M., P.O. Box 2322, Port Harcourt, Nigeria

Public enterprises in Nigeria have, until now, been characterized by inefficiency, improper planning, and ineffective forecasting. This has caused public concern in every sector, yet the basic problems confronting these corporations remain unsolved. These are: 1) inability of executives to delegate authority, 2) interference by board members and ministers in the daily operation of the corporations, thereby inhibiting planning, decision making, and control. This paper highlights some of the problems facing public corporations in Nigeria. Solutions are suggested. For example, ratio analysis, a simple forecasting tool, would be effective, and its application does not require that executives have strong quantitative skills. There are three main uses for the ratio, namely: 1) to diagnose a situation, 2) to monitor performance, and 3) to plan.

"FORECASTING, STATUS AND PROBLEMS -- RELEVANCE TO THE THIRD WORLD"

Iyengar, M.S., Managing Director, M.S. Iyengar & Associates (P) Ltd., New Delhi, India

The current status, problems and prospects in technological forecasting methodologies are critically examined. The impediments in implementation of new methods in the organization and decision making process in the polity of the Third World is discussed. The areas for research are then demarcated.

"FORECASTING IN LOW CREDIBILITY DATA ENVIRONMENTS"

Karasek, Mirek, Arabian Data Systems, P.O. Box 7610, Jeddah, Saudi Arabia

The paper deals with a problem posed by environments in which gathering and reporting of basic socio-economic data-series in a credible fashion is not a rule, but rather an exception. The methodology consists of five steps: (1) transformation and channeling all m different information sources available about one variable into an mxn matrix, (2) obtaining a first iteration of a n-element time-series, (3) designing a causal model for the subject of forecasting with each explanatory variable subject to (1) and (2), (4) using the latest version of the model to improve the data-base, (5) repeating steps (2) - (4) until both data and model become decent stepping-stones to forecasting.

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TUESDAY  
10:00-11:30

PARLOR A

COMPOSITE FORECASTING

Oxford University, Oxford OX1 3PJ, England  
Chair: *Bunn, Derek W.*, Dept. of Engineering Science, Oxford University, Oxford OX1 3PJ, England

"MULTI-PROCESS FORECASTING: PRAGMATIC OPTIMALITY FOR VACILLATION AND EQUIVOCATION"  
*Bunn, Derek W.*, Dept. of Engineering Science, Oxford University, Oxford OX1 3PJ, England

In dealing with multiple forecasts of the same time-series it is important to distinguish between two motivational themes, namely that of model-switching or that of composition. This paper reviews the assumptions and performance of these two methodologies and provides some guidelines for recognizing their appropriateness in practice.

"PLURAL ANALYSIS: COMBINING MULTIPLE APPROACHES TO FORECASTING AND OTHER JUDGMENTAL TASKS"  
*Bromage, Robert C.*, Decision Science Consortium, Inc., 7700 Leesburg Pike, Suite 421,

Falls Church, VA 22043

*Brown, Rex V.*, Decision Science Consortium, Inc., 7700 Leesburg Pike, Suite 421,

Falls Church, VA 22043

It is sensible to model an elusive uncertainty (or other judgment) in several different ways, and to see how the resulting assessments compare. Management scientists often fail to do so, for lack of satisfactory paradigms for reconciling any inconsistency or for planning the modeling in advance. This paper extends earlier work on this issue by Brown and Lindley and reports on some applications.

"ESTIMATING ERRORS IN THE AMALGAMATED FORECAST"  
*Bloom, Mitchel F.*, Bloom Forecasting, 2122 MacArthur St. W., Tacoma, WA 98466

This paper describes a method of estimating errors, using the amalgamated method of Armstrong. A microcomputer software package has been developed that provides the forecaster with information to make a judgmental assignment of small whole number weights to a set of extrapolative, econometric and judgmental methods used to forecast the same trend. Weights are based on the degree of accuracy of the method in forecasting the trend over the recent past. Using these weights, it is possible to generate most likely, upper and lower estimates for the future trend.

"SEASONAL FORECASTING - A NEW APPROACH"  
*Oliver, Robert M.*, College of Engineering, U. of California, Berkeley, CA 94720

The author presents a new formulation for seasonal forecasting. The first assumption is that an a priori or judgmental forecast for total seasonal demand,  $N$ , can be obtained. The second is, given  $N$ , the cumulative demand at any time is binomially distributed. Using Bayes rule and the theory of linear predictors, it is shown that the updating formulas consist of two separate parts: one to obtain a posteriori estimates of total demand at the end of the season, the other to obtain the a posteriori conditional binomial demand distribution within the season.

## MARKETING QUANTITATIVE APPROACHES

Chair: Bassin, William M., Sage Data, Inc., 104 Carnegie Center, Princeton, NJ 08540

"IMPROVING FORECASTS VIA DIAGNOSTIC AND SEARCH TECHNIQUES"

Bassin, William M.; Lancaster, Clifton; Richardson, David H., Sage Data, Inc., 104 Carnegie Center  
Princeton, NJ 08540

This paper describes the process of building a forecasting model of consumer expenditures for household furniture and equipment. The initial model yielded superficially good results ( $R^2 = .99$ , standard error of the estimate = 1.60% of the mean of the dependent variable), but it fared badly in diagnostic tests, and produced poor ex post simulated forecasts. Diagnostics such as leverages and collinearity measures provided clues for revising the model, and we used linear and lag search techniques to sort out the proposed revisions. The best of the proposals yielded ex post simulated forecast errors less than half as large as those from the initial model.

"FORECASTING SALES OF NEW AND ESTABLISHED BRANDS; A METHOD FOR INFORMATION FEEDBACK, OPEN LOOP,  
SALES TRAJECTORY GUIDANCE CONTROL"

Waage, Frenck, Western Electric Co., Gateway II (13th Floor), Newark, NJ 07102

This paper presents a state-space formulation of the mutually dependent forecasting and marketing management problems, creating a marketing plan for brand sales and creating the sales forecast that this plan will generate. I show how Bayesian prior-posterior revisions of forecasts are executed using a Kalman filter as sales tracking permits comparisons between actual and forecasted sales. If the actual sales begin to systematically follow a trajectory different from the forecasted trajectory, then the analysis will reveal this long before the deviation has become irreversible. I show, in this case, what changes the marketing manager must make (in the sales path guidance controls) in order to steer actual sales back on the intended trajectory. Should this prove impossible, I show how the forecast and the sales goals must be revised.

"ESTIMATION TECHNIQUES FOR MULTIPLICATIVE MODELS AND MAXIMUM LIKELIHOOD ESTIMATORS FOR THE  
NAKANISHI AND COOPER MODEL"

Khairullah, Zahid Y., School of Business, St. Bonaventure U., St. Bonaventure, NY 14778

The problem of forecasting sales volumes for new locations of large-scale stores or shopping centers has been addressed by several researchers. Approaches can be classified as Analog and Gravitational Models. Nakanishi and Cooper proposed a Multiplicative Competitive Interaction Model and suggested a method for estimating its parameters using the least squares approach. In this paper, I use Teekins' technique for multiplicative models to develop the maximum likelihood estimators for the Nakanishi and Cooper model.

"SALES FORECASTING IN A MARKETING COMPANY"

Taylor, A.J., Reckitt & Colman, Danson Lane, Hull, HU8 7DS, England

This paper describes the practical implementation of sales forecasting in a marketing company. The first part of the paper describes the forecasting techniques used to account for trends and seasonality, this last factor being of some interest as the seasonal indices are derived from a Fourier Analysis. The paper then considers the problems of turning the theory into practice via a system that is usable by company personnel. The final part of the paper reviews the use of the system and considers the problems faced by forecasters in an environment with a substantial amount of promotional activity both by the company and by its competitors.

## BIOPOLITICS: PROSPECTS FOR HOMO SAPIENS

Chair: Kort, Fred, Dept. of Political Science, U. of Connecticut, Storrs, CT 06268

Session Overview: This session will be concerned with the evolutionary perspective of the future of the human species. The impact of genetic technology and related public policy on prospective human evolution will be examined in the context of "short term forecasting." Considerations based on behavioral genetics and biological anthropology will be presented in the framework of "long term forecasting." Finally, some thought will be given to the evolutionary basis of civil rights and liberties and the resulting alternatives for the future.

Discussants: Carter, Bonnie Frank, Albert Einstein Medical Center, Northern Division, York and Tabor Roads, Philadelphia, PA 19141  
Boniface, Wendy J., School of Nursing, U. of Connecticut, Storrs, CT 06268

"THE IMPACT OF DEVELOPMENTS IN HUMAN GENETIC TECHNOLOGY ON PUBLIC POLICY IN THE COMING DECADES"  
Blank, Robert H., Dept. of Political Science, U. of Idaho, Moscow, ID 83843

Advances in human genetics promise to give man more control over his biological destiny, but, concurrently, to create new social policy dilemmas, as "givens" are challenged. These new endeavors produce not only short-term alterations, but also long-term evolutionary changes on the human species as intervention reaches the level of the gene. This paper focuses on the impact of short-term developments in selected areas of human genetics on public policy. After reviewing the literature on the current status of genetic diagnosis, screening, and therapy, attention is directed toward estimating projected availability and use of the techniques over the next decade. Finally, the policy impact of several competing scenarios of genetic technology development are discussed.

"SHAPING THE BIOLOGICAL FUTURE OF MAN: THE APPLICATION OF NEW KNOWLEDGE"  
Ginsburg, Benson E., Behavioral Genetics Laboratory, U. of Connecticut, Storrs, CT 06268

Homo sapiens is likely to continue evolving new behavioral capacities. This thesis is based upon the fact that evolution requires hereditary variability, and that novel characteristics arise not simply from gene mutations, but also by using existing genes in new ways. Evidence is presented to show that such variability exists with respect to our mental capacities and that existing genes can work in different combinations to produce new characteristics in this domain.

"THE PAST AND THE FUTURE OF HUMAN ADAPTABILITY"

Harper, Albert B., Laboratory of Biological Anthropology, Dept. of Biobehavioral Sciences, U. of Connecticut, Storrs, CT 06268

The evolutionary history of Homo sapiens has been configured by the master biobehavioral complex of hunting. Hunting, as a way of life, has modeled our evolution by placing premiums on several important parameters. Human body size including cranial capacity and intelligence are biobehavioral thresholds necessary for successful hunting. Hunting also configured the population structure of the species by dictating many highly endogamous, isolated breeding experiments. This has produced the enormous variability between the sub-populations of the species, and leads to the adaptive success of Homo sapiens, both genetic and behavioral. Significant deviations from the master pattern have occurred starting with the development of agriculture. The species is now faced with a number of energetic crises which must be solved if the species is to have a future.

"A POSSIBLE EVOLUTIONARY BASIS OF CIVIL RIGHTS AND LIBERTIES AND RESULTING ALTERNATIVES FOR THE FUTURE"  
Kort, Fred, Dept. of Political Science, U. of Connecticut, Storrs, CT 06268

The hypothesis is advanced that civil rights and liberties are the product of the evolution of behavior, in the biocultural sense. According to this hypothesis, civil rights and liberties have an evolutionary component in terms of the Modern Synthesis (Darwinian evolution and Mendelian genetics), and, in contrast to established conventional thinking in the humanities and social sciences, they are not the result of cultural development independent of biological foundations. The problems and possibilities of empirical verification of the proposed hypothesis then are considered, specifically with respect to employing regression analysis. The implications of the hypothesis with respect to ethical criteria in the political process and ramifications for policy formulation and implementation are discussed. If verifying support for the hypothesis can be obtained, then it can be inferred that the observance of civil rights and liberties enhances the survival prospects of Homo sapiens as a species, whereas their absence may contribute to extinction.

TUESDAY  
10:00-11:30

PARLOR D

ROBUST PROCEDURES IN TIME SERIES ANALYSIS

Chair: Nyquist, Hans, Dept. of Statistics, U. of Umea, S-901 87 Umea, Sweden

"A PROCEDURE FOR OBTAINING M-ESTIMATES IN REGRESSION MODELS WITH SERIALLY DEPENDENT RESIDUALS"

Coursey, Don, Dept. of Economics, U. of Arkansas, Fayetteville, AR 73701

Nyquist, Hans, Dept. of Statistics, U. of Umea, S-901 87 Umea, Sweden

Applications where error terms in a regression model display both non-normal and serially dependent behavior are considered. For the estimation of the parameters, an iterative Cochran-Orcutt type M-estimator is proposed. A proof of convergence of the iterative procedure is given. In a simulation experiment, where the least absolute error criterion is applied, the performance of the estimator is tested and the theoretical convergence properties illustrated. In particular, the problems of local versus global minimization and the existence or nonexistence of multiple solutions are discussed.

"FORECASTING PRIVATE CONSUMPTION IN SWEDEN - AN EVALUATION OF DIFFERENT APPROACHES"

Baudin, Anders, Dept. of Statistics, U. of Umea, S-901 87 Umea, Sweden

During the last decade the economic systems of the Western World have been subject to substantial fluctuations. These large variations are occasionally expected to produce large errors in economic models. When modelling economic phenomena, the knowledge of this kind of behavior should be incorporated in model estimation to produce better forecasts. The concern of this paper is forecasting the private consumption in Sweden. Two different approaches are studied -- the ARIMA and the transfer function model approach. The models are estimated using different techniques -- such as ML, LS and LAE -- based on different assumptions regarding the distribution of random errors of the models. The methods are evaluated by comparing forecasts and outcomes of an observation period outside the estimation period.

"ROBUST PROCEDURES IN TIME SERIES ANALYSIS - A REVIEW"

Nyquist, Hans, Dept. of Statistics, U. of Umea, S-901 87 Umea, Sweden

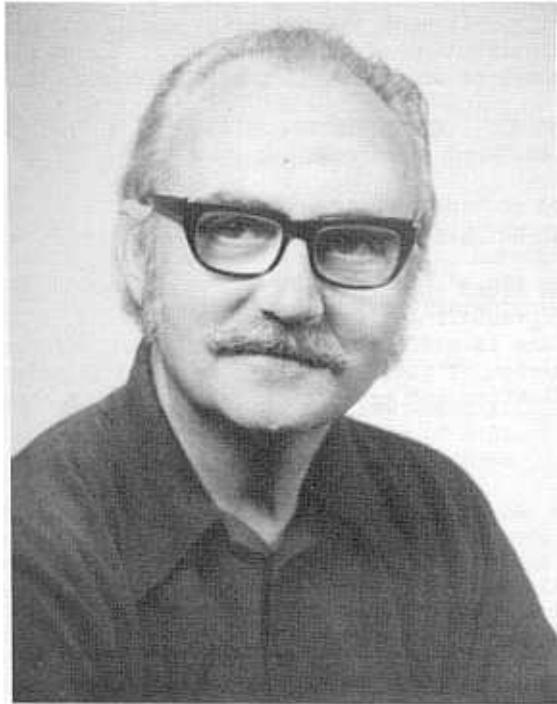
In many applications of autoregressive models, it has been found that the data are better represented by an infinite variance model. This alternative way of representing time series has raised several questions concerning the stationarity of the process and the identification, estimation and diagnostic checking of the model. In this paper, I review the discussion of these questions in the literature. Particularly, I am concerned with the problems of identification and estimation. A theorem on strong consistency is proven for a large class of estimators.

KEYNOTE SPEAKER

The First Gwilym M. Jenkins Memorial Lecture

*George E.P. Box*, Department of Statistics  
College of Letters and Science  
University of Wisconsin  
Madison, Wisconsin 53706

George E.P. Box is Vilas Professor of Statistics at the University of Wisconsin. He received a Ph.D. in Statistics and the D.Sc. degree from the University of London. He served as President of the American Statistical Association in 1978 and as President of the Institute of Mathematical Statistics in 1979. He is the recipient of the Guy Medal of the Royal Statistical Society, Professional Progress Award of the American Institute of Chemical Engineers, the Shewhart Medal of the American Society for Quality Control, and the Wilks Memorial Medal (ASA and U.S. Army).



"ASPECTS OF THE ANALYSIS  
OF TIME SERIES DATA"

Time series models describe the nature of probabilistic dependence between successive observations. Topics to be discussed include: Linear models; forecasts from linear models; forecast errors; finding the model; identification, fitting, diagnostic checking; forecasting problems -- forecast function, memory function, estimates of forecast error, all come from the model; transfer function models and forecasting; control problems; feedback affects; multiple time series models and forecasting.

Chair: *J. Scott Armstrong*, Wharton School, U. of Pennsylvania, Philadelphia, PA  
For the Gwilym M. Jenkins Memorial Fund: *Robert Carbone*, FSA, U. of Laval,  
Quebec, Canada

Introduction of Professor Box by *Otto Tomasek*, Hong Kong Telephone Company

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EXCHANGE RATE FORECASTING I	<i>Alexander, Don, New York, N.Y.</i>	104	SALON 2
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STATE & LOCAL GOVERNMENT FINANCIAL FORECASTING	<i>Bretschneider, Stuart, Syracuse U., N.Y.</i>	109	SALON 9
RATIONAL EXPECTATIONS IN ECONOMIC FORECASTING	<i>Smyth, David J., U. of Queensland, St. Lucia, Australia</i>	110	SALON 10
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UNIVARIATE TIME SERIES PANEL

This panel will discuss:

"WHAT RESEARCH IN THE PAST DECADE HAS MOST IMPROVED OUR  
ABILITY TO FORECAST USING UNIVARIATE TIME SERIES ANALYSIS?"

and

"WHAT RESEARCH SHOULD BE DONE IN THE NEXT DECADE  
TO IMPROVE UNIVARIATE TIME SERIES FORECASTS?"

An opening statement lasting no more than 10 minutes from each panelist will be followed by 20 minutes of discussion among the panelists and 20 minutes of questions from the audience.

Panelists:

*Cameron, Allan V.*

State Space Systems Inc., 2091 Business Center Drive, Irvine, CA 92715

Alan V. Cameron, President of State Space Systems, is a major contributor to the application of State Space modeling to forecasting.

*Carbone, Robert*

FSA, U. of Laval, Quebec G1K 7P4, Canada

Robert Carbone is an editor of the Journal of Forecasting. The AEP adaptive filtering univariate and multivariate forecasting methods owe their origin to his work with R.L. Longini.

*Fildes, Robert*

Manchester Business School, Manchester, M15 6PB, England

Robert Fildes, Senior Lecturer in Business Forecasting at the Manchester Business School, has held teaching and research appointments at the U. of California and the U. of British Columbia. He is author of Forecasting for Business Methods and Applications (Longmans, 1976), Forecasting and Planning (Teakfield, 1978), and A Bibliography of Business and Economic Forecasting (Gower, 1981). He is an editor of the Journal of Forecasting and Chairman of the Operational Research Society Study on Forecasting.

*Johnson, Lynwood A.*

School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA 30332

Lynwood A. Johnson's interests are in forecasting for production planning and inventory control. Dr. Johnson is coauthor of four books, including Forecasting and Time Series Analysis. He is an Associate Editor of the Journal of Forecasting.

*Pack, David J.*

Computer Sciences Divisions, Computing Applications Dept., Union Carbide, Oak Ridge, TN 37830

David Pack is a statistician in the Computer Sciences Division of the Union Carbide-operated Oak Ridge National Laboratory, Oak Ridge, Tennessee. He has played a significant role in the spread of the ARIMA (Box-Jenkins) time series forecasting methodology through provision of computer algorithms, instruction in professional education courses, and in Decision Sciences and Management Science. He is an associate editor for the Journal of Forecasting.

Chair: *Carbone, Robert*, FSA, U. of Laval, Quebec G1K 7P4, Canada

PROVINCIAL SOUTH

SCENARIOS AS A FORECASTING TECHNIQUE

Chair: *Schnaars, Steven, Dept. of Marketing, Baruch College, 17 Lexington Ave., New York, NY 10010*

"THE MULTIPLE SCENARIO APPROACH - AN AID TO STRATEGIC PLANNING AS PART OF THE INFORMATION BASE"  
*Meristö, Tarja, Dept. of Mathematics and Statistics, Turku School of Economics & Business Admin., Rehtorinpellontie 3, SF-20500 Turku 50, Finland*

The scenario approach can be understood here as a managerial tool to make alternative pictures about the future and to get the managers to think of the unthinkable. It is an essential part of strategic planning; mission scenarios are related to business idea and purpose analysis, issue scenarios to environmental analysis, and action scenarios to SBU analysis. The question is how to combine human judgment and analytical modelling techniques when producing information to support strategic decision-making. One way to do this is to construct scenarios by using delphi and cross-impact analysis together. This paper is based on scenario work that I have been involved with in a large Finnish construction firm from 1979 to 1982. The paper also reports on a questionnaire sent to 1100 European firms in 1981-82.

"A COMPARISON OF SCENARIO WRITING AND ECONOMETRIC MODELLING"

*Schnaars, Steven, Dept. of Marketing, Baruch College, 17 Lexington Ave., New York, NY 10010*

In this study, scenario writing and econometric modelling were used to forecast automobile sales. Three scenarios (most-likely, optimistic, pessimistic) were written from a judgmental interpretation of secondary data. The accuracy of the most-likely scenario was compared with that of a simple econometric model. Then the enveloping scenarios (optimistic, pessimistic) were compared with predictions made by the econometric model, when optimistic and pessimistic values for the independent variables were used. From these comparisons, inferences are drawn regarding the value of scenario writing as a market forecasting tool. The paper also provides a partially annotated bibliography of scenario analysis.

"THE ROLE OF FORECASTING IN STRATEGIC PLANNING"

*Schoemaker, Paul J.H., Graduate School of Business, U. of Chicago, Chicago, IL 60637*

This paper examines the role of forecasting in strategic planning. First, a historical perspective is offered on forecasting, strategic planning, and their relationship. Thereafter, the question is addressed of how to combine predetermined elements with critical uncertainties, taking into account the business environment, culture, and (analytic) capabilities of a company. The second part of the paper examines the multiple scenarios method as a major tool for forecasting and for strategic planning in general. Thereafter, its development and utilization in Royal Dutch/Shell will be discussed, as an instructive case in point. The paper closes with general observations on the various roles forecasting can, and should, play in strategy formulation.

## LEADING INDICATORS IN DEVELOPING COUNTRIES

Chair: *Moore, Geoffrey H.*, Center for International Business Cycle Research, Rutgers U., Newark, NJ 07102

"ECONOMIC INDICATORS AND GROWTH CYCLES IN THE PACIFIC BASIN COUNTRIES"

*Klein, Philip A.*, Kern Graduate Center, Pennsylvania State U., University Park, PA 16802

This paper compares the growth cycle chronologies presently available for Australia, Japan, Malaysia, New Zealand, South Korea, and Taiwan. The leading, coincident and lagging indicators available for these countries are evaluated with regard to their capacity to detect slowdowns in economic growth. Suggestions are made concerning the further development of cyclical indicators for countries in the Pacific area, along lines being followed in Europe and North America. The usefulness of these tools in monitoring trade and investment flows among countries is noted.

"LEADING INDICATORS OF THE ISRAEL ECONOMY"

*Fisher, Jeffrey*, Research Dept., Bank of Israel, P.O.B. 780, Jerusalem, Israel 91007

The Israel economy is beset by an ongoing imbalance between exports and imports which tends to widen with economic growth. Most cyclical episodes in Israel's economic history have been associated with implementation of policy measures designed to improve the balance of payments situation. This paper investigates the effect of such initiated cycles on the behavior of economic activities, conventionally expected to have leading cyclical tendencies, to see if such tendencies are impaired in Israel. In recent years, Israel has experienced rapid inflation, a development that has lessened the importance of money aggregates such as M1 in favor of wider aggregates (up to M4) which include linked monetary assets. The paper investigates the relevance of the various aggregates as leading indicators in such a situation.

"CYCLICAL ANALYSIS OF A SMALL OPEN DEVELOPING ECONOMY: THE GREEK CASE 1962-1982"

*Voloudakis, Evangelos*, Economic Research Dept., Bank of Greece, P.O. Box 105, Athens, Greece  
*Degas, Demetrios*, Economic Research Dept., Bank of Greece, P.O. Box 105, Athens, Greece

The present paper, an updated version of our paper contributed to the CIRET Conference in 1981, includes: (a) A new assessment of the relevance and usefulness of a cyclical analysis for a small open developing economy, with particular reference to the importance of autonomous domestic and external factors, and of the availability and quality of the data utilized; (b) The chronology of the postwar cycles of the Greek economy, as it emerged by extending the period from Q3 1980 to Q3 1982. By adding eight quarters, the weak cycle of 1976 of non-agricultural GDP disappears, so that the post-1974 period till Q2 1979 turned out to be a long upswing followed by a long downswing extending to the present; (c) A comparison of the cyclical pattern of the Greek economy with those of the U.S.A. and some major European countries. The Greek pattern conforms more closely to that of the U.S.A. rather than of the EEC or of individual large members of the Community, such as France or Germany; (d) A brief description of the revised series of leading, coincident and lagging indicators, as well as of the new composite indices. A long table of the more than 300 individual series with the corresponding scoring is appended for reference. Finally, a new exercise in forecasting is attempted.

## EXCHANGE RATE FORECASTING

Chair: Alexander, Don, New

Session Overview: This is the first of four consecutive sessions organized by Don Alexander on the subject of exchange rate forecasting. The purpose of these sessions is to bring together recent theoretical and empirical developments in the forecasting of exchange rates.

"HIGH FREQUENCY VECTOR ARMA MODELS"

Jones, Kenneth J., Dept. of Business Admin., Florence Heller School, Brandeis U., Waltham, MA 02154  
O'Reilly, Daniel F.X., Data Resources, Inc., 29 Hartwell Ave., Lexington, MA 02173

A vector ARMA model is described which produces weekly forecasts of key exchange rates, short-term interest rates, money supply components and other investment instruments. The historical fit of the model is evaluated, and its track record since January, 1983 is presented. In addition, a Bayesian vector autoregressive model is designed for the purpose of predicting a larger set of exchange rates. These models are compared for effectiveness with smaller cluster models yielding information on the relation of model size to forecast accuracy.

'HOW DOES AN INTEREST RATE CHANGE AFFECT THE EXCHANGE RATE?

Giddy, Ian H., Graduate School of Business, Columbia U., New York, NY 10027  
Kang, Ho Sang, Graduate School of Business, Columbia U., New York, NY 10027

This paper considers how an interest rate change affects the exchange rate. Sticky adjustment of goods prices produces deviations from the domestic Fisher effect and from purchasing power parity; but slippery currencies allow immediate adjustment of the exchange rate to produce uncovered interest rate parity, the international Fisher effect. The real interest rate differential is directly proportional to the deviation from purchasing power parity and decreases to zero as prices fully adjust to a monetary shock. In this model, the spot exchange rate is expressed as a function of past, present and expected values of the domestic and foreign money supplies and the current values of domestic and foreign real income. The key to an understanding of the link between a given interest rate change and the exchange rate change lies in the size of the interest elasticity of demand for money.

"FOREIGN CURRENCY OPTION VALUES"

Garman, Mark B., School of Business Admin., U. of California, Berkeley, CA 94720  
Kohlhagen, Steven W., School of Business Admin., U. of California, Berkeley, CA 94720

Foreign exchange options are a recent market innovation. The standard Black-Scholes option pricing model does not apply well to foreign exchange options, since several interest rates are involved in ways differing from the Black-Scholes assumptions. The present paper develops alternative assumptions and valuation formulas for foreign exchange options.

"USING TECHNICAL FORECASTS PROFITABLY"

Jaycobs, Rich, Roaring Brook Management, Inc 706 Bedford, Stamford, CT 0691

{Abstract not available at time of publication

## SUBJECTIVE FORECASTS AND GROUP PROCESSES

Chair: *Parente, Frederick J.*, Psychology Dept., Towson State U., Towson, MD 21204

**"THE USE OF A CORRECTION FACTOR IN EVALUATING FORECAST ACCURACY"**

*Statman, Meir*, Dept. of Finance, School of Business, U. of Santa Clara, Santa Clara, CA 95053

*Tyebjee, Tzyzon T.*, Dept. of Marketing, School of Business, U. of Santa Clara, Santa Clara, CA 95053

Many studies have noted the tendency of research and development projects to have significant time and cost overruns. A plausible implication of that finding is that better forecasting methods should be used to eliminate estimation biases. Such an implication, however, may be unwarranted if decision makers are aware of the tendency of forecasters to bias their results and, because of this, if a correction factor is applied to the forecast before decisions are made (even though the forecast itself is not changed). We used questionnaires to see whether decision makers were aware of the tendency to bias forecasts for research and development and for sales, and whether they applied correction factors to these forecasts before making decisions.

**"AN EXAMINATION OF FACTORS CONTRIBUTING TO DELPHI ACCURACY"**

*Parente, Frederick J.*, Psychology Dept., Towson State U., Towson, MD 21204

*Anderson, Janet K.*, Psychology Dept., Towson State U., Towson, MD 21204

*Myers, Patrick*, Academic Systems Research Facility, Towson State U., Towson, MD 21204

*O'Brien, Thomas*, Human Engineering Laboratories, Aberdeen Proving Grounds, Aberdeen, MD

Three experiments examined the accuracy of the Delphi method. The first experiment assessed the accuracy of group predictions over 1, 2, and 3 month time spans. Results indicated that group predictions exceeded the accuracy of the average panel member, but not that of the most accurate. Experiments 2 and 3 evaluated the contributions of polling and feedback to Delphi accuracy. Neither manipulation enhanced accuracy of the group's predictions of whether an event would occur. The effect of iterated polling was to reduce the group's error in predicting the time course for those scenarios that did occur.

**"AN APPLICATION OF TECHNIQUES FOR IMPROVING GROUP PROBLEM-SOLVING TO INCREASING THE USE OF STATISTICAL REASONING BY GROUPS ASSESSING UNCERTAINTIES"**

*Goitein, Bernard*, Business Management & Administration, Bradley U., Peoria, IL 61625

Even intuitive forecasts are likely to be better if the forecaster employs statistical reasoning in their generation. Cognitive heuristics that bear little relationship to statistical reasoning are frequently employed, however, in intuitive judgments of the probability of events. Viewing probability assessments tasks as analogous to problem solving tasks suggests that strategies developed for improving problem solving may improve probability assessments. Members of problem solving groups in which the expression of minority opinions are encouraged perform better than do individuals. It was therefore predicted (and found) that members of similarly encouraged groups make greater use of statistical reasoning than do individuals.

**"EXPERT JUDGMENTS AND RISKY SHIFT: A SYNTHESIS"**

*Gupta, Sunil*, Graduate School of Business, U. of California, Berkeley, CA 94220

*Wilton, Peter*, Graduate School of Business, U. of California, Berkeley, CA 94220

Decision makers often seek the assistance of experts when forecasting future events. Typically, these experts do not agree. In such cases, either the committee of experts is required to reach a consensus, or, the decision maker must combine these expert judgments. Important theoretical work in combining expert judgments has been published (e.g., Winkler, Dalkey, Lindley). However, this literature does not explicitly incorporate the effects of choice shifts that have been noted by behavioralists, such as Vinokur and Burnstein. Choice shift theorists, on the other hand, have not developed rigorous formal models to predict these shifts. Our paper attempts to bridge some gaps between these two streams of research. Further, we propose an experiment to test the proposed model.

## EXCHANGE RATE FORECASTING: I

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"EXPERT JUDGMENTS AND RISKY SHIFT: A SYNTHESIS"

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~ :

SALON 4

TUESDAY 2:00-3:30

#### ECONOMETRIC APPROACHES TO RESIDENTIAL ENERGY USE

William8~ Larry J.~ Electric Power Research Institute/Strategic Investments Group, 12 Sneckner Court, Menlo Park, CA 94025

"ECONOMETRIC FORECASTING MODELS OF RESIDENTIAL ELECTRICITY END-USE" Lawrence3 Anthony G.3 20620 Lomita Ave., Saratoga, CA 95070

I reviewed several recent studies of residential electricity use. In the studies covered, electricity consumption was specified to be the sum of the energy used in each of several household appliances plus an intercept representing the energy used by unenumerated appliances. The coefficient of each enumerated appliance (e.g., end-use) is called its Unit Energy Consumption (UEC). In general, the UECs were parameterized to depend on weather, income, dwelling characteristics, demographic variables, energy prices, and other variables. Most of the studies used household survey data combined with billing records. UEC estimates resulting from these studies have been incorporated into the energy forecasting models of some utilities.

"AGGREGATE RESIDENTIAL ELECTRICITY DEMAND Corio. Marie R. 258 Broadway, Apt.

: METHODS FOR INTEGRATING OVER DECLINING BLOCK RATES" 3A, New York, NY 10007

The purpose of this research was to develop a theoretical model of aggregate demand for residential electricity, based on a choice-theoretic model of an individual household's demand for a good priced under a declining block rate schedule. The model, developed by John Chipman and integrated and estimated by Marie Corio, departs significantly from earlier work in the area of residential electricity demand. In particular, it explicitly incorporates the entire rate structure in the individual demand equations, and it develops aggregate demand equations by aggregating over individuals. The model can answer rate structure questions that other models of residential energy demand have been unable to answer. Policy questions, such as the effect on household demand of changes in marginal rates or breakpoints of the rate schedule can be investigated. The model can also be extended to include the case of increasing block rate schedules. While the model deals with short-run demand for electricity, long-run appliance decisions can be incorporated.

"ON FORECASTING FUEL SHARES FOR ELECTRIC UTILITIES"

Smale~ Robert D.~ Wharton School, U. of Pennsylvania, Philadelphia, PA 19104

The problem of forecasting the percentage of electricity that is to be generated by each of several fuels presents difficulties. In modeling the demand for fuels for generation, a constraint is that the shares must add to one. This has an effect on the estimation procedure. A common solution is a logistic transformation of the fuel shares with the use of Zellner's method to estimate the equations for the different shares. By definition, the shares are highly correlated, and, by their similarity, the independent variables in the regression equation are correlated. These correlations affect the precision of estimates when using Zellner's method. A method proposed by Beaton and Tukey for assessing imprecision due to collinearity in simple multiple regression was extended to Zellner's method and proposed for use on fuel shares modeling. It was shown that two sources of imprecision can be determined; one due to correlation between dependent variables and one due to correlation between independent variables. The method is demonstrated on a model used by the Energy Information Administration to produce short term forecasts.



SALON 5

TUESDAY 2:00-3:30

Chair:

#### DIFFUSION MODELS IN MARKETING

*Kalish.. Shlomo.. Graduate School of Management, U. of Rochester, Rochester, NY 14627 and Lilien.. Gary. College of Business Administration, Pennsylvania State U., University Park, PA 16820*

#### "THE USE OF INNOVATION DIFFUSION MODELS IN NEW VENTURE PLANNING AND EVALUATION"

*Biaakman~ A. Wade Jr.~ Stone and Webster Engineering, P.O. Box 2325, Boston, MA 02107*

A system for the planning and evaluation of new ventures will be presented, and the role played by innovation diffusion models in these systems will be indicated. The deficiencies in the current state-of-the-art and the research needed to increase the utility of innovation diffusion models in new venture decision-making will be discussed.

#### "ON LINE DIAGNOSIS AND CONTROL OF NEW INDUSTRIAL PRODUCTS"

*Choffray~ Jean-Marie~ ESSEC, Boite Postale 105, 95001 Cergy, France*

This paper reports on a two year research program conducted in Europe on the diffusion of hundreds of new industrial products and technologies. This research led to the development of a decision support system that provides industrial firms with a powerful tool for diagramming and controlling market penetration new products. Use of the system is illustrated through the analysis of two new industrial products introduced recently in Europe.

#### "DIFFUSION OF HYBRID CORN : A REEXAMINATION"

*Mahajan.. Vijay.. E.L, Cox Business School, Southern Methodist U., Dallas, TX 75275 Easingwood.. Christopher..Manchester Business School, Manchester, England M156PB Muller.. Eitan.. Graduate School of Management, Dept. of Marketing, Northwestern U., Evanston, ILL 60201*

Alternative models of the rate of diffusion of a new innovation are discussed and applied to study the spread of hybrid corn in the United States, a problem originally examined by Griliches (1957) and revisited by Dixon (1980). The relative importance of "profitability" variables in explaining variations in the rate of diffusion between states is examined.

"APPLYING NEW PRODUCT DIFFUSION MODELS: CONCEPTS AND EXAMPLES"

*Kaii8h, Shiomoto, Graduate School of Management, U. of Rochester, Rochester, NY 14627 Lillien, Gary L., College of Business Administration, The Pennsylvania State University, University Park, PA 16802*

Diffusion models in marketing can be used for description and prediction, as well as for normative purposes. This paper provides a framework for developing and applying marketing diffusion models. Three case examples illustrate the concepts: a small model used for timing the introduction of a new technology, a large simulation model used for assessing a marketing program for a new technology, and an application in a competitive market with repurchase. The concepts involved with the application and implementation of these models are reviewed.

Chair:

*Lu8k. Edward J.. Wharton School, U. of Pennsylvania, Philadelphia, PA 19104*

Session Overview: This session examines what is being taught, what should be taught, and how it should be taught.

"FORECASTING IN BUSINESS SCHOOLS"

*Hanke, John, School of Business, Eastern Washington University, Cheney, Washington, 99004*

#### **ORGANIZATIONAL EXPERIENCE WITH FORECASTING TECHNIQUES :**

The study of forecasting techniques has received increased attention in recent years. How to incorporate this topic into the business school curriculum is a frequent subject of discussion. 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 622 member institutions of the American Assembly of Collegiate Schools of Business. The importance of teaching forecasting techniques at both the undergraduate and graduate level was investigated.

SALON 6

"QUANTITATIVE FORECASTING MODELS : A VIEW 5 YEARS AFTER GRADUATE SCHOOL" *Chism, Gary W.*, Rexnord Specialty Fastener Division, Torrance, California

The author describes how his perspective on quantitative forecasting models has been affected by several years' experience in industry. The paper emphasizes the educational value of practical experience as a complement to formal university training. Experience reveals the limitations of quantitative models in the "real world" context of practical applications. This is a context characterized by the judgmental and intuitive, the arbitrary, the ambiguous, the elusive, and the relative. The paper illustrates these characteristics with examples from the author's own experience.

"MAKING COMPLEX METHODS TEACHABLE"

*McGee, Victor E., Amos Tuck School of Business Administration, Hanover, New Hampshire 03755*

Multivariate Box-Jenkins ARIMA models (e.g., transfer function models) are not easy to teach. The theoretical underpinnings are quite complicated, and even though computer programs are available in many institutions, it is not always easy for students to understand the output of such programs. In the case of transfer function modelling, it is particularly difficult to persuade the students to learn what is necessary for a thorough understanding of the subject. This paper presents a very straightforward example which makes the concepts clear and which shows quite emphatically where transfer function modelling is justified. It will be presented in the form of a tutorial on transfer functions.

TEACHING

TUESDAY 2:00-3:30

**''COMPUTER AIDS FOR THE NOVICE FORECASTER''**  
WeitB~ Rob R.~ Dept. of IE/OR, U. of Massachusetts, Amherst, MA 01002

This paper describes progress towards the development of an interactive, knowledge-based consultation program to aid the non-expert in the selection and use\$of appropriate forecasting techniques. The program's 'production rule'' format is both powerful and flexible, allowing for extensive user friendly explanation and teaching capabilities, incorporating the user's judgment into the decision making process, and easy updating and debugging of the knowledge base .Various implementations will be examined in order to explore optimal computer-human interaction in the forecasting environment.



## STATE AND LOCAL GOVERNMENT FINANCIAL FORECASTING

*~: Bretschneider~ Stuart I.~ Maxwell School, Syracuse U. , Syracuse, NY 13210  
 Larkey~ Patrick D.~ Dept. of Social Science, Carnegie-Mellon U., Pittsburgh, PA 15213*

"AN APPROACH TO LOCAL GOVERNMENT FINANCIAL FORECASTING"  
*Larkey~ Patrick D.~ Dept. of Social Science, Carnegie-Mellon U., Pittsburgh, PA 15213*

This paper describes the approach and results of a project to develop and implement interactive Financial Forecasting Systems for two large City governments, an urban County government and an urban School District. The current forecasting practices of other U.S. local governments are reviewed briefly. The major elements of the Forecasting Project, data collection, Modelling and Software are then described. The departures of the project from current forecasting practice are emphasized.

"DECISION ANALYTIC EVALUATION OF MACRO-ECONOMIC FORECASTS FOR STATE AND LOCAL GOVERNMENT REVENUE FORECASTING"  
*Bretschneider~ Stuart~ Metropolitan Studies Program, Syracuse U. , Syracuse, NY IJ210 S~troeder~ Larry~ Metropolitan Studies Program, Syracuse U. , Syracuse, NY IJ210*

This paper structures the process of using macro-economic forecasts by state and local governments as a decision problem under uncertainty .This provides a formal means to assess the value of the information provided by those who forecast the national economy. The budget officer's decision is the planned level of revenues , the uncertainty stems from the stochastic nature of the generation of state or local government revenue and macro-economic forecasts constitute the prior information. The analysis is developed from five sources of macro-economic forecasts for the 1979-82 period of five economic indicators commonly used in public sector revenue forecasts. Revenue forecasting practices of the Ci ties of Cincinnati and New Orleans are used to illustrate this analysis in a specific context.

''REVISING REVENUE FORECASTS ON THE BASIS OF RECEIPTS EXPERIENCE''  
*Larkey. Patrick D.. Dept. of Social Science, Carnegie-Mellon U., Pittsburgh, PA 1521J Tsay. Ruey S.. Dept. of Social Science, Carnegie-Mellon U., Pittsburgh, PA 1521J*

The Forecasts of State and Local revenues incorporated in budgets are always wrong. The important question is : How wrong and in what direction? As the budget year unfold~ revenue estimated are revised by financial officers on the basis of week1Y or monthly receipts experience .The procedures used for revising estimates are usual1Y informal, judgmental and use data only from one or two prior years. This paper describes statistical procedures for revising revenue estimates. The procedures are illustrated on month1Y receipts data from the City of Pittsburgh, Pennsylvania.

"ECONOMETRIC ANALYSES OF STATE SCHOOL SPENDING"  
*Miner~ Jerry~ Metropolitn Studies Program, Syracuse U. , Syracuse , NY IJ210 Atm~ Jame8~ Metropolitn Studies Program, Syracuse U. , Syracuse , NY IJ210*

The study examines determinants of variations in spending for local schools among states during the period from 1970 to 1980 and projects spending on a state-by-state basis to 1990. Special emphasis is placed on the effects of federal aid on school spending, on the stability of response to aid over time, and on the influence of different state systems of support for local schools. A basic estimating equation is developed using measures of state income and tax capacity, need for school services, and the relative costs of schooling across states and over time. Then, variables are added reflecting federal aid, both in broad aggregate and in detail by aided governmental level

and function. This permits comparison of the effects of various aid programs. Analysis of pooled data for different time periods allows examination of stability of spending response to similar aid and other variables. Projections of the levels of aid and of other independent variables from official government and other sources is used along with "best estimate" coefficients to project state-by-state spending to 1990.

*~: Smyth~ David J.~ Dept .of Economics , Wayne State Uni versi ty , Detroit , Michigan 48202 and Dept. of Economics, University of Queensland, St. Lucia, Queensland, Australia 4067*

"SURVEY EXPECTATIONS DATA AND THEORETICAL EXPECTATIONS MODELS FOR GERMANY , BELGIUM AND ITALY" *Heeraiau~ Satnarine~ School of Economics & Management, Oakland U. , Rochester, MI 48063*

This paper tested several theoretical expectations models against survey expectations data for Germany, Belgium and Italy. Among the models tested were the autoregressive schemes (adaptive, regressive and extrapolative ), pairwise syntheses of these models and the rational expectations hypothesis. In addition to these models, a more general synthesized model, incorporating the autoregressive as well as the rational expectations models, was tested against the survey data. The results showed that a combination of the individual schemes explained the survey data significantly better than the single schemes .This would suggest that expectations are formed in a more heterogeneous way than is frequently assumed in empirical and theoretical research.

RATIONAL EXPECTATIONS IN ECONOMIC FORECASTING

SALON 10

"ON TESTING THE RA-TIONALITY OF ASA-NBER SURVEY DATA ON MULTI-PERIOD FORECASTS"

*Lahiri, Kajal, Dept. of Economics, State University of New York, Albany, NY 12222 Teigland, Christie, Dept. of Economics, State University of New York, Albany, NY 12222*

Professional expectations on the behavior of eleven key macroeconomic variables for the next five quarters analyzed over 1968-80 to test the so-called efficiency and consistency properties of Rational Expectations hypothesis (REH). Forecasts for only the Implicit Price Deflator, real GNP, and industrial production were found to satisfy these properties .We also studied the unbiasedness property of REH in the multi-period context and found similar results .These latter tests were conducted on the basis of the assumption that forecasts follow a generalized scaled-t distribution, because the normality assumption was resoundingly rejected in all the cases .

"THE USE OF RATIONAL EXPECTATIONS METHODS IN FORECASTING THE WORLD ECON(j/1Y")

*Minford~ Patriak~ U. of Liverpool, Eleanor Rathbone Bldg., P.O. Box 147, Liverpool L69 3BX, England*

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This paper investigated the effects of fiscal and monetary shocks on the exchange rate within a world macroeconomic model. The model has no 'supply-side' at this stage; the equilibrium (or 'natural') values of output, real interest rates, and real exchange rates were taken as exogenous. The model linked rational expectations models of 9 major OECD countries with added equations for trade blocks to close the full model. Each country model had a structure like that of the model of the UK from which forecasts are regularly produced for the UK. The paper discusses the world model's properties both theoretically and in the form of simulations. It yields new insights into the role of financial transmission as well as forming a potential framework for regular casting and analysis.

TUESDAY 2:00-3:30

#### "HOW WELL DO WESTERN AUSTRALIAN BUSINESSES FORECAST?"

*Smyth~ David J.*~ Dept. of Economics, Wayne State U., Detroit, MI 48202 and Dept. of Economics, U. of Queensland, St. Lucia, Queensland, Australia 4067

This paper analyzes the accuracy of forecasts made by West Australian Businessmen in surveys of business trends for the period 1974 to 1982. Nineteen series are analyzed, four employment, two to capital, seven to business activity and capacity, five to costs, and overall economic condition. Indices of predicted and actual changes are calculated and Preliminary results indicate the following : the forecasts did not outperform a random walk; forecasts did not meet the criteria for rationality; the businessmen were persistently optimistic in their forecasts of employment, business activity ~ costs; the businessmen, on expected a higher rate of inflation than actually took place .

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Chair.

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#### D. PACT OF MISSPECIFICATION ON ARTH{A MODEIS"

OVe80n, Richard M., Managerial Economics, Brigham Young U., Provo, UT 84602

difficulty in accurately identifying the true generating process in Box-Jenkins analysis gives to questions concerning the loss of forecasting accuracy due to misspecification. A Monte Carlo of a number of model specifications suggested that omission of either an MA or AR parameter was present in the true model ) reduced accuracy .In addition, it is important to include to account for irregular weighting of past events .~yond these concepts , it shown that overspecification detracted little from forecasting accuracy. Confidence intervals the forecasts were also examined.

EXTRAPOIATION:

#### SEMINAR A

#### AN APPLICATION FOR THE BEI.GIAN CAR MARKET"

Boghep8~ E.~ U. of Antwerp, Prinsstraat 13, 2000 Antwerpen, Belgium

MaLeod~ G.~ Gwilym Jenkins & Partners, Parkfield, Lancaster LAL 4TZ, England

#### D,fi>ROVING FORECAST ACClACY

series describing similar situations normally need models with a similar structure to describe We present a three stage procedure called AUTOMOD .First , the time series must be into groups that are expected to behave in similar ways .This classification can be for example , on product type , geographical area, presence or absence of seasonality .Next , a small representative set of time series from each group for detailed analysis .We then on the nature of a common model structure for all time series belonging to the same group . the AUTOMOD procedure uses the common structure to complete the model specification for time series. This approach introduces the effectiveness of Box-Jenkins forecasting to situations numbers of series are involved. We show how AUTOMOD was applied to the new cars registered

Be i.gi um .

#### PROBWAS IN FFORECASTING"

Geurts. Michael D.. Graduate School of Management, Brigham Young U., Provo, UT 8460? Lzwpenoe. KennethD.. Strategic Planning & Financial Analysis, AT&T, Bedminster, NJ 07921

paper concerns itself with the improvement of forecasting accuracy by analyzing and improving used in building the forecasting models .There are three areas in which the data can be and improved in order to improve forecasting accuracy .The first area is the accounting , the second is the effect of atypical events on the data, and the third is the shift data patterns that occurs over time .

TUESDAY 2:00-3:30

#### DAILY RETAIL SALES'

Rinne~ Heikki J.~ College of Business, Pennsylvania State U., University Park, PA 16802 wood~ Robert A.~ College of Business, Pennsylvania State U., University Park, PA 16802

paper presents an econometric reforecasting model for daily supermarket sales, customer visits, profits .The model accounts for seasonal patterns , both daily and monthly , as well as variables. The objective is to develop a short-term and long-term system for measuring the effectiveness of marketing and competitive actions by utilizing and cumulative residual patterns .

**TUESDAY 2:00-3:30**

**EXTRAPOLATION AND FINANCIAL FORECASTING**

Chair: *Hoppeu, James F.*, Dept. of Finance, College of Business Administration, U. of Oklahoma, Norman, OK 73069

"ASSESSMENT OF THE REACTION OF COMPETITORS' COMMON STOCK PRICES TO NEW PRODUCT ANNOUNCEMENTS" *Houman~ Z~ R.* Dept. of Finance, Loyola College, Baltimore, MD 21210

*Margenthaler~ Charzes R.* Dept. of Finance, Loyola College, Baltimore, MD 21210

The focus in this paper on investor response to major new product announcements represents a continuation of the evolution of research on capital market efficiency. Recent intervention model analysis has been proposed as being more appropriate than the traditional cumulative average residual methodology for analysis of market efficiency. This research provides an additional perspective concerning the importance of new product announcements on the reaction of competitors' common stock prices. Further, it presents a comparative investigation of the two cited methodologies to assess

the question of whether major new product announcements convey additional information that investors have not already incorporated into their decisions.

**"EQUITY MARKET ANTICIPATION OF DEFAULT RATING CHANGES"**

*Wingier, Tony R.; Angell, Robert J.; Eatman, John L.*, Dept. of Finance, U. of North Carolina, Greensboro, NC 27412

**Financial research provides contradictory evidence on the adjustment of common stock prices to a change in the firm's debt quality (default) rating.** In contrast to earlier findings, recent research suggests equity markets do not anticipate bond rating changes, particularly for the case of downgradings. Research in this area has failed to adequately control for changes in market risk that may be associated with the change in the firm's debt carrying ability. Our research employed intervention analysis to control for changes in the firm's systematic risk. Intervention analysis permits testing of the presence of excess risk adjusted returns after taking into account changes in market risk and removing possible autocorrelation. The study examined 29 electric utilities that had experienced a rating change during the 1974-81 period. Preliminary results suggest a rating change did convey meaningful information; substantial price adjustments occurred after the announcement when changes in market risk was controlled.

**"ASSOCIATION BETWEEN EPS AND INDEX OF INDUSTRIAL OUTPUT: A TRANSFER FUNCTION MODEL"**

*Ei-Sheshai, Kamal M.*, Quantitative Methods Dept., Georgia State U., Atlanta, GA 30303

The well documented relationship between stock market prices and corporate earnings has led many researchers to attempt to develop sophisticated time series models for forecasting earnings per share

(EPS). Most of the models developed thus far fall into the class of univariate ARIMA models. The predictive accuracy of these models, however, has not shown superiority to the predictive accuracy of forecasts generated by stock analysts. In a search for models that can "beat" the analyst, this study investigates the relationship between EPS and a leading indicator of business activity. The

Box-Jenkins methodology is utilized to build transfer function models relating quarterly changes in the Index of Industrial Output to quarterly changes in EPS for a sample of 86 firms over the period 1963-1977. Only about one fourth of the sampled firms showed significant relationship to the leading indicator. The predictive accuracy of the transfer function models for these firms was compared to that produced by the univariate ARIMA models.

**"A TRANSFER FUNCTION AND INTERVENTION ANALYSIS OF CREDIT CARD SALES AND BAD DEBT"**

*Hoppeu, James F.* Dept. of Finance, College of Business Administration, U. of Oklahoma, Norman, OK 73069

*McLeod, Gordon~ Gwilym Jenkins & Partners, Lancaster, LA1 4T2, England*

A portion of each month's credit card sales will become irrecoverable bad debt. For planning purposes a forecast of irrecoverable bad debt and the effect of a policy change on irrecoverable bad debt are desirable. Transfer function models relating various levels of outstanding payment accounts by an intervention analysis of a policy change were built for a company having its own credit card. Improved forecasts of irrecoverable bad debt were obtained, and the effect of the policy change was measured. Optimal forecasts of irrecoverable bad debt for varying lead times were found to be dependent on transfer function models with input series of different length of payment outstanding periods.





## HEALTH AND BIOLOGY

TUESDAY 2:00-J:JO

**~: Ord~ Keith~ Dept. of Management Science, Pennsylvania State U ., University Park, PA 16802****"USING TIME-SERIES PARAMETERS IN PREDICTING OUTCOMES OF PSYCHOTHERAPY"**

Revenstorff~ Dirk; Hahweg~ Kurt; Schindler~ LudMig~ Klinische Psychologie , Universitat Tübingen, Gartenstr. 29, 7400 Tübingen, W. Germany

in a study on marital therapy , daily ratings of several aspects of the relationship were assessed . These data were analyzed individually by time-series analysis to evaluate changes under therapy . Besides giving individual outcome measures of success and deteriorations (changes in level and slope), the analysis provided a number of other parameters characterizing the time-series (e.g., measures of autocorrelation, crosscorrelation, variation). The relationship of these indices to global outcome measures at the end of therapy and at follow-up times was studied. It was found that time-series parameters were valid for predicting therapy success six and twelve months after the time-series ended.

**"FORECASTING THE SPREAD OF AN EPIDEMIC:**

cuff~ A.D.~ Dept. of Geography, Cambridge U., Cambridge, England

Ord~ J.K.~ Dept. of Management Science, The Pennsylvania State U., University Park, PA 16802

**in order to forecast the progress of an epidemic, we must take account of both the development over time within a community and the spread to or from other communities .Since fade-out may occur , we need to use different procedures for the onset and in-epidemic phases of a disease .The methods will be discussed with reference to the spread of measles in an island community .**

**"FORECASTING OF TUMOR GROWTH AND TREATMENT"**

Deuchting~ W. and Vogelzang~ Th.~ Dept. of Electrical Engineering, U. of Siegen; D-5900 Siegen 21, Germany

**The goal of this paper is to forecast the optimum time of applying a chemotherapeutic drug .in the case of tumor diseases .This task may be performed by a large digital computer simulating the time behavior and the spatial ( three-dimensional ) distribution of growing tumors .In addition, various methods of tumor treatment ( surgery , radio-therapy , chemotherapy ) are studied. Special interest is given to the problem of forecasting the optimum method and time of therapy prior to clinical therapy**

TUESDAY 2:00-J:JO

~ :

DJPLOYMENT FORECASTING

**HOrime8~ RiohaPd A.~ Faculty of Business Administration, Simon Fraser U. , Burnaby, B.C. , V5A 1S6, Canada**

**"THE ONTARIO MANPCMER PROJECTION SYSTW"**

**Vafa.. Ray.. Ontario Manpower Canmission, 500 University Ave ., Toronto, Ontario, M5G IV7 , Canada**

The Ontario Manpower Projection System ( OMAP ) is an econometrically-driven manpower forecasting system developed and implemented by the Ontario Manpower Commission, a central agency of the Ontario Government. In its current version, the system is capable of producing five-year forecasts of the occupational manpower demand and supply in Ontario for 500 occupational categories and 23 industry sectors. The system is used by the Commission staff to project and analyze the potential labor market imbalances under alternative economic and demographic scenarios, and to assess the implications of these imbalances for the Province's training policies and labor market development strategies. The system also provides annually updated information on the potential occupational job markets for use by educational planners and career counselors.

**,, A LEADING INDICATOR IN MIXED AND MARDAA FORECASTS OF Ei,{pLQY}AENT IN AN OPEN ECONCIAY"**

**HoÜne8~ R.A.~ Faculty of Business Administration, Simon Fraser U., Burnaby, B.C., V5A 1S6, Canada**

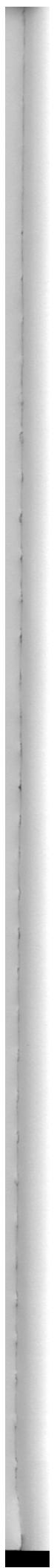
This paper presents models which incorporate a new leading indicator, developed in the paper, in regression and Box-Jenkins time series analyses designed for business and economic forecasting in British Columbia. The B.C. economy is a regional economy that is heavily reliant on primary industries and foreign trade. These special features of the B.C. economy have been taken into account in the development of a leading indicator designed initially to forecast industrial employment in the Province. The methodology involved, the results of tests applied, and the alternative uses of the indicator by B.C. business firms are discussed in the paper.

**"~LODAENT FORECASTING FOR DEVELOPING COUNTRIES"**

**Hopkins.. Miohaer.. ~loyment & Development Dept., International Labor organization, 4 Route des Morillons , CH-1211 Geneve 22 , switzerland**

This paper defines the major employment variables to be forecasted and those that can influence trends in such variables, as well as the way such forecasts can be used. This will be followed by a short review of major efforts in employment forecasting in the literature, including that of the International Labor Organization, together with an evaluation. Because most of the experience in employment forecasting has been in industrialized countries, this experience will be assessed for its usefulness in forecasting employment variables in developing countries.





## PARLOR A

### METHODOLOGY AND ACCURACY OF AUTOMOTIVE FORECASTING :

TUESDAY 2:00-3:30

RECENT RESEARCH

~ :

Kazantzopoulos.. Ol'saia.. General Motors, 767 Fifth Ave., New York, NY 10022

#### "AN ANALYSIS OF TRADE-INS AND ITS USE IN FORECASTING REPLACEMENT AUTO DEMAND"

Bipd~ Chapie8~ Mathematics Dept., General Motors Research Laboratories , Warren, MI 48090

This paper examines the holding patterns of new car buyers .First , the age distribution of trade- ins is fit with a Weibull distribution for 1969-1980. The parameters of the Weibull are then estimated via time series analysis. The shape parameter is related to levels of sales, while the scale parameter reflects changes in the holding period of trades .A model linking price to loan contract amount to term of contract to scale parameter of distribution is presented. This model is consistent with the data and with the hypothesis that buyers respond to price increases by extending the term of the loan contract and then extending the period which they hold their cars . A model of long run replacement demand ts developed from the idea that replacements are inversely proportional to the mean age of cars traded .A comparison .of model proj ections wi th actual data is made for 1981 and 1982.

#### "DEMOGRAPHIC AUTOMOBILE DEMAND"

O'Grady~ Thomas F.~ Economics Dept., General MOTors Corp., 485 W. Milwaukee Ave., Detroit, MI 48202

The number and .type of households by age or lifecycle significantlY affects transportation needs . This paper presents a demographic model of automobile demand used for long term forecasting of ownership requirements. By controlling for demographic variables, I am able to study behavior in much greater microeconomic detail than most other econometric models .Current macroeconomic and industry models lack sufficient detail to forecast segment mix well .This model has some clear contributions in the forecasting process .It is easilY understandable to management and, there- fore, can sway judgment and intuition.

#### "COMPOSITE PREDICTION OF NEW PASSENGER CAR SALES: A PRACTICAL APPICATION IN A BUSINESS ENVIRONMENT" Keen. Howard Jr ., Consolidated Rail Corp ., 15 J4 Six Penn Center Plaza, Philadelphia , PA 19104

This analysis examines whether forecast errors for new car sales in the period 1978Q3 -1982Q3 would have been lower with a composite predictor. Lack of a true "model" behind commercially-purchased forecasts, and internal budget constraints precluded the typical approach of using the estimation period to test for bias and to estimate composite weights. Consequently, an alternative procedure was used to test the component forecasts and generate predictions over horizons of up through six quarters. Compared to component projections, forecast errors of the composite prediction were lower In the two- through four-quarter ahead horizon.

#### "USE OF CONSUMER SENTIMENT INDICES IN PREDICTING DEMAND FOR AUTOMOBILES"

Srivastava, Rajendra K., Dept. of Marketing Admin. , Graduate School of Business, U .of Texas at Austin, TX 78712

Leone, Robert P., Dept. of Marketing Admin. , Graduate School of Business, U .of Texas at Austin, TX 78712

The general theory of psychological economics propoed by George Katona specifies that to better imderstand consumer expenditures two factors, "ability" and "willingness" to buy, must be considered. in this paper , we use measures of consumer senttment ( willingn~ss to buy ) and ability (price index x interest rate ) In addi tion to variables representing industry condi tions to predict the demand for automobiles .Regression models that Included consumer sentiment as a predictor seemed to capture

the turning poInts ln sales wi th greater accuracy .The fInding is supporti ve of Katona 1 s argument for using sentiment data for e-lanation of trends and as a leadi~ Indicator .

TUESDAY 2:00-3:30

**REGIONAL SCIENCE 11\***

*~: Perryman.. M. Ray.. Center for the Advancement of Economic Analysts, Baylor University, Waco, TX 76798*

**"REGIONAL ECONOMETRIC MODELS: THE 10-YEAR RECORD AND ITS CONSEQUENCES"**

*Brooking~ capi S.~ Economic & Quantitative Management, Millsaps College, Jackson, Miss. 39210 Hake~ David A.~ Center for Business & Economic Research, U. of Tennessee, Knoxville, Tenn. 37996*

This study reviewed the relevant econometric models , in~luding but not limited to , the concepts and techniques of ex-ante forecast assessment. The 10-year record of regional econometric models was examined relative to this body of literature. This examination was limited to models with a sufficient history of published or publicly released forecasts .The study concluded with recommendations for changes in strategies for model building and use .

**"THE DESIGN OF ~A ECONOMETRIC MODELS WITHIN THE FRAMEWORK OF FUNCTIONING STATE SYSTEMS: A THEORETICAL ANALYSIS WITH EXPLORATORY EMPIRICAL RESULTS"**

*Perryman, M. Ray, Center for the Advancement of Economic Analysis, Baylor U., Waco, TX 76798*

This paper describes a theoretical structure which permits the specification, estimation, and simulation of SMSA econometric models as subsystems of more general regional structures .In particular , this approach yields models that are dynamically interactive and mathematically consistent with their "parent" system. The paper also provides initial empirical and simulation results which are derived from the author ' s integration of Dallas/Ft .Worth and Houston SMSA sub-systems into the Texas Econometric Model. The suggested methodology is extremely flexible in that it can (1) be implemented at widely varying degrees of aggregation and (2 ) accommodate the existing data base for both small and large ~s .

**"HISTORICAL AND PREDICTIVE OUTPUT SIMULATIONS WITHIN A LARGE REGIONAL ECONOMETRIC MODEL"** *Perryman~ M. Ray~*

*Center for the Advancement of Economic Analysis, Baylor University,  
Waco, TX 76798*

This paper provides an analysis of the output projection mechanism within the Texas Econometric Model, which was recently completed under the direction of the author. Initially, a brief overview of the system is given, with emphasis on the theoretical foundations and expressions utilized in the output determination process. The description and evaluation of several simulation experiments, including (1) historical replication, (2) short-term (cyclical) projections under alternative national environments, and (3) long-term (trend) forecasts under varying conditions are then provided. The results yield significant evidence regarding the viability of the model and characterization of regional sensitivity to the overall economy.

**"DESIGNING GROWTH ALLOCATION MODELS TO FORECAST LOCAL DEMOGRAPHIC CHANGE"**

*Rice~ Norfleet W. Jr.~ Rice Center, 9 Greenway Plaza, Suite 1900, Houston, TX 77046*

Growth allocation models represent one response to the increasing demand for local demographic forecasts. These models incorporate mathematical and behavioral algorithms that distribute total projected growth for a large geographic area, such as a county, among smaller geographic units, such as census tracts and minor civil divisions .This paper examines the structure and operating characteristics of the Houston Growth Allocation Model developed at Rice Center. One of the unique features of this model is the use of Judgmental evidence on local growth patterns to temper analytically produced results .The systematic introduction of Judgmental evidence into the forecasting process can strengthen forecast credibility without diluting the scientific integrity of the underlying analytical framework .

**\*See related session on Monday at 2:00-3:30**



Chair:

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## FOR RULERS"

*Dror. Yehezkel. Institute for Advanced Study , Wallotstrasse 19 , D-I000 Berlin 33 , Germany*

make crucial decisions .Yet , an international survey by the author shows that rulers are not meaningfully by forecasting .This result is from obsolescence of rulers 1 equipment and qualifi-  
but also from inability of present forecasting to provide relevant inputs. Lacking in  
are : "fuzzy betting" sophistication; orientation towards grandpolicy issues ; iconoclasm understanding of rulership and its error propensities ;  
adequate handling of ignorances  
integration with policy planning ; display methods presenting complexity comprehen- without falsifications; and more. Forecasting for Rulers is  
a test case for forecasting potential in general .it shows that breakthroughs are needed in forecasting for it to be significant  
critical governmental and corporate choices.

### POLICY SCIENCE: FORECASTING FOR RULERS

PARLOR C

FOR RULERS: CONSIDERATIONS FROM A SPECIAL CASE''

Aicaza... Luis E... Petroleos de Venezuela, Ave. Libertador-La Caupolicana, Aptdo Postal 169, Caracas 1010-A, Venezuela

is possible to classify the kinds of forecasts needed by rulers. It is also possible to discover ordering of the several kinds of forecasts for rulers, in which a preference structure dominates  
by policy analysts to deliver certain kinds of forecasts and their probability of acceptance by rulers and will reveal which methods of forecasting are more palatable to rulers .The most basic  
of forecast is directed to predict performance of political systems relevant to the ruler . economic forecasts will not bother preferred political scenarios and tend to convert  
into forecasts.

Discussants:

Gabit~ Schiomo~ Ben Gurion U ., Beer-Sheva, Israel

Hader~ Michael~ Foreign Policy Research Institute, 3508 Market St. (3rd Floor),  
Philadelphia, PA 19104

TUESDAY 2:00-3:30

## NONLINEAR VS. LINEAR MODELS

Chair: *Genesio, Roberto and Milanese, Mario, Dipartimento di Automatica e Informatica, Politecnico di Torino, Corso Duca degli Abruzzi, 24, 10129 Torino, Italy*

**"RATIONAL AUTOREGRESSIVE MODELS - AN INITIAL ANALYSIS"**

*Granger, C.W.J., Dept. of Economics, U. of California, San Diego, CA 92093  
Weiss, A.A., Dept. of Economics, U. of California, San Diego, CA 92093*

Models are considered of the form  $x_t = f(x_{t-1}) + \epsilon_t$  where  $f(x)$  is a rational function, that is the ratio of two polynomials, and  $\epsilon_t$  is white noise. After a brief theoretical analysis, the results of estimating such models from generated data are presented. In some cases a substantial improvement in fit over linear models can result, but it is found that occasionally substantial estimation difficulties arise and the true non-linearity is difficult to discover.

**"THE MODELING AND IDENTIFICATION OF DISCRETE NONLINEAR MOVING AVERAGE SYSTEMS BY MEANS OF TENSOR CONVOLUTIONS"**

*Parker, Sydney R., Electrical Engineering Dept., Naval Postgraduate School, Monterey, CA 93940  
Thomas, Jay J., Electrical Engineering Dept., Naval Postgraduate School, Monterey, CA 93940*

The discrete nonlinear moving average identification problem is shown to be contained within a two dimensional impulse response solution, where convolution is applied in the time domain using a vector input that samples the nonlinear dimension regardless of the order of the nonlinearity. This approach is generalized using tensor notation and operations that are readily programmed. Also included are the use of the DFT for Volterra kernel identification, separability tests for cascaded linear/nonlinear subsystems, stability test and spectral analysis. The presentation includes several illustrative examples and applications.

**"ROBUST TIME SERIES FORECASTING BY OPTIMAL ALGORITHMS APPROACH"**

*Genesio, R.; Milanese, M.; Tempo, R.; Vicino, A., Dipartimento di Automatica e Informatica, Corso Duca degli Abruzzi, 24, 10129 Torino, Italy*

This paper presents a new approach to time series forecasting that can be considered as an alternative to classical statistical techniques when dealing with a limited number of observations or whenever statistical hypotheses reveal the data to be inadequate. The method leads to efficient forecasting techniques based on recent results of the theory of optimal algorithms. One of the most attractive features of the approach consists of avoiding the usual two-step procedure of model fitting and prediction with the fitted model. Results from analyses of real time series compare favorably with those obtained by using advanced statistical techniques, especially with regard to multistep ahead predictions.

**"THE INVERTIBILITY CONSTRAINED ESTIMATION OF THE MA AND ARMA PARAMETERS"**

*Bhansali, R.J., U. of Liverpool, Liverpool L69 3BK, England  
Mbago, M.C.Y., U. of Dar-Es-Salaam, Tanzania*

The iterative procedures of estimating the parameters of moving average and autoregressive moving average models suggested by Box and Jenkins and by Hannan tend to fail to converge, if, at any stage in the iterative process, the estimates go outside the invertibility region. The effectiveness of the modifications suggested by Osborn and by Nicholls for ensuring invertibility of these two procedures is examined by a simulation study. The modifications are compared with an alternative in which the roots crossing the invertibility boundary are replaced by their reciprocals. Estimation of the MA parameters by a full maximum likelihood and the Durbin procedures is also examined.

KEYNOTE SPEAKER

*Rudolf E. Kalman*, Swiss Federal Institute of Technology  
CH-8092 Zurich, Switzerland

Rudolf E. Kalman (Ph.D., Columbia University) is a professor of mathematical system theory at the Swiss Federal Institute as well as at the University of Florida in Gainesville. Among his many awards are the IEE Medal of Honor and the ASME Rufus Oldenburger Medal. He is on the editorial boards of a number of journals and has published over 100 papers. He is a co-author of the book, Topics in Mathematical System Theory.



"PROBLEMS WITH  
STATISTICAL FORECASTING"

This presentation deals with the interaction between the statistical and the system-theoretic aspects of prediction. My view is that the statistical aspects of prediction tend to be overemphasized while the system-theoretic aspects, at least equally crucial, are often neglected, perhaps out of ignorance. Much of conventional statistical methodology involve built-in prejudices which in the end have a major effect on the actual forecasts.

Chair: *Edward J. Lusk*, Wharton School, U. of Pennsylvania, Philadelphia, PA

KEYNOTE SPEAKER

*Spyros Makridakis, INSEAD, Fontainebleau 77305, France*

Spyros Makridakis, Professor of Management Science, has been on the faculty at INSEAD, The European Institute of Business Administration, since 1970. He received his M.B.A. and Ph.D. degrees from New York University Graduate School of Business Administration. He has been a consultant to many organizations and has held teaching or research positions with several European and American institutions. He was an ICAME fellow at Stanford University and a visiting scholar at Massachusetts Institute of Technology and Harvard University. He regularly contributes articles to professional journals and his work has appeared in several books on forecasting. He is the founding and chief editor of the Journal of Forecasting.

"FACTORS AFFECTING FORECASTING ACCURACY"

Forecasting the future has long been a challenge for mankind. Knowledge of the future promises opportunities of many kinds. It is important, however, to be realistic as to the achievements and limitations of forecasting. Why do large forecasting errors occur? Why have forecasters been unable to warn about forthcoming changes that caught almost everyone by surprise (e.g., the energy crisis, or the serious 1974/75 and prolonged 1981/83 recessions)? To gain an understanding of the forecasting process, empirical evidence dealing with forecasting accuracy is presented so that an objective idea of the size and nature of forecasting errors can be made; subsequently, the factors affecting forecasting accuracy are discussed by associating them to the empirical evidence; finally, the benefits, limitations and cost of forecasting are related to planning and strategy. At the same time, forecasting users must be warned of having unrealistic expectations. Forecasters are not prophets, nor do they possess crystal balls through which the future can be seen. Although forecasting is useful if properly applied, errors are inevitable. The critical aspect of forecasting is not its predictions, but the ability to estimate the magnitude of errors, assess the resulting uncertainty, and find effective ways to deal with the errors and the uncertainty while coping with the future.



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SESSIONS ON WEDNESDAY AT 10:00-11:30

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DOMINION BALLROOM A

WEDNESDAY  
10:00-11:30

SEASONAL ADJUSTMENTS PANEL

This panel will discuss:

"WHAT RESEARCH IN THE PAST DECADE HAS MOST IMPROVED  
OUR ABILITY TO FORECAST USING *SEASONAL ADJUSTMENTS*?"

and

"WHAT RESEARCH SHOULD BE DONE IN THE NEXT DECADE  
TO IMPROVE FORECASTING WITH *SEASONAL ADJUSTMENTS*?"

An opening statement lasting no more than 10 minutes from each panelist will be followed by 20 minutes of discussion among the panelists and 20 minutes of questions from the audience.

Panelists:

*Burman, J. Peter*

Financial Statistics, Bank of England, Threadneedle St., London EC2R 8AH, England

Peter Burman worked with the Statistical Unit at the UK Ministry of Supply from 1943 to 1945. He has been at the Bank of England since 1946 where he has been a statistical adviser since 1969. He spent 1959-62 with the International Monetary Fund. A member of Council Royal Statistical Society, he has published papers on the design of experiments, sequential sampling, and seasonal adjustment.

*Cleveland, William S.*

Bell Laboratories, 600 Mountain Ave., Murray Hill, NJ 07974

William Cleveland is a principal contributor to the SABL seasonal adjustment method.

*Dagum, Estela B.*

Seasonal & Time Series Adjustment Section, Statistics Canada, 25 Station A, Ottawa,  
Ontario K1A OTC, Canada

Estela Dagum is Director of the Time Series Analysis and Research division. She is a principal contributor to the X-11/ARIMA seasonal adjustment method and was the first recipient of the Shiskin Award presented in 1980 by the Washington Statistical Society of the American Statistical Association.

*Pierce, David*

Federal Reserve Board, Martin Building, Washington, DC 20551

David Pierce, a Senior Statistician at the Federal Reserve Board, earned his Ph.D. from the University of Wisconsin and subsequently held positions at the University of Missouri and George Washington University. He has done extensive research on the modelling, forecasting and seasonal adjustment of time series. Dr. Pierce is a Fellow of the American Statistical Association.

*Young, Allan H.*

U.S. Dept. of Commerce, 1401 K St. N.W., Bureau of Economic Analysis, Washington, DC 20230

Allan Young is the Deputy Director of the Bureau of Economic Analysis. He has major responsibilities for the preparation of the economic accounts of the United States and related forecasting and analysis. Prior to joining the Bureau in 1966, he worked with Julius Shiskin developing methods of seasonal adjustment.

Chair: *Dagum, Estela B.*, Statistics Canada, 25 Station A, Ottawa, Ontario K1A OTC, Canada

## ORGANIZATIONAL EXPERIENCE WITH FORECASTING TECHNIQUES REVIEW

Chair: *Nees, Danielle, INSEAD, 77305 Fontainebleau, France*

Session Overview: This session leads off with a paper that attempts to draw conclusions from previous studies on the use of forecasting techniques by organizations. A panel discussion follows.

"A REVIEW OF SURVEYS ON THE CORPORATE PRACTICE OF FORECASTING"

*Cox, James E. Jr., Dept. of Marketing, Virginia Polytechnic Institute, Blacksburg, VA 24061*  
*Mentzer, John T., Dept. of Marketing, Virginia Polytechnic Institute, Blacksburg, VA 24061*

Several surveys on the corporate practice of forecasting have been done over the past fifteen years. The objective of this paper is to compare the results across these surveys in order to identify trends in forecasting practice. Several areas will be investigated such as: use of forecasting techniques, accuracy provided by various methods, areas within the firm where the forecast is used, and frequency of making the forecast. Areas for future research will be pointed out. Difficulties of doing this type of research will also be indicated.

PANEL: "WHAT RESEARCH SHOULD BE CONDUCTED TO ASSESS THE USE OF FORECASTING BY ORGANIZATIONS?"

The Panelists include:

*Hanke, John, School of Business, Eastern Washington U., Cheney, WA 99004*  
*Lusk, Edward J., The Wharton School, U. of Pennsylvania, Philadelphia, PA 19104*  
*Mentzer, John T., Dept. of Marketing, Virginia Polytechnic Institute, Blacksburg, VA 24061*  
*Spies, Philip H., Unit for Futures Research, University Private Bag 5050, 76 Stellenbosch,  
South Africa*  
*Weitz, Rob R., Dept. of IE/OR, U. of Massachusetts, Amherst, MA 01002*

## PROBABILITY FORECASTING

Chair: *Murphy, Allan H.*, Dept. of Atmospheric Sciences, Oregon State U., Corvallis, OR 97331

**"PROBABILISTIC FORECASTS: SOME GUIDELINES FOR 'FUTURE' RESEARCH"**

*Wright, George*, Sir John Cass School of Life and Environmental Sciences, City of London Polytechnic, Old Castle St., London E1 7NT, England

This paper deals with the concept of calibration which refers to the external correspondence between assessed subjective probabilities and hit-rate. Evidence is presented that the psychological processes involved in forecasting future events are different from those involved in evaluating the veracity of one's own knowledge. The implication is that the results of research that has investigated the calibration of probability assessments given to general knowledge questions will not generalize to the real world where uncertainty is located in the future. Finally, future directions for research on probabilistic forecasting are sketched out. This research should lead to effective evaluation of probabilistic forecasts and selection of probabilistic forecasters.

**"CONSENSUS AND UNCERTAINTY IN ECONOMIC PREDICTION"**

*Zarnowitz, Victor*, Graduate School of Business, U. of Chicago, Chicago, IL 60637  
*Lambros, Louis A.*, Graduate School of Business, U. of Chicago, Chicago, IL 60637

The usual practice in economic forecasting is to report point predictions without specifying the attached probabilities. Periodic surveys of such forecasts produce group averages, which are taken to indicate the "consensus" of experts. Measures of the dispersion of individual forecasts around these averages are interpreted as indicating "uncertainty." However, uncertainty is properly understood to be related to the diffuseness of the underlying individual probability distributions. We analyzed data from surveys that included point and probability forecasts for selected economic variables and found little relationship between the two different measures of uncertainty. In addition, the forecasters were overconfident when assessing the probabilities of the alternative outcomes. In particular, they understated the probabilities of extreme events.

**"COMMUNICATING PROBABILISTIC FORECASTS"**

*Lipinski, Andrew J.*, Institute for the Future, 2740 Sand Hill Rd., Menlo Park, CA 94025  
*Lipinski, Hubert M.*, Institute for the Future, 2740 Sand Hill Rd., Menlo Park, CA 94025

Forecasters attempt to convey information about the future outcomes of imperfectly understood processes: political, economic, and social. The most common forecasts present an unspecified measure of a central tendency of an unspecified distribution. This paper assumes that a forecaster "knows" the entire distribution of a single random variable. Two problems are examined: 1) What single value should be transmitted if a client desires a single-value forecast, and 2) What alternatives to a single value have been found informative and useful for decision making? Examples of actual forecasts communicated to corporate clients are shown. Suggestions are made on how to extend the process to multivariate forecasts.

**"PROBABILISTIC WEATHER FORECASTS"**

*Murphy, Allan H.*, Dept. of Atmospheric Sciences, Oregon State U., Corvallis, OR 97331

Probabilistic weather forecasts have been prepared on an operational and/or experimental basis for many years. Currently, meteorologists in the United States produce thousands of objective and subjective probability forecasts each day, and probabilistic weather forecasting also has been initiated in several other countries. Some recent results of these operational and experimental programs are described, with particular reference to the reliability, resolution, and skill of the forecasts. Several issues related to probability forecasting are discussed, including the relative quality of objective and subjective forecasts and the differences between probability forecasting in meteorology and probability forecasting in other fields.

WEDNESDAY  
10:00-11:30

SALON 2

EXCHANGE RATE FORECASTING: III

Chair: Alexander, Don, New York NY

"EXCHANGE RATE MODELS - HOW WELL THEY PERFORM"

Alexander, Don, New York, NY

Cameron, Alan, State Space Systems, Inc., 2091 Business Center Drive, Irvine, CA 92715

This study compares the performance of various structural and time series exchange rate models. The first part of the study compares the predictive accuracy of the random walk model to that of time series and structural exchange rate models. The time series models include both univariate and multivariate Autoregressive and State Space Models. The structural models include recent variations of the monetary/asset exchange rate model. The structural models use actual realized values of future explanatory variables in their forecasts. The forecasts are point forecasts over different time horizons. A second part of the study will look at composite forecasts and cross sectional time series estimation as a means to improve forecast performance.

"MODELS OF EXCHANGE RATE DETERMINATION: THE CASE OF THE DOLLAR/POUND"

Edison, Hali J., Federal Reserve Board of Governors, Stop 18, Washington, DC 20551

This paper presents a model of the short run fluctuations and analyzes the long run tendencies of the dollar/pound exchange rate over the period January 1973 to January 1982. It casts light on the supposed failure of econometric models of exchange rate determination, as compared to univariate time series model. The first section of the paper outlines the theoretical and empirical models of the exchange rate literature. The next section discusses the underpinning of the econometric approach utilized in this study. Finally, the recent performance of the dollar/pound exchange rate is examined in light of this work.

"AFTER A FORECAST -- WHAT NEXT?"

Kaueller, Ira, International Monetary Market, 67 Wall Street, New York, NY 10005

This paper offers advice about how a financial manager may achieve protection from the effects of an adverse currency exchange rate move, using currency futures contracts. It provides an introduction to the futures markets and covers the way in which hedging programs are constructed, keeping in mind the two most significant risks involved: uncertainty of cash-flow and risk. The paper describes quantitative techniques that are used to manage futures hedging programs. I demonstrate the effectiveness of these methods and point out the risks involved with their usage.

## USE OF SUBJECTIVE DATA IN FORECASTING

Chair: *Acito, Frank*, School of Business, Indiana U., Bloomington, IN 47405

"A PRELIMINARY STUDY OF EXECUTIVE JUDGMENT IN FORECASTING"

*Acito, Frank*, School of Business, Indiana U., Bloomington, IN 47405

*Olshavsky, Richard W.*, School of Business, Indiana U., Bloomington, IN 47405

Many executives face forecasting situations in which traditional data-based methods are not applicable. Yet, they are still required to make forecasts. This paper describes an application of protocol analysis to the determination of an executive's subjective forecasting procedure for problems with long time horizons. Several heuristic methods identified in the protocols are described. Potential contributions of protocol analysis to forecasting include (a) better understanding of the process of subjective forecasting, (b) ideas on how to integrate quantitative and qualitative forecasting procedures, (c) ideas for improving subjective forecasts, and (d) facilitating the training of novice forecasters.

"EVALUATING COMPLEX SYSTEMS: THE SUBJECTIVE TRANSFER FUNCTION APPROACH"

*Veit, Clairice T.*, The Rand Corporation, 1700 Main St., Santa Monica, CA 90406

*Callero, Monti D.*, The Rand Corporation, 1700 Main St., Santa Monica, CA 90406

The subjective transfer function (STF) approach was developed for analyzing complex systems where many variables either directly or indirectly impact on system outcomes. The idea was to test hypotheses about how "experts" perceive their system to function. The hypothesis was algebraic functions (STFs) that specify how factors comprising the system affect judged outcomes. Once the STFs are known for all groups of system experts, they can be used to evaluate how changes in system inputs affect outcomes. We detail the steps involved in the STF approach, discuss the measurement theory, and provide illustrations from research in tactical air command and control.

"COGNITIVE DIFFICULTIES EXPERIENCED BY RESPONDENTS IN MAKING FORECASTS"

*Temkin, Sanford*, Dept. of Decision Sciences & Computers, Rider College, P.O. Box 6400, Lawrenceville, NJ 08648

The New Jersey Public Broadcasting Corporation is trying to reach more secondary school students with its educational programs. In 1983, it asked secondary school media specialists to assess alternative broadcast strategies as a means for achieving better levels of student viewership. Questionnaires were sent to 200 schools, and 60 follow-up interviews were conducted to probe into factors affecting future viewership. This paper examines the cognitive requirements and the difficulties encountered by respondents in making these projections. It also provides suggestions that respondents believe would have aided them in thinking through those cognitive requirements.

SALON 4

DATA ANALYSIS AND FORECASTING FOR THE TELEPHONE MARKET

Chair: *Levenbach, Hans, AT&T, 295 N. Maple Ave., Basking Ridge, NJ 07920*

Session Overview: Because many extrapolation techniques rely on the intelligent use of historical and environmental data, it behooves the forecaster to examine data with love and care. Often neglected, data analysis provides the forecaster with some powerful and insightful tools to develop forecasts, assess accuracy and enhance overall credibility of the forecasting product. This session explores specific instances where data-oriented techniques played a key role in the success of a forecasting application.

"FORECASTING DEMAND: A REAL WORLD EXAMPLE"

*Cohen, Rochelle, Faculty of Admin. Studies, U. of Manitoba, Winnipeg, Manitoba, Canada  
Dunford, Fraser, Faculty of Admin. Studies, U. of Manitoba, Winnipeg, Manitoba, Canada*

This paper examines the problem of forecasting in the real world. A telephone company wanted to forecast demand for telephones in order to control the inventory in their phone centres. Although in appearance this is a very straightforward forecasting problem, data difficulties made it impossible to use most of the common forecasting models. Nevertheless, the use of a simple forecasting model resulted in an inventory reduction of 45%.

"ON THE FITTING AND MODELLING OF THE DISTRIBUTION OF DEMAND FOR SPECIAL TELECOMMUNICATIONS SERVICES"  
*Horn, Paul S., Bell Laboratories, Rm. WB-10207, Holmdel, NJ 07733*

Demand for special services in the telecommunications industry is difficult to predict. Monthly changes in demand are often zero, usually of a moderate magnitude when they are not zero, but occasionally very large. Presently, an algorithm is used to forecast a point-estimate of demand for the next five years by trending the known history. For the purposes of planning, the distribution of the forecast errors would be of great use in addition to the point estimate. Two approaches to this problem will be discussed. They are: 1) Compute known errors by making ex-post forecasts and fit an appropriate distribution, and 2) Model the changes in demand as a stochastic process and derive the distribution of errors. Results, based on real data, will be presented.

"MODELING AND FORECASTING THE DEMAND FOR CUSTOMIZED TELEPHONE SERVICES UTILIZING POOLED CROSS-SECTIONAL AND LIFE CYCLE ANALYSIS"  
*Rowe, Marge L., AT&T, 295 N. Maple Ave., Rm. 17-714111, Basking Ridge, NJ 07920*

The growing demand for customized telephone services prompted the development of a forecasting strategy. Telephone, economic and demographic variables in a hierarchical data base are made available to the forecaster at any level of the data base's hierarchy. Modeling is then performed on aggregate or disaggregate quantities. The data base time series can be pooled for cross-sections across any level. Due to the scarcity of historical data on these services, a variety of data analysis strategies were explored. Classical time series analysis was seldom relevant. This data problem is overcome by pooling the time series over the numerous available cross-sections. The derivation of common models across entities with similar demographic characteristics is complicated by the various stages of life cycle maturation. Composite life cycle curves were compiled over entities with similar maturation levels.

SALON 5

WEDNESDAY  
10:00-11:30

PRAGMATIC SALES FORECASTING SYSTEMS

Chair: *Davideon, Timothy A., Applied Decision Systems, Temple, Barker & Sloane, Inc., 33 Hayden Ave., Lexington, MA 02173*

"DESIGNING SALES FORECASTING SYSTEMS FOR BUSINESS"

Speaker: *Buchin, Stanley I., Temple, Barker & Sloane, Inc., 33 Hayden Ave., Lexington, MA 02173*

"GETTING MANAGEMENT INVOLVED IN FORECASTING"

Discussant: *Levernier, Jacqueline, Kitchens of Sara Lee, 500 Waukegan, Deerfield, IL 60015*

Session Overview: Just as the forecasting researcher needs to be reminded of the values of pragmatism, so does the designer of sales demand forecasting systems. Today's business managers rarely call for the use of ARIMA models or other elegant modelling approaches when it comes to monthly forecasts for their MRP or DRP systems. Rather, the system specifications include objectives like smoother production schedules, reduced inventory carrying costs, and fewer out-of-stocks through lower forecast errors. Management wants systems for forecasting that will do the "dirty work" of data handling (tabulation, reporting and dis-aggregation). They expect to invest intellectual input periodically in the choice of models used, but they call for simplicity and flexibility. The ability to easily override any quantitative forecast is of paramount importance. In a practical sense, management wants systems they can control and understand. This session covers the characteristics of sales forecasting systems found to be most desirable by today's business community. The topic of getting management involved in the forecasting process will be developed. Software products available for both forecast modeling and for "production" forecasting systems will be identified and evaluated with respect to their "pragmatic" characteristics. A case study application of a forecasting system by a manufacturer of consumer packaged goods will be used to stimulate discussion.

SALON 6

FORECASTING NATURAL RESOURCES

Chair: *Sterman, John D., Alfred P. Sloan School of Management, M.I.T., 50 Memorial Dr., Cambridge, MA 02139*

"AN EXPERIMENT TO EVALUATE METHODS FOR ESTIMATING FOSSIL FUEL RESOURCES"

*Richardson, George P., Alfred P. Sloan School of Management, M.I.T., 50 Memorial Dr., Cambridge, MA 02139*

*Sterman, John D., Alfred P. Sloan School of Management, M.I.T., 50 Memorial Dr., Cambridge, MA 02139*

Estimates of petroleum and natural gas resources vary substantially, both over time and across estimation methods. Worse, no reliable method exists for evaluating the accuracy of the various methods for estimating resources. This paper develops a simple simulation model of an exhaustible resource to evaluate different resource estimation techniques. Protocols for various estimation methods are developed and applied to the synthetic data generated by the model. The resulting resource estimates can be compared, over time, to the model and systematic biases can be identified. It is shown that some methods yield estimates that persistently overshoot the true resource base over the lifecycle of the resource.

"LONG RUN EFFECTS OF THE CANADIAN NATIONAL ENERGY AGREEMENTS"

*Schwartz, Sandra L., Faculty of Commerce, U. of British Columbia, Vancouver, B.C. V6T 1W5, Canada*

*Fuller, J. David, Dept. of Management Sciences, U. of Waterloo, Waterloo, Ontario, N2L 3G1, Canada*

*Ziemba, William T., Faculty of Commerce, U. of British Columbia, Vancouver, B.C. V6T 1W5, Canada*

This paper presents an analysis of the long run effects of the Canadian national energy agreements using an energy policy model for Canada. Our main concerns centered around the effects on self sufficiency and fuel export possibilities, large scale energy development projects, and possible time paths for the development of nonconventional energy sources. Among our conclusions are: self-sufficiency is feasible, further tar sands development is unlikely until well into the next century, coal becomes important.

"A COMPARISON OF OLS, ARIMA AND SPECTRAL ANALYSIS TECHNIQUES FOR FORECASTING GROUND WATER LEVELS"

*Knievel, Chris, U.S. Army Corps of Engineers, Omaha, NE*

*Hui, Baldwin, Data Resources, Inc., 29 Hartwell Ave., Lexington, MA 02173*

Ground water levels can have significant impacts on urban and rural development. Four methods were used for forecasting groundwater. These were: OLS regression; Univariate ARIMA; Maximum Entropy Spectral Analysis (MESA); and Fourier Analysis (FA). Forecasts were compared on an ex post basis using (a) accuracy measures (e.g., mean squared forecast error and Theil's U), (b) right sign change and turning point analyses, (c) innovative graphical methods. For a highly cyclical time series like water table levels with both long and short term dominant cycles, MESA and FA were found to give the "best" forecasts. ARIMA forecasts tended to dampen and OLS was too dependent on accurate forecasts of independent variables.

"WHAT TO USE WHERE/WHICH TO USE WHEN IN FORECASTING FUTURE DATA REQUIREMENT"

*Reid, George W., Bureau of Water and Environmental Resources Research, U. of Oklahoma, Norman, OK 73019*

There are many different techniques to use in forecasting to the beginner. Once he has learned the methods, there is a problem of the proper selection of a technique for a specific application. The selection, of course, depends on a number of factors such as data, detail level, number of variables, incompatibilities, incomplete data, purpose, cost, or skill. The author has organized the varying forecasting techniques against associate water forecasting problems, and developed a suggested use matrix responsible to levels of inputs and outputs expected. The matrix should help the novice in selection, and the experienced forecaster as a check procedure.

## EXTRAPOLATION: INTERVENTION MODELS

Chair: *Reilly, David P.*, Automatic Forecasting Systems, Inc., P.O. Box 563, Hatboro, PA 19040

"AN APPLICATION OF INTERVENTION ANALYSIS TO A NON-STATIONARY SEASONAL TIME SERIES"  
*Cho, Byung T.*, University of Notre Dame, Notre Dame, IN 46556

This paper presents an application of intervention analysis to non-stationary seasonal business time series involving growth or decay in a drug sale shortly after introduction of the same drug in different packages in the same marketing outlets. The primary purpose of this paper is to build a parsimonious univariate intervention model for antacid drug sales by application of the iterative method developed by BOX-JENKINS-TIAO over the last fifteen years in order to generate more efficient sales forecasting than the classical time series analysis.

"ASSESSING THE TRANSIENT AND STEADY STATE EFFECTS OF A CHANGE IN DUE DATE ATTAINABILITY"  
*Melnyk, Steven A.*, Department of Management, Graduate School of Business Administration,  
Michigan State U., East Lansing, MI 48824  
*Narasimhan, Ram*, Department of Management, Graduate School of Business Administration,  
Michigan State U., East Lansing, MI 48824

One of the problems when operating a job shop has involved the effect of a change in due date attainability on scheduling performance. Past research based on steady state analysis has shown that improving due date attainability by increasing lead time estimates improves scheduling performance. In practice, however, this has not been the case. Increases in lead time estimates have been found to increase actual lead times, thus resulting in a "vicious circle." This apparent contradiction is examined using a simulated job shop and Time Series Intervention Analysis (TSIA). This vicious circle is shown to be the result of a reaction to a transient response. TSIA is used to estimate the settling time characteristics of a change in due date attainability under varying capacity utilization levels. The implications of these results for job shop management is presented.

"TRANSFER FUNCTION MODELLING WITH A MULTI-STEP INTERVENTION VARIABLE"  
*Dooley, Kathleen*, Automatic Forecasting Systems, Inc., P.O. Box 563, Hatboro, PA 19040  
*Reilly, David P.*, Automatic Forecasting Systems, Inc., P.O. Box 563, Hatboro, PA 19040

Time series forecasting frequently requires the inclusion of an intervention or dummy variable in the forecast equation. The intervention variable may represent a single identifiable change of events, such as a labor strike, or multiple changes, such as a series of back-to-back price increases. This paper focuses on Transfer Function identification of a multi-step variable using the least squares method developed by Liu and Hanssens. Both a simulated and a real example will demonstrate the effectiveness of this approach.

"THE EFFECT OF MISSPECIFIED INTERVENTION FUNCTION ON PARAMETER ESTIMATION OF TIME SERIES MODELS"  
*Wun, Lap-Ming*, Applied Mathematics Program, U. of Maryland, College Park, MD 20742  
*Alt, Frank B.*, College of Business and Management, U. of Maryland, College Park, MD 20742

Misspecification occurs when a postulated model with an intervention function is of higher (or lower) order than that of the true process which generates the observations. Maximum likelihood estimates from both correctly and incorrectly specified models are calculated by modifying the maximum likelihood function for ARMA models developed by Ljung and Box. Inspection of the trace of the matrices of mean square error show that the higher the order of the intervention function the greater the trace. Regarding the estimate of each parameter, only the mean square error of the estimate of the parameter, which is linearly related to the parameter that has been included (excluded) by mistake, tends to be inflated (deflated).

## METHODS FOR INDUSTRY FORECASTING

Chair: *Fildes, Robert*, Manchester Business School, Manchester, M15 6PB, England

"DETAILED FORECASTS BY REGION BY INDUSTRY WITH PARTIAL INFORMATION"

*Jacobson, Paul*, Informetrica Limited, P.O. Box 828, Station 8, Ottawa, K1P 5P9, Canada  
*McCracken, M.C.*, Informetrica Limited, P.O. Box 828, Station 8, Ottawa, K1P 5P9, Canada

Informetrica produces forecasts to 1990 of construction expenditures by province and by industry. These forecasts are consistent with national forecasts by industry and total investment by province forecasts. In addition, partial information is available on certain major projects. Use is made of a "biproportional matrix adjustment" (or RAS technique) to force consistency with the econometric estimates and partial judgmental information. This paper describes the current model, elaborates on the techniques used, and describes the lessons learned from the process. The paper should be of interest to practitioners who have the problem of producing consistent detailed forecasts, with additional, but partial, information.

"AN EVALUATION OF CONSTRUCTION INDUSTRY FORECASTING IN THE UK"

*Fildes, Robert*, Manchester Business School, M15 6PB, England

Forecasts of construction industry output are produced in the United Kingdom by NEDO, a quasi governmental agency with a secretariat which advises industry panels of experts representing firms in the industry, trade unions and the government itself. NEDO forecasts have been produced half-yearly for 10 years. This paper looks at NEDO's historical accuracy in contrast with an econometric model of output. The paper asks whether NEDO's forecasts could have been improved, and considers the sources of error in the forecasts. Finally, it considers the influence of institutional factors on forecast accuracy.

"THE PRICE AND DEMAND OF POLYSTYRENE: AN INDUSTRIAL APPLICATION"

*Richardson, David H.; Skidmore, Craig J.; Narcowich, Michael, M.*, SAGE DATA, 104 Carnegie Center, Princeton, NJ 08540

This paper documents the construction of a forecasting model for polystyrene (PS). The output consists of forecasts of the demand for PS and its price. Since PS competes with other plastic resins in a number of applications, we expected important cross-elasticities with respect to price. Our approach emphasizes state-of-the-art industry modeling as well as econometric and statistical techniques. The demand model is primarily driven by the end markets, but also by relative prices and the business cycle. The price model is driven by costs, capacity constraints, and demand. Cross-correlations of the residuals, the correlation matrix of the regression coefficients, leverages and studentized residuals provided valuable information. In addition, we performed tests for the time dependence of coefficients, an ex ante forecasting experiment, and a chi-squared test for generalized model adequacy.

SEMINAR A

EVALUATION OF FORECASTING MODELS

Chair: *Sobol, Marion G., Management Science and Computers, Cox School of Business  
Southern Methodist U., Dallas, TX 75275*

"DESIGNING USE-RELATED PROCEDURES FOR FORECAST EVALUATION"

*Willis, Raymond E., School of Management, U. of Minnesota, 271 19th Ave. South,  
Minneapolis, MN 55455*

Management needs for forecasts range from applications to short-range planning such as scheduling and control of production, inventories, workforce, and cash flow, through medium-range decisions such as the acquisition and allocation of resources, then to the long-range strategic direction of the overall organization. Each application presents different implications for what is meant by a "good" forecast and raises different problems on how alternative forecasts can and should be evaluated. This paper explores different possible definitions of a "good" forecast, alternative criteria on which a forecast can be evaluated, and the implications for the choice and/or design of evaluation procedures.

"CHOOSING THE BEST VALIDATION STRATEGY FOR MULTIPLE REGRESSION ANALYSIS"

*Sobol, Marion G., Management Science & Computers, Cox School of Business, Southern Methodist U  
Dallas, TX 75275*

Multiple regression equations designed to explain or predict should be validated. Validity tests can take on many forms and can be used to improve regression equations. Methods of data splitting, use of new data sets, and data adjustment must be considered when formulating validity tests. Types of validity, types of tests, and criteria for validity are discussed. These are evaluated, and illustrated using regression equations that were designed to predict success in graduate school. Two data sets were used to illustrate different possibilities for validity tests. The paper focuses on strategies for choosing the ideal validity test.

"TESTING THE ASSUMPTIONS BEHIND FORECASTING MODELS"

*Staal, P.M.v.d., Technische Hogeschool Delft, postbus 5050, 2600 GB Delft, Holland*

Starting from a widely reorganized and empirically demonstrated fact, that the validity of underlying assumptions is the major determinant of the accuracy of forecasting techniques, the paper presents a methodological evaluation of a number of frequently used techniques. The evaluation will be preceded by a more general epistemological and methodological account on forecasting as a cognitive enterprise. The evaluation deals specifically with the assumptions and their validity behind techniques, such as quantitative explorative techniques, model-building and simulation, so called intuitive techniques such as Delphi, interactive game simulation and normative scenario writing.

"STATISTICAL METHODS AND ECONOMIC FORECASTING"

*Shvyrkov, Vladislav V., Dept. of Decision Science & Computer, Rider College, Lawrenceville,  
NJ 08648  
Liu, Chao-Nan, Dept. of Economics, Trenton State College, Trenton, NJ 08625*

In applying statistical methods to economic forecasting, one should be aware that statistical computations are only valid on the average. They may not be readily applied to a particular forecasting period. The validity of statistical findings depends on the fulfillment of a basic assumption in statistics -- the population must be homogeneous. Although the assumption of homogeneity should be tested, it has been neglected in most forecasting models. It is maintained that logical statements about the causal relationships in economics can be deduced only if the forecasting model is constructed on a homogeneous data set.

## MEASURING ACCURACY OF MICRO AND MACRO MODELS

Chair: Jain, Chaman L., College of Business Administration, St. John's University, Jamaica, NY 11439

**"MEASUREMENTS OF FORECASTING ACCURACY"**

Chen, Thomas P., College of Business Administration, St. John's University, Jamaica, NY 11439

There are various concepts in measuring forecasting accuracy. This paper reviews some of the common criteria for measuring accuracy in micro-forecasting. Relationships among these common criteria and problems of selecting a criterion are explored. Special attention is paid to the nature of data and the selection of a forecasting technique to obtain minimum forecasting error. This paper also looks into the distribution and time-series properties of forecasting errors. Mean squared error is decomposed and compared with regression analysis, which is treated as a forecasting method.

**"ARE BUSINESS FORECASTS CAUSATIVE?"**

Little, Charles H., College of Business Administration, St. John's University, Jamaica, NY 11439

Business conditions forecasts are readily available to most businessmen. To the extent that they act on this information, forecasts can "cause" the event forecasted to happen. This premise is explored by examining the differences between forecasted and actual changes in the U.S. economy. In particular, forecast of aggregate output, employment, and prices are examined. Regression techniques are used to determine the nature of the relation between forecasted changes and actual changes lagged over different time periods. The object is to see if the pattern of forecasting accuracy over different time lags can support the premise.

**"EVALUATING FORECASTING ACCURACY ON THE BASIS OF EXPOST ANALYSIS"**

Jain, Chaman L., College of Business Administration, St. John's University, Jamaica, NY 11439

The objective of this paper is to determine how well naive models forecast sales of companies whose sales patterns are: (1) highly stable, (2) somewhat stable, and (3) highly unstable. The data used in this study will be of food and department stores listed in the Value Line.

**"A CRITIQUE OF THE CHASE ECONOMETRIC REGIONAL MODEL"**

Chang, Monica Yen, Economic Analysis, New York Telephone Co., 1695 Ave. of the Americas, New York, NY 10036

Based on Chase's own documentation of its regional model and some hands-on simulation experience of the New York State Model (a particular version of the CE regional model), an attempt is made to examine the model's theoretical foundation, its system of equations, and the demographics submodel. In order to set the stage for discussion, an overview of the model structure is briefly presented, followed by criticisms on the three items just mentioned. A conclusion is drawn with regard to the overall modeling effort and its forecast performance. This paper summarizes the advantages and disadvantages of employing the Chase Model in assisting routine business decision-making.

## SOCIOTECHNOLOGICAL SYSTEM FORECASTING

Chair: *Chen, Kan*, Program in Urban, Technological & Environmental Planning, U. of Michigan,  
Ann Arbor, MI 48104

"USING DEAD RECKONING AND ECONOMIC FORECASTING"

*Shilling, John D.*, Comparative Analysis & Projections Div., The World Bank, 1818 H Street N.W.,  
Washington, D.C. 20433

Economics is an inexact science, measurement of basic data is at best approximate, and most interesting relationships change rapidly in developing countries. Key variables determining economic prospects are often impossible to include into models. Models and their mathematical algorithms, however, are deceptively precise, which often complicates the process of constructing and using economic projection models in developing countries. This paper examined macro models intended for operational policy purposes and how they are used. These models try to be analytically good and have sufficient plausibility to influence policy. Thus, a great deal of judgment is required in constructing, using and interpreting projection models in developing countries, the "dead reckoning" element.

"RESIDENTIAL ENERGY FORECASTING BY END-USE"

*Bruye, Alfred J.*, Corporate Planning, Consumer Power Company, 212 West Michigan Ave.,  
Jackson, MI 49201

*Langley, Richard D.*, Corporate Planning, Consumer Power Company, 212 West Michigan Ave.,  
Jackson, MI 49201

Utility forecasters could have produced acceptable forecasts for the late 60's and early 70's by applying a ruler and pencil to historical sales figures. But the OPEC oil embargo and other conditions in the 70's caused a major structural change in the economy that made it difficult to rely on historical data for forecasting electric and gas sales. Thus, the emphasis on forecasting in the utility industry is shifting to "end-use" methods (i.e., methods in which sales forecasts are made by multiplying the number of appliances of various types by their average consumptions in various target years). End-use methods allow the forecaster to analyze various policies and to consider alternative scenarios based on a range of capital costs, operating costs, fuel costs and customer behavior in the selection of new and replacement appliances. This paper discusses the application of an end-use model to forecast space heating saturations by type of space heater.

"THE USE OF MATHEMATICAL MODELS IN AUTOMOTIVE TRANSPORTATION POLICY ANALYSIS: A CASE STUDY"

*Richardson, Barbara C.*, Program in Urban, Technological & Environmental Planning, U. of Michigan,  
Ann Arbor, MI 48104

Mathematical models are used widely in automotive transportation policy analysis. The use of a case-study model, the Sweeney Passenger Car Gasoline Demand Model is examined to determine users' cognizance of the model's limitations and benefits and the impact on the policy process of model application. Because of users' lack of awareness of the model's characteristics, the model has sometimes been misused. In addition, model use has impacted major automotive/energy policy decisions of the 1970's. Involvement in model applications by model authors or peer reviewers helps ensure the appropriate use of models.

"QUANTITATIVE TECHNIQUES FOR A HEALTH CARE DEVELOPMENT MODEL"

*Siagian, Berlian*, Ministry of Health, Republic of Indonesia, Jakarta, Indonesia

Health household surveys, health care facility assessment, and budget forecasting were used for a regional health planning project. Household surveys reflect the true health condition of an area. The additive models of utilization, and incapacitation, which have been derived from household data, set the algorithm to compute age specific utilization, and incapacitation rates. The impact of different health care development alternatives also could be derived from the models. Descriptive statistics on incidence rate, together with age specific utilization, and incapacitation rates were inputs to compute incapacitation days. Different budgetary levels produced different incapacitation days. Simulation of a 21 year planning period in one region that currently has one hospital, 29 health centers, and 48 subhealth centers, suggested the addition of three hospitals, 50 health centers, and 216 subhealth centers.

## FORECASTING IN EDUCATIONAL INSTITUTIONS

Chair: *Kierstead, Fred, U. of Houston/Clear Lake City, 2700 Bay Area Blvd., Houston, TX 77058*

"STRATEGIES FOR OVERCOMING MISUTILIZATION OF EDUCATIONAL FORECASTS"

*Dede, Chris, U. of Houston/Clear Lake City, 2700 Bay Area Blvd., Houston, TX 77058*

*Kierstead, Fred, U. of Houston/Clear Lake City, 2700 Bay Area Blvd., Houston, TX 77058*

Lack of communication between forecasters and decisionmakers has long been a problem in education. One effect is poor strategic planning. Some forecasters have produced "studies" strongly biased in favor of some preconceived vision of schooling; educational policymakers have frequently ignored accurate and timely forecasts. This paper will suggest strategies for minimizing the problems and maximizing the benefits of long-range educational planning.

"SHORT-TERM ENROLLMENT PROJECTIONS BASED ON TRADITIONAL TIME SERIES ANALYSIS"

*Brooks, Dorothy Lynn, U. of Texas at Arlington, P.O. Box 19125, Arlington, TX 76019*

Short-term projections, based on traditional time series analysis, were made of enrollments at two universities. Because higher education enrollments are related to economic activity, a mathematical model was developed that incorporated an economic component. Regression equations containing trend, seasonal, and cyclical (economic) terms were used for projection. These equations, their residuals, and the projections were analyzed and compared with another forecaster's work. Recommendations for further work are suggested.

"PREDICTING PERFORMANCE IN THE GRADUATE SCHOOL OF BUSINESS ADMINISTRATION AT MICHIGAN STATE UNIVERSITY"

*Collier, Henry W., College of Business & Public Admin., Florida Atlantic U., Boca Raton, FLA 33431*

The paper provides descriptive analysis of admission procedures of the GSBA at Michigan State University. It relates GMAT scores, demographics, and undergraduate GPA to successful performance in the MBA program. The best predictors of performance in the MBA program were in order of importance (1) quantitative score on the GMAT, and (2) undergraduate GPA. Other factors contributed little to the prediction. Although the results were statistically significant at  $\alpha = .05$ , a very small portion of the total variance was accounted for by the model. Restriction of range of the variables led to measurement problems. Further research is needed to determine factors that will better predict performance of students entering the program.

"PRAGMATIC RESEARCH: FORECASTING STUDENT ENROLLMENTS FOR STRATEGIC PLANNING"

*Campbell, William E., Montgomery College, Rockville, MD 20850*

*Doan, Henry M., Montgomery College, Rockville, MD 20850*

The paper presents a model projecting total and discipline enrollment for the college to set its enrollment objectives. The projections also serve as a guide in budget building and the improvement of planning and scheduling for course sections, faculty employment, etc., to meet enrollment objectives. Using population components, regression, or moving average as appropriate, the projections were based on historical data. Previous enrollment patterns were assumed to predict future trends, with adjustments being made to reflect changes in the community and disciplines. Facility and resource constraints were considered.

## MODELING CAUSE AND EFFECT TO PREDICT MARKET DEMAND

Chair: *Cave, William C.*, Prediction Systems, 200 Atlantic Ave., Manasquan, NJ 08736

Session Overview: Increasing the accuracy of a model requires the addition of more information. This additional information can come from additional time series (driving force) data, but might not. Additional information can be derived from knowledge of the structure of the market network. This knowledge can be used to formulate model structures which transform existing data so as to extract more information, and produce more accurate predictions. Session speakers will present pragmatic examples based on their work experiences.

"A FORECASTING MODEL FOR MAJOR APPLIANCE FACTORY SHIPMENTS"

*Babb, Christopher T.*, Raytheon Company, 141 Spring Street, Lexington, MA 02173

A multi-step monthly forecasting model of major appliance factory shipments will be presented that is based on a structural state-space methodology. The unobservable series on customer retail sales will be specified as a state variable driven by a set of lagged economic variables. Behavioral functions for the aggregate of appliance manufacturers will be formulated, using linear decision rules for production, order backlogs, and inventories. Based on multi-period quadratic cost functions, the linear decision rules will be both reactive and anticipative. Unadjusted data series will be employed in conjunction with an explicit modeling of seasonal factors.

"ROBUST ESTIMATION OF TIME VARYING PARAMETERS"

*Rosenkranz, Evelyn*, Forecasting Techniques & Modeling Dept., Western Electric Co., Gateway II, Newark, NJ 07102

In a rapidly changing and uncertain environment, the forecaster cannot invoke the assumptions of stationarity embedded in traditional methods. This paper presents a modeling approach that can be used to address this problem. The methodology incorporates the estimation of time varying parameters using a Kalman Filter and a robust technique based on the underlying distribution of the data. Subsequent forecasts are then monitored and revised in a Bayesian framework as additional data becomes available.

"A GRAPHICAL APPROACH TO MODELING MARKET CAUSE AND EFFECT"

*Cave, William C.*, Prediction Systems, 200 Atlantic Ave., Manasquan, NJ 08736  
*Guilfoyle, Richard H.*, Prediction Systems, 200 Atlantic Ave., Manasquan, NJ 08736

The desire to build causal market models stems from the fact that random driving forces can be used to predict future responses when time constants and delays can be modeled which correlate them. The difficulties encountered result from complex relationships between cause and effect, typically being nonlinear as well as nonstationary. The graphical approach offers a means for characterizing these relationships in a way that allows the modeler to easily express his knowledge of the market structure, incorporate information not found in the data, and thus gain prediction accuracy.

"SYMBOLIC NETWORK MODELING OF A CONSUMER GOODS COMPANY"

*Scacchia, John H.*, Statistical Applications, General Foods Corp., Tarrytown, NY 10591

Market share predictions are developed for the dominant manufacturers in a consumer goods product line by means of symbolic modeling. The model consists of three integrated networks describing demand generation, consumption, and production. The demand generation network is developed structurally on the basis of key marketing mix variables and competition. Optimal control techniques are applied to determine improved pricing and advertising spending policies. Strategic planning applications of the methodology will be stressed. The power and flexibility of the symbolic network modeling approach will be illustrated.

## PARLOR B

## FINANCIAL AND ECONOMIC FORECASTING

Chair: *Elton, Edwin J.*, Dept. of Finance, New York U., New York, NY 10006

"OPTIMAL SURVEY AGGREGATION: APPLICATION TO PRICES AND ECONOMIC ACTIVITY"

*Hasbrouck, Joel*, Dept. of Finance, Wharton School, U. of Pennsylvania, Philadelphia, PA 19104

This paper addresses econometric issues involved in using past prediction accuracy to derive optimal weights for survey respondents' current forecasts of economic variables. Univariate and multivariate forecast aggregation techniques are discussed. A general factor-analytic technique is presented for use in situations in which the number of forecasters is large relative to the performance track records. Several techniques are applied to the Livingston surveys of consumer price index and industrial production expectations. The performance of these forecasts, as measured by average bias and root-mean-square prediction error, indicated significant improvement over the naive forecast formed as a simple average over all respondents.

"GBA SURVEY OF ATTITUDES AND EXPECTATIONS IN THE FINANCIAL COMMUNITY: A PROGRESS REPORT"

*Wachtel, Paul*, Dept. of Economics, Graduate School of Business, New York U., 90 Trinity Place, NY 10006

The Graduate School of Business Administration at NYU conducts a semi-annual survey of attitudes and expectations in the financial community. The respondents are CEOs and other major officers of commercial banks, brokerage firms, insurance companies and other financial institutions in the U.S. The survey collects forecasts on such items as GNP, inflation, and interest rates. Unique features of this new survey are: a) The respondents provide a measure of forecast uncertainty; b) The survey provides information about the long-term prospects for the economy. (e.g., consensus expectations for the next five years are for an average annual inflation rate of 6.4 percent and a real growth rate of 2.9 percent for GNP.); c) The respondents provide answers to specific questions about economic policy. (e.g., results from the latest survey indicate general support for the monetary policies now being followed by the Federal Reserve.) This paper describes the survey methodology and analyzes results from the past two surveys.

"ON THE FORECASTING OF ACCOUNTING RATIOS: PRELIMINARY EVIDENCE"

*Manegold, James G.*, School of Accounting, U. of Southern California, Los Angeles, CA 90089-1421  
*Katz, Rachelle*, College of Business Administration, Loyola Marymount U., Los Angeles, CA 90045

The use of accounting ratios to evaluate the economic condition of firms is widespread, yet little is known about the time-series properties of such ratios. This paper provides evidence on the time-series properties of accounting ratios. The paper discusses the application of time-series analysis to ratios where the numerator and denominator may be generated by different processes. Empirical evidence is then provided on the existence of these problems in accounting ratios. Finally, implications for users of financial ratios are discussed.

"FORMATION OF PROFESSIONAL ANALYSTS' EARNINGS ESTIMATES"

*Gultekin, Mustafa N.*, Graduate School of Business Administration, New York U., 100 Trinity Place, New York, NY 10006

This paper examines the rationality and the formation of earnings estimates. While there is a large body of research in the accounting and finance literature examining various properties of the earnings estimates by the professional analysts, surprisingly, there is almost no research investigating the formation of earnings expectations of the financial analysts. The survey data of this study differs from the others. It covers the longest time period with the largest number of companies (270), each followed by at least 3 analysts for each of the 106 months for the period of March 1973 to December 1981. Three topics were investigated: 1. The "rationality" of earnings estimates in terms of unbiasedness and efficiency for each of the months. 2. The change in formation of estimates as the forecast horizon nears. 3. The degree to which the financial analysts utilize information from extrapolative forecasts.

## STATISTICAL APPROACHES TO FORECASTING

Chair: *Shaman, Paul*, Dept. of Statistics, Wharton School, U. of Pennsylvania, Philadelphia, PA 19104

"THE MULTI-STATE BAYESIAN LINEAR GROWTH MODEL-APPLICATIONS TO BRAZILIAN TIME SERIES"

*Souza, R.C.*, Grupo de Sistemas, DEE, PUC/RJ, Catholic University, Rio de Janeiro, Brazil  
*Neto, J.J. Farias*, Grupo de Sistemas, DEE, PUC/RJ, Catholic University, Rio de Janeiro, Brazil

This paper uses an approximate formulation of the Bayesian Linear Growth Model recently introduced in the literature. Emphasis is given to the four-state version of the model for series subject to discontinuities such as transients, step and slope changes. The model is applied to two Brazilian time series and the results are discussed.

"ECONOMIC FORECASTING USING A MACROECONOMETRIC MODEL OF THE U.S. BASED ON OPTIMUM CORPORATE PRICING"

*Taylor, L.W. Jr.*, Investment Analysis Co., 139 Milstead Rd., Newport News, VA 23601  
*Maniyar, Vinod P.*, Dept. of Management & Marketing, Christopher Newport College, 50 Shoe Lane, Newport News, VA 23606

This paper attempts to improve econometric modeling for macroeconomic forecasting by applying Kalman filter techniques of control theory. The coefficients of our model are determined by a spectral analysis of economic trends. Examination of economic variables, especially production and prices during a typical business cycle, reveals evidence of nonlinear behavior, and therefore, our model includes such nonlinear phenomena involving prices. The approach taken in this paper is to examine a model of corporate earnings to derive an optimum pricing. The ex post inflation forecasting performance of our model surpasses the ex ante performance of the famous econometric models.

"PREDICTION INTERVALS FOR FORECASTS OF AUTOREGRESSIONS"

*Stine, Robert A.*, Wharton Analysis Center, U. of Pennsylvania, Philadelphia, PA 19104

A prediction interval forms a region in which a future unobserved value falls with a specified probability. For Gaussian autoregressions, the standard prediction intervals fail to obtain the normal probability value. By adjusting the common estimate of mean squared error we obtain a more accurate interval. Results from Monte Carlo simulations support the value of the revised interval. We also suggest methods appropriate to non-Gaussian series.

"THE BOX-JENKINS METHOD IS A CLASSIC EXAMPLE OF CURING THE DISEASE BY KILLING THE PATIENT"

*Vishwakarma, Keshav P.*, School of Economics, La Trobe U., Melbourne (Bundoora), Victoria Australia 3083

The Box-Jenkins (ARIMA) method of time series forecasting has become well-known. It has been the subject of numerous articles and several books. Also many computer software packages are commercially available for it. This paper demonstrates that, nevertheless, the Box-Jenkins method lacks logical consistency and is deficient in many ways. Four crucial flaws are elaborated: (1) The basic, but mistaken, idea underlying the method is that the output (solution, response) of a stable linear difference equation driven by a stationary Gaussian white noise process (input) is also invariably a stationary process; (2) It does not provide information on vital time series elements like the trend and the seasonal variation; (3) For series with rising or falling trend, it produces forecasts that have unbounded variance; (4) The Box-Jenkins results on the stability of linear difference equations are counter to established mathematical convention.

## PRODUCTIVITY FORECASTING

Chair: *Selman, Victor and Bartfeld, Charles I.*, The American University, Center for Technology and Administration, Washington, DC 20016

"ENHANCING PRODUCTIVITY BY DECISION-RISK ANALYSIS"

*Selman, Victor*, The American U., Center for Technology & Admin., Washington, DC 20016  
*Bartfeld, Charles I.*, The American U., Center for Technology & Admin., Washington, DC 20016  
*Selman, Jerry*, ERA, Inc., 120 West 49th St., Bayonne, NJ 07002

America's competitive productivity ranking can be improved for domestic (and global) markets by the formal Decision-Risk Analysis Methodology. Risks, gaps, timing, inventory, bottlenecks, etc., in existing and innovative new production systems can be determined by risk-analytic approaches so that trouble-spots can be identified and eliminated, or their negative effects minimized/reversed. By the structuring of credible and acceptable productivity decisions with known risks, second-order effects of production changes; such as, morale, working conditions, profitability, etc., can be controlled.

"PRODUCTIVITY AND QUALITY CONTROL CIRCLE ACTIVITIES"

*Ishikawa, Akira*, Graduate School of Management, Rutgers U., Newark, NJ 07102

This presentation encompasses, first of all, a comparison of productivity on different dimensions between the U.S. and Japanese firms. Secondly, one of the forces, the Quality Control Circle activity that has brought forth such differences will be compared from three independent angles. Thirdly, future prospects of productivity between two countries will be envisaged in light of their objectives.

"IMPROVING PRODUCTIVITY IN THE SECURITIES INDUSTRY BY TRIPLE EXPONENTIAL SMOOTHING"

*Jimerson, Douglas A.*, DeRank Investment Corp., Arlington, VA 22201  
*Selman, Victor*, The American U., Center for Technology & Admin., Washington, DC 20016

This presentation exhibits how trend-adjusted exponential smoothing can be applied to stock market forecasting in order to improve productivity in the securities industry. The study uses New York Stock Exchange data from 1980 to the first quarter of 1982 to evaluate, by extrapolation, the trend-adjusted smoothing model's effectiveness in forecasting actual market price movements. The results of this study indicate that the trend-adjusted exponential smoothing model equivalent to the 30 week moving stock average is a good stock market forecasting tool. The results derived are in agreement with accepted technical analysis methods of stock market forecasting. The results are also in keeping with the trends that actually evolved.

SESSIONS ON WEDNESDAY AT 12:00-1:30

<u>TITLE</u>	<u>CHAIRPERSON</u>		
MULTIVARIATE TIME SERIES (PANEL)	<i>Carbone, Robert, U. of Laval, Quebec</i>	155	DOMINION BALLROOM A
ANALYSIS OF MACROECONOMIC MODELS	<i>Oller, Lars-Erik, Ministry of Finance, Finland</i>	156	PROVINCIAL SOUTH
IMPROVING THE QUALITY OF SUBJECTIVE FORECASTS	<i>Lockett, A.G., Manchester Business School, England</i>	157	PROVINCIAL NORTH
FORECASTING THE SATELLITE TELECOMMUNICATIONS DEMAND	<i>Kratochwil, Dan, Western Union, McLean, Virginia</i>	158	SALON 1
EXCHANGE RATE FORECASTING IV	<i>Alexander, Don, New York, N.Y.</i>	159	SALON 2
TRANSPORTATION FORECASTING II	<i>Stein, Martin M., Abt Associates, Cambridge, MA</i>	160	SALON 3
SEASONALITY IN ECONOMIC TIME SERIES	<i>Juselius, Katarina, Swedish School of Economics, Helsinki</i>	161	SALON 4
FORECASTING AND PLANNING FOR EMERGING MARKETS	<i>Yatrakis, Pan, Xerox Corp., Stamford, Connecticut</i>	162	SALON 5
POLITICAL RISK FORECASTING	<i>Coplin, William D., Syracuse U., N.Y.</i>	163	SALON 6
AGRICULTURAL FORECASTS	<i>Fildes, Robert, Manchester Business School, England</i>	164	SALON 9
USING SEGMENTATION FOR ECONOMIC FORECASTS	<i>Weale, M.R., U. of Cambridge, England</i>	165	SALON 10
GRAPHICAL METHODS FOR TIME SERIES	<i>Polhemus, Neil, Princeton U., New Jersey</i>	166	SEMINAR A
PRACTICAL ISSUES IN SALES FORECASTING BY COMPANIES	<i>Lowenhar, Jeffrey A., Temple U., Philadelphia</i>	167	SEMINAR B
URBAN FORECASTING & STRATEGIC CHANGE	<i>Gappert, Gary, U. of Akron, Ohio</i>	168	SEMINAR C
POLICY RESEARCH	<i>Henshel, Richard L., U. of Western Ontario, London, Canada</i>	169	SEMINAR D
TECHNICAL ISSUES IN TIME SERIES FORECASTING	<i>Char, A.R., CompuServe, Columbus, Ohio</i>	170	PARLOR A
MARKETING: QUALITATIVE APPROACHES	<i>Fitzgerald, Paddy G., Brighton Polytechnic, England</i>	171	PARLOR B

## ANALYSIS OF MACROECONOMIC MODELS

Chair: Öller, Lars-Erik, Economics Department, Ministry of Finance, P.O. Box 295,  
SF-00171 Helsinki 17, Finland

## "MACROECONOMIC FORECASTING WITH A MULTIVARIATE TIME SERIES MODEL"

Öller, Lars-Erik, Economics Dept., Ministry of Finance, P.O. Box 295 SF-00171 Helsinki 17, Finland

The modeling technique applied here has features in common with univariate, econometric and judgmental forecasting. Theoretically and empirically we start from the univariate ARIMA model (Box and Jenkins). In the multivariate, i.e., the vector ARIMA (VARIMA) model by Tiao and Box, lagged relationships between variables can be introduced. Econometrically the model is in reduced form where all right hand side variables are predetermined. Exogenous variables can then be added in transfer functions. Economic behavior during sample period is analyzed in simulations where the variables are shocked one at a time. Judgment is introduced in subjective forecasts of exogenous variables. Non-zero future shocks are briefly discussed. The model was used as an aid in government short-term forecasting.

## "A FORECASTING MODEL OF THE SERVICES ACCOUNT OF THE U.S. BALANCE OF PAYMENTS: PRELIMINARY RESULTS"

Proctor, Allen J., International Research Dept., Federal Reserve Bank of New York,  
33 Liberty St., New York, NY 10045

This paper describes a 28 equation, quarterly, partial equilibrium model of the services account of the U.S. balance of payments, designed to serve as an in-house forecasting tool for policy analysis. With few exceptions, the model indicated that the responses of overall services transactions were inelastic with respect to real GNP, prices, and the effective dollar exchange rate. The design of in-house models often is limited by institutional needs, resources, and procedures. The paper illustrates several ways to respond to these constraints. The paper also discusses methodological problems associated with modeling services behavior.

## "FORECASTING THROUGH CAUSAL STRUCTURE: SOME EXPERIMENTS WITH THE INDONESIAN ECONOMY"

Parikh, Ashok, School of Economic & Social Studies, U. of East Anglia, Norwich NR4 7TJ, .K

This paper proposes alternative estimable econometric models for the Indonesian economy for the period 1969-1980. Before formulating the models, we tested the leading hypothesis that there is a strong causal relationship between money supply and aggregate price index. To our surprise, Granger and Sims' tests favored the hypothesis of contemporaneous causality between money supply and price level on quarterly data. We used this information to treat both money supply and price level as endogenous variables in all of our models. One of the other novel features of the study was that the money supply was decomposed into different components and price level into sub-aggregates. Structural analysis and forecast performance of our five models were examined using both within-sample and post-sample period model simulation.

## "ALTERNATIVE SPECIFICATIONS OF THE DEMAND FOR MONEY AND THEIR IMPLICATIONS FOR FORECASTING AND POLICY ANALYSIS WITH LARGE MACROECONOMETRIC MODELS"

Robins, Russell, Data Resources, Inc., 29 Hartwell Ave., Lexington, MA 02173  
Leahy, Cary, Data Resources, Inc. 29 Hartwell Ave., Lexington, MA 02173

The demand for money is an important function in large macroeconometric models because of its central role in monetary policy. The interest-rate responsiveness of money demand determines the interest rate changes consistent with the initial change in monetary policy, the subsequent changes on aggregate demand, and the price level. This paper uses the DRI macroeconometric model to investigate these issues, finding that the model's predictive power and its estimates of the relative potency of monetary and fiscal policy is dependent upon the specification of the money demand function.

## IMPROVING THE QUALITY OF SUBJECTIVE FORECASTS

Chair: *Lockett, A.G.*, Manchester Business School, Manchester M15 6PB, England

"AN APPROACH TO THE MEASUREMENT OF PROBABILITY USING PAIRWISE COMPARISONS"

*Gear, A.E.*, Dept. of Business Studies, Trent Polytechnic, Burton St., Nottingham NG1 4BU, England  
*Lockett, A.G.*, Manchester Business School, Manchester M15 6PB, England

An approach to the assessment of discrete probabilities is presented. It is based on pairwise comparisons using the subjective scale developed by Saaty for analyzing hierarchies in general. The results of two experimental trials in research and development situations are presented. One involves a replication over an extended time period, and the other uses a series of subjects undertaking the same evaluation separately. Preliminary results indicate the potential of the method for deriving subjective probability estimates in practice. The underlying conceptual differences between this and other methods are identified and discussed.

"A COMPUTERIZED DECISION AID FOR FORECASTING THE EFFECT OF AIRBASE ATTACKS ON ENEMY SORTIE GENERATION CAPABILITY"

*Donnell, Michael L.*, The Decision Sciences Section, PAR Technology Corp., P.O. Box 2005, Reston, VA 22090

A computerized decision aid was developed to assist a Tactical Air Force Targeteer in planning his Offensive Counter Air mission. The model utilizes cost-benefit analysis to determine that specific set of attacks on enemy airbases and their components that, for a given number of friendly sorties, will keep the highest number of enemy sorties out of the air. Estimation of benefit is purely judgmental. Experts estimate the maximum percentage of enemy sorties that will be kept from flying by destroying each airbase component. The effects of attacks on multiple components are calculated by recursive application of the equation  $E_{i,j} = E_i + E_j - E_i \times E_j$ .

"EFFECTS OF MEMORY ON INDIVIDUAL AND GROUP DECISION-MAKING"

*Holt, Robert W.*, Psychology Dept., George Mason U., Fairfax, VA 22030

The effects of memory structure and process on individual and group decision-making are explored using a basic framework of eight principles of memory structure and process. These principles are applied to individual decision-making by emphasizing the elicitation of necessary information, the motivation to process this information, and the selection of processes used to transform the information into an individual decision. The application to group decision-making emphasizes the unique effects the presence of others has on the information available to the group, the motivation to process the information, and the processes used to transform the information into a group decision.

"THE ROLE OF INTANGIBLES IN FORECASTING"

*Vargas, Luis G.*, Graduate School of Business, U. of Pittsburgh, Pittsburgh, PA 15260

This paper presents a model based on the Analytic Hierarchy Process (AHP) that uses intangible information in forecasting. The approach is based on two extensions of the AHP: random judgments to account for the judgments of a large number of decision makers, and the prioritization of an infinite non-denumerable set of alternatives to determine the impact of intangibles on variables that are input to forecasting models. The approach is illustrated in an application to the prediction of stock prices.

## EXCHANGE RATE FORECASTING: TV

Chair: Alexander, Don, New York, NY

"SOME SOURCES OF INACCURACY IN EXCHANGE RATE FORECASTING MODELS"

Isard, Peter, Federal Reserve Board of Governors, Stop 18, Washington, DC 20551

The paper discusses problems that may have contributed to the poor forecasting performance of empirical exchange rate models developed during the past decade. One problem is the lack of careful attention to the concept of what anchors expectations about long-run levels of exchange rates. I contend that the long-run purchasing power parity hypothesis has two different interpretations, and I emphasize that models of exchange rate determination have ignored the important role of creditor behavior and country risk in analyzing the influence of current account developments on current and expected exchange rates. I address deficiencies in modelling the premium for bearing exchange risk and discuss the measurement of "news," the relevance of short versus long-term interest rates in exchange rate models, the inefficient modelling of exchange rate expectations, and the treatment of serial correlation.

"PPP AS A TRADING STRATEGY"

Bilson, John F.O., Graduate School of Business, U. of Chicago, Chicago, IL 60637

The purchasing power parity (PPP) theory of exchange rates has fallen into disrepute among academic and commercial foreign exchange analysts. In this paper, I demonstrate that PPP forecasts are useful when used in conjunction with other available forecasts. In particular, when combined with market forecasts implicit in forward prices, and technical forecasts from time series analysis, the PPP forecast increases the profit and lowers the risk of a multicurrency investment portfolio. The paper illustrates procedures for combining forecasts, and demonstrates how forecasts can be used in making financial decisions.

"ALTERNATIVE APPROACHES TO GENERAL EQUILIBRIUM MODELING OF EXCHANGE RATES AND CAPITAL FLOWS:

THE MCM EXPERIENCE"

Hooper, Peter; Haas, Richard D.; Symansky, Steven A.; Stekler, Lois, Federal Reserve Board of Governors, Stop 18, Washington, DC 20551

This paper outlines a common theoretical framework from which different approaches to modeling exchange rates can be derived. The framework focuses on the class of models in which assets denominated in different currencies are imperfect substitutes. The alternative approaches involve: 1) modeling the markets for securities (and monies) denominated in different currencies and 2) modeling the balance of payments. Problems involved in implementing the different approaches empirically are discussed. These include the availability of data on holdings of securities by currency of denomination and by country of holder, and the interpretation of bank-related capital flows in the balance of payments. Finally, the paper reviews our experience to date with the alternative approaches in developing the Federal Reserve Board staff's Multicountry Model (MCM).

"ACCOUNTING FOR NONLINEARITIES TO IMPROVE THE OUT-OF-SAMPLE FIT OF EMPIRICAL EXCHANGE RATE MODELS"

Meece, Richard, School of Business Admin., U. of California, Berkeley, CA 94720  
Rogoff, Kenneth, International Monetary Fund, Washington, DC 20431

Small empirical exchange rate models such as the monetary model, with and without slow price adjustment, and the portfolio balance model fit poorly out of sample. In previous research, we found that they failed to outperform a random walk model. The present work attempts to improve the performance of these models by using Kalman Filter techniques to account for time-varying coefficients, and by allowing variables to have nonlinear effects on the exchange rate. The latter modification is motivated by the frequent statements of exchange market traders that factors which are "out of line" become disproportionately important. The yen, mark and pound exchange rates against the dollar are analyzed.

## TRANSPORTATION FORECASTING II\*

Chair: Stein, Martin M., Abt Associates Inc 55 Wheeler St Cambridge, MA 02138

"A COMPARISON OF THE APPLICATION OF MULTIVARIATE TIME SERIES ANALYSIS AND STRUCTURAL ECONOMETRIC MODELS FOR PROJECTIONS OF U.S. TRAFFIC ACCIDENT TRENDS"

Stein, Martin M., Abt Associates Inc., 55 Wheeler St., Cambridge, MA 02138  
Beauregard, Marianne A., Abt Associates Inc., 55 Wheeler St., Cambridge, MA 02138

This paper presents alternative multivariate time series analyses of U.S. traffic fatality data. Resulting equations were used to forecast values that were compared among themselves and with the actual trends. Based on these results, a hybrid structural model that includes variables found to have a strong leading correlation with accident trends was designed and tested. Projections from the structural model tracked actual fatality experience more closely than did any of the time series analyses. The results suggest that use of multivariate time series analysis can be an efficient and cost-effective aid in the design of structural models.

"FORECASTING TRAFFIC FLOWS"

Fisch, Oscar, Dept. of City & Regional Planning, College of Engineering, Ohio State U., Columbus, OH 43210

The disjointedness of the planning sequence of the trip-generation process/trip-distribution process, is the main subject of this paper. I approached this disjointedness problem by analyzing the central properties of the independently discovered balancing methods of trip distribution models in relation to critical issues. It is the purpose of this paper to support the balancing factors approach in forecasting trip distribution matrices with a methodological interpretation and to explain behaviorally the balancing factors. In the process, I want to show the spatial interaction between trip production and attraction, and the emerging need for simultaneous specification and estimation of the trip generation process.

"FORECASTING STATE DEMAND FOR GASOLINE - A COMPARISON OF THE STRUCTURAL EQUATION APPROACH AND THE UNIVARIATE TIME SERIES APPROACH"

Cheng, David C., Center for Business & Economic Research, U. of Alabama, University, ALA 34586  
Ferguson, Carl E., Center for Business & Economic Research, U. of Alabama, University, ALA 34586

In this paper, we used a structural demand equation and a time series analysis to forecast demand for gasoline in 1979 and 1980, a period of dramatic price change for each of the 48 contiguous states of the United States. The annual state demand equation was estimated based on the flow-adjustment approach. Baseline forecasts by Wharton Econometric Forecasting Associates were used for constructing the 1979 and 1980 values of the national and state exogenous variables. In the time series analysis, monthly state gasoline consumption data since 1974 were used. The relative forecasting accuracy of these two approaches was compared and evaluated.

"TRAVEL DEMAND ANALYSIS AND MODAL SPLIT ESTIMATION BY EIGENVECTOR SCALING OF ALTERNATIVE TRANSPORTATION MODES IN HIERARCHICAL DEMAND STRUCTURES"

Banai-Kashani, Alireza, Dept. of City & Regional Planning, U. of Pennsylvania, Philadelphia, PA 19104

In the behavioral approaches to the analysis of travel demand, it has been generally hypothesized that "trips" result from a "decision-process" by trip-makers, individually and/or collectively, with characteristics that can be analyzed in relation to the attributes of the transportation "network." "Behavioral" approaches are hence contrasted with the "mechanistic" approaches in which the analysis of trips is undertaken with the behavioral bases for trip-making as essentially given. This paper develops a procedure for travel demand estimation using Saaty's Analytic Hierarchy Process. The output of this procedure is an estimate of the trip distribution by mode, or "modal split." The estimate closely approximates the observed modal split pattern for the inter-city travel problem simulated. This procedure is proposed for forecasting.

\* See related session on Monday at 2:00-3:30 PM.

## SEASONALITY IN ECONOMIC TIME SERIES

Chair: *Juselius, Katarina*, Swedish School of Economics, Arkadiagatan 22, Helsinki 10, Finland

**"FORECASTING THE MONEY SUPPLY IN TIME SERIES MODELS"**

*Bagshaw, Michael*, Federal Reserve Bank of Cleveland, P.O. Box 6387, Cleveland, OH 44101  
*Gavin, William T.*, Federal Reserve Bank of Cleveland, P.O. Box 6387, Cleveland, OH 44101

Time series techniques are used to forecast quarterly money supply levels in this study. Results indicated that a bivariate model including an interest rate and M-1 predicted M-1 better than the univariate model and as well as a 5-variable model that added prices, output and credit. The paper also presents evidence on the issue of using seasonally adjusted data in forecasting with time series models. The implications of these results apply to all econometric forecasting. Results confirm the hypothesis that using seasonally adjusted data leads to substantially worse results than using non-seasonally adjusted data.

**"NON-STATIONARITY AND SEASONALITY IN THE DISTURBANCE TERM OF ECONOMETRIC RELATIONS, WITH APPLICATIONS ON THE DEMAND FOR MONEY"**

*de Vos, Aart F.*, Free University, Postbus 7161, 1007 MC, Amsterdam, The Netherlands

A plea is made that one should specify a broad class of econometric macro-relations as the sum of a causal part, a random walk, a seasonal term with stationary yearly sum, and a stationary error term. These models, also advocated by Harvey in 1982, may be estimated using the Kalman filter. The a priori reasons for this specification are discussed, as well as the problems involved in making this choice on empirical grounds. Two empirical studies on the demand for money from the econometric and the time-series traditions are reanalyzed to strengthen the arguments.

**"SEASONALITY IN REGRESSION. THE 'BOX-JENKINS' AND THE UNOBSERVED COMPONENTS MODEL"**

*Hylleberg, Svend*, Institute of Economics, U. of Aarhus, 8000 Aarhus C, Denmark

The econometric modelling technique was integrated with the well-known time series modelling technique advocated by Box and Jenkins and by Nerlove and others to build a model for economic seasonal time series. The approach follows that of Zellner, Palm, Wallis, Engle, Hendry, Nerlove, Plosser and others, and develops estimation procedures based on maximum likelihood principles. Among the tools is a scoring algorithm where the derivatives are evaluated by the Kalman filter. This played a prominent role in the estimation of the simultaneous econometric model and in the estimation of unobserved components models. In all cases, Lagrange Multiplier tests were used as diagnostics. The suggested modelling procedures were applied to a small macro model for the United Kingdom.

**"DYNAMIC REGRESSION MODELS AND SEASONALITY IN THE EXOGENOUS VARIABLE. AN APPLICATION TO THE DEMAND FOR MONEY IN FINLAND"**

*Juselius, Katarina*, Swedish School of Economics, Arkadiagatan 22, Helsinki 10, Finland

Dynamic regression models with seasonality in the exogenous variable is investigated using the additive unobserved components (AUC) approach. A small simulation study is performed to investigate the effect of incorrectly using fourth order differencing to account for the seasonal fluctuations in the model. The effects on the long run properties of the model are considered. The demand for money is specified based on the AUC approach and the empirical results are compared with the simulation results.

## SEASONALITY IN ECONOMIC TIME SERIES

Chair: *Juselius, Katarina*, Swedish School of Economics, Arkadiagatan 22, Helsinki 10, Finland

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## FORECASTING AND PLANNING FOR EMERGING MARKETS

Chair: *Yatrakis, Pan*, Xerox Corporation, P.O. Box 1600, Stamford, CT 06904

**"FORECASTING THE PRICE EVOLUTION OF NEW ELECTRONIC PRODUCTS"**

*Dino, Richard*, Center for Economic Analysis, 202-51 Soundview Ave., Stamford, CT 06904

In recent years the markets for electronic products have experienced extremely aggressive price competition. Although advances in technology have provided some defense of profit margins, shortened product life cycles have exacerbated the financial risks of introducing new products. In such an environment, the evaluation of the financial viability of a proposed product for a new market demands reliable forecasts of the price evolution that may be expected over the product life cycle. Prices in new markets change in a pattern similar to and related to product life cycles. At least three stages of price decline have been experienced in electronic product markets. This paper describes the price life cycle and the product market events that characterize each stage. Techniques are discussed for identifying the transition points between the stages. The specification of the price vs. quantity relationship in each principal stage is described.

**"PREDICTING RATES OF TECHNOLOGICAL DIFFUSION FOR NEW PRODUCTS THROUGH CONSIDERATION OF OPTIMAL MARKETING STRATEGIES"**

*Funk, Jeff*, Dept. of Engineering & Public Policy, Carnegie-Mellon U., Pittsburgh, PA 15213

*Ayres, Robert U.*, Dept. of Engineering & Public Policy, Carnegie-Mellon U., Pittsburgh, PA 15213

Economists have found that profitability is a strong factor in the rate at which new technologies are introduced. We quantified this by considering a firm's optimal production path with a new product. The firm produces the product at a rate that will maximize its objective function. We assume this objective function to be the present value of future profits over some time horizon, subject to a constraint on cumulative losses allowed. This methodology requires the new products to have quantifiable demand and cost functions, although there will be uncertainty in both. This uncertainty is part of the need for a cumulative loss constraint. Each firm has different cost functions, discount rates, and cumulative loss constraints resulting in each firm having a different production path. However, each firm will sell at the same price and this price determines the total market demand. The total rate at which the new product is introduced is the summation of the rates at which individual firms market the new product. Because this methodology requires a quantifiable market demand function, it is most useful for products that are close substitutes for existing products (e.g., plastic bottles for glass bottles).

**"INTEGRATION OF MARKET DYNAMICS AND TECHNOLOGICAL CHANGE IN A STRATEGIC PLANNING MODEL"**

*Hornor, Joseph F.*, Cyclical Management Associates, 237 Rockrimmon Rd., Stamford, CT 06903

New product technologies act as strong change agents in a market. They may change the interests and habits of purchasers and create new markets. New technologies may also impact existing products by initiating their obsolescence or extend the life of older products if they can adopt the new technology. A methodology is described for measuring the characteristics of potential impacts from a technological change. These quantified impacts are then applied to conventional forecasts of the product life cycle.

## POLITICAL RISK FORECASTING

Chair: *Coplin, William D.*, Maxwell School, Syracuse University, Syracuse, NY 13210

Session Overview: This session will explore the methodological problems associated with evaluating political risk analysis. It will look at such criteria as track record accuracy and utility, and examine how such criteria can be applied to specific political risk studies and to systems of analysis.

"ASSESSING POLITICAL RISK FORECASTS: THE NEED FOR A COMPARATIVE APPROACH"

*Coplin, William D.*, Maxwell School, Syracuse University, Syracuse, NY 13210

*O'Leary, Michael K.*, Maxwell School, Syracuse University, Syracuse, NY 13210

Political risk forecasting has become an increasingly important field for academic social scientists as well as business and government officials who use the forecasts. Considerable controversy exists over the best way to make forecasts, the use such forecasts can have in business and government decisions, and how to evaluate the track record of such forecasts. The most fruitful way to assess existing approaches and evaluate the utility and track record of political risk forecasts is through a comparative method. Traditional scientific criteria of accuracy in absolute terms cannot be used because of measurement problems. An approach that evaluates the comparative accuracy and utility of different methods and sources of data is more appropriate. Examples of such comparative analysis include a comparison of forecasts from a commercial service, World Political Risk Forecasts (WPRF), a survey of bankers' perceptions from Institutional Investor magazine, and a time series comparison between WPRF and the news media on the evolution of the regime in South Korea.

## AGRICULTURAL FORECASTS

Chair: *Fildes, Robert*, Manchester Business School, Manchester M15 6PB, England

"MULTIVARIATE TIME SERIES ANALYSIS APPLIED TO AN AGRICULTURAL MARKET"

*Cordier, Jean*, Institute of International Agri-food Management, ESSEC, Boite Postale 105,  
95021 Cergy Pontoise, France

*Indjejehagopian, Jean-Pierre*, Dept. of Statistics, ESSEC, Boite Postale 105, 95021 Cergy Pontoise,  
France

Multiple time series analysis, MARMA, was used to analyze the price system of a competitive agricultural market. The primary objective of this study was to determine the location of the reference market and to provide participants in the market with a system to forecast prices. The emphasis was on operationalizing the concept of causality, in the sense of Granger-Wiener, in a multivariate analysis, as compared with a univariate analysis. The results of the study allowed a comparison of the structural forms and forecasting accuracies of the MARMA model and the inferred "bivariate reductions," with bivariate models estimated using classical procedures.

"FORECASTING DEMAND FOR TABLE EGGS IN CANADA"

*Harvey, Dan*, Bureau of Management Consulting, Ottawa, Ontario, K1A 0S5, Canada  
*Pretty, Roger*, Bureau of Management Consulting, Ottawa, Ontario, K1A 0S5, Canada

This article presents results of work done to produce a system for forecasting the demand for table eggs in Canada. The forecast system was produced for the Canadian Egg Marketing Agency, an organization that coordinates the marketing of eggs in Canada. The authors discuss the reasons for producing forecasts and outline the forecasting systems which used both time series and causal models. Problems with data and forecast interpretation are discussed, together with commentary on how the forecasts were used.

"FORECASTING THE MILK PRODUCTION BY AGRICULTURAL CENTRALS IN FINLAND"

*Huuhtanen, Pentti*, U. of Tampere, P.O. Box 607, SF-33101 Tampere 10, Finland  
*Liski, Erkki*, U. of Tampere, P.O. Box 607, SF-33101 Tampere 10, Finland

This paper considers the problem of predicting future values of a series of monthly milk quantities produced by agricultural centrals in Finland. First we focused on univariate forecasting procedures such as Box-Jenkins methods, exponential smoothing and stepwise autoregression. We also tried a Bayesian approach. Further, we used regression and multiple time series models on information contained in related time series. Different procedures were compared simultaneously by using a certain kind of multivariate technique. Conclusions are drawn on which methods were most valuable.

## AGRICULTURAL FORECASTS

Chair: *Fildes, Robert, Manchester Business School, Manchester M15 6PB, England*

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SALON 10

USING SEGMENTATION FOR ECONOMIC FORECASTS

Chair: Weale, M.R., Dept. of Applied Economics, U. of Cambridge, Sidgwick Ave.,  
Cambridge CB3 9DE, England

"FINANCIAL FORECASTING IN A DISAGGREGATE MODEL"

Weale, M.R., Dept. of Applied Economics, U. of Cambridge, Sidgwick Ave., Cambridge CB3 9DE, England

A disaggregate forecasting model of the UK Financial Economy, developed as part of the Cambridge Multisectoral Dynamic Model, is described. The model differs from most conventional models in the emphasis placed on stocks and in being disaggregate over both institutions and assets. It forecasts 10 sectors' asset or liability stocks from income, asset price, and using saving derived in the "real" Multisectoral Dynamic Model. It allocates these aggregates over 32 instruments using share equations and equating supply and demand. Revaluations are derived from stock equilibrium and interest rate movements. Interest rates themselves are forecasts by reaction/term structure functions from the bank base rate. The model is compared with conventional flow-based forecasting models of the UK.

"EVALUATING THE FORECASTING ACCURACY AND PROPERTIES OF THE MICROSIM MICROANALYTIC MODEL"

Moeller, John F., The Policy Research Group, 1120 19th St. NW, Washington, DC 20036  
Hayes, Richard, The Policy Research Group, 1120 19th St. NW, Washington, DC 20036

This paper reports the results of extensive experimentation with the MICROSIM microanalytic model to evaluate (1) the accuracy and stability of its short-run and long-run socioeconomic, demographic aggregated and disaggregated forecasts, and (2) the degree of interaction among its behavioral modules. Simulation estimates with the model over a 15 year period were analyzed and compared to other forecasts and published administrative data. Results show (1) limited module interaction, (2) model stability for long-run estimates, (3) the need for "macro" alignment factors to reduce forecast errors and track business cycles, and (4) a need for disaggregated alignment factors, or model refinements, in several behavioral equations.

"MULTIDIMENSIONAL FORECASTING"

Willekens, Frans, Netherlands Interuniversity Demographic Institute, Box 955, 2270 AZ Voorburg  
The Netherlands  
Guvenç, Nazlı, Netherlands Interuniversity Demographic Institute, Box 955, 2270 AZ Voorburg,  
The Netherlands

In multidimensional forecasting, the interdependence between the individual items of a group is a key concern. The basic issues are (i) appropriate modelling of the observed interdependencies, and (ii) prediction of changes in interdependencies (structural changes). The paper consists of three main sections. The first section reviews methods for multidimensional forecasting. The second section presents a forecasting model in which the components to be forecasted are the interdependencies themselves. The idea is that any observed set of multiple classified items to be forecasted is the outcome of underlying interactions between the variables in the classification. If all the interactions can be modelled, we can focus on the interaction in forecasting the multiple items. The model presented is a generalized linear model, developed for the analysis of contingency tables. The third section applies the proposed generalized linear forecasting model to interregional migration flows in the Netherlands. An application to forecasting structural change in input-output tables is also described.

"A LINK-VECTOR AUTOREGRESSIVE FORECASTING MODEL WITH VARYING PARAMETERS: INTERNATIONAL EVIDENCE"

Sims, Evangelos O., Whittemore School of Business & Economics, U. of New Hampshire, Durham, NH 03824  
Yenigün, D., Whittemore School of Business & Economics, U. of New Hampshire, Durham, NJ 03824

In a major study, Sims introduced the vector autoregressive model as an alternative to conventional macroeconomic models. Vector autoregressive models, which use a minimum of a priori theory, have recently been satisfactorily used in forecasting major economic variables in a closed economy. This study developed a vector autoregressive multi-country system in which individual countries were linked together via a common variable within a dynamic identity. Estimation of the system was made by varying parameter regression. Each period's forecasts for individual countries and the "world" were interrelated, both time-wise and cross-sectionally.

## GRAPHICAL METHODS FOR TIME SERIES

Chair: *Polhemus, Neil W.*, School of Engineering & Applied Science, Princeton U., Princeton, NJ 08544

Session Overview: The use of graphical techniques in time series analysis and forecasting is a particularly effective means for allowing the analyst to uncover the useful information in the data and to exert control over the analysis process. This session will discuss the use of graphics in time series analysis, with particular emphasis on model-building and interactive forecasting. Some new graphical tools for analyzing time series will be presented, as will new techniques for applying graphical methods in interactive computing environments.

## "GRAPHICAL METHODS FOR TIME SERIES MODELING"

*Cleveland, William S.*, Bell Laboratories, Murray Hill, NJ

Graphs are powerful tools for building time series models and assessing their validity. Several graphical methods for time series analysis, including adjusted variable plots and various residual plots, will be discussed. Their application to a large number of data sets shows (1) a few surprises in some well known data sets, (2) moving average parts of ARIMA models, which cause unpleasant nonlinearities in the parameter estimation, are not needed, (3) including a deterministic stable seasonal component in a model for a seasonal time series is almost always sensible, and (4) it is essential to have ways of dealing with outliers.

## "INTERACTIVE TECHNIQUES FOR TIME SERIES ANALYSIS AND FORECASTING VIA DATAPLOT"

*Filliben, James J.*, Statistical Engineering Division, Administration Building, A-337,  
National Bureau of Standards, Washington, D.C.

The benefits of time series analysis for modeling and forecasting are substantially increased when carried out in an interactive environment -- analyses take less time; analyses are more thorough; underlying mechanisms are better understood; modeling is improved; and forecasting is more accurate. A variety of time series analysis and forecasting techniques will be discussed. The illustrated techniques will be drawn from an interactive, portable (ANSI FORTRAN 77), high-level, English-syntax language/system (DATAPLOT) with extensive capabilities in graphics, data analysis, and time series analysis.

## "GRAPHICAL SUPPORT SYSTEMS FOR INTERACTIVE FORECASTING"

*Polhemus, Neil W.*, School of Engineering & Applied Science, Princeton U., Princeton, NJ 08544

The application of graphical methods to interactive time series analysis and forecasting requires software that is designed to meet the special demands of interactive computing environments. Full-screen programming, nondisruptive graphics generation, audit trails, screen paging, menu drivers, and two-way transfer of graphic information are some of the important issues that arise in developing an effective graphical support system for interactive data analysis. This paper discusses some of the important requirements for interactive forecasting systems, with illustrations drawn from the STATGRAPHICS system. The paper examines these issues from the perspective of users of large mainframe computers as well as for users of personal computers and workstations.

SEMINAR B

WEDNESDAY  
12:00-1:30

PRACTICAL ISSUES IN SALES FORECASTING BY COMPANIES

Chair: *Lowenhar, Jeffrey A., Dept. of Marketing, School of Business Administration Temple U Philadelphia, PA 19122*

"WHAT MANAGERS SHOULD KNOW ABOUT FORECASTING"

*Gross, Charles W., Stuart School of Business Administration, Illinois Institute of Technology Chicago, IL 60616*

Recently, considerable attention has been paid in the literature to the need for better communication between managers and forecasting technicians. Obviously, this is a two-way street, with technicians needing to understand more about the decision framework of management and with managers needing to grasp at least the basics of the technical aspects of forecasting. This paper focuses on many of the fundamentals that managers should grasp so that they can be in a better position to communicate with technicians and assess the merits of accepting a particular forecast for decision making.

"THE CONVOLUTED PROCESS OF SALES FORECASTING AT ONE CONSUMER PRODUCTS COMPANY"

*Lowenhar, Jeffrey A., Dept. of Marketing, School of Business Administration, Temple U., Philadelphia, PA 19122*

Sales forecasting is a pervasive activity in the modern complex organization. As a dynamic process, it requires that both managers and forecasters understand the participatory nature of their roles. This paper presents a case study of how one large \$200 million division of a multi-national consumer products company does its sales forecasting. The complex issues of involved decision-makers, the actual forecasting process, information sources used, and methods chosen will be presented. The analysis, although specific to this company, is generalizable to many of the issues facing management in the sales forecasting process.

"BUILDING CREDIBILITY: THE FORECASTER'S OTHER JOB"

*Multz, Arnold, 5185A Stoneridge, Columbus, Ohio 43213*

A forecaster has credibility when his forecast is used as a significant factor in decisions, just as marketing information or cost data are used. This paper argues that, in an organization, credibility comes down to three issues: (1) Translation: Is the forecaster understandable? (2) Accuracy: Is the forecaster right? and (3) Fit: Is the forecaster accepted as a member of the management group? The paper also presents ideas on how a forecaster can accomplish these objectives.

"A PRAGMATIC FOUNDATION FOR FORECASTING"

*Ekambaram, S.K., G-113 (Old Plot No. 600), Annanagar East, Madras-600 102, India*

A foundation for forecasting is presented: (1) Decide what to forecast in consultation with the users. (Two-way communication is essential.); (2) Study the system of operation of the forecast and specify its stable features. Begin with forecasts of these stable features. These would indicate the accuracy and details feasible in forecasts to meet requirements of the users who in turn will adjust their planning. Forecasting and Planning should be an integrated process; (3) Select methods on how to forecast with the information available; (4) Check forecasts against actuals by simulation.

SEMINAR C

URBAN FORECASTING AND STRATEGIC CHANGE

Chair: *Gappert, Gary*, Institute for Futures Studies and Research, U. of Akron, Akron, OH 44325

Session Overview: Will we need cities in the future?

"SCENARIOS FOR URBAN CHANGE"

*Shostak, Arthur*, Dept. of Sociology, Drexel U., Philadelphia, PA

I present seven scenarios for urban change. This draws upon material developed for Philadelphia's Tri-centennial.

"FORECASTING THE EFFECT OF TRANSITIONAL STRATEGIES ON CITIES"

*Knight, Richard V.*, Institute for Futures Studies and Research, U. of Akron, Akron, OH 44325

This presentation discusses transitional strategies for older industrial cities based upon work on Cleveland and northeast Ohio. This material will focus on the problems of re-conceptualizing the city in terms of human and institutional development. The final topic will be a presentation of a complex model for the strategic management of urban futures.

"SCANNING FOR DEVELOPMENTAL OPPORTUNITIES: RETROSPECT AND UPDATE ON THE PHILADELPHIA PAST, PRESENT, AND FUTURE PROJECT"

*Rubin, Michael S.*, Dept. of Social Systems Sciences, The Wharton School, U. of Pennsylvania, Philadelphia, PA 19104

This discussion will focus on the identification of 50 "civic investment opportunities" which resulted from Philadelphia: Past, Present and Future, an eighteen month city-wide strategies development process. The opportunities which were identified through 3 qualitative techniques -- sequential paradigm production, environmental scanning, and TKJ -- are now going through a second stage development. The second stage is based on a Mediated Development Approach in which the identified opportunities are further shaped and modified by multi-party interests or co-ventures, and are progressively detailed by intermediary consultants. Through this process the detailing and modification will be evaluated against the environmental scan, which will itself be subjected to re-evaluation. Special attention will be directed to the negotiations inherent in this process; and to the importance of projects as "exploratory media."

SEMINAR D

POLICY RESEARCH

Chair: *Henshel, Richard L.*, Dept. of Sociology, U. of Western Ontario, London, N6A 5C2, Canada

"FORECASTING AS A MODEL FOR POLICY EVALUATION RESEARCH"

*Stimson, John*, Dept. of Sociology/Anthropology & Geography, William Patterson College,  
Wayne, NJ 07470

*Stimson, Ardyth*, Sociology/Social Work Dept., Kean College of New Jersey, Union, NJ 07083

The evaluation researcher receives practical benefits by adopting the orientation of the social forecaster. Forecasting accommodates the constant flux of applied policy situations more completely than quasi-experimentation. Traditional designs demand control, manipulation, and randomization. These unrealistic requirements can be replaced by emphasis on prediction, understanding, and monitoring of the numerous variables in any change-effort. Forecasters' attempts to anticipate the several alternative futures that might be caused by an intervention are, therefore, antidotes to traditional policy analysts' experimentalist rigidities. Impact measurement, proof of time-priority, and specification of alternative causes can all be better understood when evaluations are explicitly seen as forecasts of an expected outcome from imposed policy stimuli.

"THE PLACE OF VALUES IN ECONOMIC FORECASTING: A SYSTEMS APPROACH"

*Curtis, Richard K.*, School of Liberal Arts, Indiana U. at Indianapolis, 925 W. Michigan St.,  
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Like other areas of forecasting, economic forecasting has tended to ignore values (apart from the proxy value of money itself). As a result, economic forecasting has been overly simplistic. An overarching value system for the 21st century, based on a neo-evolutionary, systemic approach, can help to provide the necessary parameters to ensure a more disciplined, consistent, and systematic science of forecasting. By redefining economics on the basis of systemic energy, the processing of values become more objectively identifiable and measurable. A three-tiered value system, arising out of the nature of value itself, may provide a sounder basis for economic forecasting.

"USING QUALITATIVE HISTORICAL OBSERVATIONS FOR FORECASTING"

*Funkhouser, G. Ray*, Graduate School of Management, Rutgers U., 180 University Ave., Newark, NJ 07102

Quantitative forecasting generally uses data that have been available only for a relatively short period of history. However, future behavior and events are predicted on cultural and behavioral patterns that developed over centuries. Using a "gunsight analogy," some ideas are proposed for utilizing historical observations to forecast the course of events. Historical observations are the "rear sight," present observations the "front sight." Environmental changes subsequent to forecasts are analogous to "windage." As an illustration, predictions are derived by sighting from Tocqueville's observations of America prior to industrialization (1830s) through contemporary conditions. Possibilities, advantages and limitations of this approach are explored.

"MATHEMATICAL PREDICTION FOR PRESIDENT REAGAN'S PERFORMANCE"

*Kao, Stephen S.T.*, Center for Rating the Presidents, 30 Illinois St., Racine, WI 53405

The presidents, from Washington to Carter, were rated by an objective method, based on seven categories: unemployment, inflation, productivity, integrity, leadership, foreign policy, and domestic policy. From these data, a Presidential Performance Index Curve was developed. President Reagan's performance was statistically predicted by the Polynomial-Fit Program of GE Time Sharing Statsystem II using the Presidential Performance Index Curve developed here. These predictions will be compared with his true performance.

PARLOR A

TECHNICAL ISSUES IN TIME SERIES FORECASTING

Chair: *Char, A.R.*, CompuServe Inc., 5000 Arlington Centre Blvd., Columbus, OH 43220

"THE NON-LINEAR EFFECT OF CLIMATIC VARIABLES WITHIN THE CONTEXT OF A BOX-JENKINS TRANSFER FUNCTION MODEL"

*McLeod, G.*, Director, Gwilym Jenkins & Partners, Parkfield, Greaves Rd., Lancaster, LA1 4TZ, England

A description of the effect of climatic variables often requires that the possibility of non-linearities be considered. This paper describes an approach to the detection and formulation of non-linear effects using Box-Jenkins methods. The application of the approach is illustrated by reference to examples drawn from the energy (gas, electricity and gasoline consumption) and construction (housing starts) sectors.

"THE SPECIFICATION OF A MODEL STRUCTURE: AN EMPIRICAL APPLICATION OF CAUSALITY TESTS"

*Tan, J.K.*, Southern Company Services, P.O. Box 2625, Birmingham, ALA 35202

*Tan, K.J.*, U. of Alabama, University, ALA 35486

The proper specification of a forecasting model structure is important when seeking to predict the behavior of certain economic variables. The purpose of this study is to emphasize the importance of Granger's N-way causality tests in model building and specification. The St. Louis model is used as an example to illustrate the procedures for conducting N-way causality tests. Possible limitations of the results of these tests are discussed. It is suggested that an understanding of the N-way causality tests will contribute to a better understanding of econometric model building.

"IDENTIFICATION OF TIME SERIES MODELS - SOME ISSUES OF STRUCTURAL CHANGE"

*Nazem, Sufi M.*, Dept. of Decision Sciences, U. of Nebraska, Omaha, NE 68132

The Box-Jenkins approach to model building and forecasting has often been handicapped due to the lack of sufficient historical observations in time series data. In addition to the data problems, most time series related to business and economic information suffer from frequent changes in structural relationships. This paper addresses the issues of model building with short-run time series data and suggests a pragmatic solution to these problems. To illustrate the suggested solution, the paper employs an empirical analysis of economic and other time series data.

"DIAGNOSTIC TESTS FOR AUTOREGRESSIVE - MOVING AVERAGE MODELS"

*Ljung, Greta M.*, School of Management, Boston U., 704 Commonwealth Ave., Boston, MA 02215

Diagnostic checking is an integral part of the model building procedure proposed by Box and Jenkins. Two possible tests discussed by these authors involve overfitting the model or checking the residuals for possible serial correlation using a portmanteau test. Recently, Godfrey employed the score or Lagrange multiplier principle to derive an alternative test. This paper examines the properties of these tests for sample sizes common in practice. Attention is focused on both the empirical significance level and power of the tests. The relationship between the different test procedures is discussed.

## MARKETING: QUALITATIVE APPROACHES

Chair: *Fitzgerald, Paddy G.*, Dept. of Business Studies, Brighton Polytechnic, Moulsecoomb Brighton, BN2 4AT, England

**"THE INFLUENCE OF FORECASTING ON PURCHASING STRATEGIES"**

*Fitzgerald, Paddy G.*, Dept. of Business Studies, Brighton Polytechnic, Moulsecoomb Brighton, BN2 4AT, England

Most practitioners operating in the field of procurement and supply are trying to improve their forecasting capabilities. This paper seeks to show that such an objective is often misplaced. In supply chains, the search for better forecasting is usually an attempt to cope with longer time horizons. This, in turn, leads to greater pipeline stocks. A simple model was used to demonstrate the adverse effect this has on dynamic behavior and the stability of the supply chain. Some discussion is reported on the interaction between buying and selling logistics and strategies. Finally, work is presented to show how different purchasing strategies can be used to reduce an organization's working capital and response time.

**"ESTIMATED DEMAND ELASTICITIES AND ADJUSTMENT OF MARKET SHARE FOR AN INFANT INDUSTRY"**

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*Rao, U.L. Gouranga; Huber, Paul B.; Brown, Murray G.*, Dalhousie U., Halifax, Nova Scotia, B3H 3J5, Canada

Disruption of market equilibrium must be expected whenever the protection level for the infant industry is higher than its potential capacity. Such costly protection not only disrupts the equilibrium, but it may lead to inefficiency in the industry. This paper shows how, in practice, protection can be modified with regard to the estimated demand elasticities so that, in the short run, the excess demand is removed and the remaining demand guarantees a market share to the domestic producers.

**"FORECASTING WHEEL OF FOREIGN FORTUNE"**

*Feik, LuAnne*, St. Norbert College De Pere, WI 54115

For many marketers, 160 countries represent a cloudy globe rather than a crystal clear ball of opportunity. To identify potential target markets around the world, the pragmatic forecasting method I propose begins by adding rings, representing foreign environments, to McCarthy's basic marketing model wheel. A process involving environmental factors, such as diplomatic relations, national languages, levels of economic development, and competition, is proposed to identify promising marketing options. The object is to find good matches between the marketer's domestic and foreign environments.

**"DESIGNING FORECASTING SYSTEMS FOR SEASONAL COMMODITIES WITH VERY SHORT LIFE CYCLES"**

*Bayne, Clarencey*, Concordia U., 1455 Maisonneuve Blvd. West, Montreal, Quebec, H3G 1M8, Canada

This paper focuses on the fashion industry where there is much to be gained by putting structure to the highly qualitative predictions used in the planning stages that proceed production and marketing. One of the central problems derives from the fact that the life of the product is frequently less (a season) than the set-up and production time (nine months to a year). During the marketing stages, more information becomes available, but there is little opportunity for making adjustments to production and marketing strategies that were based on the initial unadjusted forecasts. I delineate the problems inherent in using conventional forecast systems and look at how modification or innovations in distribution and marketing systems can help management to arrive at more effective forecasts.

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