ISF 93 - The Thirteenth Annual

INTERNATIONAL SYMPOSIUM ON FORECASTING

8:00 a.m. June 10 - 1:30 p.m. June 12, 1993
Pittsburgh, Pennsylvania, USA
at the Pittsburgh Hilton and Towers, Gateway Center

Sponsored by the International Institute of Forecasters, a non-profit organization, collaboration with

H. John Heinz III School of Public Policy and Management
Carnegie Mellon University

and

Richard T. Farmer School of Business Administration
Miami University (Ohio)

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ACKNOWLEDGMENTS

The ISF 93 Committee would like to thank the following institutions for making important contributions to the organization of the symposium and/or to the preparation of the program book:

The H. John Heinz III School of Public Policy and Management, Carnegie Mellon University

The Richard T. Farmer School of Business Administration, Miami University (Ohio)

We would like to thank the following people for providing special help in organizing sessions and recruiting speakers:

Celal Aksu

Jim Thompson

Tom Yokum

City of Pittsburgh
Sophie Masloff, Mayor

February 24, 1993

Dear Friends:

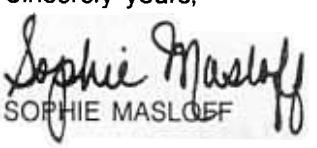
Welcome to Pittsburgh.

As Mayor, I am delighted to personally welcome the International Institute of Forecasters Conference to the City of Pittsburgh. We are delighted to be your hosts.

While you are here, I urge you to take a good look around. Pittsburgh in the 1990s is a city poised for opportunity. No longer a smokey city, Pittsburgh's economy is diversified with growth in the areas of high tech and biomedical research. We enjoy new partnerships with our world class universities that are generating exciting new research about the opportunities within the global marketplace. Within walking distance of your conference hotel, you will find the best of Pittsburgh's cultural and retail amenities: our symphony, ballet, opera and sports teams. Please take a walk and explore our unique ethnic neighborhoods. Sample one of our restaurants. I am sure you will find Pittsburgh has a little something for everyone's taste.

I thank you for choosing Pittsburgh for your conference and I hope you will come back again soon for a visit.

Sincerely yours,



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City of Pittsburgh

By virtue of the authority vested in me as Mayor of the City of Pittsburgh, I do hereby proclaim June 9 to June 12, 1993 as

INTERNATIONAL INSTITUTE OF FORECASTERS DAYS

throughout the City of Pittsburgh to focus attention on the International Symposium on Forecasting taking place at the Pittsburgh Hilton and Towers; to officially welcome these professional researchers and practitioners from different countries, disciplines and organizations who have come together to unify the art and science of forecasting; to wish all in attendance much success in hopes that this meeting is both memorable and productive to the field of forecasting.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the City of Pittsburgh to be affixed.

Date **February, 1993**

Sophie Masloff

Sophie Masloff, Mayor

THE THIRTEENTH INTERNATIONAL SYMPOSIUM ON FORECASTING

Pittsburgh, Pennsylvania, USA
June 9 - 12, 1993

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MESSAGE FROM THE GENERAL CHAIRPERSON

Dear Conferees,

Welcome to the 13th International Symposium on Forecasting! We have an exciting program for you and are anxious to get it under way.

While continuing to address forecasting applications and methods of importance as in past symposiums, this conference places more emphasis on organizational-level forecasting issues. In this vein, our distinguished plenary and featured session speakers will address topics like competitiveness, quality management, communication of risks, new forms of manufacturing, new products, the workings of capital markets, and methods that deal with structural change--all in regard to forecasting.

Our breakout sessions have several parallel tracks designed to meet varied kinds of forecasting interests and needs. We believe that both academics and practitioners will be able to find sessions of interest throughout the conference. It is particularly pleasing that we will be honoring Robert G. Brown on his 70th birthday with special sessions. Bob Brown has had profound impacts on both the theory and practice of forecasting.

There are many social activities that will be taking place, so we will have many opportunities to meet new people and share interests. For many of you unfamiliar with Pittsburgh, I am sure that you will be very pleasantly surprised with the beauty and vitality of this city. June is a great month to be in town. Culturally, there is an abundance of activity and the beautiful Pittsburgh Hilton places us right in the middle of it all.

Lastly, I want to extend thanks to the organizers of the conference--especially Anne Koehler, Hans Levenbach, John Snyder, and Coral Davis I also wish to warmly thank the session organizers; presenters; the hotel staff at the Pittsburgh Hilton; and, of course, you, for attending this great conference.

Yours sincerely,

Wil

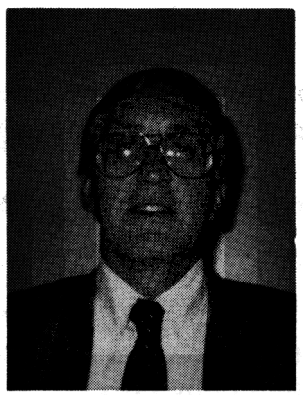
Wilpen L. Gorr
General Chairperson

ISF 93 ORGANIZING COMMITTEE

Wilpen L. Gorr
General Chairperson

Anne B. Koehler
Program Co-Chairperson

Richard T. O'Connell
Program Co-Chairperson



Hans Levenbach
Financial Chairperson

John R. Snyder
Exhibits Chairperson

Coral Davis
Local Arrangements

Fred Collopy
Academic Liaison

Robert Goodrich
Corporate Liaison

GENERAL INFORMATION

Registration and Message Center

The Symposium registration area is located in the foyer of the Mezzanine Level. Registration Desk hours are as follows:

Wednesday	June 9	7:30 a.m. - 5:30 p.m.
Thursday	June 10	7:30 a.m. - 7:00 p.m.
Friday	June 11	7:30 a.m. - 7:00 p.m.
Saturday	June 12	7:30 a.m. - 10:00 a.m.

A bulletin board will be located in the registration area for personal messages, phone calls, announcements, changes in program, etc.

Badges

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

Business Center

FAX machines, copiers, computers, and secretarial services, to name a few, are available for a fee to conferees in the hotel's Executive Center located on the Lobby Level.

Continental Breakfasts, Coffee Breaks, and Luncheons

Continental breakfast will be available Thursday, Friday, and Saturday in the Ballroom ~~Foyer~~ each morning. Coffee and tea will be available during the morning and afternoon breaks in the corridor outside of the session rooms on the Mezzanine Level. Luncheons are held in the King's Gardens which are also located on the Mezzanine Level.

Social Events

Wednesday, June 9

- 5:00 - 7:00 p.m. Welcome Reception will be held in the King's Gardens on the Mezzanine Level.
- 7:30 p.m. Pittsburgh Pirate Baseball at Three Rivers Stadium*

Thursday, June 10

- 8:30 a.m. - 5:00 p.m. — A day-long tour for spouses has been arranged with Gray Line Sightseeing to Falling Water, Edgar Kaufmann's house built by Frank Lloyd Wright.*

- Evening — Free for you to explore the Three Rivers Arts Festival, attend the Civic Light Opera's production of The Wizard of Oz or simply explore any of the many attractions that Pittsburgh has to offer. Feel free to stop at the Registration Desk where you will find an assortment of brochures that will assist you in choosing things to see and do.

Friday, June 11

- 7:30 - 11:00 p.m. — A three-hour river cruise on the Gateway Clipper Fleet's *Party Liner*. Relax with cocktails and dinner while listening to the entertaining sounds of a dixieland jazz band.*

Saturday, June 12

- Noon - 1:30 p.m. — Farewell Reception will be held in the Kings Gardens on the Mezzanine Level.

**PLEASE NOTE:* *The baseball game, spouses tour, and river cruise are all paid events. If you purchased tickets when you mailed in your reservation, they are included in your reservation package and should be picked up at the Registration Desk. For conferees who would like to attend but did not purchase tickets in advance, a limited number of tickets for the baseball game and river cruise will be available for purchase at the Registration Desk.*

Conference Staff

Conference assistants will be available throughout the Symposium to provide help. These aides can be identified by the green "Local Arrangements Committee" ribbon attached to their badge.

Additional Copies of Program Book

Additional copies of this Program Book may be purchased at the registration desk for $10.00. After the conference, copies may be purchased for $15, by contacting Professor Anne B. Koehler, Department of Decision Sciences, Richard T. Farmer School of Business Administration, Miami University, Oxford, OH 45056. Make checks payable to IIF.

SYMPOSIUM HEADQUARTERS The Pittsburgh Hilton and Towers

... is a luxury hotel with 717 rooms recently remodeled at a cost of over $17 million. The location is simply the best in Pittsburgh. Amenities include three excellent restaurants, a fitness center with sauna and steam rooms, jogging course across the street in Point State Park along Pittsburgh's three rivers, foreign currency exchange, multi-lingual staff and multiple-language directories, handicapped rooms, and nonsmoking rooms.

The management and staff welcome you to the PITTSBURGH HILTON AND TOWERS. We are delighted to have you as our guest. Our desire is to make your visit both enjoyable and memorable.

HOTEL SERVICES AND PERSONAL SERVICES

Automobile Rental

Contact our concierge at extension 5140 for assistance.

Babysitters

Touch 5140 for concierge. Note: Babysitting agencies are not affiliated with the Hotel, and as such, the Hotel is not responsible for the services rendered by these agencies.

Baggage Service/Check Room

Arrangements can be made for the handling of luggage, packages, and other articles Touch 62.

Bell Captain

For assistance with luggage and baggage storage Touch 62

Business Center

Located on the lobby level. A full-service office for all needs including secretarial, photocopying, telecopying, and facsimile. Hours: Monday through Friday 7:00 a.m. to 7:00 p.m., Saturday 9:00 a.m. to 12:00 noon. Touch 5353.

Cashier

For assistance with your account or for safe deposit boxes, please contact reception desk. Touch 63.

Check Cashing

Hotel guests wishing to cash checks may do so with the proper credit identification through the Reception Desk. The limit is $50 cash per day and $250 cash per stay.

Check-In/Check-Out Time

Check-In begins at 3:00 p.m Check-Out time is 12:00 noon

Conference Call

Touch 0 for Hotel communications.

Credit Cards

American Express, Optima, Visa, MasterCard, Diners Club, Carte Blanche, Discover

Currency Exchange

International currency exchange rates are available through the reception desk. Touch 63.

Doctor

A list of doctors and medical services in this area is available at the Assistant Manager's desk in the lobby. In case of emergency, touch 66.

Fitness Center

Located on the 4th floor. Hours from 6:00 a.m. - 10:00 p.m.

Guest Service Hotline

If anything in your room is not right, we want to correct it. Please contact our Guest Service Hotline. Touch 69.

Hilton Reservation Service

For immediate reservations at any of our Hilton Hotels worldwide, touch 5455, or dial 1-800-HILTONS.

Housekeeping

The housekeeper will provide special guest room services including irons, iron boards, foam pillows, extra blankets, hair dryers, and cribs. Touch 67.

Ice Machines

An ice machine is located by the elevator lobby on your guest room floor level. On the Towers floors, ice is located on the 24th floor in the Towers Lounge.

Laundry/Valet

Laundry bags and information are located in your guest room closet. One day service, if received by 9:00 a.m., Monday through Friday. Touch 68.

Limo Service

Limousine arrangements available through our concierge. Touch 5140.

Lost and Found

Contact security. Touch 5389.

Mail and Information

Stamps are available at Mail and Information. Guest mail is held at the Reception Desk.

Meetings/Banquet Schedule

Touch Channel 8 on your TV set

Messages

Touch 0 on the phone or 88 on your TV set

Restaurants

The Pittsburgh Hilton & Towers offers full-service restaurants for your dining pleasure.

Restaurant Reservations

For your convenience, advance reservations are suggested for the Sterling's Restaurant. Touch 5311.

Room Service

See our menu in the In Room Dining Section. Room Service is open 6:00 a.m. - 11:30 p.m., Monday through Saturday, 7:00 a.m. - 11:30 p.m. Sunday.

Safe Deposit Boxes

Safe deposit boxes are available free of charge at the Reception Desk.

Shoe Shine

Located on the Lobby Level in the Barbershop/Hair Salon. Touch 5496.

Shopping

Our concierge will be happy to acquaint you with a variety of shopping opportunities. Touch 5140.

Taxi Service

Conveniently located in front circle of Hotel For assistance, touch 5317.

Television

For assistance in adjusting the color on your television set, touch 69.

Telex/Telegram Service/Fax

Telex/FAX service is available through the Business Center (Lobby Level) Monday through Friday, 8:00 a.m. - 7:00 p.m.

Vending

A wide variety of beverages and snacks are available in your Servi-Bar. Key may be obtained at the Reception Desk.

Wake-Up Service

The Hotel operator will schedule your requested wake-up call. Touch 0.

Weather

For the current time and temperature, please touch 64.

HOTEL RESTAURANTS

Sterling's Steak & Seafood Restaurant

A tradition in Pittsburgh for the finest steaks and seafood. Our pastry cart confections are homemade and irresistible. Open seven nights a week from 5:00 p.m. to 11:30 p.m. Touch 5311 for reservations.

The Promenade Cafe

A cafe setting and tasty cuisine are perfect for breakfast, lunch, and dinner. Open seven days a week. Touch 5304.

Scenes

The place to see and be seen. At the center of it all. Scenes offers a great escape for refreshing cocktails and conversation. Open Monday through Saturday, 5:00 p.m. through 12:00 midnight. Touch 5312.

The Pub Sports Bar

Enjoy your favorite draft beer or cocktail in our Sports Bar while meeting friends or just testing your skills at our sports oriented video games or pool table. Featuring four T.V.'s broadcasting sports events all day. Open seven days a week from 11:00 a.m. to 2:00 a.m. Touch 5305.

Room Service

We are as proud of our Room Service meals as any we serve in our restaurants. With good reason. Our standards are just as high in preparing and presenting your breakfast, lunch, dinner, or late night snack. We take extra care to insure that your order is as it should be: on time and complete.

AREA ATTRACTIONS - CITY SIGHTS

THEATER

Benedum Center for the Performing Arts, 719 Liberty Avenue, 456-2600

This sumptuously restored 2,800-seat theater is the new home of the Pittsburgh Ballet, the Pittsburgh Opera, the Civic Light Opera, the Dance Council, plus being the stage for off-broadway productions.

Heinz Hall for the Performing Arts, 600 Penn Avenue, 392-4800. Box Office: 392-4900.

Built in 1926 a an elegant movie palace, Heinz Hall has been renovated into one of Pittsburgh's major performing arts centers. Home of the Pittsburgh Symphony and the Youth Symphony, Heinz Hall also stages concerts, the Pittsburgh Broadway Services, and other popular shows.

MUSEUMS & GALLERIES

Carnegie Science Center, One Allegheny Avenue, 237-3400

The Pittsburgh Hilton & Towers is proud to be the official hotel of our city's newest attraction. Start the day in the four-story high Omnimax Theater. Then check out our universe by gazing at the stars in the planetarium. Don't forget to try all of the hands-on science exhibits and the grand finale of the day is a tour through the World War II submarine, USS Requin (summer season). There is something for the whole family at the Carnegie Science Center. Open 10:00 a.m. to 5:00 p.m., Monday through Thursday; 10:00 a.m. to 9:00 p.m., Friday and Saturday; 10:00 a.m. to 6:00 p.m., Sunday.

Fort Pitt Museum, Point State Park, 281-9284

The Park is located directly across from The Pittsburgh Hilton & Towers. The Fort Pitt Blockhouse, built in 1764, is the last remnant of Old Fort Pitt and is the oldest structure in the city. The Fort Pitt Museum depicts the region's history up to 1800. Open Tuesday through Saturday, 9:00 a.m. to 5:00 p.m.; Sunday, from noon to 5:00 p.m.

The Pittsburgh Children's Museum, Allegheny Center, 322-5058

Founded by the Junior League of Pittsburgh in 1983 and located in the historic old post office building. The Museum offers three floors of interactive exhibits where kids learn through hands-on participation. Hours vary through the year. Call for information.

The Carnegie, 4400 Forbes Avenue, 622-3131

The institute's world-renowned museums house fine art masterpieces, plus exhibits of natural history and anthropology. Open Tuesday through Saturday, 10:00 a.m. to 5:00 p.m.; Sunday from 1:00 p.m. to 5:00 p.m. Extended hours on Friday.

PRE-CONFERENCE WORKSHOPS

HANDS-ON FORECASTING SKILLS

Workshop 1a: Introduction to Time Series Forecasting
Wednesday, June 9, 8:30 a.m. to 12:00 Noon
Dr. Hans Levenbach, President of Delphus, Inc. and Dr. Jeanne Doll, IBM

Goal: Provide an introduction to time series forecasting concepts and methods. Participants will receive a complimentary copy of *The Spreadsheet Forecaster*, a comprehensive set of spreadsheet templates for forecasting.

Workshop 1b: Advanced and Multivariate Time Series Methods
Wednesday, June 9, 1:30 to 5:00 p.m.
Dr. Robert Goodrich, President of Business Forecast Systems and Eric Stellwagen, Business Forecast Systems

Goal: Provide an overview of the most commonly-used advanced time series methods and multivariate models.

SENIOR MANAGEMENT SEMINAR

Workshop 2: A Unified Corporate Approach to Inventory, Production, and Distribution
Wednesday, June 9, 1:30 to 5:00 p.m.
Dr. Robert G. Brown, President, Materials Management Systems

Goal: Establish a unified corporate approach to improve product forecasting, balance inventory costs, reduce lead time, and provide a decision-oriented database.

Please Note: Workshops are not part of the regular ISF program. Separate registration fees are required. The fees for Workshops 1a and 1b are $150 each. The fee for Workshop 2 is $250. Registration fees are payable in advance or at the registration desk.

ROUNDTABLES ON BRIDGING THE GAP BETWEEN THEORY AND PRACTICE IN FORECASTING

Richard De Roeck
Tucson, Arizona 85745, USA
Essam Mahmoud
American Graduate School of International Management, Glendale, Arizona 85306, USA

The International Institute of Forecasters recognizes the importance of closing the communication gap between researchers and practitioners in the field of forecasting.

In the summer of 1990, at the Delphi conference in Greece, much dialogue took place in a very informal atmosphere addressing the possible causes of such a gap. As a result, roundtables were held at the 1991 New York symposium and the outcome of these sessions was written up in *Bridging the Gap Between Theory and Practice in Forecasting* by Mahmoud et al. (IJF 8, 1992). This issue has been strongly supported by both the current and past presidents of IIF as well as many members of the institution.

The momentum of Delphi and New York will continue in Pittsburgh '93. Two roundtables will be held -- one on June 10 and one on June 11, both from 2:00 p.m. to 3:30 p.m. Forecasting in all of its aspects is the only topic of the proposed dialogue. This year we will focus on finding solutions to closing the gap. In particular, we will try to identify problems that practitioners continually face in the implementation of their forecasts and what the researchers could offer to overcome these problems. Moreover, researchers will benefit from the dialogue by implementing many practical issues or examples in the classroom.

Hopefully, the dialogue will generate an agenda for future work, not only at the annual symposium where an award is presented to the best forecaster of the year, but also through the ongoing network of both researchers and practitioners connected with this effort.

All interested in participating in this challenging roundtable are invited to register at the main desk.

PLENARY PANEL SESSION

MOST IMPORTANT DEVELOPMENTS IN FORECASTING: PAST AND PRESENT

CHAIR --Moderator: *J. Scott Armstrong*
The Wharton School, University of Pennsylvania, Philadelphia, PA 19104, USA

Panel Members:

Robert Fildes
Department of Operational Research and Operations Management, Management School, Lancaster University, Lancaster LA1 4YX, UK

Robyn Dawes
Department of Social and Decision Sciences, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Michael Lawrence
Department of Information Systems, University of New South Wales, Kensington 2033, NSW, Australia

Keith Ord
Management Science and Information Systems, Pennsylvania State University, University Park, PA 16802, USA

Each of the panel members has been asked to identify the most important advance in forecasting over the past decade. "Most important" is judged in terms of improvement (actual or potential) in the ability to make forecasts. Many organizations may not have taken advantage of these developments. In addition, each panel member will describe "a specific research project that he believes will produce the most important findings over the next decade." Given the diversity of our panel, it should be interesting to see how much they agree on the past and future. Also of interest is how can we fund the research with the highest payoff?

Scott Armstrong has been working on forecasting problems since he first met a time series at Eastman Kodak in 1960. From his experience there and at Xerox and Polaroid, he learned that poor forecasting produces poor planning which reduces profitability ... and that organizations often forecast poorly. His life as a marketing professor at Wharton for the last 25 years has convinced him that much that he knew about forecasting in 1960 was wrong. An optimist by nature, he expects that expert systems will replace forecasters.

9:00 - 10:00 A.M. **THURSDAY** **BALLROOM 2**

PANEL MEMBERS

Robyn M. Dawes

Robyn M. Dawes is a Professor of Psychology in the Department of Social and Decision Sciences at Carnegie Mellon University. He served as that department's head for a five-year term. He has recently been named a University Professor at CMU. He is the author of over 130 journal articles and four books (one, *Rational Choice in an Uncertain World*, 1988, having received the 1990 William James Book award of the Division of General Psychology of the American Psychological Association).

Robert Fildes

Robert Fildes is Editor-in-Chief of the *International Journal of Forecasting* and Professor in the Management School, Lancaster University. He has published four books in forecasting and planning. He was co-founder in 1981 of the International Institute of Forecasters and in 1985 of the *International Journal of Forecasting*. He has published numerous articles in academic journals, including *Management Science*, and the *JORS*.

Michael Lawrence

Michael Lawrence is Professor of Information Systems at the University of New South Wales. He received his Ph.D. from the University of California, Berkeley in 1967. His previous working experience includes 8 years at Corning Glass Works and Ciba-Geigy Corporation. His primary research interests are in forecasting and decision making, particularly focused on how human judgment can be appropriately supported by computer systems.

J. Keith Ord

Keith Ord is the David McKinley Professor of Business Administration and Professor of Statistics at the Pennsylvania State University. His research interests include forecasting and applied statistical modeling and he remains committed to the view that simpler is not necessarily better when making forecasts.

PLENARY SESSION

FORECASTING, INFORMATION QUALITY, AND STRATEGIC MANAGEMENT

A. Blanton Godfrey
Chairman and CEO, Juran Institute, Inc., 11 River Road, Wilton, CT 06897, USA

Total Quality Management -- three buzz words in the 1990s. What is really happening in leading companies? What is working, what is not working? In this presentation, I shall try to answer these questions and focus some of my remarks on forecasting quality, information quality, and strategic management. Information quality is a relatively new area of quality management. Few companies have fully realized the critical impact on company operations of the quality of their information flows. Incomplete information, data errors, open feedback loops, and incorrect models are causing companies losses of large sums of money and dissatisfied customers. We often see the effects of the lack of information quality management. We also often see the impact of poor forecasts. There are many reasons for these poor forecasts. Few are related to the mathematics or technology. Most are related to the quality of the information or the strategic use of the forecasts. Many companies in the US are still struggling with strategic quality management and strategic planning. The quality improvement activities of the company are only loosely tied to strategic goals. There is much activity, but few results. There is little impact on the bottom line, little improvement in customer loyalty. Other companies have carefully constructed a strategic quality plan. Their quality activities are clearly linked to the strategic goals, the key objectives and the company's vision. Their results have been truly stunning.

A. Blanton Godfrey is Chairman and Chief Executive Officer of Juran Institute, Inc. Juran Institute is respected worldwide for its creative leadership in managing for quality which had its origin in the writings and training courses of Dr. Joseph M. Juran. Founded in 1979, Juran Institute provides a wide range of educational products and services devoted to the concepts of managing for quality -- quality goods, services, and processes. Prior to joining Juran Institute in August, 1987, Dr. Godfrey was with AT&T Bell Laboratories in Holmdel, New Jersey. He headed the Quality Theory and Technology Department which is responsible for applied research in the areas of quality, reliability, and productivity. Dr. Godfrey holds an M.S. and Ph.D. in Statistics from Florida State University, and a B.S. in Physics from Virginia Tech. He is an Adjunct Associate Professor at Columbia University where he teaches a graduate course in quality management and control in the School of Engineering and Applied Science. He is co-author of *Modern Methods for Quality Control and Improvement*, John Wiley and Sons, 1986. In 1987, it was named book of the year by the Institute of Industrial Engineers. He is also a co-author of *Curing Health Care: New Strategies for Quality Improvement* published in 1990 by Jossey-Bass. From 1987 through 1990, he contributed to the creation of the Malcolm Baldrige National Quality Award and Served as a judge for the first three years of the award.

12:00 - 2:00 P.M. THURSDAY LUNCHEON SPEAKER KINGS GARDENS

PLENARY SESSION

WHAT DO FORECASTS (SEEM TO) MEAN?

Baruch Fischhoff
Department of Social and Decision Sciences, Carnegie Mellon University, Pittsburgh, PA 15213, USA

A forecast is just the set of probabilities attached to a set of future events. In order to understand a forecast, all one needs to do is to interpret those two bits of information. Unfortunately, there are pitfalls to communicating each element, so that the user of a forecast understands what its producer means. These potential problems begin with ambiguity regarding the event being predicted and just what is being said about it. They continue with the difficulty of determining the relevance of the problem that the forecaster has solved for the problem that the user is facing, and then go on to epistemological and sociological issues of trust and context. A simple framework will be offered for considering these communication problems, and then illustrated with a mixture of data and speculations. Some thought will be given to the criticality of these problems, and to procedures that might reduce them.

Baruch Fischhoff is Professor of Social and Decision Sciences and of Engineering and Public Policy at Carnegie Mellon University. He holds a B.S. in mathematics from Wayne State University and an M.A. and Ph.D. in psychology from the Hebrew University of Jerusalem. He is recipient of the American Psychological Association's Early Career Awards for Distinguished Scientific Contribution to Psychology (1980) and for Contributions to Psychology in the Public Interest (1991). He is a Fellow of the Society for Risk Analysis, as well as recipient of its distinguished Achievement Award (1991). He is a member of the Institute of Medicine of the National Academy of Sciences. In 1991, he received the SRA Distinguished Contribution Award of the Society for Risk Analysis. He has been on the editorial board of the Society's journal since its inception and was a plenary speaker at its Philadelphia meeting.

9:00 - 10:00 A.M. **FRIDAY** ~~BALLROOM 2~~ KINGS GARDENS

PRESIDENTIAL ADDRESS

FORECAST EDUCATION: DOES IT MAKE A DIFFERENCE?

Stuart Bretschneider
Associate Director, Center for Technology and Information Policy, The Maxwell School, Syracuse University, Syracuse, NY 13244, USA

Over the past decade, the amount and quality of research on forecasting has dramatically increased. Many universities offer formal courses in forecasting and there has been a growing interest in professional certification of forecasting. All this suggests that there now exists a critical mass of knowledge surrounding forecasting, which is transferable through formal educational mechanisms. One of the central issues in forecasting, and a major ingredient in a formal course on forecasting is the relative accuracy of human judgmental forecasts versus simple quantitative methods. This paper reports on an experiment designed to test the hypothesis: individuals with formal training in forecasting will be more accurate in applying judgment to forecasting than individuals without such training.

Dr. Stuart Bretschneider is currently a Professor of Public Administration at Syracuse University's Maxwell School of Citizenship and Public Affairs. Upon arriving at the Maxwell School in 1982, and with the aid of a grant from the Mellon Foundation, Dr. Bretschneider integrated computer and information management into the school's Public Administration curriculum. He also served on the National Association of Schools of Public Affairs and Administration's (NASPAA) ad-hoc committee for computer education in Public Administration. Over the past decade, Dr. Bretschneider has continued to actively enhance all aspects of the computer and information education at the Maxwell School. Dr. Bretschneider is also Associate Director of Syracuse University's Technology and Information Policy Program (TIPP). The Maxwell School's Technology and Information Policy Program functions in conjunction with the L. C. Smith School of Engineering's Institute for Energy Research, in which Dr. Bretschneider also serves as a Senior Research Associate. His current research interests include public management, information systems, technology assessment and forecasting, public sector financial forecasting, decision-making in public organizations, and applied statistics. Dr. Bretschneider has published over twenty articles in journals such as *Management Science, Decision Sciences, Public Administration Review, International Journal of Forecasting,* and *Evaluation Review*. A Director and currently President of the International Institute of Forecasting, Dr. Bretschneider also serves as an Associate Editor for the *International Journal of Forecasting*. Dr. Bretschneider is currently the new Managing Editor for the *Journal of Public Administration Research and Theory*. He is a member of the Institutes of Management Science, ACM, ASPA, and the International Institute of Forecasting.

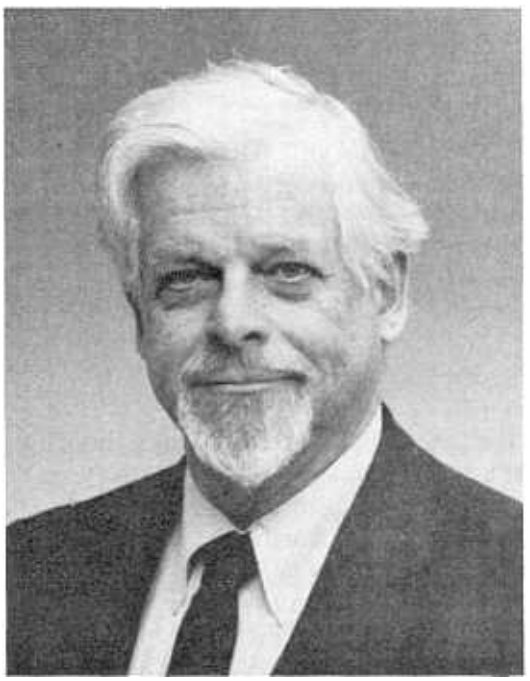
12:00 - 2:00 P.M. FRIDAY LUNCHEON SPEAKER KINGS GARDENS

FEATURED SPEAKER

ONE-CAST, TWO-CAST

Robert G. Brown
President, Materials Management Systems, Inc., P.O. Box 239, Thetford Center, VT 05075, USA

When I started to use war-time operations research for peace-time industry, an obvious area of application was production and inventory control. There was a modest body of literature about the theory which usually stipulated, "If usage will be f(x) then ...". It seemed to me to be important to have an operational means for concluding just what f(x) is. That started me on the first rung of a tall ladder to develop practical methods of forecasting. Looking back, I don't think those early efforts were worth a full four (or fore).



Robert G. Brown is founder and president of a small consulting firm: Materials Management Systems, Inc., which still specializes in forecasting, inventory management, production planning, and control. Mr. Brown holds a bachelors degree and a masters degree from Yale University. He has published several books: *Statistical Forecasting for Inventory Control (1959), Smoothing, Forecasting and Prediction of Discrete Time Series (1963), Decision Rules for Inventory Management (1967), Management Decisions for Production Operations (1971), Source Book in Production Management (1971), Materials Management Systems (1977), Advanced Service Parts Inventory Control (1982), Shirley He Hath Born (1984),* and *Consultantmanship (1993).* He has held teaching appointments at Yale, Boston, Northeastern, and Lehigh Universities. He is a member of the Yale Club of New York City, the Royal Scottish Automobile Club (Glasgow) and the Athenaeum (London). He is also a member of quite a few professional societies.

SPECIAL SESSIONS IN HONOR OF R. G. BROWN'S 70TH BIRTHDAY

SESSION I **THURSDAY** **10:30 - 12:00** **RIVERS**

CHAIR: *Lilian Shiao-Yen Wu*, IBM Research Division, T. J. Watson Research Center

BOB BROWN
Lilian Shiao-Yen Wu, IBM Research Division, T. J. Watson Research Center
ONE-CAST, TWO-CAST
Robert G. Brown, President, Materials Management Systems, Inc.

SESSION II **THURSDAY** **4:00 - 5:30** **RIVERS**

CHAIR: *James G. Thompson*, Delphus, Inc.

FORECASTING SERVICE PARTS WITHOUT HISTORY: THE SATURN EXPERIENCE
Carl V. Cull, Saturn Corporation
WHICH COLOR WILL YOU WEAR TOMORROW, AND WHICH ONE A YEAR FROM TOMORROW?
Alan Dransfield, Textile Products Division, Ciba-Geigy Corporation
A SUCCESSFUL PARTNERSHIP, R. G. BROWN AND XEROX CORPORATION
James McDonald, Xerox Corporation

SESSION III **FRIDAY** **10:30 - 12:00** **RIVERS**

CHAIR: *James G. Thompson*, Delphus, Inc.

THE PERILS OF SERVICE PARTS FORECASTING
Larry M. Newbanks, Caterpillar, Inc.
APPROACHING THE YEAR 2000: HOW TECHNOLOGY IS HELPING SYNCHRONIZE PLANNING BETWEEN CUSTOMERS, SUPPLIERS, AND THIRD PARTIES
James G. Thompson, Delphus, Inc.

SESSION IV **FRIDAY** **4:00 - 5:30** **RIVERS**

CHAIR: *Stephen A. DeLurgio*, Bloch School, University of Missouri-Kansas City

THE THEORETICAL, PRACTICAL, AND CONTINUING CONTRIBUTIONS OF ROBERT G. BROWN IN FORECASTING SYSTEMS
R. G. Brown, Materials Management Systems
Carl Bhame, American Software, Inc.
James G. Thompson, Delphus, Inc.
Lilian Wu, IBM Research Division, T. J. Watson Research Center
Stephen A. DeLurgio, Bloch School, University of Missouri-Kansas City

FEATURED SPEAKER

FORECASTING ECONOMIC TRANSFORMATION: THE RISE AND GLOBAL TRANSFER OF KNOWLEDGE INTENSIVE PRODUCTION SYSTEMS

Chair and Speaker: *Richard Florida*
Heinz School, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Panel Members:

Sam Cole
Center for Regional Studies, Hayes Hall, SUNY Buffalo, Main Street Campus, Buffalo, NY

Richard Meltzer
Advanced Systems Engineer, EDS, Detroit, Michigan

Davis Jenkins
Applied Learning, New Standards Project, LRDC, University of Pittsburgh, Pittsburgh, PA

Technologically advanced economies are undergoing an epochal transformation from a mass production system where the principal source of value was physical labor to a new era of innovation-mediated production where the principal component of value-creation, productivity and economic growth is knowledge and intellectual capabilities. This new era of innovation-mediated production will require deep and fundamental changes in the organization of enterprise, regions, nations, and international economic and political institutions. Survival in this new era will require the development of new organizational forms and systems, such as teams and new incentive systems, which decentralize decision-making, mobilize intellectual capabilities, and harness the knowledge and intelligence of all members of the organization. This presentation will focus on fundamental trends that are emergent in this new age of capitalism and use real world examples to draw key lessons for the development of enterprise, regional, and national strategies. Given this changed environment, forecasting cannot be based on the assumptions of the old system of mass production organization, but must take into account the emergent tendencies of capitalism in the age of innovation-mediated production.

Richard Florida is Associate Professor of Management and Public Policy at Carnegie Mellon University's Heinz School of Public Policy and Management. A noted expert on Japanese companies in the United States, he works closely with business and government to develop innovative approaches to business strategy and economic revitalization. He serves as consultant and advisor to multinational corporations and federal and state government agencies. Dr. Florida has written more than 50 articles and his research has been featured in numerous newspapers and magazines in both the United States and Japan. His new book, *Beyond Mass Production: The Japanese System and Its Transfer to the United States,* coauthored with Martin Kenney, examines the successes and failures of more than 400 Japanese "transplant" companies in the automobile, steel, tire, and electronics industries. His 1990 book, *The Breakthrough Illusion: Corporate America's Failure to Move from Innovation Mass Production,* is the definitive study of why American industry fails to turn cutting-edge innovations into successful commercial products.

FEATURED PANEL SESSION

PANEL: THE NEW FORECASTING CHALLENGE -- NETWORKED MANUFACTURING

CHAIR -- Moderator: *Pierre Lefrancois*
Groupe de recherche en gestion logistique, Faculté des sciences de l'administration, Université Laval, Ste-Foy, Quebec, Canada G1K 7P4

Panel Members:

Essam Mahmoud
American Graduate School of International Management, Thunderbird University, Glendale, AZ 85306, USA

Thomas Morton
Graduate School of Industrial Administration, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Timothy A. Davidson
Mercer Management Consultants, 99 Hayden Avenue, Lexington, MA 02173, USA

Current industrial megatrends indicate that the forthcoming manufacturing environment is to be characterized by technology-intensive networked entrepreneurial firms having to produce an evolving variety of parametric products in small series or to order -- this under high pressures for concurrent performance in price, quality, response time, service and product time from design to market. The overall manufacturing environment is to be information rich, as exemplified by the massive invasion of high-powered low-cost computing work stations and the worldwide implementation of pan-industry computer-integrated manufacturing networks. This panel discussion will first try to identify the major challenges, both from a theoretical and a practical point of view, facing forecasters in a networked manufacturing environment: new product forecasting, forecasting MRP-driven demand, forecast errors costing, etc. The discussions will then try to propose a research agenda to help analyze, understand, and solve some of these problems.

Pierre Lefrancois is associate professor of quantitative methods and operations management in Department operations et systemes de decision and codirector of Groupe de recherche en gestion de la logistique at Université Laval. He received a M.Sc. in computer sciences and operations research from Université de Montréal and a Ph.D. in management science from Université Laval. His research interests are in production planning and control, stochastic modeling, object-oriented manufacturing systems, and time series forecasting.

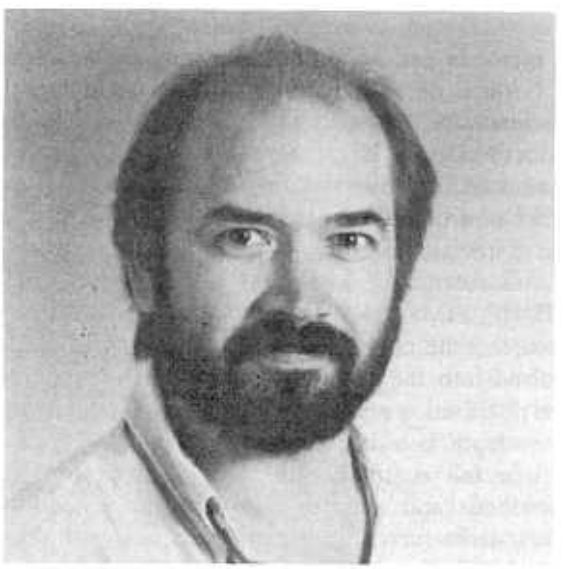
He is the author of articles in journals such as *International Journal of Forecasting, International Journal of Production Research, IIE Transactions* and *Journal of Intelligent Manufacturing.* He is a member of IIE, IIF, TIMS, ORSA, APICS, and IEEE. As codirector of Groupe de recherche en gestion logistique, Professor Lefrancois is deeply involved into the study of the architecture of intelligent production and distribution networks. The research undertaken takes advantage of in-depth knowledge of the multiple facets of logistic networks in their full complexity in view of proposing concepts, approaches, methods and tools to maximize the potential of the networks. His specific current research works deal with the design, organization, and operation of the internal manufacturing network of industrial firms, the design and management of symbiotic firms, and networks of firms driven by massive subcontracting and the elaboration of a theoretical methodology for modelling intelligent logistic networks and the development of software environments to support such modelling. These researches are funded by NSERC, FCAR and CEFRIO.

FEATURED SPEAKER

ARTIFICIAL NEURAL NETWORKS: FORECASTING TOOL OF THE FUTURE?

Halbert L. White, Jr.
Department of Economics, University of California, San Diego, La Jolla, CA 92093, USA

Artificial neural networks are a class of models developed by cognitive scientists interested in understanding how brains process information. In their simplest form, these models can be interpreted as parametric nonlinear regression models, capable of "learning" using various parametric estimation methods. The extreme flexibility of these models underlies their successful use in a wide range of application areas, ranging from diagnosis of heart attacks to control of automobile engines. These models have also been applied to various forecasting problems. In this talk, I give an introduction to artificial neural network models from a forecasting perspective, and discuss practical aspects of using these models for forecasting, illustrated with an application to forecasting foreign exchange rate movements.



Halbert White, Ph.D. is Professor of Economics at the University of San Diego (UCSD), and is a member of UCSD's Institute for Neural Computation. A native of Kansas City, Missouri, Dr. White attended Princeton University, where he graduated as valedictorian. He received his doctorate in economics from MIT in 1976, and has since taught and conducted research in econometrics. From 1987 onwards, much of Dr. White's research has been devoted to understanding the capabilities and limitations of artificial neural networks using modern statistical methods. He has published numerous articles in economics, statistics, and neural networks. His books include *Asymptotic Theory for Econometricians* (Academic Press, 1984), *A Unified Theory of Estimation and Inference for Nonlinear Dynamic Models* (Basil Blackwell, 1988), and *Artificial Neural Networks: Approximation and Learning Theory* (Basil Blackwell, 1992). In recognition of his work in these areas, he has been elected a Guggenheim Fellow and a Fellow of the Econometric Society. A major focus of Dr. White's current research is the application of neural network and nonparametric statistical methods to time series forecasting.

2:00 - 3:30 P.M. **FRIDAY** **BRIGADE**

PLENARY AND FEATURED SESSIONS

Day and Time	Location	Speakers
Thursday		
9:00 A.M.	Ballroom 2	MOST IMPORTANT DEVELOPMENTS IN FORECASTING: PAST AND PRESENT *J. Scott Armstrong, Robyn Dawes, Robert Fildes, Michael Lawrence, Keith Ord*
10:30 A.M.	Rivers	IN HONOR OF R. G. BROWN'S 70TH BIRTHDAY I *Lilian Shiao-Yen Wu, Robert G. Brown*
12:00 NOON	King's Gardens	FORECASTING, INFORMATION QUALITY, AND STRATEGIC MANAGEMENT *A. Blanton Godfrey*
2:00 P.M.	Rivers	FORECASTING ECONOMIC TRANSFORMATION: THE RISE AND GLOBAL TRANSFER OF KNOWLEDGE INTENSIVE PRODUCTION SYSTEMS *Richard Florida*
4:00 P.M.	Brigade	THE NEW FORECASTING CHALLENGE: NETWORKED MANUFACTURING *Pierre Lefrancois, Timothy A. Davidson, Essam Mahmoud, Thomas Morton*
4:00 P.M.	Rivers	IN HONOR OF R. G. BROWN'S 70TH BIRTHDAY II *Carl V. Cull, Alan Dransfield, James McDonald*
Friday		
9:00 A.M.	Ballroom 2	WHAT DO FORECASTS (SEEM TO) MEAN? *Baruch Fischhoff*
10:30 A.M.	Rivers	IN HONOR OF R. G. BROWN'S 70TH BIRTHDAY III *Larry M. Newbanks, James G. Thompson*
12:00 NOON	King's Gardens	FORECAST EDUCATION: DOES IT MAKE A DIFFERENCE? *Stuart Bretschneider*
2:00 P.M.	Brigade	ARTIFICIAL NEURAL NETWORKS: FORECASTING TOOL OF THE FUTURE *Halbert L. White, Jr.*
4:00 P.M.	Rivers	IN HONOR OF R. G. BROWN'S 70TH BIRTHDAY IV *R. G. Brown, Carl Bhame, James G. Thompson, Lilian Wu, Steve DeLurgio*

PLENARY AND FEATURED SESSIONS

Saturday

8:30 A.M.	Rivers	REFLECTIONS ON PRACTICAL UTILITY AND APPLICATIONS OF NEW PRODUCT DIFFUSION MODELS *Vijay Mahajan*
10:30 A.M.	Brigade	EARNINGS FORECASTING RESEARCH: ITS IMPLICATIONS FOR CAPITAL MARKETS RESEARCH *Lawrence D. Brown*

SCHEDULE OF SESSIONS IN CHRONOLOGICAL ORDER

Thursday, June 10, 1993	Page	Session	Location
7:30 - 9:00 a.m.		CONTINENTAL BREAKFAST	Ballroom Foyer
9:00 - 10:00	1	OPENING PLENARY SESSION Plenary Panel - J. Scott Armstrong	Ballroom 2
10:30 - 12:00			
	2	IN HONOR OF R. G. BROWN'S 70TH BIRTHDAY I Featured Speaker - R. G. Brown	Rivers
	3	TOURISM I	Brigade
	4	POPULATION	Allegheny
	5	ACCOUNTING AND FINANCE I	Chartiers
	6	ECONOMIC I (MACRO)	Traders
	7	MODEL IDENTIFICATION & ADJUSTMENT	Forbes
	9	EXCHANGE RATES	Board
	10	NEURAL NETWORKS I	King's Terrace
	11	JUDGMENTAL I	Duquesne
12:00 - 2:00			
	xxi	LUNCHEON Featured Speaker - A. Blanton Godfrey	King's Gardens
2:00 - 3:30			
	12	OPERATIONS I - FEATURED Featured Speaker - Richard Florida	Rivers
	13	SOFTWARE I	Brigade
	14	THEORY AND PRACTICE I	Allegheny
	15	ACCOUNTING AND FINANCE II	Chartiers
	16	ECONOMIC II (MACRO)	Traders
	18	FORECAST ERROR	Forbes
	19	APPLICATIONS I	King's Terrace
	21	JUDGMENTAL II	Duquesne

Page	Session	Location
12:00 - 2:00		
xxiii	LUNCHEON Presidential Address - Stuart Bretschneider	King's Gardens
2:00 - 3:30		
46	OPERATIONS II	Rivers
47	NEURAL NETWORKS II - FEATURED Featured Speaker - Halbert L. White, Jr.	Brigade
48	THEORY AND PRACTICE II	Allegheny
49	ACCOUNTING AND FINANCE V	Chartiers
50	ECONOMIC V (MACRO)	Traders
52	MARKETING I	Forbes
54	UNIVERSITY	Board
55	ECONOMIC IX (CYCLES)	King's Terrace
57	JUDGMENTAL IV	King's Plaza
4:00 - 5:30		
59	IN HONOR OF R. G. BROWN'S 70TH BIRTHDAY IV	Rivers
60	NEURAL NETWORKS III	Brigade
61	TEACHING II	Allegheny
62	ACCOUNTING AND FINANCE VI	Chartiers
63	ECONOMIC VI (MACRO)	Traders
64	MARKETING II	Forbes
66	OPERATIONS III	Board
67	ECONOMIC X (STATIONARITY)	King's Terrace
68	JUDGMENTAL V	King's Plaza

Saturday, June 12, 1993		Session	Location
7:30 - 8:30 a.m.		CONTINENTAL BREAKFAST	Ballroom Foyer
	Page		
8:30 - 10:00			
	70	MARKETING III - FEATURED Featured Speaker - Vijay Mahajan	Rivers
	71	ACCOUNTING AND FINANCE VII	Brigade
	72	OPERATIONS IV	Allegheny
	73	ECONOMIC VII (SEASONALITY)	Traders
	75	STRUCTURAL II	Forbes
	76	COMPARISON I	Board
10:30 - 12:00			
	78	MARKETING IV	Rivers
	80	ACCOUNTING AND FINANCE VIII - FEATURED Featured Speaker - Lawrence D. Brown	Brigade
	81	CHAOS	Chartiers
	82	ECONOMIC VIII (MACRO)	Traders
	83	STRUCTURAL III	Forbes
	84	COMPARISON II	Board

Session Ballroom 2	OPENING PLENARY SESSION	Thursday 9:00 - 10:00

WELCOME

GENERAL CHAIRPERSON: *Wilpen L. Gorr*
Heinz School, Carnegie Mellon, Pittsburgh, PA 15213, USA

MOST IMPORTANT DEVELOPMENTS IN FORECASTING: PAST AND PRESENT

CHAIR -- Moderator: *J. Scott Armstrong*
The Wharton School, University of Pennsylvania, Philadelphia, PA 19104, USA

Panel Members:

Robert Fildes
Department of Operational Research and Operations Management, Management School, Lancaster University, Lancaster LA1 4YX, UK

Robyn Dawes
Department of Social and Decision Sciences, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Michael Lawrence
Department of Information Systems, University of New South Wales, Kensington 2033, NSW, Australia

Keith Ord
Management Science and Information Systems, Pennsylvania State University, University Park, PA 16802, USA

Each of the panel members has been asked to identify the most important advance in forecasting over the past decade. "Most important" is judged in terms of improvement (actual or potential) in the ability to make forecasts. Many organizations may not have taken advantage of these developments. In addition, each panel member will describe "a specific research project that he believes will produce the most important findings over the next decade." Given the diversity of our panel, it should be interesting to see how much they agree on the past and future. Also of interest is how can we fund the research with the highest payoff?

CHAIR: *Lilian Shiao-Yen Wu*
IBM Research Division, J. Watson Research Center, Yorktown Heights, NY 10598, USA

BOB BROWN

Lilian Shiao-Yen Wu
IBM Research Division, T Watson Research Center, Yorktown Heights,. NY 10598, USA

Bob Brown is an original. My association with Bob Brown began in 1984 when Bob was a consultant for IBM on setting up IBM's personal computer logistics system. Bob started me and so many others on "the first rung of a tall ladder to develop practical methods of forecasting". He has not only been a pioneer in the theory of our subject, but also has had major impact on the practice of forecasting as well.

Earlier this year, I talked to Bob for several days about his views on forecasting in his beloved home in Thetford, Vermont. My talk will be based on those interviews.

ONE-CAST, TWO-CAST

Robert G. Brown
President, Materials Management Systems, Inc., P.O. Box 239, Thetford Center, VT 05075, USA

When I started to use war-time operations research for peace-time industry, an obvious area of application was production and inventory control. There was a modest body of literature about the theory which usually stipulated, "If usage will be f(x) then ...". It seemed to me to be important to have an operational means for concluding just what f(x) is. That started me on the first rung of a tall ladder to develop practical methods of forecasting. Looking back, I don't think those early efforts were worth a full four (or fore).

CHAIR: *Geoffry I. Crouch*
Tourism Management Group, The University of Calgary, Calgary, Canada

AN ANALYSIS OF INTERNATIONAL TOURISM DEMAND FOR TURKEY

Orhan Icoz
Dokuz Eylul University, Buca, Turkey
Turgut Var
Department of Recreation, Park, and Tourism Sciences, Texas A&M University, College Station, TX 77841, USA

The objective of this investigation is to determine the relative importance of the selected variables affecting international tourism demand for Turkey, by using time series data between 1979-1989. These variables are per capita income of the 20 main tourist generating countries, relative exchange rates between tourist generating countries and Turkey, relative prices between these countries and Turkey, distances between these countries and Turkey, and finally, international oil prices. The results indicate that per capita income, distance, and international oil prices variables are significant.

DETERMINANTS OF INTERNATIONAL INBOUND TOURIST EXPENDITURES IN SOUTH KOREA: AN ECONOMIC APPROACH

Choong-Ki Lee, Turgut Var, Thomas W. Blaine
Department of Recreation, Park, and Tourism Sciences, Texas A&M University, College Station, TX 77841, USA

This study provides estimates of demand functions for international inbound tourist expenditures in South Korea. Econometric models for the eight origin countries were constructed on the basis of the following selected variables: real per capita income, relative prices, real exchange rates, and three dummy variables representing two oil crises, and the Seoul Olympic Games. The empirical results show that the income variable is most significant for all countries in explaining the international demand for tourism in South Korea. In general, the variables of relative prices and real exchange rates were also found to be significant and elastic.

FORECASTING SEYCHELLES INBOUND TOURISM

Alan M. Sykes and Stephen F. Witt
European Business Management School, University of Wales, Swansea, SA2 8PP UK

The Seychelles Ministry of Tourism and Transport keeps meticulous records of visiting tourists and produces monthly totals for different countries of origin. This paper looks at the demand for tourism in the Seychelles from the UK over a period of ten years. Explanatory models using standard multiple regression techniques, generalized linear modelling,and general method of data handling type algorithms are derived and contrasted. Implications for future tourism modelling are discussed.

CHAIR: *K. V. Rao*
Department of Sociology, Bowling Green State University, Bowling Green, OH 43403, USA

RATIO-CORRELATION AS A SHORT-TERM COUNTY POPULATION PROJECTION METHOD: A CASE STUDY FOR WASHINGTON STATE

David A. Swanson
Arkansas Institute for Economic Advancement, University of Arkansas, 2801 South University, Little Rock, AR 72204-1099, USA
Donald M. Beck
Pacific Northwest Laboratories, P.O. Box 999, Richland, WA 99352, USA

We propose a new approach to developing short-term county population projections that has a high potential for accuracy without requiring substantial data and intellectual labor inputs. Tests of accuracy examined over three time periods for the method against two commonly-used alternatives using data for Washington State suggest that the proposed method performs well. One advantage of the method is that unlike the two alternatives, formal measures of uncertainty can be constructed in the form of forecast intervals, which also appear to provide accurate assessments of uncertainty associated with county population projections made using the method.

ENROLLMENT PROJECTIONS FOR PUBLIC SCHOOLS IN OHIO, 1990-2000

S. Rao Didugu
Department of Sociology, Bowling Green State University, Bowling Green, OH 43403, USA

The importance of school enrollment projections in the educational planning has been realized for a long time. Accurate forecasting facilitates administrators to consider options and plan to make necessary adjustments in the infrastructure such as buildings, classrooms, and teachers. Since enrollments are closely related to the three components of population change (births, deaths, and migration), any changes in these demographic components have profound impact on the enrollment trends. Forecasters employ various projection techniques relating school enrollments with these components.

FORECASTING PATTERNS OF BLACK HOMICIDES IN ATLANTA: 1990-2000: APPLICATION OF ARIMA MODELS

Komanduri S. Murty
Clark Atlanta University, 740 Beckwith Street, SW, Atlanta, GA 30314, USA
K. V. Rao
Department of Sociology, Bowling Green State University, Bowling Green, OH 43403, USA

Atlanta, Georgia, ranks first among cities in the U.S. in violent crime rates and third in homicide rates. This research proposes an analysis of homicide patterns in Atlanta from 1990 through 2000, in terms of homicide rates by victim-offender relationship, race and gender of both perpetrators and victims, perpetrators' motives, weapons utilized, and seasonal variation (month, day, and time of homicide). Motives are classified as follows: verbal argument, emotional argument, sex related, lovers tiff, alcohol and drug, theft, and other. Homicide patterns will be analyzed by both statistical and graphic methods. Annual percentage change in homicides by all aforementioned variables will be compared and tested for statistical significance utilizing t-test procedures. Autoregressive methods (ARIMA) are employed to predict the homicide trends by 2000.

CHAIR: *Michael Gift*
Edwin L. Cox School of Business, Southern Methodist University, Dallas, TX 75275, USA

THE ASSOCIATION BETWEEN THE DISPERSION OF ANALYSTS FORECASTS AND MARKET MEASURES OF UNCERTAINTY

Bradford Cornell
Graduate School of Management, University of California, Los Angeles, CA 90024, USA
John Gould
Cornerstone Research, 1000 El Camino Real, Menlo Park, CA 94025, USA
Wayne Landsman
Kenan-Flagler Business School, University of North Carolina, Chapel Hill, NC 27599-3490, USA

This study provides an extended examination of the relation between trading volume and the arrival of information as captured in analysts earnings data. Much of the prior empirical literature has been limited due to either design or data considerations. New insights are sought through: 1) the use of the I/B/E/S Individual Analysts (Detail) database from which more timely estimates of dispersion can be developed, 2) an extended examination of the earnings uncertainty/volume relation into the returns domain (variability), and 3) examining the stability of these relations over a period of significant market volatility, the market crash of 1987.

CHARACTERISTICS OF INDIVIDUAL ANALYSTS' EARNINGS FORECAST REVISIONS

Kirt Butler
Finance Department, Eli Broad Graduate School of Management, Michigan State University, East Lansing, MI 48824, USA
Lise Graham
Department of Finance, College of Business, University of Wisconsin, La Crosse, WI 54601, USA

This paper investigates the timing and magnitude of individual security analysts' revisions of annual earnings forecasts subsequent to quarterly earnings announcements. The sample consists of 49 large firms with fiscal years ending in December selected from the top 65 firms in the December 1986 Fortune Index. These firms are matched with forecasts of primary earnings per share before extraordinary items from an I/B/E/S database of individual analyst forecast supplied by Lynch, Jones, and Ryan for the period 1983-1986. Initial results indicate that positive earnings announcements are associated with larger forecast revisions than are negative announcements. Also, forecast revisions for firms which report early in the announcement cycle are less timely than those which report late in the cycle.

HOW GOOD ARE ANALYSTS' FORECAST OF EARNINGS? COMPARE THEM WITH ACCURACY OF THE AUDITORS THAT AUDIT EARNINGS

Raymond N. Johnson and John Settle
School of Business Administration, Portland State University, Portland, OR 97207, USA

This paper presents a view that reported earnings are imprecise since the audit procedure provides reasonable assurance of freedom from *material* misstatements. Since reported earnings are no more accurate than auditor's materiality estimates, forecasts of earnings cannot be any more precise. An empirical model of auditor's materiality judgements is presented. Using materiality to gauge forecast accuracy, this paper shows that many forecasts are quite accurate. This finding may indicate that analysts focus more on reported earnings than actual underlying earnings. This paper also reveals a systematic bias that is present in EPS forecasts. A company's history of (1) earnings stability and (2) overly optimistic or pessimistic forecasts allows an identification of which forecasts are most likely to be accurate.

CHAIR: *Robert P. Trost*
Department of Economics, George Washington University, Washington, DC 20051, USA

THE FORECASTING ATTRIBUTES OF TREND- AND DIFFERENCE-STATIONARY REPRESENTATIONS FOR MACROECONOMIC TIME SERIES

David N. DeJong
Department of Economics, University of Pittsburgh, Pittsburgh, PA 15260, USA
Charles H. Whiteman
Department of Economics, University of Iowa, Iowa City, IA 52242, USA

We analyze the forecasting attributes of trend- and difference-stationary representations of the U.S. macroeconomic time series studied by Nelson and Plosser (1982). Predictive densities based on models estimated for these series (which terminate in 1970) are compared with subsequent realizations compiled by Schotman and van Dijk (1991) (which terminate in 1988). Predictive densities obtained using the extended series are also derived to assess the impact of the subsequent realizations on long-range forecasts. Of particular interest are comparisons of the coverage intervals of predictive densities corresponding to the competing specifications. In general, we find that coverage intervals based on difference-stationary specifications are far wider than those based on trend-stationary specifications for the real series, and slightly wider for the nominal series. This additional width is often a virtue in forecasting nominal series over the 1971-1988 period, as the inflation experienced during this time was unprecedented in the 1900s. However, the evolution of the real series has been relatively stable in the 1900s hence the uncertainty associated with difference-stationary specifications generally seems excessive for these data.

GAS DEMAND FORECASTING USING CO-INTEGRATION

John C. Parker and James R. Ireland
Consumers Gas, P.O. Box 650, Scarborough, Ontario, Canada M1K 5E3

CRAFT is a system of 157 variables in 55 forecasting equations. The model is used to forecast natural gas demand for three weather zones and four market sectors within the Consumers Gas franchise. It uses co-integration to test long-run relationships in the data. An Error Correction Mechanism (ECM) is used to link the long-run with the short-run. The dichotomy of energy demand being fixed in the short-run due to capital spending fits naturally within the ECM framework. This paper reports typical results, examines the problems of using such a model and discusses possible extensions to the model.

AN INTEGRATED BAYESIAN VECTOR AUTOREGRESSION AND ERROR CORRECTION MODEL FOR FORECASTING ELECTRICITY CONSUMPTION AND PRICES

Fred Joutz and Robert P. Trost
Department of Economics, The George Washington University, Washington, DC 20052, USA
G. S. Maddala
Department of Economics, The Ohio State University, Columbus, OH 43210, USA

In a well-known article, Sims (1980) criticized the Cowles Commission approach to modeling economic time series through a system of simultaneous equations. Since this critique, there has been a shift in the modeling of economic variables from the structural equations approach with strong identifying restrictions endorsed by the Cowles Commission towards a joint time series model with very few restrictions. One such model is the Bayesian vector autoregression (BVAR) model and another is based on the Error Correction Model (ECM) and the theory of cointegration. In this paper, we compare the forecasting performance of these two models with monthly time series data on U.S. residential electricity consumption and price.

CHAIR: *Blyth C. Archibald*
School of Business Administration, Dalhousie University, 6152 Coburg Road, Halifax, N.S., Canada B3H 1Z5

BOX-JENKINS MODEL EQUIVALENCIES

Amitabh Chandra
Department of Computing & Decision Sciences, W. Paul Stillman School of Business, Seton Hall University, South Orange, NJ 07079, USA
George Heitmann
Department of Management Science & Information Systems, Smeal College of Business Administration, Penn State University, University Park, PA 16802, USA
Rose S. Prave
School of Management, University of Scranton, Scranton, PA 18510, USA

Two researchers examining the same sample ACF/PACF pattern may reach different conclusions as to the appropriate ARIMA model to estimate. A parsimonious representation, *ceteris paribus*, is always to be preferred, and adherence to that principle may often lead to unambiguous model identification. Unfortunately, it is easily possible to confuse AR and MA structures for some (usually small) values of ϕ_p and θ_q, because the decay and cut-off patterns that differentiate between the two may not be readily evident. This paper looks at the detailed structure of model equivalencies for p and $q \leq 3$, and provides some guidelines as to the value of ϕ_p and θ_q for which model "misspecification" is likely to occur.

PREDICTION WITH A LINEAR REGRESSION MODEL AND ERRORS IN A REGRESSOR

Bo Jonsson
Department of Statistics, Uppsala University, P.O. Box 513, S-751 20, Uppsala, Sweden

This paper focuses on prediction when a non-stochastic regressor (x) is measured with error. For a wide range of x-values around the mean of x in the estimated period, OLS yields a better predictor in terms of MSE than one based on consistent estimation. This can be so also when x follows a trend and predictions are made for the next observation. When the error variance of the regressor differs between the prediction and estimation periods, a predictor based on a modified OLS estimator, adjusted for that difference, behaves as the OLS predictor in the case of equal error variances.

THE EFFECT OF NON-RESPONDENTS ON SURVEY-BASED FORECASTS

Seppo Pitkanen
Lappeenranta University of Technology, P.O. Box 20, 53851 Lappeenranta, Finland

The paper deals with cases where survey forecasts are produced by using correlations and regression. The common attitude among researchers towards incomplete samples is to check whether the known distributions of background variables correspond to those of the sample. If not, one may weight the sample. Incomplete samples may, however, lead to three types of error: an existing correlation is not observed; the means of the variables are biased; or the correlation observed is not real. Here the last problem is analyzed, and it is shown that conventional significance tests are not powerful enough to prevent a wrong decision.

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ADAPTIVE FORECASTING USING SECOND ORDER EXPONENTIAL AUTOREGRESSIVE MODELS

B. Chandra
Department of Mathematics, Indian Institute o Technology, Hauz Khas, New Delhi 110 016

The paper presents an adaptive forecasting procedure using second order exponential autoregressive models. The procedure has been illustrated on a time series data concerning the number of telephone calls arriving during an interval time at a particular telephone exchange.

CHAIR: *H. O. Stekler*
Industrial College of the Armed Forces, National Defense University, Fort Lesley J. McNair, Washington, DC 20319, USA

THE DYNAMICS OF FOREIGN EXCHANGE RATES: A VARIABLE AND DYNAMIC SPEED OF ADJUSTMENT PROCESS

Yueh H. Chen
Department of Finance, College of Management, National Sun Yat-sen University, Kaohsiung, Taiwan, R.O.C.
Winston T. Lin
School of Management, State University of New York at Buffalo, 325A Jacobs Management Center, Buffalo, New York 14260, USA

This paper proposes an intrinsically non-linear partial adjustment model with dynamic and variable speeds of adjustment to analyze and forecast foreign exchange rates. Theoretically, the dynamic behavior of current and future spot rates is viewed as being determined by the combined effect of a dynamic and variable speed of adjustment function and a desired exchange rate function which is assumed to be linear in some economic variables used to achieve internal and external equilibrium. Empirically, the model is applied to the exchange rates of four major currencies during the time period of January 1973 to December 1990 for four different time horizons. We find that the non-linear dynamic model improves on forecasting performance, implying that non-linearities in the sense of functional forms are exploitable for improved point forecasting of exchange rates.

ECONOMIC CONVERGENCE IN THE CARRIBBEAN

DeLisle Worrell
Central Bank of Barbados, P.O. Box 1016, Bridgetown, Barbados

The countries of the English-speaking Caribbean belong to the Caribbean Economic Community (CARICOM) - an integration grouping that dates from 1973. Although they have made progress in non-economic cooperation, the countries' economic fortunes diverged significantly during the 1970s and 1980s. In the late 1980s, many embarked on uncoordinated stabilization policies, starting with widely different initial conditions. So far, little convergence has been achieved. Using simulations with an econometric model, this paper addresses the following questions: Will current economic policies achieve convergence and over what period? Would an alternative suite of policies provide for more rapid convergence? The model to be used bears a great similarity to those reported in Khan, Monteil and Haque (1991).

EXCHANGE RATE FORECASTING USING ARIMA MODELS

Kuldeep Kumar
Department of Economics and Statistics, National University of Singapore, 10, Kent Ridge Crescent, Singapore

The use of ARIMA models to forecast exchange rates may not be intuitively appealing to one with economics knowledge. However, the factors that influenced the past exchange rates could still be influencing the present exchange rates and the complex system of economy could have brought forth a predictable movement pattern in the exchange rates. This is the idea that underlies the use of ARIMA models to forecast exchange rates and in this paper we have shown that ARIMA models are indeed helpful in forecasting exchange rates. The exchange rates of Singapore dollars has been given as an example.

CHAIR: *Gerson Lachtermacher*
Department of Management Sciences, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G2

AN APPLICATION OF NEURAL NETWORK TECHNOLOGY TO TRADING

Gordon J. Goetsch
900 Tollis Parkway, #404, Broadview Heights, OH 44147, USA

This presentation will discuss the application of neural network technology to the creation of an automated trading decision system. Some background on the evaluation of trading performance in the oil future market and on neural network technology is presented. The neural network based forecasting component of the system is trained on a historical market database of examples and is used to forecast short-term price movements. Technical trading decisions are generated from these forecasts. The system has been applied to the oil futures market and achieved results comparable to human traders.

AN INVESTIGATION OF THE USE OF FEEDFORWARD NEURAL NETWORKS FOR FORECASTING

Gregory R. Madey
Department of Administrative Sciences, Graduate School of Management, Kent State University, Kent, OH 44242, USA

Artificial neural networks (ANNs), in recent years, have become one of the more promising paradigms in computing technology. ANNs are different from any other computing disciplines in that they try to simulate the learning processes of the human brain. We implement the fully connected feedforward neural network model for time-series forecasting using a Generalized Reduced Gradient, version 2, as a method for learning. Both simulated and actual data are used in determining the effectiveness of the neural network as a forecasting model in comparison with the Autobox implementation of the Box-Jenkins model. In general, the best of neural network models were superior to the best of Box-Jenkins models.

BACKPROPAGATION NEURAL NETWORKS IN TIME SERIES FORECASTING

Gerson Lachtermacher and J. D. Fuller
Department of Management Sciences, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1

A major constraint on the use of backpropagation neural networks as a practical forecasting tool is the extreme length of the data series required for estimation of the large number of parameter ("weights") in the neural network. A related problem is the unreasonably long time for the computations that estimate the parameters. To overcome these problems, we use the Box-Jenkins models to identify the series' "principal components", which suggest a small network structure, thus reducing the data required and the computation time. We test the methodology on several series, and compare the forecasting ability with other methods.

CHAIR: *Marcus O'Connor*
University of New South Wales, Kensington 2033, NSW, Australia

AN EXAMINATION OF THE JUDGMENTAL IDENTIFICATION AND EXTRAPOLATION OF TREND IN TIME SERIES

Emma Winton and Bob Edmundson
University of New South Wales, Kensington 2033, NSW, Australia

This study examined the differences between the identification and extrapolation of trend by people. Results indicate that subjects fit a good model of trend in a series, but the extrapolated trend differed from the modelled trend. Subjects had a tendency to damp the trend when extrapolating and to increase the dampening as the forecast horizon increased. They also tended to dampen downward series more than upward series.

AN INVESTIGATION OF COMPONENTS OF JUDGMENTAL FORECASTING SKILL

Thomas R. Stewart and Daniel Bernstein
Center for Policy Research, State University of New York, Albany, NY 12222, USA

The performance of judgmental forecasts depends jointly on a) the environmental or economic system about which forecasts are made, b) the information system that brings data about the environment to the forecaster, and c) the cognitive system of the forecaster. Forecasting performance can be decomposed into seven components: environmental predictability, fidelity of the information system, reliability of information acquisition, reliability of information processing, match between environment and forecaster, conditional bias, and unconditional bias. Measures are available for each of these components, but their statistical properties and sensitivity to changes that affect forecasting performance have not been extensively studied. This paper reports the results of an application of Monte Carlo techniques to investigate how measures of components of skill reflect the nature of the environmental system, the information system, and the cognitive system of the forecaster.

THE ANCHORING AND ADJUSTMENT HEURISTIC IN TIME SERIES FORECASTING

Michael Lawrence and Marcus O'Connor
University of New South Wales, Kensington 2033, NSW, Australia

This paper examines the existence of the anchoring and adjustment heuristic in judgmental time series extrapolation. This heuristic has been shown to be a characteristic of many judgmental decision tasks. The study shows that the heuristic does not describe the behavior of judgmental time series forecasters. Contrary to expectations, the results suggest that people often make excessive, rather than insufficient, adjustments from the anchor.

FORECASTING ECONOMIC TRANSFORMATION: THE RISE AND GLOBAL TRANSFER OF KNOWLEDGE INTENSTIVE PRODUCTION SYSTEMS

Chair and Speaker: *Richard Florida*
Heinz School, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Panel Members

Sam
Center for Regional Studies, Hayes Hall, SUNY Buffalo, Main Street Campus, NY, USA
Richard Meltzer
Advanced Systems Engineer, EDS, Detroit, Michigan, USA
Davis Jenkins
Applied Learning, New Standards Project, LRDC, University of Pittsburgh, Pittsburgh, PA, USA

Technologically advanced economies are undergoing an epochal transformation from a mass production system where the principal source of value was physical labor to a new era of innovation-mediated production where the principal component of value-creation, productivity and economic growth is knowledge and intellectual capabilities. This new era of innovation-mediated production will require deep and fundamental changes in the organization of enterprise, regions, nations, and international economic and political institutions. Survival in this new era will require the development of new organizational forms and systems, such as teams and new incentive systems, which decentralize decision-making, mobilize intellectual capabilities, and harness the knowledge and intelligence of all members of the organization. This presentation will focus on fundamental trends that are emergent in this new age of capitalism and use real world examples to draw key lessons for the development of enterprise, regional, and national strategies. Given this changed environment, forecasting cannot be based on the assumptions of the old system of mass production organization, but must take into account the emergent tendencies of capitalism in the age of innovation-mediated production.

Session Brigade	SOFTWARE I	Thursday 2:00 - 3:30

REFLECTIONS ON FORECASTING SOFTWARE: IS IT MEETING OUR NEEDS?

CHAIR --Moderator: *Leonard J. Tashman*
University of Vermont, Burlington, VT 05405, USA

Panel Members:

Robert L. Goodrich
Business Forecast Systems, Inc., 68 Leonard Street, Belmont, MA 02178, USA
Gary LeVee
Information Advantage Inc., 12900 Whitewater Dr., Winnetonka, Minneapolis, MN 55343, USA
Hans Levenbach
Delphus, Inc., 103 Washington St., Suite 348, Morristown, NJ 07960, USA
Robert S. Rycroft
Mary Washington College, Fredericksburg, VA 22401, USA

The panel will evaluate the present state of forecasting software and suggest areas for future software development. Discussion will include issues regarding *usefulness* in business applications, *educational merit and suitability* in the classroom, and *forecasting methodology* such as up-to-dateness , breadth versus depth of options, and forecasting accuracy.

CHAIR: *Somnath Das*
Accounting Faculty, Haas School of Business, University of California-Berkeley, Berkeley, CA 94720, USA

ANALYSTS' INTERIM EARNINGS FORECASTS: A HORIZON EFFECT IN FORECAST BIAS

Sok-Hyon Kang, John R. O'Brien, Konduru Sivaramakrishnan
Accounting Faculty, Graduate School of Industrial Administration, Carnegie Mellon University, Pittsburgh, PA 15213-3890, USA

In this paper, we test whether quarterly earnings forecasts issued by security analysts are consistent with predictions from the rational expectations hypothesis. In particular, we evaluate the unbiasedness, efficiency, and consistency properties by examining analyst forecasts of quarterly earnings over a *sequence* of forecasting horizons. Our evidence suggests that the expectation formation process underlying analysts' forecasts is adaptive, and yields forecasts that exhibit a negative ex-post bias. Furthermore, we find the degree of bias to be systematically different across different horizons (i.e., a "horizon" effect). This horizon effect is independent of the adaptive process of expectation formation and is indicative of non-informational factors (e.g. analyst incentives) influencing the forecasting process.

IMPACT OF ANALYSTS' FORECASTS ON INVESTMENT DECISIONS

Pradyot K. Sen
Department of Accounting & Law, School of Management, University of Buffalo, State University of New York, Buffalo, NY 14260, USA

When firms of different quality (type) undertake an investment project, absent the information on firm type, the capital market must assign the same valuation to all firms. Such distorted valuation also adversely affects the manager's incentives for making a correct investment decision. This paper shows that if analysts' forecasts have (desirable) characteristics that are likely to improve the "good" firms' market valuation, then they also reduce the distortion of the managers' investment decisions. The results indicate that the analysts' forecasts not only improve the informational efficiency of the market, but also improve the productive efficiency of the firms.

THE NATURE OF ACCURACY AND BIAS IN FINANCIAL ANALYSTS' FORECASTS OF ACCOUNTING EARNINGS

Somnath Das
Accounting Faculty, Haas School of Business, University of California, Berkeley, CA 94720, USA
Praveen Sinha
Department of Accounting & Law, University of Buffalo, State University of New York, Buffalo, NY 14260, USA

Recent research has focussed its attention on documenting systematic differences in the forecasting ability of different analysts. The evidence to date suggests that there is no significant difference in the forecast accuracy across individual analysts once the firm specific and time specific effects are controlled for. The popular belief, however, is quite the contrary. The primary purpose of this paper is to address this apparent inconsistency between a documented evidence of no difference versus the evidence from the behavioral literature that is consistent with a popularly held belief.

CHAIR: *Ken Holden*
Liverpool Business School, Liverpool John Moores University, 98 Mount Pleasant, Liverpool, L3 5UZ, England

IMPROVING MACRO-ECONOMIC FORECASTS: THE ROLE OF CONSUMER CONFIDENCE

Roy Batchelor
City University Business School, Frobisher Crescent, Barbican, London EC2Y 8HB, UK
Pami Dua
Department of Economics, University of Connecticut, Schofieldtown Road, Stamford, CT 16903, USA

The failure of (primarily model-based) professional economic forecasts to predict the recent cycle in economic activity has led to increased interest in the idea of supplementing model forecasts with more qualitative predictors. This paper uses a large cross-section/time series database on U.S. economic forecasts to test (a) whether one type of qualitative variable -- the Michigan SRC consumer confidence indicator -- could be used to improve these forecasts, and (b) whether the improvements are indeed greater for forecasts generated by econometric models with little judgmental adjustment.

FORECASTING LONG MEMORY TIME SERIES

J. D. Byers and D. A. Peel
Department of Economics, University College, Aberystwyth, Dyfed SY23 3BD Wales

Standard approaches to modelling and forecasting economic time series involve the extraction of one or more unit roots, i.e., the assumption that the autoregressive representation contains factors of the form $(1 - L)^d$ where $d = 1$. Recently, attention has been directed at fractional d and it has been suggested that fractional differencing leads to improved forecasts. We investigate this using a number of economic time series.

FORECASTING WITH PARTIAL CURRENT INFORMATION IN RATIONAL EXPECTATIONS MODELS: AN APPLICATION TO THE QUARTERLY LIVERPOOL MACROECONOMIC MODEL

Kent Matthews
Liverpool Business School, Liverpool John Moores University, 98 Mount Pleasant, Liverpool L3 5UZ, UK
Simon Blackman
Department of Economics & Accounting, University of Liverpool, P.O. Box 147, Liverpool L69 3BX, UK

An algorithm is constructed for the implementation of partial current information in non-linear rational expectations models. The algorithm is tested on an artificial linear macro model that can be checked against a tractable theoretical solution. The algorithm is shown to work for linear models and is therefore tested on the quarterly Liverpool Macroeconomic model. The tests constitute ex-post forecasting on historical data and ex-ante forecasts using the input data files of forecasts made during 1990-92.

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COMPARISON OF FORECASTS FROM 'K ECONOMETRI(MODELS AND BAYESIAN VE TOR AUTOREGRESSIVE MODELS

Holden
Liverpool B '8 M /erpool L3 5UZ
England

The annual forecasts produced each autumn from three prominent UK econometric models are analyzed to check their accuracy and are compared with forecasts from three Bayesian vector-autoregressive models. The accuracy is examined for each set of forecasts up to four years ahead, for different horizons and also for different target years. The behavior of the forecast errors is also considered, as is the effect of forming simple combinations of the different forecasts.

CHAIR: *George Heitmann*
Smeal College of Business, Penn State University, University Park, PA 16802, USA

PREDICTION INTERVALS FOR TIME SERIES FORECASTS: SIMULATION EVIDENCE ON HEURISTICS PROPOSED IN THE LITERATURE

K. A. Yeomans
Faculty of Management, University of Witwatersrand, Johannesburg, 2 St. David's Place, Parktown, Johannesburg, 2193 South Africa

The purpose of this paper is to investigate a number of the heuristics proposed in the literature for the construction of post-sample forecast prediction intervals. Most of the earlier research has relied on the analysis of actual time series (e.g. the M-Competition) which, by definition, represent a single sample of data (realization) from some assumed, underlying generating model. In this study, the author uses a simulation approach in which repeated samples, with given error assumptions, are drawn from specified time series models. The heuristic based prediction intervals produced are then checked to ascertain whether the expected percentages of model (population) values lie outside these bounds.

THE EFFECT OF FORECASTING HORIZON ON OPTIMAL PARAMETER VALUES

Mike Bendixen and Paul Kaplan
The Graduate School of Business Administration, University of the Witwatersrand, 2 St. David's Place, Parktown, Johannesburg, 2193 South Africa

Forecasting model parameter optimization is conventionally based on errors generated by one-period-ahead forecasts. However, the forecaster is often concerned with longer forecasting horizons. Both point and cumulative forecasts for these longer horizons may be of interest. The research reported in this paper examines the effect of forecasting horizon on optimal parameters for Brown's double and Holt's two-parameter exponential smoothing models. The optimal parameters were determined for simulated manifestations of known linear trend and stochastic trend models. Both MSE and MAPE were used as optimization criteria for point and cumulative forecasts over 1, 3, 6 and 12 period-ahead forecasting horizons.

DIAGNOSTIC CHECKS OF WINTERS' MODELS

Blyth C. Archibald
School of Business Administration, Dalhousie University, 6152 Coburg Road, Halifax, N.S., Canada, B3H 1Z5

Winters' seasonal exponential smoothing procedure can be made into a model by appending an error term. We consider three ways of doing this and investigate the forecast performance on the 406 monthly seasonal series in the Makridakis et al forecast competition data. We also examine whether the models pass standard diagnostic checks, and compare forecast performance of those that do and don't.

CHAIR: *Manfred Krautschneider*
Mathematics Department, Monash University, P.O. Box 197, Caulfield East 3175, Australia

HAZARDOUS WASTE REVISITED

Barbara A. Price, H. C. Haynsworth, Robert Waked
School of Business Administration, Winthrop University, Rock Hill, SC 29733, USA

At the Twelfth International Symposium on Forecasting, the authors presented a paper that described the development of a model designed to forecast the hazardous waste content of the ash produced by an incinerator licensed to dispose of hazardous materials. At that time, the data available for analysis was relatively sparse. However, based upon the conclusion by the management of the incinerator that the model appeared to offer opportunities for improving the operating efficiency of their plant, additional data was made available. This paper describes the revised model that was developed based upon this new information.

AN UPDATE ON THE ARCO-BN PROJECT

Bruce Abramson
Department of Computer Science and Social Science Research Institute, University of Southern California, Los Angeles, CA 90089-0781, USA

The ARCO-BN project is an ongoing collaboration between researchers at USC and corporate planners at ARCO. The project emerged from the belief that the new modeling technologies of belief networks (BN's) and influence diagrams (ID's) can offer new insights into the dynamics of the world oil market, and can thus lead to more accurate price forecasts. The project's first product was ARCO1, a system that used a BN implementation of the target capacity utilization (TCU) model of the world oil market to forecast quarterly average prices to a one-year horizon. This paper relates the story of how this system helped us identify some of the theory's inherent weaknesses, and how we then used an ID to help strengthen our implementation.

FORECASTING AND CONTROL FOR A TIME SERIES COUNT DATA MODEL

Kurt Brannas
Department of Economics, University of Umea, S-901 87 Umea, Sweden

Time series count data is becoming more widely available. A recently suggested model class makes accounting for serial correlation feasible. An easily calculated linear forecast function is introduced and its properties are examined. Optimal control solutions for average count or frequency and of probabilities for events are given. The techniques are illustrated using a model of road accident frequencies in a Swedish county.

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FORECASTING CONTINGENT LIABILITY LOSSES IN INSURANCE AND SELF-INSURANCE MARKETS

Gary K. Widmer
2 San Moritz, 7A George Silundike Street, Bulawayo, Zimbabwe

This paper focuses on the problems inherent in effective forecasting of the ultimate losses likely to occur in the casualty insurance and self insurance markets. The analysis concentrates on the reporting and settlement delays in "long-tailed" (skewed) liability lines of business (such as for products liability), which present serious difficulties for reasonably reliable forecasting of contingent liability losses and expenses. The importance to forecasting of preparing and maintaining an accurate Liability Statistical Loss and Expense History is emphasized. The major thrust of the paper involves forecasting the ultimate losses of casualty direct insurers: however, it is also applicable to self-insured corporations. The author compares insurance and reinsurance (the secondary market) emphasizing that the longer delay patterns of the latter make effective forecasting reinsurance liabilities much more difficult.

CHAIR: *Janet A. Sniezek*
Department of Psychology, University of Illinois at Urbana-Champaign, Chapaign, IL 61820, USA

WISHING, HOPING, AND FORECASTING

Timothy Buckley
Department of Psychology, University of Illinois, Champaign, IL 61820-0942, USA

Studies have generally shown that the more desirable the outcome, the more likely one is to predict its occurrence. However, it is postulated here that the effects of desirability are moderated by the perception of environmental uncertainty (i.e., the more certain the environment, the less effect desirability has). Furthermore, it is hypothesized that forecasting expertise moderates the effects of desirability primarily by reducing uncertainty. Thus, experts and novices may both be equally prone to the desirability bias under conditions of high uncertainty. Evidence supporting the model is presented. Implications for forecasting applications are discussed.

CONFIDENCE IN CONTROLLING TIME SERIES: EFFECTS OF ADVISING AND OBSERVING

Peter Ayton
Department of Psychology, City University, London, UK
Nigel Harvey
Department of Psychology, University College of London, London, WC1E 6BT, UK

In judgmental control tasks, people make a series of decisions to ensure that the output of some systems stays within some specified target range. Success will depend on the ability to forecast the behavior of the system and the influence of any interventions made to control this behavior. We present experiments which test the ability of individuals to forecast their control. Our studies find that perceived control is greater than actual control, that this disparity increases after collusion with a co-controller, and that observers, though more skeptical about controllers' responses, are just has overconfident concerning the efficacy of their alternative (but unused) suggestions.

WEIGHTING AND TRIMMING: A HEURISTIC FOR AGGREGATING JUDGMENTS UNDER UNCERTAINTY

Ilan Yaniv
Graduate School of Business, Center for Decision Research, 1101 East 58th Street, Chicago, IL 60637, USA

In the process of making decisions, individuals frequently poll opinions from several sources. The aggregation of these judgments and predictions -- which are often inconsistent and to some degree uncertain -- involves a cognitive process of transforming a series of inputs into a global judgment. We found that people rely on a weighting and trimming heuristic: Input judgments are monotonically weighted according to degree of confidence associated with them; however, highly confident and extreme opinions are trimmed. Results of a computer simulation showed some advantages to a weighting and trimming procedure relative to other benchmark schemes for aggregation. In conclusion, we discuss the psychological bases of weighting and discounting and the conditions under which it is likely to be useful.

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INFLUENCES ON CONFIDENCE IN JUDGMENT AND PREDICTION

Janet A. Sniezek
Department of Psychology, University of Illinois, Champaign, IL 61820-0942, USA

The manner and extent of utilization of forecasts in decision making depends largely on the confidence that is placed in them. Thus it is important to understand the factors that make persons more or less uncertain about the quality of their own forecasts and those of their advisors. In this presentation, we report the results of a series of studies concerning the relationship between the process by which judgmental forecasts are produced and evaluated and the confidence that advisors and judges have in these forecasts. Implications for theories of judgment under uncertainty and potential applications in the production of judgmental forecasts are discussed.

CHAIR: *James G. Thompson*
Delphus, Inc., 103 Washington Street, Suite 348, Morristown, NJ 07960, USA

FORECASTING SERVICE PARTS WITHOUT HISTORY: THE SATURN EXPERIENCE

Carl V. Cull
Saturn Corporation, P.O. Box 1500, Spring Hill, TN 37174-1500, USA

One of the particular problems confronting the service parts operation when launching a new model is to forecast the usage of parts when there is no history. Bob Brown suggests in his seminars that one of the best strategies to begin with is to find an "analogous" product and apply the histories on corresponding parts. The talk will describe the process Saturn uses to select the parts stocked at the local level at product launch, prior to having usage or "failure" history. The talk will show how forecasts were made for aggregated volumes of groups of service parts and also how the forecasts of individual parts were made based on "analogous models."

WHICH COLOR WILL YOU WEAR TOMORROW, AND WHICH ONE A YEAR FROM TOMORROW?

Alan Dransfield
Textile Products Division, Ciba-Geigy Corporation, P.O. Box 18300, Greensboro, NC 27419-8300, USA

The journey from the raw material called aniline to the finished synthetic dyestuff product takes, typically, nine months. Yet, in contrast, the step from a consumer's whim to the purchase of a specifically colored and styled garment is almost instantaneous. The Textile Industry addresses this timing difference with its Quick Response program, which in essence passes much of the forecasting problem back to the dyestuff producer. This talk discusses the way in which Ciba-Geigy found a successful solution, both operationally and organizationally, to this forecasting and materials management dilemma.

A SUCCESSFUL PARTNERSHIP, R. G. BROWN AND XEROX CORPORATION

James McDonald
Xerox Corporation, 800 Philips Road, Building 214, Webster, NY 14580, USA

Mr. McDonald will present an overview of his experience as Manager of Service Parts Planning, developing a state of the art material planning system to forecast, order, and resupply the Xerox Service Parts Logistic Network, supporting approximately 12,000 technicians maintaining Xerox copiers, printers, and work stations throughout North America. R. G. Brown served as the project consultant during development and implementation and significantly influenced the very successful design.

PANEL THE NEW FORECASTING CHALLENGE NETWORKED MANUFACTURING

CHAIR Moderator *Pierre Lefrancois*
Groupe de recherche en gestion logistique, Faculte de ;ciences de 'administration
Universite Laval, Ste-Foy, Quebec, Canada G1K 7P4

Panel Members

Essam Mahmoud
American Graduate School of International Management 'hunderbir sity, Glendale, AZ 8530(
6010, USA
Thomas Morton
Graduate School of Industrial Administration, Carnegie ! itt i213, USA
Timothy A. Davidson
Mercer Management Consultants, 99 Hayden Avenue,] xingt(MA (JSA

Current industrial megatrends indicate that the forthcoming manufacturing environment is to be characterized by technology-intensive networked entrepreneurial firms having to produce an evolving variety of parametric products in small series or to order -- this under high pressures for concurrent performance in price, quality, response time, service and product time from design to market. The overall manufacturing environment is to be information rich, as exemplified by the massive invasion of high-powered low-cost computing work stations and the worldwide implementation of pan-industry computer-integrated manufacturing networks. This panel discussion will first try to identify the major challenges, both from a theoretical and a practical point of view, facing forecasters in a networked manufacturing environment: new product forecasting, forecasting MRP-driven demand, forecast errors costing, etc. The discussions will then try to propose a research agenda to help analyze, understand, and solve some of these problems.

Session Allegheny	TEACHING	Thursday 4:00 - 5:30

CHAIR: *Alan E. Pankratz*
Economics Department, #5 FOB, Depauw University, Greencastle, IN 46135, USA

EXPERIENTIAL LEARNING IN FORECASTING

James E. Cox, Jr.
325 Williams Hall, Illinois State University, Normal, IL 61761, USA

Recently in the educational community there has been an increased emphasis on improving students' active involvement in learning. It has been well proven that students learn more when they put into practice the concepts they learn in their classes. This paper describes the benefits and outlines a procedure to incorporate experiential learning in teaching forecasting. Examples of student outcomes will also be given.

FORECASTING IN THE REAL WORLD: BUSINESS VS. THE BUSINESS SCHOOL

Robert L. Goodrich
Business Forecast Systems, Inc., 68 Leonard St., Belmont, MA 02178, USA

Ideally, business schools and statistics departments would be significant technical resources for corporate forecasting. However, our company's experience in teaching forecasting seminars and responding to customer concerns tells us otherwise. Academics live in a world of ideas, ideal data, and standard statistical forecasting models. Practitioners simply look for solutions in a very messy and complex world. Research and teaching fail sufficiently to address concerns like product hierarchies, aggregation and disaggregation, product groups, low volume discrete distributions, etc. Textbooks even miss important facts about standard models. This paper discusses some of the means by which academe can increase its relevance to the corporate world.

IMPROVING THE TEACHING OF FORECASTING FOR THE 21ST CENTURY

Gregory Hudak
Information Resources Inc., 150 North Clinton St., Chicago, IL 60661, USA

Forecasting is often presented today in the same fashion as it was ten, twenty, or thirty years ago. Preoccupation with methodology obscures the functionality of forecasting. Poor introductory texts and courses lead to business professionals leery of forecasting, with critical misconceptions about forecasting, and unable to integrate results effectively. Problems are compounded when the training of forecasting professionals fails to address these key issues. This paper highlights shortcomings of many forecasting texts and courses, and offers suggestions for improvements.

CHAIR: *Alan E. Pankratz*
Economics Department, #5 FOB, Depauw University, Greencastle, IN 46135, USA

EXPERIENTIAL LEARNING IN FORECASTING

James E. Cox, Jr.
325 Williams Hall, Illinois State University, Normal, IL 61761, USA

Recently in the educational community there has been an increased emphasis on improving students' active involvement in learning. It has been well proven that students learn more when they put into practice the concepts they learn in their classes. This paper describes the benefits and outlines a procedure to incorporate experiential learning in teaching forecasting. Examples of student outcomes will also be given.

FORECASTING IN THE REAL WORLD: BUSINESS VS. THE BUSINESS SCHOOL

Robert L. Goodrich
Business Forecast Systems, Inc., 68 Leonard St., Belmont, MA 02178, USA

Ideally, business schools and statistics departments would be significant technical resources for corporate forecasting. However, our company's experience in teaching forecasting seminars and responding to customer concerns tells us otherwise. Academics live in a world of ideas, ideal data, and standard statistical forecasting models. Practitioners simply look for solutions in a very messy and complex world. Research and teaching fail sufficiently to address concerns like product hierarchies, aggregation and disaggregation, product groups, low volume discrete distributions, etc. Textbooks even miss important facts about standard models. This paper discusses some of the means by which academe can increase its relevance to the corporate world.

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CHAIR: *Celal Aksu*
Accounting Department, School of Business and Management, Temple University, Philadelphia, PA 19122, USA

THE FORECASTIBILITY OF DYNAMIC QUARTERLY ACCOUNTING EARNINGS IN THE PRESENCE OF STRUCTURAL CHANGES

Conrad Chang, C.S. Agnes Cheng, Thomas R. Noland
Department of Accountancy & Tax, College of Business Administration, University of Houston, Houston, TX 77204-6283, USA

Previous studies report that earnings series experience structural changes. This study uses the Dynamic Linear Growth Model (DLGM) [Harrison and Stevens, 1971, 1976; West and Harrison, 1989], a state-space model that allows parameters to vary over time, to forecast earnings levels and earnings growth. Because of its capability to react responsively to the most recent structural changes in earnings series, the DLGM generates better forecasts than fixed-parameter models.

THE INCREMENTAL INFORMATION CONTENT OF REVENUES IN PREDICTING EARNINGS

Celal Aksu
Accounting Department, School of Business & Management, Temple University, Philadelphia, PA 19122, USA
Gerald Lobo
School of Management, Syracuse University, Syracuse, NY 13244, USA

In this study, firm's quarterly earnings and sales series are modeled jointly to investigate whether sales contains information about future earnings over and above that which is already contained in past earnings. Univariate ARMA and Transfer Function methods are used to identify and estimate the firm-specific univariate and bivariate earnings models, respectively. If there is information about earnings contained in the historical data of sales, a transfer function model using earnings as the output and sales as the input series should yield more accurate forecasts of earnings.

THE EFFECT OF SFAS NO. 14 SEGMENT DATA ON EARNINGS INFORMATIVENESS

Gordian A. Ndubizu and Sung S. Kwon
Department of Accounting, College of Business & Administration, Drexel University, Philadelphia, PA 19104-2875, USA

The additional disclosures mandated by Statement of Financial Accounting Standard (SFAS) No. 14 are expected to decrease agents' specific noise, leading to a simultaneous improvement in informedness and consensus. On the other hand, the changes required by SFAS No. 14 in the number of reportable segments increased errors in measuring segment transfer prices and allocating common enterprise costs. Our results appear to support the notion that SFAS No. 14 disclosures reduce earnings uncertainty, which increases informedness and consensus. We also find that changing segment number reduces informativeness, but not enough to override the economic effect of additional segment disclosures.

continued on next page

SALES FORECASTING AND EXCEPTION DETECTION IN A DECISION SUPPORT SYSTEM

David P. Reilly
Automatic Forecasting Systems, Inc., P.O. Box 563, Hatboro, PA 19040, USA

This paper will focus on a retail food chain and use weekly data to forecast and determine unusual store activity. A computer system (AUTOBOX) integrating both data management and flexible reporting will use time series data to segregate stores according to time series model characteristics. We will discriminate between stores using the within store information. The problem of pooled cross-sectional time series will also be discussed with examples.

CHAIR: *Jan G. De Gooijer*
Department of Economic Statistics, University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands

SOME RESULTS ON THE IDENTIFICATION AND ESTIMATION OF THRESHOLD MOVING AVERAGE MODELS

Jan G. De Gooijer
Department of Economic Statistics, University of Amsterdam, Roetersstraat 11, 1018 WP Amsterdam, The Netherlands
Kuldeep Kumar
Department of Economics and Statistics, National University of Singapore, 10 Kent Ridge Crescent, Singapore 0511

Over the past few years much attention in nonlinear time series has focused on threshold autoregressive models. In contrast, relatively little work has been done on modelling and estimating moving average type of nonlinearities. In this paper, the self-exciting threshold moving average will be considered. In particular, a simple yet widely applicable method for distinguishing between low order self-exciting threshold moving average models and low order moving average models is presented. The method is based on the pattern of theoretical conditional autocorrelation function. Some simulation results and a real-world example exemplify the proposed identification method. Also a conditional least squares method for estimating the parameters in threshold moving average models will be discussed.

MODELLING NONLINEARITY IN U.S. GROSS NATIONAL PRODUCT 1889-1987

Timo Terasvirta
Research Department, C-51, Bank of Norway, PB 1179 Sentrum, N-0107 Oslo, Norway

This paper considers modelling the annual logarithmed per capita gross national product of the United States in 1889-1987. Some authors have suggested that the parameters of the process generating the data have changed over time, but formal parameter constancy tests do not support this argument. The series turns out to be nonlinear and can be adequately characterized by an exponential smooth transition autoregressive model. For comparison, a detrended series is also considered, found nonlinear and modelled using a logistic smooth transition autoregressive model. The behavior of the estimated models is discussed, and it is seen that the nonlinearity is needed to describe the response of the process to exceptionally large exogenous shocks.

MODELLING BUSINESS CYCLE DATA USING AUTOREGRESSIVE ASYMMETRIC MOVING AVERAGE MODELS

Kurt Brannas
Department of Economics, University of Umea, S-901 87 Umea, Sweden
Jan G. De Gooijer
Department of Economic Statistics, University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands

Much business cycle research is based on an assumption of symmetric cycles, though it is frequently argued that the downturns are steeper and more short-lived than the upturns; implying cyclical asymmetries. Here, cyclical asymmetries are approached from a time series modelling point of view. A new class of nonlinear autoregressive asymmetric moving average models is introduced. These models are able to deal with symmetric as well as asymmetric phenomena. A likelihood estimation procedure and a Wald test statistic for symmetry are presented. Evidence of asymmetry is found in U.S. real GNP growth rates and in a number of macroeconomic time series.

Session Forbes	TOURISM II	Thursday 4:00 - 5:30

CHAIR: *Stephen Witt*
European Business Management School, University of Wales, Singleton Park, Swansea SA2 8PP UK

MODELLING AND FORECASTING INTERNATIONAL SHORT-TERM TOURIST ARRIVALS TO AUSTRALIA WITH TIME SERIES AND ECONOMETRIC MODELS

N. Kulendran
Department of Econometrics, Monash University, Clayton, Victoria 3186, Australia

The main aim of this study is to forecast the quarterly short-term tourist flow to Australia from the USA, Japan, UK, and New Zealand. Autoregressive integrated moving average, basic structural time series, time varying coefficient, periodic, intervention and regression models are examined. Models are estimated from March 1975 to December 1989 and forecasting performance assessed for 1992.

FORECASTING INTERNATIONAL TOURISM USING ARIMA MODELS

Egon Smeral
Austrian Institute of Economic Research, Vienna, Austria

The paper concentrates on ARIMA (Autoregressive Integrated Moving Average) models for forecasting international tourism demand for the years 1993 and 1994. Instead of forecasting future movements of a variable in a causal framework, predictions are based solely on the past behavior of the variable. This could be advantageous when the future values of the explanatory variables are unknown; their forecast error may be so large as to make the total forecast error of the variable unacceptably large. In the last section, the levels of accuracy of selected causal and time series models for forecasting are compared.

PRIOR INFORMATION IN INTERNATIONAL TOURISM FORECASTING

Geoffrey I. Crouch
Tourism Management Group, The University of Calgary, Canada

Numerous studies have been carried out over the last 30 years which have empirically estimated the determinants of international tourism demand. To date, forecasting studies in international tourism have been based on sampling information derived from an analysis of data pertaining to the particular situation under study. Prior information or knowledge has almost never been incorporated in such studies because previous demand studies have produced widely varied results. Consequently, there has been some considerable uncertainty about how to use prior information. The proposed paper would summarize the results of a study which has attempted to clarify the use of prior information.

continued on next page

AN ANALYSIS OF THE TOURIST SECTOR IN SPAIN

Pilar Gonzales and M. Paz Moral

Dpto. de Econometria y Estadistica Instituto de Economia Publica, Lehendakari Aguirre, 83 4805 Bilbao, Spain

The interest of this paper is focused on the study of the recent evolution of the external demand for the Spanish tourist services. The analysis is split into two parts. First of all, a univariate time series analysis is performed within the framework of stochastic unobserved component models. The estimation of the trend component and of the underlying growth for the series Real Revenue from Tourism allows us to study the long term behavior of the external demand and to distinguish the periods of rapid growth from those of recession. A time series model with explanatory variables is proposed in the second section. The results obtained show that the recent period of stagnation is due mainly to a price effect, since the income effect is irrelevant. The computed forecasts suggest that although the recession is over, the short term expectations are of stagnation.

Session Board	SOFTWARE II	Thursday 4:00 - 5:30

CHAIR: *Robert Rycroft*
Mary Washington College, Fredericksburg, VA 22401, USA

AUTOMATIC OUTLIER DETECTION

Victor Glass
National Exchange Carrier Association, 100 South Jefferson, Whippany, NJ 07981, USA

DataScreen screens data for unusual jumps. This PC software package automatically locates and estimates both large transient jumps and persistent shifts in time series data. It is a new approach to data screening developed at NECA that is very fast and highly accurate.

FORECAST QUALITY MANAGEMENT TOWARD A STANDARD TEST FOR AUTOMATIC FORECASTING SYSTEMS

Manfred Krautschneider
Mathematics Department, Monash University, P.O. Box 197, Caulfield East 3175, Australia

The users of automatic forecasting systems are not likely to be statistical forecasting experts. Consequently, there should be some minimum standard that these systems meet. A set of principles and tests is proposed that should give the user some confidence in their forecasting systems. The performance of some commercial software is reported in the light of such tests. It is proposed that a standard set of tests be adopted and periodically reviewed to ensure "best forecast practice". Who should be responsible for testing for compliance?

POTENTIAL WAYS OF INTRODUCING AI TECHNIQUES INTO FORECASTING SYSTEMS

V. Assimakopoulos and A. Konida
Management Systems Unit, National Technical University of Athens 42, 28th October Str., GR 10682, Athens, Greece

This paper carries out a survey of Artificial Intelligence (AI) techniques, with emphasis given on Object Oriented Design, and of potential ways of incorporating them into existing forecasting systems for improving their performance. On the one hand, there is the need of figuring out effective ways of introducing judgment and learning procedures into a forecasting system in a consistent, formalized way while on the other, there is the efficiency of such techniques in handling empirical knowledge and uncertainty as well as in supporting inductive learning. The present paper focuses in particular on identifying which AI techniques can be incorporated in specific parts of existing forecasting software packets with the intention of developing an integrated approach.

CHAIR: *Bruce Abramson*
Department of Computer Science and Social Science Research Institute, University of Southern California, Los Angeles, CA 90089, USA

SPEED LIMITS AND HIGHWAY ROAD ACCIDENTS: A TIME SERIES COUNT DATA REGRESSION APPROACH

Per Johansson
Department of Economics, University of Umea, S-901 87 Umea, Sweden

The paper deals with the effects of a lowered speed on the number of fatal, injury, and property accidents on Swedish highways by an intervention analysis. Estimations are performed with Poisson, negative binomial, and extensions to these count data models. The extended models account for overdispersion that is correlated over time. The inferences of the parameters are highly dependent on the assumed form of overdispersion. The performance of the alternative models with respect to predictive ability is examined. It is found that the models allowing for serial correlation have the best ex ante forecasting performance.

FORECASTING OF PASSPORT APPLICATIONS FOR THE UNITED KINGDOM PASSPORT AGENCY

Andy Jones and J. MacLeod
256 C Research and Planning Unit, 50 Queen Anne's Gate, London SW1H 9AT, UK

For many years, the United Kingdom Passport Agency has had difficulty predicting the number of passport applications it will receive. This has often led to large backlogs of work and long queues at issuing offices. The problem became particularly acute in the late eighties as the result of a very sharp and unexpected rise in applications. This paper describes the main features of the passport application time series and outlines two forecasting models developed to predict applications from a few months to a few years ahead. The performance of these models is assessed by comparing forecasts with actual passport intake.

MODELING AND FORECASTING U.S. PATENT APPLICATION FILINGS

Frederick L. Joutz and Robert Trost
Department of Economics, The George Washington University, Washington, D.C. 20052, USA
Kay Adams, Douglas Kim, Gus Mastrogianis
Office of Long Range Planning and Evaluation, U.S. Patent and Trademark Office, Washington, D.C. 20231, USA

The U.S. Patent Office (USPTO) is faced with the task of estimating levels of demand for its products and services both in the short and long term. The need for reliable forecasts of patent application filings has been accentuated by the recent funding changes affecting the USPTO. Following enactment of the Omnibus Budget Reconciliation Act of 1990, the USPTO underwent a transition to a fully fee funded environment. In addition, the international patent community has been trying to coordinate efforts to better serve global clientele. As part of this effort the USPTO constructed annual and quarterly models of U.S. patent application filings. The forecasting capability of naive, arima, and econometric models are compared.

CHAIR: *Peg Young*

Department of Veterans Affairs, Office of Inspector General, 810 Vermont Avenue, N.W., Washington, DC 20420, USA

MEASURING INTERVENTIONS IN MORTALITY TIME SERIES DATA

George Wesley and Peg Young

Office of Inspector General, Department of Veterans Affairs, 810 Vermont Avenue, NW, Washington, DC 20420, USA

In order to determine the existence of possible interventions (step, pulse, or slope changes) in monthly mortality rates, a procedure was developed within the Office of Inspector General to pinpoint those periods of time. This paper derives the model that signals the data points that fall outside expected limits of variability, thereby highlighting the occurrence of a possible intervention. The model is based upon a procedure originally designed to monitor the interventions in stock price time series. The model is then demonstrated on data to illustrate its potential.

FORECASTING THE IMPACT OF PROPOSED HEALTH REFORMS ON THE HEALTH INSURANCE MARKET

Edwin C. Hustead

Hay/Huggins Company, Inc., Actuarial and Benefits Consultants, 1500 K Street, NW, Suite 1000, Washington, DC 20005, USA

Most of the proposals for health care/insurance reform would build on the current employer-based health insurance structure. As a result, these proposals would require restructure and realignment of the health insurance market. The paper would present and discuss the factors that must be considered in building a model that would forecast the impact of the proposed reforms on the health insurance market. These include changes in pricing of insurance, selection of insurers, removal of underwriting restrictions, changes in taxation of health insurance premiums, and mandated coverage. The author would apply actuarial methods to estimate the factors.

FORECASTING PATIENT OUTCOME: A TOOL FOR EVALUATION

R. Clifton Bailey

Health Standards and Quality Bureau, Health Care Financing Administration, Department of Health and Human Services, 6325 Security Blvd., Baltimore, MD 21207-5187, USA

At the Health Care Financing Administration, a model for prediction of patient mortality following the admission of a Medicare beneficiary is used in an annual evaluation of hospitals. The model helps establish those factors that are important to short-term and long-term outcome. As an evaluation tool, the model can be used to evaluate different modes of treatment. As a forecasting tool, the model provides a summary of the vast experience of medical practice. In this mode, it provides a powerful tool for decision making. Some examples based on the HCFA experience will illustrate the utility of the model.

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FORECASTING HEALTH PERSONNEL SERVING HIV/AIDS PATIENTS

Daniel Gordon

Bureau of Analysis and Program Evaluation, New York State Department of Health, Albany, NY 12237-0006, USA

Projections of health personnel who will be serving HIV/AIDS patients depend on factors that are (a) suitable for formal projection techniques such as the number of HIV-ill persons and the stage of their disease, (b) weakly projectable, such as changes in utilization rates associated with medical practice changes, or (c) not projectable, such as governmental policies. In this study, projection of hospital, nursing home, primary care, and home care sectors were deemed to warrant different approaches, because of differences in reliability of baseline data and susceptibility to the above factors.

CHAIR: *J. Scott Armstrong*
The Wharton School, University of Pennsylvania, Philadelphia, PA 19104, USA

WHAT DO FORECASTS (SEEM TO) MEAN?

Baruch Fischhoff
Department of Social and Decision Sciences, Carnegie Mellon University, Pittsburgh, PA 15213, USA

A forecast is just the set of probabilities attached to a set of future events. In order to understand a forecast, all one needs to do is to interpret those two bits of information. Unfortunately, there are pitfalls to communicating each element, so that the user of a forecast understands what its producer means. These potential problems begin with ambiguity regarding the event being predicted and just what is being said about it. They continue with the difficulty of determining the relevance of the problem that the forecaster has solved for the problem that the user is facing, and then go on to epistemological and sociological issues of trust and context. A simple framework will be offered for considering these communication problems, and then illustrated with a mixture of data and speculations. Some thought will be given to the criticality of these problems, and to procedures that might reduce them.

CHAIR: *James G. Thompson*
Delphus, Inc., 103 Washington Street, Suite 348, Morristown, NJ 07960, USA

THE PERILS OF SERVICE PARTS FORECASTING

Larry M. Newbanks
Caterpillar, Inc., P.O. Box 474, Morton, IL 61550, USA

The service parts business depends heavily on forecasting. Caterpillar Parts and Service Support (P&SS) receives regular "advice" from suppliers, customers, as well as other areas of P&SS, that we need to improve forecasts. However, P&SS' success in providing industry leading service to customers is not simply achieved by improving forecasts. It's also a matter of learning to live with them. We start with a view that a forecast is always wrong and work from there. Many of the concepts P&SS uses today to forecast and distribute service parts are based on R. G. Brown's work with Caterpillar 30 years ago. We have never stopped building on these concepts.

APPROACHING THE YEAR 2000: HOW TECHNOLOGY IS HELPING SYNCHRONIZE PLANNING BETWEEN CUSTOMERS, SUPPLIERS, AND THIRD PARTIES

James G. Thompson
Delphus Inc., 103 Washington Street, Suite 348, Morristown, NJ 07960, USA

The new global competitiveness and challenges have spawned programs that increase the need for fast, seamless planning processes within and across organizations. Such factors as Integrated Third Party Services, plus Just-In-Time, Zero Inventories, Quick Response, and similar Supply Chain Strategies, force cooperative forecasting and planning efforts. At the same time, new technologies are helping to bridge the differences in how forecasts are made and used between marketing and operations and between customers, suppliers, and supporting third parties. However, subtle differences exist in the form information must take as it moves between organizations. This talk will describe how different needs for forecast periods or "buckets," units of measure and geography were overcome in a recent design of a cross-organizational planning system. Significant portions of the design make use of R. G. Brown's published works of the last twenty years.

CHAIR: *Fred Collopy*
Weatherhead School of Management, Case Western Reserve University, Cleveland, OH 44106, USA

ASYMMETRICAL CONFIDENCE INTERVALS FOR FORECASTING USING EX ANTE BOUNDARIES BASED ON CAUSAL FORCES

J. Scott Armstrong
The Wharton School, University of Pennsylvania, Philadelphia, PA 19104, USA
Fred Collopy
Weatherhead School of Management, Case Western Reserve University, Cleveland, OH 44106, USA

We describe an empirical procedure for calculating confidence intervals. The procedure uses distributions of ex ante forecast errors in a given direction (above actual or below actual). Thus, there is no need to assume symmetric confidence intervals. Separate distributions are calculated depending on the causal forces because the confidence bounds are expected to be larger in the direction of the causal forces. The confidence intervals are calculated using simple regressions across the forecast horizons given certain constraints.

THE USE OF MACHINE LEARNING TO REFINE RULE-BASED FORECASTING: AN ANALYSIS AND EMPIRICAL STUDY

Fred Collopy
The Weatherhead School of Management, Case Western Reserve University, Cleveland, OH 44106, USA
Monica Adya
The Weatherhead School of Management, Case Western Reserve University, Cleveland, OH 44106, USA

The weights used to effect actions in rule-based forecasting were established subjectively, on the basis of expert judgment. Some limited empirical calibration was conducted. In this study, we use a machine learning technique, a genetic algorithm, to significantly extend the calibration. Genetic algorithms offer several prospects for improving rule-based systems. In addition to improved calibration, conditions that may have been overlooked by experts in their formulation of rules may be identified. They may prove also useful in customizing rule-based systems for particular environments. An empirical study is described.

WHAT'S WRONG WITH RULE-BASED FORECASTING?

Katherine A. Auer
The Weatherhead School of Management, Case Western Reserve University, Cleveland, OH 44106, USA

Because traditional extrapolation methods perform well only under some conditions, Collopy and Armstrong (1992) developed rule-based forecasting, a procedure that exploits forecasting expertise and domain knowledge to let the features of a time series determine the extrapolation technique used. Their study indicated that rule-based forecasting provides superior forecasts in most of the cases they examined. There are some situations, however, in which it did not perform as well as other methods. This paper examines these less successful cases, with the intent of identifying the conditions under which rule-based forecasting fails.

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IMPLEMENTATION OF FORECASTING USING ARTIFICIAL INTELLIGENCE TECHNIQUES: A SURVEY

Monica Adya
The Weatherhead School of Management, Case Western Reserve University, Cleveland, OH 44106, USA

I surveyed studies that have applied artificial intelligence techniques to forecasting. Of the studies done over the past decade, most implemented forecasting knowledge in rule-based expert systems and a few used machine learning techniques. In addition to the basic need for increasing the accuracy of forecasts, most of the studies recognized the need to incorporate human judgement into the forecasting process. Most also attempted to combine several forecasting techniques. Few studies performed any validations of their models. These few were also the only ones to conduct competitions with traditional forecasting techniques. Most relied on literature to gather expert knowledge; few utilized any formal knowledge elicitation procedures.

Session Allegheny	IMPLEMENTATION	Friday 10:30 - 12:00

CHAIR: *John T. Mentzer*
Department of Marketing, Virginia Tech, Blacksburg, VA 24061-0236, USA

SALES FORECASTING PRACTICES: PAST AND PRELIMINARY NEW FINDINGS

John T. Mentzer and Kenneth B. Kahn
Department of Marketing, Virginia Tech, Blacksburg, VA 24061-0236, USA
Dwight E. Thomas, Jr.
AT&T Network Systems, P.O. Box 26014, Greensboro, NC 27410, USA

This session will present an overview of the findings concerning forecasting management practices from over sixteen previously published studies. Findings on issues such as technique familiarity, satisfaction, usage, area of application, evaluation criteria, forecasting computer systems, and forecasting management approaches will be reviewed. In addition, the preliminary findings from a comprehensive new survey, including many industries and countries, sponsored by AT&T, and building upon the findings of these previous studies will be presented. Particular emphasis will be given to administrative issues and trends over the past decade.

THE IMPACT OF FORECASTING COMPETITIONS

Robert Fildes
Department of Operational Research and Operations Management, Management School, Lancaster University, Lancaster LA1 4YX, UK
Spyros Makridakis
INSEAD, Boulevard de Constance, Fontainebleau, France

Comparative forecasting accuracy, evaluated through forecasting competitions has been a popular research topic for more than twenty years. These competitions have a direct analogue in organizations that need to choose the "best" forecasting method for their particular situation. This presentation will first examine what has been learned within the forecasting community from such competitions. In particular, it is concluded that conventional ARIMA modelling has proved inadequate, compared with simpler, more robust approaches. It will then be demonstrated that these results, taken from a variety of forecasting competitions, have been neglected by academic statisticians who have preferred to focus on extending the ARIMA modelling framework. The presentation concludes with a challenge to research statisticians: can they develop a class of model that is better fitted to business and economic data, or alternatively, can they refute the conclusions we forecasters have drawn from twenty years of research on comparative forecasting accuracy?

EARNINGS EXPECTATIONS

CHAIR -- Moderator: *Mustafa Gultekin*
Finance Faculty, Kenan-Flagler Business School, University of North Carolina, Chapel Hill, NC 27599, USA

Panel Members:

Lawrence D. Brown
Samuel P. Capen Professor of Accounting and Chairman, Department of Accounting and Law, University of Buffalo, State University of New York, 372 Jacobs Management Center, Box 604000, Buffalo, NY 14260-4000, USA

John Guerard
Daiwa Securities Trust, One Evertrust Plaza, Jersey City, NJ 07928, USA

Richard B. Boebel
A. B. Freeman School of Business, Tulane University, New Orleans, LA 70118-5669, USA

CHAIR: *P. Geoffrey Allen*
Department of Resource Economics, University of Massachusetts, Amherst, MA 01003, USA

COMPARING PROBABILITY FORECASTS DERIVED FROM THEORETICAL DISTRIBUTIONS

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

In making probabilistic forecasts, a simple way of selecting the appropriate theoretical distribution is to estimate parameters using historical data, transformed if necessary, to make them stationary. The method is demonstrated using daily electricity peak loads, a set of extreme values whose forecast distributions may come from the exponential, Cauchy, or Weibull families. Parameters are estimated by maximum likelihood procedures. Selections among competing parent distributions are made using the Neyman-Pearson maximum likelihood ratio test. Calibration of actual peak load against post-sample forecast distributions of peak loads determine the usefulness of the model for making predictions.

CALIBRATION AND UPDATING IN SINGLE AND SIMULTANEOUS EQUATIONS ECONOMETRIC MODELS

Stanley R. Johnson and T. Kesavan
Heady Hall, Department of Economics, Iowa State University, Ames, IA 50011, USA

Econometric models are often calibrated to provide more accurate forecast of future outcomes by placing more weight on the recent information. However, calibration is generally misrepresented in such analysis and consequently, misunderstood by many as being "opportunistic". This paper provides a generalized framework to updating and practical methods for calibration within the context of econometric models. The methods recognize the probabilistic nature of the forecasts and efficiently combine the available information to produce "optimal" forecasts. In this connection, the calibration and updating methods employed in this study are rationalized with the structure advanced and could be effectively adapted in econometric models for timely use of forecasting and policy analysis.

Session Board	SOFTWARE III	Friday 10:30 - 12:00

CHAIR: *Gregory R. Madey*
Department of Administrative Sciences, Graduate School of Management, Kent State University, Kent, OH 44242, USA

ECONOMIC PLAN COMPUTER FORECASTING SYSTEM (EPCFS)

Guo Ming
Yunnan Economic Information Centre (YEIC), 156 East Dongfend Road, Kunming, 650041, The People's Republic of China

EPCFS has a good Chinese interface for its users. The users can operate it easily through selecting Chinese menu (e.g. EDIT, PRINT, RUN). Even though the users may be unfamiliar with computers, they can also use it correctly without any difficulties. Thus, EPCFS can be put on the working tables of economic decision makers (or planners). EPCFS has been successfully used by Yunnan Planning Commission to map out the Eighth Five-Year Plan of Yunnan Province and forecast economic growth of Yunnan, and also used by Yunnan Economic Commission and Yunnan Price Commission.

THE CCSO FORECASTING PRACTICE: MODELS AND SOFTWARE

Gerard H. Kuper and Siep Kroonenberg
Department of Economics, University of Groningen, P.O. Box 800, 9700 AV Groningen, The Netherlands

The CCSO group has built various econometric models, mainly of the Dutch economy and designed for forecasting and policy analysis. CCSO runs its models under GUESS (Groningen University Econometric Simulation System), which is developed in-house. GUESS is menu-driven, compiler-based, and can handle fairly large models efficiently. Running a model involves (i) converting the model specification into Pascal source; (ii) selecting data from the database; (iii) calculating an efficient solution order; (iv) simulating and (v) evaluating the results. All these tasks can be accomplished with only a few keystrokes. GUESS can read and write Lotus spreadsheets and supports graphics and custom reports.

A HYPERTEXT BASED FRAMEWORK FOR FORECASTING SUPPORT SYSTEMS

Gregory R. Madey and Craig L. Williams
Department of Administrative Sciences, Graduate School of Management, Kent State University, Kent, OH 44242, USA

This paper presents a conceptual framework for a hypertext based forecasting support system. The framework is designed to support an integrated and comprehensive set of tools (i.e., a forecasting workbench) to assist with model development, improve forecast quality, increase efficiency and productivity, reduce training requirements, and decrease forecast development time. A brief review of three categories of software is presented: model management software, hypertext software, and forecasting software. A process diagram of the procedures involved in developing a forecast is presented to illustrate the need for integrating these three types of software. The necessary hardware and software components for developing such a framework are given and a prototype, The Forecasters Workbench, is presented. Finally, the strengths and weaknesses of such an approach are examined and areas for future research identified.

CHAIR: *Per Johansson*
Department of Economics, University of Umea, S-901 87 Umea, Sweden

PRELIMINARY SURVEY RESULTS ON THE FORECASTING CONTENT OF MANAGEMENT'S DISCUSSION AND ANALYSIS (MD & A): AN S.E.C. REQUIREMENT FOR PUBLICLY TRADED COMPANIES

Jay D. Forsyth
Department of Accounting, Central Washington University, 6000 16th Avenue, SW, Seattle, Washington 98106, USA

The Securities and Exchange Commission require registrants to disclose known trends or uncertainties that they expect to have a material impact on their financial resources and operating components (sales, costs, environmental problems, etc.). The survey is focused on a sample of Fortune 500 firms over a three-year period. The survey has two objectives. One is to ascertain overall compliance with the MD&A disclosure guidelines. The other is to determine the extent that firms use forecasting techniques in evaluating trends or uncertainties critical to the continuation of the entity.

EFFECTS OF TASK FORMAT ON PROBABILISTIC FORECASTING OF STOCK PRICES

Dilek Onkal and Gulnur Muradoglu Sengul
Bilkent University, Faculty of Business Administration, 06533 Ankara, Turkey

Recent literature on the accuracy of forecasting in financial markets reveals contradictory results. Since the use of point and interval predictions by themselves may not aid in explaining various aspects of forecasters' performances, probabilistic forecasting may present a better alternative that can be used to gain insight into forecasting accuracy in such settings. This study aims to explore the differences in various dimensions of forecasting accuracy that may result from the task structure used to elicit the probability forecasts. In particular, we examine the effects of using dichotomous-outcome versus multiple-outcome task structures on the performance of security analysts' probabilistic forecasts.

FORECASTING FOR TRADE IN FUTURES

Manfred Krautschneider
Mathematics Department, Monash University, P.O. Box 197, Caulfield East 3175, Australia

The special characteristics of futures trade make it a challenging forecasting problem. This paper reports some lessons learned in the development of some successful strategies for Stock Market Index Futures, and presents the results of a study of such trades on the Sydney Futures Exchange.

CHAIR: *Michael Lawrence*
University of New South Wales, Kensington 2033, NSW, Australia

THE EFFECT OF TEMPORAL AGGREGATION ON JUDGMENTAL TIME SERIES EXTRAPOLATION

Hoon Chae, Bob Edmundson, Marcus O'Connor
University of New South Wales, Kensington 2033, NSW, Australia

This study investigates the effect of temporal aggregation in judgmental time series extrapolation. Using data from the M-competition, monthly series were transformed into quarterly series and vice versa. In a laboratory study using post-graduate students, it was found that there was little effect of aggregation and disaggregation on forecast accuracy. However, for the early time horizons, quarterly forecasts aggregated from monthly forecast data were more accurate than the forecasts from the quarterly data.

GRAPHICAL ADJUSTMENT OF INITIAL FORECASTS: HOW GOOD ARE PEOPLE AT THE TASK?

Joa Sang Lim and Marcus O'Connor
University of New South Wales, Kensington 2033, NSW, Australia

There have been a number of empirical studies on the effectiveness of judgmental adjustment to statistical forecasts. Generally, the results have been mixed. This study examined the impact of the reliability and the framing of the additional forecast upon the revision process in a longitudinal forecasting task. A 2-between, 2-within factorial experiment was conducted with post-graduate students using real-life time series. It was found that judgmental adjustment improved the accuracy of initial eyeballing irrespective of the reliability of the additionally presented forecast. But it did not outperform the statistical reference forecast. Framing did not affect adjustment.

DECISION MAKING IN THE PRESENCE OF ASYMMETRIC LOSS FUNCTIONS

Michael Lawrence
University of New South Wales, Kensington 2033, NSW, Australia
Peter Ayton
Department of Psychology, City University, London, UK

There is considerable evidence that the quality of judgmental estimates of confidence intervals is poor. This could be due to the fact that such judgements are rare and so have low "ecological validity". This study reports on the use of an alternative to the confidence interval, a loss adjusted forecast, which is the forecast judged to minimize the forecaster's perception of the loss function. The study explored the ability of individuals to produce loss adjusted forecasts by asking people to forecast time series with asymmetric loss functions.

CHAIR: *Wilpen L. Gorr*
Heinz School, Carnegie Mellon, Pittsburgh, PA 15213, USA

ARTIFICIAL NEURAL NETWORKS: FORECASTING TOOL OF THE FUTURE?

Halbert L. White, Jr. (Featured Speaker)
Department of Economics, University of California-San Diego, La Jolla, CA 92093, USA

Artificial neural networks are a class of models developed by cognitive scientists interested in understanding how brains process information. In their simplest form, these models can be interpreted as parametric nonlinear regression models, capable of "learning" using various parametric estimation methods. The extreme flexibility of these models underlies their successful use in a wide range of application areas, ranging from diagnosis of heart attacks to control of automobile engines. These models have also been applied to various forecasting problems. In this talk, I give an introduction to artificial neural network models from a forecasting perspective, and discuss practical aspects of using these models for forecasting, illustrated with an application to forecasting foreign exchange rate movements.

A NOVEL APPROACH TO FORECASTING USING SUPERVISED NEURAL NETWORK ARCHITECTURES

J. Ahmad, H. A. Fatmi, A. Mahmood
Department of Electronic and Electrical Engineering, King's College London, The Strand WC2R 2LS, UK

In 1942, Kolmogorov proposed a universal method for extrapolation and interpolation of stationary time series based on his axiomatic theory of probability. Recently, we discovered that a supervised neural network learning architecture can be developed based on the above theory for forecasting of stationary events. Some experiments carried out with the method will be described in the paper.

ARTIFICIAL NEURAL NETWORKS APPLIED TO MANAGERIAL FORECASTING: AN ANALYSIS AND EMPIRICAL STUDY

Wilpen L. Gorr, Daniel Nagin, and Janusz Szczypula
Heinz School, Carnegie Mellon University, Pittsburgh, PA 15213, USA

This paper attempts to make clear the comparative advantages of common, supervised-learning neural network models for prediction purposes. In particular, the logistic squashing function of neural networks provides automatic means for 1) nonlinear transformations, 2) discretizing continuous variables, and 3) switching model components depending on input conditions. We apply neural networks in a comparative study of professional school admission decisions with 1) a simple linear rule used by practitioners and 2) multiple linear and stepwise polynomial regression models designed to match neural network capabilities.

CHAIR: *Kusam W. Ketkar*
W. Paul Stillman School of Business, Seton Hall University, 400 S. Orange Avenue, South Orange, NJ 07078, USA

FORECASTING RESIDUAL VALUES AND AUTOMOBILE LEASING STRATEGIES

Kusum W. Ketkar
Department of Economics, W. Paul Stillman School of Business, 400 South Orange Avenue, Seton Hall University, South Orange, NJ 07078, USA
Amitabh Chandra
Department of Decision and Information Sciences, W. Paul Stillman School of Business, 400 South Orange Avenue, Seton Hall University, South Orange, NJ 07078, USA

The automobile lease business experienced an impressive growth in the United States in the 1980s. Starting from an annual rate of 6% in 1983, the growth rate had reached 25% by 1992. Finance companies rushed to capture a market share of this growing business. However, as auto fleets started to come back by the mid-1980s, the realized residual values fell far short of estimated values and consequently substantial losses were borne by the finance companies. The objective of this paper is to explain the interdependence of new and used car markets and develop a forecasting model that can be used by managers to predict residual values.

ARE FINANCIAL MARKET FORECASTS RATIONAL?

Albert E. DePrince, Jr.
Department of Economics and Finance, College of Business, Box 27, Middle Tennessee State University, Murfreesboro, TN 37129, USA

The assumption of rational expectations is a key difference between modern-day monetarists and Keynesians. This study evaluates various forecasts and expectational variables to assess the presence of systematic information in the error between various forecasts/expectational variables and the eventual outcomes. The forecast data used in this study are obtained from the Blue Chip Financial Survey, in which the writer has been a participant since its inception in September 1982. The expectational variables are obtained from the yield curve for U.S. Treasury securities, the futures market, and commodity prices.

PREDICTABILITY OF MONEY DEMAND WITH DATA CONTAMINATED BY SEASONAL NOISE

Elias C. Grivoyannis
W. P. Stillman School of Business, Seton Hall University, 400 South Orange Avenue, South Orange, NJ 07079, USA

Using seasonally adjusted data to model the behavior of rational decision makers throws away information and introduces possibly severe bias. As a result, we should expect that application of the officially seasonally adjusted figures in econometric analysis increase the danger of obtaining misspecified models with spurious dynamic relationships and poor forecast performance. This paper is treating seasonality as an integrated part of a structural demand-for-money econometric model. It uses both seasonally adjusted and unadjusted data, and simulates the economy for a post sample period. The objective is to assess the magnitude of the forecast error under conditions of data contamination by seasonal noise.

CHAIR: *Karen S. Hamrick*
Economic Research Service, U.S. Department of Agriculture, 1301 New York Avenue, NW, Room 928, Washington, DC 20005, USA

FORECASTING THE CONNECTICUT ECONOMY

Pami Dua and Subhash C. Ray
Department of Economics, University of Connecticut, Storrs, CT 06269, USA

A vector autoregressive model is estimated for the state of Connecticut and used to forecast key regional economic variables. These variables include total nonagricultural employment, the unemployment rate, total personal income, housing permits authorized, and the consumer price index. The forecasts from the VAR model are compared with benchmark forecasts generated from univariate time series models.

A TRADE MODEL OF THE GLOBAL URANIUM INDUSTRY

Martin R. Morman
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The purpose of this study is to develop and empirically estimate a working model of the international trade of uranium. The export supply model is a function of market growth, business cycle, relative prices, balance of payments adjustments, and the tradeoffs between the various objectives of economic policy within the host and trading countries. The import demand model is a function of the demand for nuclear power, the rate of return on competing fuels, the level of inventories, and governmental policies. The export demand and supply equation are estimated using two-staged least squares (2SLS) and three stage least squares. The model is used to forecast the demand for exports and to evaluate policy alternatives in the uranium industry.

CAR EXPENDITURES AND HOUSEHOLD ATTITUDES/INTENTIONS, GRANGER CAUSALITY TESTS AND FORECASTS EVALUATION

Anders Agren
Department of Statistics, University of Uppsala, P.O. Box 513, S-751 20, Uppsala, Sweden

Surveys collecting households' attitudes about their own and the general economic situation as well as their buying plans for certain durables are being performed in several countries. The predictive value of indices based on such data from the Swedish surveys is investigated using the Granger causality test and a forecast evaluation. Main findings are: i) Buying plans (6-12 months ahead) of new cars perform best. ii) Attitude indices to not compete with the plan indices. iii) Indices based on buying plans for used cars have no predictive value. iv) An indicator based on car registration statistics seem to be even better than the plan indices.

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SIMULTANEOUS USE OF DATA WITH DIFFERENT TIME AGGREGATION IN CONSTRUCTING A QUARTERLY MACROECONOMIC MODEL OF THE GREEK ECONOMY

Tserkezos, Dikaios E.

Department of Economics, University of Piraeus, 80-86 M. Karaoli - D. Dimitriou, Piraeus 185 34, Greece

In recent years, the construction of temporally disaggregated models has gained favor. In this paper, following a related series "missing" data approach, we attempt to construct a Quarterly Macroeconomic Model of the Greek Economy. The suggested approach is a "missing data" technique similar to Sargan - Drettakis (1974), Gilbert (1977) and Tserkezos (1989), following an approach suggested by Anderson (1957). We treat the "missing" quarterly observations as unknown parameters which have to be estimated simultaneously with the other parameters of a quarterly (dynamic) model in which some of the under disaggregation variables are the dependents, taking into account the available annual observations and the appropriate functional and stochastic specification between the dependent and the independent variables.

CHAIR: *Colin F. Jex*
Department of Operational Research and Operations Management, Lancaster University, Lancaster LA1 4YX, UK

IMPLEMENTING A SALES FORECASTING SYSTEM - EXPERIENCES AT MILES, INC., DIAGNOSTIC DIVISION

James H. Noller
Marketing & Sales Systems Development, Miles, Inc., 1127 Myrtle Street, Elkhart, IN 46515, USA
Eric A. Stellwagen
Business Forecast Systems, Inc., 68 Leonard Street, Belmont, MA 02178, USA

In 1991, Miles Inc. began implementation of a PC based forecasting system to help their marketing staff to track and forecast produce sales more accurately. The system addresses a wide range of issues commonly faced by large corporations (e.g. evaluating forecast performance, data aggregation, shipment histories vs. demand, replacement products, etc.). This presentation will cover all aspects of the project, including why such a system was necessary, how the requirements were defined, how the system was designed, how the software was selected, how the system was implemented, and what benefits were derived from the new system.

SALES FORECASTING CONSIDERING ADVERTISING EFFECTS: APPLICATION OF TREND-CYCLE DECOMPOSITION IN COINTEGRATED SYSTEMS

Duk Bin Jun and In Seong Song
Korea Advanced Institute of Science and Technology, 373-1 Kusong-dong, Yusong-ku, Taejon, Korea

A long run and short run relationship between sales and advertising are analyzed within a new framework of trend-cycle decomposition of cointegrated time series. Sales and advertising have the long run relationship by sharing an unknown common trend, while the short run effect of advertising on sales and the feedback effect of sales on advertising are also incorporated into the relationships of cycle components of sales and advertising. The application result of the proposed model for the well-known Lydia Pinkham data is compared with those of other models. The proposed model shows better forecasting capability than any of the others.

CONDITIONS WHEN MARKET SHARE MODELS ARE USEFUL FOR FORECASTING: FURTHER EMPIRICAL RESULTS

Roderick J. Brodie and Andre Bonfrer
Department of Marketing and International Business, Private Bag 92 019, University of Auckland, New Zealand

The increased availability of data and access to computers has meant that econometric methods are readily available to model and forecast market share. However, controversy exists over their usefulness. For example, Brodie and deKluyver's (1987) review of empirical studies revealed that the predictive accuracy of causal market share models was not consistently better than that of a naive model. In contrast, Kumar and Heath (1990) found that causal models consistently outperformed the naive model when using disaggregated weekly scanner data. This paper reports the results of a replication and extension study which confirms Kumar and Heath's findings. The paper concludes by clarifying the conditions when market share models are useful for forecasting.

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SEQUENTIAL ESTIMATION AS AN AID TO EXPLORATORY DATA ANALYSIS FOR MARKET SHARE MODELS

Colin F. Jex
Department of Operational Research and Operations Management, Lancaster University, Lancaster LA1 4YX, UK

Sequential estimation methods are often adopted in order to allow for parameter changes in a model. They can also be used to explore data in the time domain before embarking upon traditional estimation methods. A case study using the data from Brodie & DeKluyver (1984), whilst only marginally improving upon forecast accuracy, sheds some light on the problem of why explanatory models have difficulty in outperforming "naive" models on some data sets. It has always been assumed in comparative studies that model parameters are constant in time. There is no a priori reason as to why this should be so; the contrary is more likely to be the case when dealing with models of human behavior. We show that there is considerable evidence for time dependent behavior in the Brodie and DeKluyver data. This is particularly critical for evaluation of forecasting performance since it occurs predominantly during the holdout period of that study.

CHAIR: *J. Holton Wilson*
Department of Marketing, 100 Smith Hall, Central Michigan University, Mt. Pleasant, MI 48859, USA

AGGREGATED VERSUS DISAGGREGATED FORECASTING: FORMAT, FRAMING, AND HUMAN INFORMATION PROCESSING

John S. Morris, Teresa P. Gordon, Byron J. Dangerfield
College of Business and Economics, University of Idaho, Moscow, ID 83844, USA

Recent work on computer-generated, quantitative models for forecasting family items has shown that forecasting individual, disaggregated items is generally more accurate than subdividing an aggregate forecast. This study examines whether human decision makers are similarly affected by the format of the information provided. Preliminary results show that with contextually "neutral" data, human decision processes yield results consistent with quantitative models. The full experiment will also test for non-neutral contextual factors (e.g., labelling data as "revenue" or "expense") that prior research suggests may bias the judgmental forecasts of humans.

FORECASTING IN AN MBA CURRICULUM

Chaman L. Jain
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The role of forecasting is expanding in business. More and more companies are moving toward a formal forecasting system, thereby increasing the demand for professional forecasters. Are the business schools meeting this demand? The objective of this study is to see how many business schools offer one or more courses in forecasting. Do those who offer a course in the area offer it as an elective or required course? What kind of forecasting courses do they offer? Do they offer a course on microforecasting, macroforecasting, or both? In which department, within a business school, do they place a forecasting course? The study will be based on a survey of MBA catalogs. The schools which will be surveyed are the ones which are accredited by the AACSB (American Assembly of Collegiate Schools of Business).

CHAIR: *Robert M. Kunst*
Institute for Advanced Studies, Stumpergasse 56, A-1060 Vienna, Austria

ELICITING TURNING POINT WARNINGS FROM BUSINESS SURVEYS

Lars-Erik Oller
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Some guidelines are derived for choosing between business survey answers "higher", "equal", and "lower", or any linear combination of these when forecasting output. The ubiquitous balance is not defined on the scale used and is one of many possible linear combinations. Seasonal variation is found in survey answers and possibly a unit root. Data does not contradict rational output expectations. Corroborating earlier findings, survey data seem to contain early warning information on business cycle turning points.

EFFECTS OF TEMPORAL AGGREGATION IN TIME SERIES MODELS WITH CYCLICAL BEHAVIOR

Pilar Gonzalez
Departmento de Econometria y Estadistica, Facultad de CC.EE. y Ernpresariales, Avda, Lehendakari Ejercito 83, 48015 Bilbao, Spain

This paper deals with the consequences of temporal aggregation in structural time series with cyclical behavior. With aggregation, we expect there will still be cyclical behavior in the aggregates (except in some special cases) although the period of the cycle changes. One of the problems raised by temporal aggregation is the phenomenon known as *aliasing*. If the series at the unit interval exhibits cyclical behavior of period shorter than the sample interval, then this cycle will appear in the aggregates at an alias frequency. Some results are presented about how to compute the alias frequencies. Secondly, we study the effect of aggregation in forecasting for the seasonal structural models. Results show that the gains in forecasting efficiency are considerable for seasonal models.

ASYMMETRIES IN BUSINESS CYCLES: ECONOMETRIC TECHNIQUES AND EMPIRICAL EVIDENCE

Stefan Mittnik and Zhiqiang Niu
Department of Economics, State University of New York at Stony Brook, Stony Brook, NY 11794-4384, USA

There is increasing evidence that business cycles are asymmetric. This is not only of theoretical interest, but has direct implications for macroeconomic forecasting. The paper surveys econometric techniques suitable for modeling asymmetric business cycles and reviews the empirical evidence concerning the asymmetry hypothesis for the postwar U.S. economy.

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Substitute session A Research Project in Economic Forecasting - Results & Implementation
Lars-Erik Öller

A TECHNIQUE FOR ISOLATING CHANGES IN LONG-TERM TRENDS

V. Assimakopoulos
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The most reliable component of a time-series, for forecasting purposes, is the shape of the long-term trend. However, the presence of cycles makes it difficult to identify and predict the changes in such trends. While up to now, emphasis has been given in identifying and measuring cyclical behavior, this paper presents a technique that aims at removing cyclical effects from long-term trends. This technique is based on a transformation that is successively applied on the original time series. Each time the transformation is applied, an observation is selected and replaced by the average of its adjacent observations. This results in the elimination of the cyclical component. Independently of their depth, the cycles are being removed in ascending order relative to their length. This leads to "brushing off" the long-term trends from any cyclical effects. A specialized software has been developed in Pascal. The proposed technique was applied in a set of time series from the M- and M2-Competition and the results are presented in this paper.

CHAIR: *Robert P. Bood*
Department of Business Administration and Management Sciences, Faculty of Economics, University of Groningen, P.O. Box 800, 9700 AV Groningen, The Netherlands

IMPROVING JUDGMENTAL FORECASTING: WHAT CAN WE LEARN FROM RESEARCH?

Paul Goodwin
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George Wright
Strathclyde Graduate Business School, 130 Rottenrow, Glasgow G4 0GE, UK

This paper reviews the research literature on judgmental time series forecasting to assess: (i) the quality of inferences about judgmental forecasting in practice which can be drawn from this research, (ii) what is currently known about the processes employed by people when producing judgmental forecasts, and (iii) the current evidence that strategies such as decomposition, improving the forecaster's technical knowledge, mathematical correction of biases, and provision of feedback can lead to more accurate judgmental forecasts. A key focus of the paper is the identification of areas where further research is needed.

COMMUNICATION AND FORECASTING CHALLENGES IN THE MEDICAL DECISION MAKING CONTEXT: ADVERSE OUTCOMES AT LOW PROBABILITIES OF OCCURRING

Dennis J. Mazur
Department of Veterans Affairs Medical Center, Oregon Health Sciences University, Portland, Oregon, USA

Communicating about and forecasting events with low probabilities of occurrence are required aspects of information disclosure in the judicial doctrine of informed consent. This study of 160 patients seen for continuity clinic visits in a university-based Department of Veterans Affairs Medical Center provides evidence that while patients prefer their physicians use verbal probability expressions in joint decision making sessions, patients differ widely in the numerical interpretations they give to low probability terms in the medical decision making context.

A STUDY OF FORECASTERS' BEHAVIOR

Kajal Lahiri and Sanjay Shah
Department of Economics, State University of New York, Albany, NY 12222, USA

This study analyzes behavior of professional forecasters using data on non-price variables such as the industrial production, non-residential fixed investment, and the unemployment rate. In particular, we explore the cause of irrationality of forecasters. We propose a rational expectations errors in variables model, construct a covariance matrix that captures individual heterogeneity and serial correlation within a target year. Expectations data are obtained from the Blue Chip Economic Indicators survey. We find forecasters are not conservative, they suffer from group-pressure bias, and they use information in the news rationally.

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THE RELATIVE INFLUENCE OF PROFESSIONAL EXPERIENCE AND THE TASK ON THE OVERALL QUALITY OF TIME SERIES EXTRAPOLATIVE JUDGMENT

Mary E. Wilkie
Department of Psychology, Glasgow Caledonian University, Glasgow, G4 OBA, UK

An experiment is reported which compares the quality of currency professionals' and mathematicians' probabilistic time series extrapolative judgment across three horizons on a currency forecasting task. As hypothesized, decompositional analyses of the subjects' judgments showed no overall difference between the groups in terms of accuracy; although profession by horizon interactions were observed on three important aspects of performance. In addition, a striking horizon effect was observed, but this was not in the predicted direction. Possible explanations are offered for these results and some suggestions for future research are outlined.

CHAIR: *Stephen A. DeLurgio*
Bloch School, University of Missouri-Kansas City, Kansas City, MO 64110, USA

THE THEORETICAL, PRACTICAL, AND CONTINUING CONTRIBUTIONS OF ROBERT G. BROWN IN FORECASTING SYSTEMS

Presenters:

R. G. Brown
Materials Management Systems, P.O. Box 239, Thetford Center, VT 05075-0239, USA

Carl Bhame
American Software, Inc., 470 East Paces Ferry Road, Atlanta, GA 30305, USA

James G. Thompson
Delphus Inc., 103 Washington St., Suite 348, Morristown, NJ 07960, USA

Lilian Shiao-Yen Wu
IBM Research Division, T. J. Watson Research Center, Yorktown Heights, NY 10598, USA

Steve DeLurgio
Bloch School, University of Missouri-Kansas City, Kansas City, MO 64110, USA

This session highlights the important contributions that Robert Brown has made by reviewing the past, current, and future state of the art in forecasting systems. Representatives of forecasting software companies will discuss the theoretical and practical significance of this pioneer's many contributions to the state of the art. A review of this scholar's significant contributions should be of interest to all of those involved in forecasting. A review of Mr. Brown's work should stimulate the appetite of all forecasters.

CHAIR: *John R. Snyder*
College of Business, Colorado State University, Fort Collins, CO 80523, USA

MODEL SELECTION AND PREDICTION RISK IN NEURAL NETWORK LEARNING

John Moody
Department of Computer Science, Oregon Graduate Institute, 19600 NW Von Neumann Dr., Beaverton, OR 97006, USA

Model selection techniques and prediction risk estimation are crucial for developing near-optimal neural-network-based prediction models. We first present objective methods for selecting the number of units, the set of input variables, and the set of non-zero weights for nonparametric network models. Doing this requires efficient heuristic search procedures and reliable model selection criteria. We next present a new algebraic estimate of prediction models called the generalized prediction error, extending Mallow's CP, Akaike's FPE, and Barron's PSE. We present the prediction of corporate bond ratings as an illustrative problem.

HIGH-LEVEL NEURAL NETWORK BASED MODELS FOR ELECTRIC LOAD FORECASTING

Emil Pelikan
Institute of Computer Science, Pod vodarenskou vezi 2, 182 07 Prague 8, Czech Republic

In this paper we discuss nonlinear neural network forecasting techniques based on combination of different models. We use feedforward multilayer neural networks, radial basic function networks, and linear regression models as components to construct higher-level predictors. With power consumption data from the West-Bohemian area of the Czech Republic, we demonstrate the effectiveness of our model in comparison with common neural network and linear models.

COMPARATIVE STUDY OF NEURAL NETWORK AND STATISTICAL MODELS FOR PREDICTING CRIMINAL RECIDIVISM

Jifa Wei, Jonathan Caulkins, Jacqueline Cohen, Wilpen Gorr
Heinz School, Carnegie Mellon University, Pittsburgh, PA 15213, USA

Predicting criminal recidivism is important for selective incarceration and other criminal justice policies. We apply a common linear rule, multiple regression, other statistical procedures, and two neural network models to two large data sets, including a replication of a major study. While finding important, if marginal improvements due to neural networks in one data set, we find no advantage in the second. In general, we find that the data used for recidivism research has fundamental limitations.

APPLICATION OF NEURAL NETWORKS TO PREDICT FOREIGN EXCHANGE TURNING POINTS

John R. Snyder
College of Business, Colorado State University, Fort Collins, CO 80523, USA

Neural Networks are used to predict turning points in foreign currency exchange rates. Foreign currencies include Deutschmarks, Japanese yen, Swiss franks, and British pounds. The models are built on daily prices.

ISSUES AND ANSWERS ABOUT TEACHING FORECASTING: A PANEL DISCUSSION

CHAIR - Moderator: *James E. Cox, Jr.*
325 Williams Hall, Illinois State University, Normal, IL 61761, USA

Panel Members:

J. Thomas Yokum
Angelo State University, 2601 West Avenue N., San Angelo, TX 76909, USA
Dwight Thomas
AT&T Network Systems, 3330 W. Friendly Avenue, Greensboro, NC 27410, USA
J. Holton Wilson
Department of Marketing, 100 Smith Hall, Central Michigan University, Mt. Pleasant, MI 48859, USA

This panel will deal with issues related to the effective teaching of forecasting. Areas that will be addressed include: structure of the course, incorporation of the forecasting process, topics that must be covered, incorporation of experiential learning, methods for teaching quantitative methods, and overcoming teaching hindrances.

CHAIR: *Gerald Lobo*
School of Management, Syracuse University, Syracuse, NY 13244, USA

MANAGERS' REPUTATION, ANALYSTS' FORECAST PERFORMANCE, AND INVESTORS' EXPECTATION ADJUSTMENTS

Jerry C. Y. Han
Department of Accounting & Law, School of Management, University of Buffalo, State University of New York, Buffalo, NY 14260, USA

This paper examines the relation between managers' reputation and (1) forecast bias and accuracy of sell-side security analysts, and (2) investors ex ante expectation adjustments to analysts' forecast bias. Popular financial press and several recent studies claim that sell-side analysts' tend to prepare optimistic forecasts to maintain/improve the relationship with managers because analysts' future information gathering and brokerage firms' revenues may be conditional on a good analysts-managers relationship. The results show that: (1) analysts' forecasts are more optimistic for less reputable firms; (2) analysts' forecasts are more accurate for more reputable firms; and (3) investors act as if they are aware of the source of analysts' optimistic forecast bias and adjust their expectations accordingly.

EFFECTS OF ALTERNATIVE MEASURES OF EARNINGS UNCERTAINTY ON THE EARNINGS-STOCK RELATION

Steven R. Fritsche, Florence R. Kirk, Gerald J. Lobo
School of Management, Syracuse University, Syracuse, NY 13244, USA

This study examines the effects of two alternative measures of ex ante earnings uncertainty on the coefficient relating earnings to returns. It investigates whether security analysts' earnings forecast dispersion and historical earnings variability are merely substitute measures of earnings uncertainty, or complementary measures, each capturing different aspects of earnings uncertainty. Although security analysts' forecast dispersion and historical earnings variability are highly correlated, each is significantly negatively related to earnings coefficients even after controlling for the effects of the other. Our conclusion is that security analysts' earnings forecast dispersion and historical earnings variability are complementary measures of earnings uncertainty.

AN EXPLANATION FOR THE RELATIONSHIP OF BOOK-TO-PRICE RATIONS WITH SECURITY RETURNS

Ranjan Sinha
Department of Accounting, School of Management, Boston University, Boston, MA 02215, USA

Fama and French (1992) find a positive relationship between book-to-price ratios and future expected returns. Return on book equity is an important determinant of book-to-price ratios. Empirical evidence indicates that although return-on-equity differences across firms persist over long periods, extreme returns-on-equity show a tendency to revert toward the cross-sectional average. It is hypothesized here that investors ignore this reversion property, and that correction of the resultant overreaction contributes to the returns associated with book-to-price ratios. The evidence obtained is consistent with this hypothesis.

CHAIR: *Haiyan Song*
Department of Accountancy and Economic D.I.T., Dundee DD1 1HC

QUARTERLY FORECASTS OF HE U.S. RURAL UNEMPLOYMENT RATE

Karen S. Hamrick
Economic Research Service, U.S. Department of Agriculture, 1301 New York Avenue, NW, Room 928, Washington, DC 20005-4788, USA

Rural areas currently account for about 26 million workers, or 21 percent of the U.S. labor force. Accurate forecasts of rural employment conditions are helpful in designing policies to aid rural development. Quarterly forecasts of the U.S. rural unemployment rate using a structural model were examined for their reliability. The forecasts from the structural model were compared with those from a Box-Jenkins model and from a VAR model to see if greater accuracy could be obtained from using time series techniques.

A RELATIONSHIP BETWEEN MANUFACTURING PRODUCTION AND DIFFERENT BUSINESS SURVEY SERIES IN SWEDEN

Reinhold Bergstrom
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The relationship between production in total manufacturing measured as an ordinary volume series and various barometer series from the Swedish Business Tendency Survey is investigated using data from the period 1968-1990. Models are constructed using a systematic strategy aiming at parsimonious models. The best barometer series is found to be volume of production and a model including this series is a significant improvement on the best autoprojective model. There is a close relationship between the barometer production series and the annual change in the volume series. Other barometer series are not found to provide additional information. Finally, more truly "forecasting" models based on the information set available at time point "t-1" are obtained.

FORECASTING MAGNITUDES OF CHANGE WITH LONG-LEADING INDEXES: SIX COUNTRIES

Geoffrey H. Moore
Center for International Business Cycle Research, Columbia University, New York, NY 10027, USA
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This paper examines the ability of long-leading indexes developed at the Center for International Business Cycle Research to forecast yearly changes in the magnitude and direction of real gross domestic product for six countries: Australia, France, Germany, Japan, the United Kingdom, and the United States. These forecasts are based on a regression analysis which utilizes the yearly changes in real GDP as the dependent variable and the six-month smoothed growth rates of the long-leading index for each country as the independent variable. An evaluation will be made of the mean absolute errors of the above forecasts with those of the *Globescope* consensus forecasts for each country.

CHAIR: *Kenneth D. Lawrence*
School of Industrial Management, New Jersey Institute of Technology, Newark, NJ 07102, USA

AN APPLICATION OF A NEURAL NETWORK MODEL TO FORECAST UNIVERSITY GIFT GIVING

Kenneth D. Lawrence
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Robert Stawicki
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Sheila M. Lawrence
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A neural network model has been applied to various disciplines for the purpose of solving complex problems. In a business field, the model has been mainly applied in the financial area to predict bond ratings, stock price performance, and the financial health of thrift institutions. In the present paper, a neural network model that processes input data consisting of gift givers' demographic, as well as behavioral data, is developed to predict the level of university gift giving. The network's ability to discriminate the loyal and occasional contributions is compared with the traditional discriminant analysis to demonstrate the advantages of neural network models as a highly accurate prediction tool.

TECHNOLOGICAL MARKET FORECASTING

Michael D. Geurts
Marriott School of Management, Brigham Young University, Provo, Utah, USA
Kenneth D. Lawrence
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Rosa Lemel
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There are three types of forecasting involved with technology: (1) forecasting what new technologies will be developed (2) forecasting when a new technology will be developed (3) forecasting the spread or diffusion of a new technology. This paper will concern itself with the development of three types of forecasts just mentioned in forecasting the advancement or improvement in existing technology and an innovative or new technology that did not previously exist.

continued on next page

WEIGHTING JUDGMENTAL FORECASTS

Kenneth D. Lawrence
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Judgmental forecasting approaches often suffer from various limitations and biases. When systematic changes take place, quantitatively oriented forecasting models are of little use. In such cases, judgmental forecasts are indispensable. Since improvement and learning require feedback and evaluation, errors in one situation can be compared with errors in similar situations to determine the extent of their significance. It has been shown that combining individual forecasts into a composite forecast improves the accuracy of the forecasts. This paper will use a multicriteria mathematical programming to weight the individual judgmental forecasts into a composite forecast.

NEW PRODUCT FORECASTING WITH A SPATIAL DIMENSION

Kenneth D. Lawrence
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Bien Wei
Graduate School of Management, Rutgers University, Newark, New Jersey, USA
Lazer Spasovic
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The diffusion model has long been used to predict the new product diffusion process over its life cycle. However, the spatial dimension of the diffusion process has never been fully explored. This paper combines the gravity model to forecast the distribution outcome of a new demand generated by the diffusion mechanism. The economic and social forces behind such spatial interaction are also investigated. While empirical data sets are treated to test the model, a Poisson regression technique is employed to lessen the estimation problem.

Session Board	OPERATIONS III	Friday 4:00 - 5:30

CHAIR: *Barbara A. Price*
School of Business Administration, Winthrop University, Rock Hill, SC 29733, USA

FORECAST ERROR SENSITIVITY IN MRP SYSTEMS

Robert Fildes and Brian Kingsman
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One of the principle business areas where forecasting is applied is in manufacturing where service levels, ordering and stock holding costs are affected by demand uncertainty. This paper analyzes the effect of demand forecast error on the total costs of manufacturing in alternative Materials Requirements Planning systems. Earlier research has claimed that complex MRP systems are more sensitive to forecast error than simple systems and that the impact of such errors is financially important. However, the research is flawed by being specific to particular cost structures and implausible error assumptions. This research examines more realistic error specifications and their effects on the comparative performance of lot sizing rules for different levels of MRP complexity.

A TWO-STAGE APPROACH TO DEMAND FORECASTING

Paul J. Fields
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J. Keith Ord
Division of Management Science, 3109 Business Administration, Pennsylvania State University, University Park, PA 16802, USA

When the production cycle is shorter than the period for which demand is forecast, the production cycle can be divided into two stages. While first stage production would be determined by an initial forecast of demand, second stage production would be determined by the demand observed in the first stage and the inventory remaining after the first stage. Consequently, a two-stage extension of the classic one-stage "newsboy problem" is formulated and solved. The analytical results are compared to empirical results from a case study and it is shown that substantial reductions in forecast mean square error may result.

PRAXIS FORECASTING: SATISFYING DISTRIBUTION CHANNEL DEMAND

Kenneth J. M. Frasier-Sleyman
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This paper is a case study of the development of a distribution requirements planning system which achieved such impressive results that the gains can be used as benchmarks for a "best in class" criterion, which I call DRP II*. It includes techniques for creating the requisite forecasting skills, policy for handling interventions and limiting capital investment and a methodology for overcoming the weaknesses of many DRP systems by establishing a linkage between DRP and MRP. The role of forecasting in effectuating customer satisfaction, the need for centralized control of consensus forecasting, information technology requirements, record accuracy measurement, and "pull" logistics are also discussed.

CHAIR: *Lars-Erik Oller*
National Institute of Economic Research, Box 20(S-103 ɔckholm, Sweden

FORECASTING FRACTIONALLY INTEGRATED PROCESSES

Robert M. Kunst
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Michael A. Hauser
University of Economics and Business Administration, Augasse 2-6, A-1090 Vienna, Austri

Financial data series have been described to exhibit two non-standard time series features. Firstly, variance often changes over time, with alternating phases of high and low volatility. Such behavior is well captured by ARCH models. Secondly, long memory may cause a slower decay of the autocorrelation function than would be implied by ARMA models. Fractionally integrated models have been suggested as explanations. This paper develops maximum likelihood estimation for time series models accounting for both ARCH and fractional integration. Eventual gains with respect to forecasting are assessed by Monte Carlo simulation and by application of the procedure to the Standard & Poor 500 Index.

NEARLY NONSTATIONARY ARMA PROCESSES MISSPECIFIED AS LONG-MEMORY PROCESSES AND THE EFFECTS ON FORECASTS

Bonnie K. Ray
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Nuno Crato
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Nearly nonstationary time series, such as autoregressive processes with a root close to the unit circle, have autocovariance and spectral sample properties that are almost undistinguishable from those of a long-memory process, such as a process which follows a fractionally differenced ARMA (FARMA) model. Because of this, some model misspecification may occur in trying to distinguish between the two types of processes. In this paper, we look at some examples where misspecification has occurred and determine the consequences for long-range forecasting.

AN ANALYSIS OF NONSTATIONARITY USING A SINGULAR VALUE DECOMPOSITION OF A SEQUENCE OF WINDOWED SPECTRA

James B. Ramsey and Dave Thomson
C.V. Starr Center for Applied Economics, Faculty c Arts and Scienc New York University, 269 Mercer Street, New York, NY 10003, USA

This paper builds on the earlier work of Thomson using multi-window tapers to provide more efficient estimates of spectral components. Many economic and financial time series are known to be nonstationary, so that procedures that allow one to isolate the effect of the nonstationarity are potentially useful, not only in trying to model the series, but also in improving the forecasts that are obtainable from analysis of the series. The main idea that is exploited in this paper is that the rectangular matrix created by estimating the spectra of a sequence of overlapping "time slices" of the data can be decomposed into spectral and "time" components by the singular value decomposition. This approach is applied to a small group of economic and financial time series with very interesting results.

CHAIR: *Paul Goodwin*
Faculty of Computer Studies and Mathematics, University of the West of England, Frenchay, Bristol BS16 1QY, UK

THE VALUE OF SCENARIO-ANALYSIS FOR STRATEGIC MANAGEMENT

R. P. Bood and Th. J. B. M. Postma
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Scenario-analysis is increasingly propagated to support the strategic management of organizations. In addition to generating forecasts by combining separate quantitative and qualitative forecasting techniques, scenario analysis has several unique functions especially valuable to strategic management. Examples are the provocation of the mental models of managers, the building of consensus and the acceleration of organizational learning processes. The paper critically examines several functions of scenarios on the basis of recent insights from both cognitive psychological and strategic management research. Elaborating on this analysis, the support of these functions using group decision support systems is discussed.

INTERACTIONS AMONG ECONOMIC FORECASTERS: TESTING THE DELPHI CONJECTURE

Roy Batchelor
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The Delphi Technique relies on the conjecture that poorly informed forecasters will be more influenced by the forecasts of other forecasters than will well informed forecasters. This paper tests the conjecture by examining sequences of forecasts produced by individuals contribution to the Blue Chip Economic Indicators consensus forecasting service. There proves to be little correlation between the weight given to other forecasts when an individual forecast is revised, and the past and prospective accuracy of the individual forecast.

FROM SCENARIO GENERATION TO STRATEGIC PLANNING: A NEW METHOD OF ANALYSIS

Bartolomeo Sapio
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This paper provides an original method, SEARCH (Scenario Evaluation and Analysis through Repeated Cross impact Handling), allowing the construction of both qualitative and quantitative scenarios to be embodied into strategic planning. Subjective judgements are integrated with other instruments to void the risk of simplifying reality down to unacceptable levels. The grafting of cross impact analysis inside a qualitative framework guarantees the internal consistence of scenarios and lets the planner keep contact with the general context. As an application, we used the SEARCH methodology to build scenarios concerning remote banking, the set of services usable by means of electronic supports that connect banks to domestic and firm users.

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JUDGMENTAL FORECASTS OF INTERMITTENT PRODUCT DEMAND

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Charles N. Smart
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We analyze the judgmental forecasting process of a manufacturer of lawn care products. The firm develops demand forecasts by combining sales force judgments made at a very low level of spatial and temporal aggregation. At this level, forecasters have detailed customer knowledge, but demand is intermittent (i.e., highly variable and often zero) and seasonal. We describe the distribution of forecast errors, variations in accuracy across forecasters, and the effectiveness of forecast revisions. We also determine the relative accuracy of simple statistical alternatives to the judgmental forecasts.

CHAIR: *Stuart Bretschneider*
Maxwell School, Syracuse niversity, 3 ink H yracuse NY 3244, USA

REFLECTIONS ON PRACTICAL TILITY AND APPLICATIONS OF NEW PRODUCT DIFFUSION MODELS

Mahajan
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Reflecting on current analytical developments in the innovation diffusion area, this presentation contends that these developments have surpassed the practical utility and applicability of diffusion models. Product life cycle analyses are not done in isolation. They are invariably tied in with some important decisions about resource allocation. Real world applications that demonstrate the benefits of diffusion models for such decisions will clearly enhance the practical utility of diffusion models. Several application/illustrations will be presented to highlight these concerns.

Commentators

Wilpen L. Gorr
Heinz School, Carnegie Me ittsburgh, PA 15213
Stuart Bretschneider
Maxwell School, Syracuse U Link H Syrac 3244, USA

CHAIR: *Mustafa Gultekin*
Finance Faculty, Kenan-Flagler Business School, University of North Carolina, Chapel Hill, NC 27599, USA

ANOTHER LOOK AT EARNINGS FORECASTING IN JAPAN

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The purpose of this study is to re-examine the excess returns associated with the forecasting of earnings in Japan. We find that the forecasting of operating earnings enhances returns relative to forecasting of sales, net income, or recurring income for the 1985-1992 period. The earnings forecast is used in a composite model constructed with outlier and multicollinearity augmented techniques. The composite model with earnings forecasts outperforms the historical data model by 250 basis points annually.

INDIVIDUAL ANALYSTS' EARNINGS FORECASTS AND CONSENSUS FORECASTS

Jennifer Conrad, Mustafa Gultekin, Wayne Landsman
Kenan-Flagler Business School, University of North Carolina, Chapel Hill, NC 27599, USA

In this study, we analyze the characteristics of the individual analysts' forecasts and the consensus forecasts constructed from these forecasts. Specifically, we address the question of how different are simple consensus forecasts constructed without regard to the timing of individual forecasts' updates and a consensus forecast which weights individual forecasts occurring at different times differently. We also look at the correlation of these consensus forecasts with price changes at forecast announcement and actual earnings announcement dates to assess the market's forecast of earnings.

A PORTRAIT OF FINANCIAL ANALYSTS AND OPTIMISTS

Richard B. Boebel
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Using I/B/E/S database, I analyze the error characteristics of the fiscal year earnings forecasts and five-year earnings growth forecasts made by financial analysts. I also explore the relationship between the two forecasts, testing for consistency between forecasts. I find that fiscal year earnings forecasts exhibit significant positive bias, primarily caused by analysts over-optimism. When I examine five-year growth forecasts, I can not detect forecast improvement over time; analysts again appear too optimistic. In addition, short- and long-term forecasts appear to be inconsistent with one another. Growth rates implied by fiscal year forecasts are very different from five-year growth forecasts.

CHAIR: *M. M. Naim*
Systems Dynamics Group, School of Electrical, Electronic, and Systems Engineering, University of Wales College of Cardiff, P.O. Box 917, Cardiff, CF2 1XH, UK

ANTICIPATION OF TEMPORARY BOTTLENECKS IN ASSEMBLY LINE START UPS

David J. Tyler
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Most studies of assembly line design have considered the equilibrium state, excluding the numerous perturbations occurring during the start up phase. Contemporary line-production environments are not characterized by stability, and new tools are needed which are capable of handling dynamic change within the manufacturing system. This paper presents a methodology for forecasting the behavior of labor-intensive flow lines -- incorporating operator learning effects. The approach allows the identification of temporary bottlenecks and the assessment of their potential impact on the total system. As a result, management has the opportunity to review alternative strategies. The potential for simulation modelling is demonstrated.

THE "RIPPLE" LEARNING CURVE MODEL

M. M. Naim
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A number of alternative curve fit methodologies are presented for the six parameter "Ripple" curve, thus enabling the practical application of a suite of industrial dynamics-based learning curve models which have been advocated for a structured approach to modelling and forecasting improvement in industrial systems. Included in the suite of learning curves are the simpler "Time Constant" and "S" models, the algorithms of which have already been successfully developed and evaluated. The modelling and forecasting capabilities of the "Ripple" model are evaluated via the use of simulation modelling experiments and an industrial application.

PRODUCTIVITY LOSSES DURING AMT START-UP

John Cherrington
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The examination of the lost productivity associated with the implementation of new technology suggests that a recognizable hierarchy of production losses exists, based on the effects of strategic and operational planning control decisions. Forecasting the final values of these losses may be achieved by modelling as supplementary time series to the basic start up curve. Specific examples include: repair, breakdown, operator methods, and operator training, related to the start up of advanced manufacturing technology. The measures of performance are related to production hours, but may also be related to costs as well.

CHAIR: *Philip Hans Franses*
Econometric Institute, Erasmus University, Rotterdam, P.O. Box 1738, NL-3000 DR Rotterdam, The Netherlands

FORECASTIBILITY OF DRIVEN OSCILLATORS WITH NOISE

James B. Ramsey
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In a previous article, it was discovered that some economic time series are usefully represented as driven oscillators with noise. The parameters of the dynamic model are assumed to change over time, but at a rate that is slow relative to the time scale defined by the dynamic model's main harmonics. This paper concentrates on the forecasting issues raised by that approach. An alternative method for estimating the model's parameters has been developed that facilitates the forecasting of growth rates of macro-economic variables. The forecasts are compared to those obtained from seasonal dummies for time periods for which the parameter drift can be ignored and for periods when this is not true.

EXPECTATIONS FORMATION IN AGRICULTURAL MARKETS

W. Emo Kuiper
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Prices and quantities of many agricultural commodities contain a strong cyclical component in addition to their seasonal pattern. In this paper, we study half-yearly time series describing four Dutch vegetable markets. We address the question of whether the producers' production decisions could be based on rational expectations instead of naive expectations. For that, we construct a bivariate recursive model with periodically varying coefficients to explain the price and quantity series. Due to this, and to the test procedure that we use, the rational expectations hypothesis can be efficiently tested using only OLS and GLS estimations. The empirical results do not reject the rational expectations hypothesis.

THE EFFECTS OF SEASONALLY ADJUSTING A PERIODIC AUTOREGRESSIVE PROCESS

Philip Hans Franses
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Traditional methods for the analysis of seasonal and nonstationary time series assume that seasonality and dynamics can be separated in some sense. Many time series in macroeconomics display patterns which indicate that this separation may not be valid. Periodic autoregressive processes can be suitable for modeling and forecasting series with these characteristics. In this paper, it is documented how traditional methods like Census X-11 adjustment and the Box-Jenkins three-step analysis perform when the data generating process is a periodic process.

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A MODEL SELECTION STRATEGY FOR TIME SERIES WITH INCREASING SEASONAL VARIATION

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Anne B. Koehler
Department of Decision Sciences, Miami University, Oxford, OH 45056, USA

This paper proposes a model selection strategy for time series with increasing seasonal fluctuations, which is based on a sequence of tests for seasonal and nonseasonal unit roots. The ease of application of the strategy is illustrated with several examples.

CHAIR: *J. Thomas Yokum*
Department of Business Administration, Angelo State University, San Angelo, TX 76909, USA

FORECASTING LOW IMPACT DISJOINT STRUCTURES

J. Thomas Yokum
Department of Marketing, Angelo State University, San Angelo, TX 76909, USA
Robert Sweeney
Department of Finance, Wright State University, Dayton, OH 45406, USA

Disjoint structures are unexpected discontinuous changes in the underlying economic structure. Low impact changes may not cause judgmental adjustments of the modeled process. An extensive simulation compares different causal coefficient structures on the ability to maintain adequate accuracy over various sample and structure adjustments.

STRUCTURAL SHIFTS IN A STATE-SPACE MODEL WITH UNKNOWN NUMBER OF JOIN POINTS

Hiroki Tsurumi
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After surveying the current statistical procedures to detect structural shifts, I propose a Bayesian procedure to detect regime changes in the state space model. It is assumed that we do not know how many regimes are in the sample. We compare the Bayesian procedure with the generalized likelihood ratios given by Willsky and Jones as well as with a Bayesian procedure by Kashiwagi. Moreover, we suggest a predictive density procedure to forecast a structural change. The Bayesian procedure is applied to analyze foreign exchange data.

STATISTICAL ANALYSIS OF STRUCTURAL CHANGES FOR TIME-DEPENDENT POVERTY-AFFLUENCE MODELS

Pranab Kumar Sen
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The usual indexes of poverty and affluence (of a society or community) reflect the extents to which individuals fall below a minimal acceptable standard of living and beyond the normal standard of living respectively. These, in turn, rest on suitable formulation of poverty lines as well as affluence lines, and the income distribution of the individuals in the society or community. The income distribution, in turn, depends on the definition of real income which needs a lot of adjustments due to various socio-economics (and welfare) functions. These functions vary over time. This complex picture is examined with due importance on the so called "change-point" models which may crop up in a variety of contexts.

CHAIR: *Derek W. Bunn*
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THE ACCURACY OF FORECASTING: ADDITIONAL EMPIRICAL EVIDENCE

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Robert Fildes
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For the last twenty years, empirical studies using real data have compared the accuracy of all major forecasting methods, providing an objective basis for judging their usefulness and relevance for applied predictions. The Makridakis and Hibon (1979), the Makridakis et al. (1982), and the Makridakis et al. (1993) studies using a large number of series have concluded the following: (a) simple methods perform as well or better than more complex and statistically sophisticated ones, (b) a simple arithmetic average of methods (obviously containing some sub-optimal ones) does as well or better than the best of individual methods, (c) the performance of different methods depends upon the accuracy measure used, and (d) the performance of various methods relates to the time horizon involved and the type of data utilized (monthly, quarterly, yearly). Fildes (1992), using a data set of 263 series, concluded that based on his findings "generalizations as to the relative performance from one forecasting competition to another are not valid". This paper shows that such a conclusion is not supported when his own data is evaluated using the same programs and procedures as those utilized in the previous studies by Makridakis and Hibon and the M-Competition.

THE ACCURACY OF PARAMETERLESS FORECASTING MODELS COMPARED TO M-COMPETITION PERFORMANCES

Stephen DeLurgio and Tony Sukadil
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Research (e.g. M-competition) has shown that simple forecasting models perform as well as complex models when incorporating correct patterns (i.e., trend, seasonal, random). The performance of simple parameterless smoothing models are compared to the performances of methods reported in the M-competition. The 1001 series of the M-competition are forecasted using this system. The system is as accurate or more accurate than the best of those used in the M-competition. Results are compared to those of Makridakis' Sliding Scale Simulation. The system is implemented using a LOTUS 1-2-3(tm) template and has parsimonious appeal and accuracy.

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RELATIVE ACCURACY OF TIME-SERIES METHODS IN FORECASTING U.S. FIRMS' EARNINGS PER SHARE

Fay Cobb-Payton
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Young Kim
Clark Atlanta University, Atlanta, Georgia, USA

Previous research reports that the prespecified models proposed by Brown-Rozeff, Foster, and Griffin-Watts outperform the user-identified ARIMA models for forecasting corporate earnings. This research has been disputed by recent findings. Our research shows that user-identified models consistently performed better than the prespecified models in generating ex-ante one-, two-, three- and four-quarter-ahead forecasts of the thirty U.S. firms' earnings per share. It was found that Winters' exponential smoothing also outperforms the prespecified ARIMA models.

COMPARISON OF SEASONAL COMPONENT ESTIMATION IN MULTI-ITEM, SHORT-TERM FORECASTING

D. W. Bunn and A. I. Vassilopoulos
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We extend previous work on the use of group versus individual seasonal indices for multi-item, short-term forecasting in two directions. One class of methods is derived from the procedures developed for combining forecasts. The second employs the general class of Stein Rules to obtain shrinkage estimates of seasonal components. A comparative evaluation has been undertaken of several versions of these methods, based upon both simulation and real data from the retailing sector.

CHAIR: *Dipak Jain*
Kellogg Graduate School of Management, Northwestern University, Evanston, IL 60208, USA

INCORPORATING SELF-SELECTION INTO MODELS OF FORECASTING SALES

Pradeep Chintagunta
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Mike Morgan
School of Hotel Administration, Cornell University, Ithaca, NY 14853, USA

A problem in retail sales forecasting occurs when managers choose when to open and close outlets based on expected sales volume. In this case, lagged values of sales (as well as other explanatory variables) may be "missing" or not depending on previous open/close decisions. Moreover, the value of sales at any time can be affected through the cumulative effects of prior open/close decisions. Both systematic and random components of sales are subject to the effects of a self-selection process imposed through the temporal sequence of managerial decisions. Some modelling approaches that minimize forecasting error subject to the self-selection process are explored. An empirical illustration using time series observations from a restaurant operation is provided.

MARKETING MIX EFFECTS ON THE DIFFUSION OF INNOVATIONS: MODELING ESTIMATION AND FORECASTING IMPLICATIONS

Dipak Jain
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A comprehensive framework is proposed that can incorporate and analyze the effects of marketing mix variables on the diffusion of new products. Specifically, the Cox proportional hazard formulation is used to investigate the effects of price and advertising on the rate of adoption of consumer durables. The empirical findings from analyzing the data set on three consumer durables suggests that both price and advertising have significant impact on the rate of adoption. The diffusion parameters (coefficients of innovation and imitation, and the market potential) are biased downwards if price and advertising effects are not accounted for in the diffusion model. Further, the Marketing Mix model is superior to the Basic Bass diffusion model both in terms of goodness-of-fit and predictive criteria. Substantive marketing insights and forecasting implications from the empirical findings are discussed.

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A FEEDBACK MODEL FOR OPTIMAL ADVERTISING UNDER UNCERTAINTY AND ITS FORECASTING IMPLICATIONS

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Katherine B. Ensor
Department of Statistics, Rice University, Houston TX 77251, USA
Kalyan Raman
College of Business Administration, University of Florida, Gainesville, FL 32611, USA

We examine optimal advertising policy for a firm competing in an industry in which sales depend upon recommendations of service professionals. We model changes in sales from one period to the next; increases in sales depend on advertising expenditures, which impact awareness of potential customers both directly and indirectly via service professionals. Decreases in sales occur when potential customers do not purchase, possibly due to failure to act upon a professional's recommendation. Parameter values are estimated for data from a home inspection firm through a simulation based technique, and using the resulting parameterized model, sales are predicted. We calculate the optimal advertising expenditures under this policy and also obtain a one-step-ahead forecast for sales under conditions of optimal advertising.

RELATIVE IMPORTANCE OF VARIOUS FACTORS THAT INFLUENCE ACCURACY INDICES OF COMBINATION FORECASTS

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We represent an empirical analysis that identifies a complex pattern of influence of three factors on the accuracy of one-period-ahead forecasts generated by six different combination techniques (SA, SB, WAV, WAVCV, ULS, and CLS). We used quarterly U.S. GNAP data and both time series and econometric forecasts for testing the main and interaction effects of the following factors -- errors in each forecast, relative information content of each forecast and the method of combination of the forecasts.

CHAIR: *Jonathan P. Pinder*
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MODELING MULTIVARIATE COINTEGRATED SYSTEMS: INSIGHTS FROM NONLINEAR DYNAMICS

Gary L. Shoesmith and Jonathan P. Pinder
Babcock Graduate School of Management, Wake Forest University, Winston-Salem, NC 27109, USA

Johansen's (1988) test for cointegration is applied to Litterman's (1986) six-variable system to obtain error correction mechanism (ECM) and Bayesian ECM (BECM) versions of the model. The Brock, Dechert, and Scheinkman (1987) (BDS) test for independence, from the nonlinear dynamics literature, is then applied to the error structures of each estimated equation of the BECM and ECM models, plus two BVAR versions of the model. The results show that none of the models produce independent and identically distributed (iid) errors for all six equations. Of the Bayesian restricted models, the BECM version yields iid errors in four of six equations, compared to only two using either BVAR in differences or the original BVAR in levels. The BDS results also suggest the elimination of the Bayesian prior from the BECM model. Excluding the prior, the ECM errors are iid in five cases. These results combined with previous evidence regarding the superior forecasting performance of BECM over ECM models suggest future experimentation with less restrictive BVAR priors or hybrid specifications based on the nonlinear dynamics literature.

QUANTIFYING NONLINEAR DYNAMICS OF ELECTRIC PEAK LOAD TIME SERIES

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We present evidence that the dynamic structure of changes in daily electric peak load of a small utility is similar in complexity to structures of known chaotic processes but less complex than those of nonlinear stochastic systems with signal to noise ratio ≤ 15. Results from employing two tests based on the correlation integral, the BDS [(Brock et al. (1987)] and β [Kaboudan (1993)], provide the evidence. The first helps rule out that a process is IID [independently and identically distributed], while the second helps quantify the relative complexity of a nonlinear series by estimating a coefficient resembling the process' signal to noise ratio.

TESTING FOR NONLINEAR DEPENDENCE IN INVENTORY DATA

Jonathan P. Pinder
Babcock Graduate School of Management, Wake Forest University, Winston-Salem, NC 27109, USA

This article investigates whether actual inventory time series contain any nonlinearities. The Brock, Dechert, and Scheinkman [1987] (BDS) test for independence is demonstrated and indicates the presence of significant nonlinear dependence. Thus, the assumption of IID of the stochastic inventory models are violated. This suggests that stochastic inventory models that allow for nonstationarity and/or dependence are required. The use of the BDS statistic for measuring the progress of forecasting model development is also demonstrated.

CHAIR: *Edward L. Melnick*
Department of Statistics and Operations Research, Management Education Center, New York University, 44 West 4th Street, Suite 856, New York, NY 10012, USA

BOOTSTRAPPING STATE-SPACE MODELS

David S. Stoffer
Department of Mathematics, University of Pittsburgh, Pittsburgh, PA 15260, USA
Kent D. Wall
Defense Resources Management Education Center, Naval Postgraduate School, Monterey, CA 93943, USA

The bootstrap is proposed as a method for assessing the precision of Guassian maximum likelihood estimates in linear state-space models. Our results apply to ARMA models since they are a special case of state-space models. The performance of the bootstrap for finite samples is measured using simulation results for a two-state model with 50 and 100 observations. The bootstrap is then applied to two situations, one used in a test for efficient capital markets and one used to analyze quarterly earnings data. Some preliminary results on the performance of the bootstrap to obtain the precision of forecast errors will also be presented.

AN ALGORITHM FOR ESTIMATING PARAMETERS OF STATE-SPACE MC

Lilian Shiao-Yen Wu and J. R. M. Hosking
IBM Research Division, Yorktown Heights, NY 10598, USA
Jeffrey S. Pai
University of Connecticut, Storrs, CT 06268, USA

Kalman's state-space model is widely used for analyzing and forecasting multivariate time series data. Shumway and Stoffer (1982) have given an algorithm, based on the EM (expectation-maximization) algorithm, for estimating the parameters of the model. In practice, however, one often requires features not present in Shumway and Stoffer's algorithm. Some elements of the state transition matrix may be known, and some may be related to each other (e.g. some elements may be equal). Two covariance matrices that occur in the state-space model may have some elements that are known to be zero, and the matrices may not be invertible. We have developed an algorithm for estimating parameters of the state-space model which incorporates these features. This paper describes the algorithm and gives examples of its use.

BAYESIAN ANALYSIS OF REGIONAL IBM REVENUE USING SAMPLING BASED METHODS

Jeffrey Pai, Nalini Ravishanker, Alan E. Gelfand
University of Connecticut, Storrs, CT 06268, USA

Sampling based methods are used for Bayesian modeling and prediction of regional IBM revenue available monthly for several geographic regions. Stationary seasonal autoregressive models are simultaneously fit to the regional data series using various error covariance structures to capture the strong intra-regional dependence. Graphical techniques using predictive distributions are employed to select among models. Outlier estimation and prediction under the most adequate model are used for planning and to measure the effect of special promotional events.

CHAIR: *Michele Hibon*
The European Institute of Business Administration, Boulevard de Constance, 77305 Fontainebleau Cedex, France

COMPARISON OF OLS AND PCR IN TIME SERIES

Resat Kasap
Department of Statistics, Faculty of Sciences and Arts, Gazi University, 06500 Ankara, Turkey

Multicollinearity is an important problem in linear models and also presents problems in multivariate time series. Principal Components Regression (PCR) is one method that has enjoyed success in fitting general linear models to data where independence assumptions relate to the error terms. This paper therefore seeks to investigate the suitability of this method in a time series context. After the situation is described, a full scale simulation study is described where, in fact, the technique is found to be not particularly suitable for time series data.

FORECASTING METROPOLITAN EMPLOYMENT LEVELS USING NATIONAL INDICATORS: A CROSS-MSA COMPARATIVE EVALUATION

Barry R. Weller
Penn State-Erie, The Behrend College, Station Road, Erie, PA 16563

This paper seeks to determine whether statistically significant improvements can be made in the accuracy of metropolitan employment forecasts by incorporating information from readily available national indicators. While prior studies have examined this issue on a region-by-region basis, this paper seeks more general results by examining the efficacy of the leading indicator/transfer function approach across approximately 30 MSAs, regions different both in size and industrial composition. For each MSA baseline ARIMA models and indicator driven transfer function models are built and out-of-sample forecasts generated. Comparative forecast accuracy of the two sets of models is evaluated from numerous originals, over intervals of widely varying degrees of instability. Forecast horizons range from one to twelve months. The paper concludes with statistical tests of differences in forecast accuracy of the two approaches. Factors explaining these differences are discussed.

TIME SERIES FORECASTS OF COUNTY NON-AGRICULTURAL EMPLOYMENT LEVELS

Ken Hung and David Merrifield
College of Business and Economics, Western Washington University, Bellingham, Washington 98225, USA

The monthly employment data for Whatcom County are collected from January 1976 to November 1991. Out-of-sample forecasts for the next 6 months are made using one of the 13 models fitted with the data collected. The accuracy of the forecasts measured by seven criteria is then compared across all fitted models. It is found that the regression model with lag and seasonal variables selected via backward regression routine performs the best in forecasting across all measures of forecasting accuracy to be followed by Winter's smoothing and Box-Jenkins transfer function model.

continued on next page

FORECASTING WITH THE DYNAMIC LINEAR REGRESSION MODEL

Abdul Latif
Department of Econometrics, Monash University, Clayton, Victoria 3168, Australia

The interest in dynamic regression models has been growing rapidly among applied economists. It is well known that the Ordinary Least Squares (OLS) estimator often underestimates the coefficient of the lagged dependent variable. It may, therefore, reduce the accuracy of the forecasts in dynamic models. In this paper, we compare the predictive performance of the dynamic regression model when the coefficient of the lagged dependent variable is estimated by OLS, shrinkage type, and the marginal likelihood estimators. A new predictor is also proposed for the dynamic model which is independent of the estimation of the coefficient of the lagged dependent variable.

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The International Institute of Forecasters: An International Institute aimed at promoting the discipline of Forecasting.

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Enclosed is my payment for $65.00
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Please also send a free examination copy of the *IJF* to our library. The address of the library is

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THE FOURTEENTH INTERNATIONAL SYMPOSIUM ON FORECASTING

Sponsored by the International Institute of Forecasters
in collaboration with the Stockholm School of Economics

June 12 - 15, 1994
Stockholm, Sweden
Theme:
INDUSTRIAL FORECASTING

To obtain information concerning ISF 94, please contact:

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ISF 93 - The Thirteenth Annual

INTERNATIONAL SYMPOSIUM ON FORECASTING

8:00 a.m. June 10 - 1:30 p.m. June 12, 1993
Pittsburgh, Pennsylvania, USA
at the Pittsburgh Hilton and Towers, Gateway Center

Sponsored by the International Institute of Forecasters, a non-profit organization, in collaboration with

H. John Heinz III School of Public Policy and Management
Carnegie Mellon University

and

Richard T. Farmer School of Business Administration
Miami University (Ohio)

ISF 93 - The Thirteenth Annual

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Miami University (Ohio)

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ACKNOWLEDGMENTS

The ISF 93 Committee would like to thank the following institutions for making important contributions to the organization of the symposium and/or to the preparation of the program book:

The H. John Heinz III School of Public Policy and Management, Carnegie Mellon University

The Richard T. Farmer School of Business Administration, Miami University (Ohio)

We would like to thank the following people for providing special help in organizing sessions and recruiting speakers:

Celal Aksu

Jim Thompson

Tom Yokum

City of Pittsburgh
Sophie Masloff, Mayor

February 24, 1993

Dear Friends:

Welcome to Pittsburgh.

As Mayor, I am delighted to personally welcome the International Institute of Forecasters Conference to the City of Pittsburgh. We are delighted to be your hosts.

While you are here, I urge you to take a good look around. Pittsburgh in the 1990s is a city poised for opportunity. No longer a smokey city, Pittsburgh's economy is diversified with growth in the areas of high tech and biomedical research. We enjoy new partnerships with our world class universities that are generating exciting new research about the opportunities within the global marketplace. Within walking distance of your conference hotel, you will find the best of Pittsburgh's cultural and retail amenities: our symphony, ballet, opera and sports teams. Please take a walk and explore our unique ethnic neighborhoods. Sample one of our restaurants. I am sure you will find Pittsburgh has a little something for everyone's taste.

I thank you for choosing Pittsburgh for your conference and hope you will come back again soon for a visit.

Sincerely yours,

Sophie Masloff
SOPHIE MASLOFF

/arm

City of Pittsburgh

By virtue of the authority vested in me as Mayor of the City of Pittsburgh, I do hereby proclaim June 9 to June 12, 1993 as

INTERNATIONAL INSTITUTE OF FORECASTERS DAYS

throughout the City of Pittsburgh to focus attention on the International Symposium on Forecasting taking place at the Pittsburgh Hilton and Towers; to officially welcome these professional researchers and practitioners from different countries, disciplines and organizations who have come together to unify the art and science of forecasting; to wish all in attendance much success in hopes that this meeting is both memorable and productive to the field of forecasting.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the City of Pittsburgh to be affixed.

Sophie Masloff

Sophie Masloff, Mayor

Date **February, 1993**

THE THIRTEENTH INTERNATIONAL SYMPOSIUM ON FORECASTING

Pittsburgh, Pennsylvania, USA
June 9 - 12, 1993

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MESSAGE FROM THE GENERAL CHAIRPERSON

Dear Conferees,

Welcome to the 13th International Symposium on Forecasting! We have an exciting program for you and are anxious to get it under way.

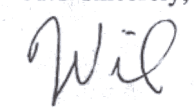
While continuing to address forecasting applications and methods of importance as in past symposiums, this conference places more emphasis on organizational-level forecasting issues. In this vein, our distinguished plenary and featured session speakers will address topics like competitiveness, quality management, communication of risks, new forms of manufacturing, new products, the workings of capital markets, and methods that deal with structural change--all in regard to forecasting.

Our breakout sessions have several parallel tracks designed to meet varied kinds of forecasting interests and needs. We believe that both academics and practitioners will be able to find sessions of interest throughout the conference. It is particularly pleasing that we will be honoring Robert G. Brown on his 70th birthday with special sessions. Bob Brown has had profound impacts on both the theory and practice of forecasting.

There are many social activities that will be taking place, so we will have many opportunities to meet new people and share interests. For many of you unfamiliar with Pittsburgh, I am sure that you will be very pleasantly surprised with the beauty and vitality of this city. June is a great month to be in town. Culturally, there is an abundance of activity and the beautiful Pittsburgh Hilton places us right in the middle of it all.

Lastly, I want to extend thanks to the organizers of the conference--especially Anne Koehler, Hans Levenbach, John Snyder, and Coral Davis. I also wish to warmly thank the session organizers; presenters; the hotel staff at the Pittsburgh Hilton; and, of course, you, for attending this great conference.

Yours sincerely,



Wilpen L. Gorr
General Chairperson

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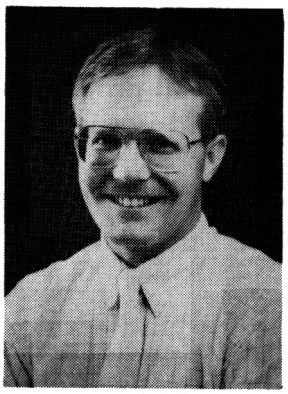

John R. Snyder
Exhibits Chairperson

Coral Davis
Local Arrangements

Fred Collopy
Academic Liaison

Robert Goodrich
Corporate Liaison

GENERAL INFORMATION

Registration and Message Center

The Symposium registration area is located in the foyer of the Mezzanine Level. Registration Desk hours are as follows:

Wednesday	June 9	7:30 a.m. - 5:30 p.m.
Thursday	June 10	7:30 a.m. - 7:00 p.m.
Friday	June 11	7:30 a.m. - 7:00 p.m.
Saturday	June 12	7:30 a.m. - 10:00 a.m.

A bulletin board will be located in the registration area for personal messages, phone calls, announcements, changes in program, etc.

Badges

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

Business Center

FAX machines, copiers, computers, and secretarial services, to name a few, are available for a fee to conferees in the hotel's Executive Center located on the Lobby Level.

Continental Breakfasts, Coffee Breaks, and Luncheons

Continental breakfast will be available Thursday, Friday, and Saturday in the Ballroom ~~Foyer~~ each morning. Coffee and tea will be available during the morning and afternoon breaks in the corridor outside of the session rooms on the Mezzanine Level. Luncheons are held in the King's Gardens which are also located on the Mezzanine Level.

Social Events

Wednesday, June 9

- 5:00 - 7:00 p.m. Welcome Reception will be held in the King's Gardens on the Mezzanine Level.
- 7:30 p.m. Pittsburgh Pirate Baseball at Three Rivers Stadium*

Thursday, June 10

- 8:30 a.m. - 5:00 p.m. — A day-long tour for spouses has been arranged with Gray Line Sightseeing to Falling Water, Edgar Kaufmann's house built by Frank Lloyd Wright.*

- Evening — Free for you to explore the Three Rivers Arts Festival, attend the Civic Light Opera's production of The Wizard of Oz or simply explore any of the many attractions that Pittsburgh has to offer. Feel free to stop at the Registration Desk where you will find an assortment of brochures that will assist you in choosing things to see and do.

Friday, June 11

- 7:30 - 11:00 p.m. — A three-hour river cruise on the Gateway Clipper Fleet's *Party Liner*. Relax with cocktails and dinner while listening to the entertaining sounds of a dixieland jazz band.*

Saturday, June 12

- Noon - 1:30 p.m. — Farewell Reception will be held in the Kings Gardens on the Mezzanine Level.

**PLEASE NOTE:* *The baseball game, spouses tour, and river cruise are all paid events. If you purchased tickets when you mailed in your reservation, they are included in your reservation package and should be picked up at the Registration Desk. For conferees who would like to attend but did not purchase tickets in advance, a limited number of tickets for the baseball game and river cruise will be available for purchase at the Registration Desk.*

Conference Staff

Conference assistants will be available throughout the Symposium to provide help. These aides can be identified by the green "Local Arrangements Committee" ribbon attached to their badge.

Additional Copies of Program Book

Additional copies of this Program Book may be purchased at the registration desk for $10.00. After the conference, copies may be purchased for $15, by contacting Professor Anne B. Koehler, Department of Decision Sciences, Richard T. Farmer School of Business Administration, Miami University, Oxford, OH 45056. Make checks payable to IIF.

SYMPOSIUM HEADQUARTERS -- The Pittsburgh Hilton and Towers

... is a luxury hotel with 717 rooms recently remodeled at a cost of over $17 million. The location is simply the best in Pittsburgh. Amenities include three excellent restaurants, a fitness center with sauna and steam rooms, jogging course across the street in Point State Park along Pittsburgh's three rivers, foreign currency exchange, multi-lingual staff and multiple-language directories, handicapped rooms, and nonsmoking rooms.

The management and staff welcome you to the PITTSBURGH HILTON AND TOWERS. We are delighted to have you as our guest. Our desire is to make your visit both enjoyable and memorable.

HOTEL SERVICES AND PERSONAL SERVICES

Automobile Rental

Contact our concierge at extension 5140 for assistance.

Babysitters

Touch 5140 for concierge. Note: Babysitting agencies are not affiliated with the Hotel, and as such, the Hotel is not responsible for the services rendered by these agencies.

Baggage Service/Check Room

Arrangements can be made for the handling of luggage, packages, and other articles. Touch 62.

Bell Captain

For assistance with luggage and baggage storage. Touch 62.

Business Center

Located on the lobby level. A full-service office for all needs including secretarial, photocopying, telecopying, and facsimile. Hours: Monday through Friday 7:00 a.m. to 7:00 p.m., Saturday 9:00 a.m. to 12:00 noon. Touch 5353.

Cashier

For assistance with your account or for safe deposit boxes, please contact reception desk. Touch 63.

Check Cashing

Hotel guests wishing to cash checks may do so with the proper credit identification through the Reception Desk. The limit is $50 cash per day and $250 cash per stay.

Check-In/Check-Out Time

Check-In begins at 3:00 p.m. Check-Out time is 12:00 noon.

Conference Call

Touch 0 for Hotel communications.

Credit Cards

American Express, Optima, Visa, MasterCard, Diners Club, Carte Blanche, Discover

Currency Exchange

International currency exchange rates are available through the reception desk. Touch 63.

Doctor

A list of doctors and medical services in this area is available at the Assistant Manager's desk in the lobby. In case of emergency, touch 66.

Fitness Center

Located on the 4th floor. Hours from 6:00 a.m. - 10:00 p.m.

Guest Service Hotline

If anything in your room is not right, we want to correct it. Please contact our Guest Service Hotline. Touch 69.

Hilton Reservation Service

For immediate reservations at any of our Hilton Hotels worldwide, touch 5455, or dial 1-800-HILTONS.

Housekeeping

The housekeeper will provide special guest room services including irons, iron boards, foam pillows, extra blankets, hair dryers, and cribs. Touch 67.

Ice Machines

An ice machine is located by the elevator lobby on your guest room floor level. On the Towers floors, ice is located on the 24th floor in the Towers Lounge.

Laundry/Valet

Laundry bags and information are located in your guest room closet. One day service, if received by 9:00 a.m., Monday through Friday. Touch 68.

Limo Service

Limousine arrangements available through our concierge. Touch 5140.

Lost and Found

Contact security. Touch 5389.

Mail and Information

Stamps are available at Mail and Information. Guest mail is held at the Reception Desk.

Meetings/Banquet Schedule

Touch Channel 8 on your TV set.

Messages

Touch 0 on the phone or 88 on your TV set.

Restaurants

The Pittsburgh Hilton & Towers offers full-service restaurants for your dining pleasure.

Restaurant Reservations

For your convenience, advance reservations are suggested for the Sterling's Restaurant. Touch 5311.

Room Service

See our menu in the In Room Dining Section. Room Service is open 6:00 a.m. 11:30 p.m., Monday through Saturday, 7:00 a.m. - 11:30 p.m. Sunday.

Safe Deposit Boxes

Safe deposit boxes are available free of charge at the Reception Desk.

Shoe Shine

Located on the Lobby Level in the Barbershop/Hair Salon. Touch 5496.

Shopping

Our concierge will be happy to acquaint you with a variety of shopping opportunities. Touch 5140.

Taxi Service

Conveniently located in front circle of Hotel. For assistance, touch 5317.

Television

For assistance in adjusting the color on your television set, touch 69.

Telex/Telegram Service/Fax

Telex/FAX service is available through the Business Center (Lobby Level) Monday through Friday, 8:00 a.m. - 7:00 p.m.

Vending

A wide variety of beverages and snacks are available in your Servi-Bar. Key may be obtained at the Reception Desk.

Wake-Up Service

The Hotel operator will schedule your requested wake-up call. Touch 0.

Weather

For the current time and temperature, please touch 64.

HOTEL RESTAURANTS

Sterling's Steak & Seafood Restaurant

A tradition in Pittsburgh for the finest steaks and seafood. Our pastry cart confections are homemade and irresistible. Open seven nights a week from 5:00 p.m. to 11:30 p.m. Touch 5311 for reservations.

The Promenade Cafe

A cafe setting and tasty cuisine are perfect for breakfast, lunch, and dinner. Open seven days a week. Touch 5304.

Scenes

The place to see and be seen. At the center of it all. Scenes offers a great escape for refreshing cocktails and conversation. Open Monday through Saturday, 5:00 p.m. through 12:00 midnight. Touch 5312.

The Pub Sports Bar

Enjoy your favorite draft beer or cocktail in our Sports Bar while meeting friends or just testing your skills at our sports oriented video games or pool table. Featuring four T.V.'s broadcasting sports events all day. Open seven days a week from 11:00 a.m. to 2:00 a.m. Touch 5305.

Room Service

We are as proud of our Room Service meals as any we serve in our restaurants. With good reason. Our standards are just as high in preparing and presenting your breakfast, lunch, dinner, or late night snack. We take extra care to insure that your order is as it should be: on time and complete.

AREA ATTRACTIONS - CITY SIGHTS

THEATER

Benedum Center for the Performing Arts, 719 Liberty Avenue, 456-2600

This sumptuously restored 2,800-seat theater is the new home of the Pittsburgh Ballet, the Pittsburgh Opera, the Civic Light Opera, the Dance Council, plus being the stage for off-broadway productions.

Heinz Hall for the Performing Arts, 600 Penn Avenue, 392-4800. Box Office: 392-4900.

Built in 1926 a an elegant movie palace, Heinz Hall has been renovated into one of Pittsburgh's major performing arts centers. Home of the Pittsburgh Symphony and the Youth Symphony, Heinz Hall also stages concerts, the Pittsburgh Broadway Services, and other popular shows.

MUSEUMS & GALLERIES

Carnegie Science Center, One Allegheny Avenue, 237-3400

The Pittsburgh Hilton & Towers is proud to be the official hotel of our city's newest attraction. Start the day in the four-story high Omnimax Theater. Then check out our universe by gazing at the stars in the planetarium. Don't forget to try all of the hands-on science exhibits and the grand finale of the day is a tour through the World War II submarine, USS Requin (summer season). There is something for the whole family at the Carnegie Science Center. Open 10:00 a.m. to 5:00 p.m., Monday through Thursday; 10:00 a.m. to 9:00 p.m., Friday and Saturday; 10:00 a.m. to 6:00 p.m., Sunday.

Fort Pitt Museum, Point State Park, 281-9284

The Park is located directly across from The Pittsburgh Hilton & Towers. The Fort Pitt Blockhouse, built in 1764, is the last remnant of Old Fort Pitt and is the oldest structure in the city. The Fort Pitt Museum depicts the region's history up to 1800. Open Tuesday through Saturday, 9:00 a.m. to 5:00 p.m.; Sunday, from noon to 5:00 p.m.

The Pittsburgh Children's Museum, Allegheny Center, 322-5058

Founded by the Junior League of Pittsburgh in 1983 and located in the historic old post office building. The Museum offers three floors of interactive exhibits where kids learn through hands-on participation. Hours vary through the year. Call for information.

The Carnegie, 4400 Forbes Avenue, 622-3131

The institute's world-renowned museums house fine art masterpieces, plus exhibits of natural history and anthropology. Open Tuesday through Saturday, 10:00 a.m. to 5:00 p.m.; Sunday from 1:00 p.m. to 5:00 p.m. Extended hours on Friday.

EXHIBITORS AT ISF 93

Exhibits will be located in Ballrooms 3 and 4 on the Mezzanine Level. A wide variety of educational materials and software will be on display. Exhibit hours are 9:00 to 5:30 on Thursday and Friday and 9-12 on Saturday.

Meeting ID badges will be required for admission.

John Wiley and Sons, Ltd.

John Wiley and Sons is a well-known publisher of business and economic products with extensive offerings for forecasters including the popular forecasting text, *Forecasting Methods for Management*, by Makridakis and Wheelwright, and the *Journal of Forecasting*.

Elsevier Science Publishers

Elsevier Science Publishers, under its North Holland label, publishes the *International Journal of Forecasting*, the journal of the International Institute of Forecasters. They are well known for their economics, business, and operations research offerings.

Automatic Forecasting Systems

AFS formed in 1975 to develop and market advanced forecasting systems. They pioneered the development of automatic forecasting systems. AFS offers univariate, transformation, and ARIMA software with their two products **AutoBox** and **MTS**. At this symposium, AFS will be demonstrating their new graphics/spreadsheet products.

Business Forecast Systems

BFS provides software, training, education, and consulting in the area of statistical forecasting. Their software products include **ForeCalc, Forecast Master Plus,** and **Forecast Pro**. In their 1992 evaluation, *PC WORLD* gave Forecast Pro an overall grade of A.

Smart Forecasts

Smart Software, Inc., founded in 1983, specializes in the development of business forecasting software with expert system capabilities. Their newest product, **Smart Forecasts Turbo BATCH Edition** is designed for users with massive forecasting problems, i.e., tens of thousands of items in their inventories.

Delphus, Inc.

Delphus, Inc., is a consulting and software development firm specializing in forecasting solutions for businesses. They will be introducing their new windows based product, **Pure Planner**, at this conference.

Pacific Forecasting Systems, Inc.

PFSI has provided forecasting system development and market analysis services for medium to large consumer products companies since 1984. Their primary offering is **foreGraph**, a Macintosh/VAX client/server application, which offers a graphic interface and analytical tools designed for product and sales management, as well as an integrated database management and flexible report generating capability. Each system is customized to meet the specific needs of the client.

International Association of Forecasters

Sweden will host the 14th International Symposium of Forecasting in Stockholm. The conference chairman is Sune Karlsson.