The Eighth International Symposium on Forecasting

June 12-15, 1988 / Amsterdam, The Netherlands

Program/Abstracts

sponsered by
The International Institute of Forecasters in collaboration with
The University of Amsterdam and Free University Amsterdam

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United Kingdom

DE BURGEMEESTER
VAN AMSTERDAM

Welcome to Amsterdam!

It is a pleasure for me to be able to welcome the participants of the Eighth International Symposium on Forecasting to Amsterdam.

As I understand the symposium will cover as many aspects as possible in the field of theory and practice of forecasting.

So, I am happy to be able to offer you, as a kind of welcome, some certainties.

Amsterdam has recently climbed to a seventh place in the international ranking of congress organizers.

This is greatly due to the RAI where you will gather, too. A successful organisation in an excellent building will be guaranteed!

Amsterdam, as a city, is a wonderful and ever surprising host. You will no doubt, like it too.

As far as the symposium on forecasting is concerned, I wish you all the success. Although, to me, a symposium that takes place for the eighth time, has proven its success already!

The Burgomaster of Amsterdam,

(E. van Thijn)

ACKNOWLEDGEMENT

We here like to thank the following institutions and firms for their kind contribution to the Eighth International Symposium on Forecasting:

The University of Amsterdam
Free University Amsterdam
Koninklijke Nederlandse Akademie van Wetenschappen
Elsevier Science Publishers B.V.
KLM Royal Dutch Airlines
IBM Nederland NV
Ministry of Economic Affairs
Mayor and Aldermen of Amsterdam

MESSAGE FROM THE GENERAL CHAIRPERSON

On behalf of the ISF 88 Organizing Committee and the International Institute of Forecasters, I welcome you to Amsterdam and the Eighth International Symposium on Forecasting.

The Organizing Committee has endeavored to structure a scientific program of wide interest and outstanding quality. Over 450 papers in more than 100 sessions are presented by many internationally well-known forecasting experts. As such this is the largest number of papers ever presented at the International Symposia on Forecasting. The program covers a wide range of forecasting topics from both the theory and practice of forecasting. We hope that many papers presented at the Symposium will appear in the International Journal of Forecasting published by North-Holland.

As the scientific program features many more papers than originally planned, some "unfairness" in the time allocation has occurred. This is due to early contributors, before the unexpectedly large number of eventual submissions had been realized. We do, however, apologize to the many less fortunate speakers, whose material clearly merits far longer than the meager time-slots allotted for them in the program.

Amsterdam, popular throughout the world, hardly needs any introduction. We have arranged an interesting social and cultural program to provide participants and companions of ISF 88 with opportunities to enjoy the main attractions of the city and its environs.

The Organizing Committee thanks the many people who have helped us, especially Philomeen van Dielen from "Textline" who typed this program book and the University of Amsterdam and the Free University Amsterdam for their support. Finally, the contributions of keynote speakers, feature speakers, session organizers and session chairpersons are deeply appreciated.

We hope that you find ISF 88 a stimulating and enjoyable Symposium and that you will be among us in Vancouver next year.

Jan G. de Gooijer
General Chairperson, ISF 88

EXHIBITION

From Monday through Wednesday the following firms and publishers will exhibit the latest developments in software, books and consulting services.
The exhibition will be situated around the main lecture hall.

Companies present at the exhibition:

Business Forecast Systems
68 Leonard Street, Belmont MA 02178, USA
Telephone: (617) 484-5050
Telex: 710-3201382

Business Forecast Systems, Inc. (BFS) specializes in the development and sale of statistical software. BFS also provides training, educational seminars, and consulting services in the area of statistical forecasting. FORECAST PRO is a PC-based software package that combines artificial intelligence and state-of-the-art technologies to allow users to prepare accurate forecasts quickly and easily. The package includes an on line expert system to analyze the data and recommand the appropriate methodology. Time serieds analysis techniques include exponential smoothing, Box-Jenkins and dynamic regression. BFS is currently seeking distributors for FORECAST PRO in the European marketplace.

Databel
Prinsengracht 508, 1017 KH Amsterdam, The Netherlands
Telephone: (020)-250805

DATABEL FUNDAMENTAL ANALYSIS (DFA). Databel's archives contain interim company figures of all Dutch firms that publish consistently. These data have been recalculated to uniform definitions of seasonally adjusted sales, costs and profits. DFA is a (Dfl. 6400.-) annual subscription programme including: interim figures of 90 companies on disk, automatically updated at regular intervals; seasonal adjustment and statistical analysis of sales, costs, earnings; graphic facilities; sales and earnings per economic sector; macro economic data. A DFA spinoff, producing sales/earnings graphs for 90 companies is on sale on this symposium (Dfl. 125.-). We claim to be the only in our field of research.

Datamedia
Bernadottestrasse 10, 2000 Hamburg 50, Federal Republic of Germany
Telephone: (040)-3909427

FOCA - Forecasting Software for Economic Time Series is now available in version 4.0 with the following features:
Expert Assistance: performs analysis and all forecasting methods. The user can concentrate on the economic problem without having to worry about statistics and parameter estimation; Programming language: enables the forecast of many series on a regular basis, turns a model into a turn-key application. Includes also graphics; EGA-Graphics on all levels: time series plots, scattergrams, 3D-graphs on screen plotter or printer, graphs can be edited; direct access to standard software Lotus, Symphony, DBASE, etc. Come and see us for your personnal demonstration.

DON/E
Don Econometrics
Van Aerssenstraat 214, 2582 JW The Hague, The Netherlands
Telephone (070)-555918

Don Econometrics presents the SIMPC software package, a compiler-based system to solve medium-sized and large models efficiently on the PC. Tailored to the needs of the econometric model user, the SIMPC system offers a rich interactive environment to run simulations, change parameters or exogenous variables, target behaviorals with automatic add-factor computation, study baseline and alternative scenarios (both in graphs and tables), compute derived series. etc. The powerful model language is based on TSP, extended with several TROLL features and user-defined functions. A separate module is available to transfer existing TROLL models. Lotus worksheet datafiles are supported to interface to other applications.

Gwilym Jenkins & Partners Ltd.
Parkfield, Greaves Road, Lancaser LA1 4TZ, United Kingdom
Telephone: (0524)-61831

Gwilym Jenkins & Partners offers a range of services to enable Box-Jenkins methods to be applied to the solution of practical problems. During the exhibition GJP will be demonstrating two software systems for the microcomputer: MICRANAL: for users with statistical expertise to become involved in model building and operational use; CONSUMER: designed for users with neither statistical or business expertise, but who wish to make use of powerful forecasting methods in the consumer product market. GJP is shortly to release further systems related to ENERGY and TRANSPORT & TRAVEL applications. Please come to the GJP stand for further information.

John Wiley & Sons Ltd.
Baffins Lane, Chichester, W. Sussex PO19 1UD, United Kingdom
Telephone: (0243)-770366
Telex: 86290

Wiley publish a range of books and journals in the field of forecasting, and econometrics, and their application in planning and management. A selection of publications are shown on our stand where the Wiley representative will be glad to assist you and discuss proposals or suggestions for new books and journals for worldwide publication. We hope to welcome you to our exhibit, or to hear from you at our Editorial Department, John Wiley & Sons Limited, Baffins Lane, Chichester, PO19 1UD, England.

Pergamon Press
Headington HillHall, Oxford OX3 0BW, United Kingdom
Telephone: (0865)-64881
Telex: 83177
Telefax: (0865)-60285

QM Software, Forman
P.O. Box 44127, Linden 2104, Johannesburg, South Africa
Telephone: (011)-7821044

Forman, an acronym for 'Forecasting for Management', brings the power of the microcomputer to bear in producing long, medium and short-term forecasts quickly and easily. The package has been designed by QM Software specifically with the needs of pracising managers in mind. It is menu driven throughout and requires only a few key depressions for the implementation of the most sophisticated analytica/forecasting methods. The most widely used modelling techniques for forecast generation, including moving averages, census decomposition, exponential smoothing, mathematical trend curves, adaptive filtering, Box-Jenkins and multiple regression, are now within the reach of all managers.

SPSS Benelux BV
P.O. Box 115, 4200 AC Gorinchem, The Netherlands
Telephone: (01830-36711
Telex: 21019

SPSS, introduced in 1966, is accepted as an comprehensive yet flexible and users-friendly software for statistical analysis, data management, forecasting and presentation software that operates on all major computers (PC/XT/AT, small, medium, large mainframes). SPSS software is being used by nearly 1,000,000 users worldwide. Applications of its software include all forms of survey analysis for market research and product testing, personnel evaluations, decision support, healthcare analysis, and computer performance evaluation. The module SPSS Trends provides comprehensive modeling and forecasting capabilities, a.o. curve fitting, smoothing procedures, Box-Jenkins methods and spectral analysis. For more information: SPSS Benelux BV-01830-36711

STOA & AFS, Inc.
Buro voor Statistische & Operationele Adviezen & Automatic Forecasting Systems, Inc.
c/o Dr.Ir. E.G.F. van Winkel
Fazantlaan 4, 5613 CC Eindhoven, The Netherlands
Telephone: (040)-437969/473601

Automatic Forecasting Systems has special competence in the area of time-series analysis, particularly the time domain methods of Box-Jenkins Modeling. AFS's products for the IBM-PC and compatibles have received rave reviews for their unique contribution to forecasting by incorporating "expert systems" features (AUTOBJ, AUTOBOX). AFS has been providing software to universities and industry since 1976 and recently introduced MTS, the first IBM-PC product for Vector-ARIMA. Now, AFS is proud to present a new version of AUTOBOX. STOA is a recently founded consultant in Statistics and Operational Analysis, specialized in time-series analysis and forecasting. Among other things STOA is the official AFS agent for Holland. AFS and STOA invited you to send your data: we will provide a free analysis which will be delivered to you at our combined booth.

Elsevier Science Publishers BV
P.O. Box 1991, 1000 BZ Amsterdam, The Netherlands
Telephone: (020)-5862911

Elsevier Science Publishers BV is one of the world's leading publishers of scientific and technical books and journals. Free sample issues of our many outstanding journals are available at the booth including, Technical Forecasting and Social Change, Journal of Policy Modeling, and Journal of Economic and Social Measurement.

Van Stockum, Belinfante & Coebergh
Venestraat 11, 2511 AR The Hague, The Netherlands
Telephone: (070)-656808

Van Stockum, Belinfante & Coebergh is one of the ten largest bookshops in Holland, located in the center of The Hague, with over 50.000 titles in stock. Among many other specialties: Marketing/management and computer sciences. On The Eighth International Symposium on Forecasting Van Stockum, Belinfante & Coebergh represent the following publishers: Prentice Hall, Kluwer, Oxford University Press and Cambridge University Press.

International Institute of Forecasters (IIF) and **Ninth International Symposium on Forecasting**
University of Houston, College of Business Administration
4800 Calhoun Road, Houston TX 77004, USA

Visit us to join the International Institute of Forecasters, obtain information on the ISF 89 in Vancouver, find out how to submit a paper to the International Journal of Forecasting (IJF), obtain information about the special issues for the IJF, purchase copies of the Program Book for ISF 88 and also for previous symposiums, join the Consultants Clearing House, join the Placement Service, leave your suggestions on how to improve future symposiums, and submit your entry for the ISF 88 Forecasting Conference. You can also examine the list of registrants to see who is at this symposium.

SOCIAL PROGRAM

Sunday, June 12
18.00-20.00 hrs.
INFORMAL GET-TOGETHER in the lounges of the RAI Congress Centre
Drinks and a typical Indonesian buffet will be served.

Monday, June 13
18.00-19.00 hrs.
OFFICIAL RECEPTION hosted by the Ministry of Economic Affairs and the Mayor and Aldermen of Amsterdam in the Van Goghmuseum.
At 17.30 hrs. bus transport will be provided from the RAI Congress Centre to the museum.

Tuesday, June 14
20.30-23.30 hrs.
Price: Dfl. 38.- p.p.
CANDLELIGHT TOUR
This romantic evening cruise through Amsterdam's enchanting canals is a memorable experience. You can relax in glass-enclosed comfort while wine and Dutch cheese will be served. Soft music wafts through your candlelit launch as it glides past the sparkling city. En route a Dutch drink will be served at a typical pub. The bridges and monuments along the canals are illuminated. Departure from the RAI Congress Centre; arrival in the city centre. (No organized transport back.)

Wednesday, June 15
20.00 hrs.
Ticket price: Dfl. 50.-
'DE NEDERLANDSE OPERA' - Nixon in China.
Each year as part of the Holland Festival there are special performances in the 'Muziektheater'. 'Nixon in China' is such a performance, a production of 'De Nederlandse Opera' and its choir, the Dutch National Ballet and the Holland Festival Orchestra, with members of the best orchestras such as: 'Het Concertgebouworkest' and the Orchestra of the 18th Century. The opera is in English. Director: Peter Sellars. Composer: John Adams.

LUNCH-TIME RECREATION

On Monday June 13, Ahrend Groep NV, Amsterdam, offers you the following audio visual movie in "De Grote Zaal", time: 12.45-13.16 hrs.

THE RUWENZORI MOUNTAINS, audio visual movie on a source of the Nile.

This 31 minutes long story starts at a height of 16,000 feet in the middle of the world (the Equator) with the images of clouds, ice, snow and rocks. A document on the source of life appears through a sequence of portraits of landscapes, vegetation and water in all its stages. Since we are fragments in this entity we can only show aspects. The audio visual movie is therefore a cultural statement without a commentary voice, telling what to see; which enables the audience to draw new conclusions every time it watches it. The audio visual movie is made by artist photographer Peter Westerveld (1951, Tanga, Tanzania), who spends most of his time in the East African region and by photographer Hendrik Jan van Brandwijk, who specializes in audio visual productions besides his photographic work. This presentation is organised by the Int. Art & Environment Foundation, Westeinde 29, 2512 GS The Hague, The Netherlands, phone (31)70-650406 or (31)20-931886.

POST-SYMPOSIUM TOURS

The dense railway network in the Netherlands, the frequency of services and the short distances enable the visitor to see a great deal of the Netherlands by train. Why not buy a day-excursion ticket to a tourist attraction; particularly suitable for people who like to go their own way. Tickets include:

individual departure possibilities
the return train journey from Amsterdam Central Station to the chosen destination
if applicable, local bus or tram fare
a detailed information set in English, to be handed out at the Symposium registration desk
a substantial discount.

For tours number 1, 4 and 5 early booking is strongly recommended. Tickets will be reserved when payment has been received.
Children: 0-3 years old are free of charge
4-9 years old are half price.

Registration is possible at the registration desk before Monday, June 13. Bookings for these tours can also be made for Friday, Saturday and Sunday.

1. **GIETHOORN, THE VENICE OF THE NORTH** (not on Sundays)
Price: Dfl. 50.- including coffee and cake (or french fries and lemonade)

All transport in this picturesque village is by 'punt' as its streets consist entirely of canals. Included is a punt-cruise and reduced admission fees to some Giethoorn museums.

2. **DE ZAANSE SCHANS**
Price: Dfl. 27.50, including coffee and pancake

A 17th and 18th century industrial and ship-building village of forest green wooden structures located on the river Zaan. Many buildings house museums of antiquity, old bakeries, grocery shops or workshops. Of great interest are the four working windmills which can be visited.

3. **ENKHUIZEN AND ZUIDERZEE MUSEUM**
Price: Dfl. 30.-

Mediaeval port town with many canals which houses the outdoor Zuiderzee Museum, a restored Zuiderzee village depicting life there a century ago (which can only be reached by boat).

4. **CANOE TRIP** (not on Sundays)
Price: Dfl. 65.-, including canoe and lunch

A possibility of holding a sports day on the Veluwe, by participating in a canoe trip of ca. 16 kilometers long and enjoy the fauna, flora, wildlife and rural tranquility. Life jackets can be hired on the spot at Dfl. 2.-

5. **BICYCLE TOUR WEESP NIFTARLAKE**
Price: Dfl. 20.- including rent of bicycle

36 kilometres trip through a magnificent lake district, south-west of Amsterdam, and along the river Vecht with its many mansions. A typically Dutch recreation: travel in comfort by train to Weesp, where a bicycle will be waiting for you. Follow your own route or use the tour description. Please note that the bicycle store requires:
- some identification (passport)
- a deposit of Dfl. 50.- (refundable)

GENERAL INFORMATION

Registration/information
The registration/information desk is situated on the ground floor of the RAI Congress Centre, Europaplein, 1078 GZ Amsterdam, telephone 5491212.
Services are provided for registration, hotel accommodation, tickets for trams and buses, excursion program and social events.

The registration/information desk will be open on:
Sunday June 12 from 16.00 - 19.00 hours.
Monday till Wednesday June 13-15 from 08.00 hours onwards.

Lunches
All organized congress lunches and coffee and tea during breaks are included in the congress fee.

Hotel information
For requests concerning hotel accommodation please contact the registration/information desk.

Bank services
During the congress the ABN-bank has an office in the registration area for the exchange of foreign currency and other banking facilities. Opening hours are the same as those of the registration/information desk.

Language
The official congress language is English.

Badges
ADMITTANCE TO THE LECTURE HALLS IS RESTRICTED TO REGISTERED PARTICIPANTS WEARING THEIR NAME-BADGE. All participants, exhibitors and accompanying persons are kindly requested to wear their name-badge during all congress meetings and social gatherings.

Daily bulletin
Each day of the congress a daily bulletin is provided with latest information. You are kindly requested to pick up your copy at the registration/information desk.

Slides Equipment
To have a last check on the sequence of your slides, slides equipment is available in the registration area. Slides should be handed there, at least 30 minutes before your session starts, and can be picked up after the session.

Local transport
From RAI Railway Station there is a direct connection to Amsterdam Schiphol Airport, The Hague and Rotterdam. The city centre and the Central Railway Station can easily be reached by tram no. 4, the Amstel Railway Station by buses no. 8 and no. 15. For details about trams and buses, see the public transport (GVB) information leaflet. Taxi stands are located at central positions in the city. The system of 'hailing taxis' is not known in The Netherlands. There are no special transport arrangements between congress centre and the hotels.

Car parking
Underground parking space is available at the congress centre; also for overnight parking. Car parking tickets for the duration of the congress are available at the registration desk. Price: Dfl. 28.-. Tickets for one entry are obtainable from the ticket-machine in the hall. Price: Dfl. 7.50.

Telephone/telegraph
Telephone booths are available in the lounges of the congress centre. They can be used for local calls. For telegrams and international telephone calls participants can apply to the telephone exchange.

First Aid
A first aid service is open during the congress.

CONFERENCE PROGRAM

HOW TO FIND YOUR SESSION

The Symposium consists of 121 sessions most of them covering one and a half hours and containing up to 5 speakers. These sessions are distributed over 13 lecture rooms. The place of these rooms can be found on the inside of the cover of this program book. In general each room is devoted to a particular stream of papers. The streams are:

Room	Stream	Session numbers
GZ	Plenary sessions	1 - 13
MZ	Methods and Software	14 - 22
III	Finance & Business	23 - 31
IV	Practice, State Space & Miscellaneous	32 - 40
V	Macroeconomics	41 - 49
VI	Mathematics and Models	50 - 58
VII	Miscellaneous	59 - 67
VIII	Accounting, Marketing & Logistics	68 - 76
IX	Dealing with the Future	77 - 85
X	Environment, Energy and Economics	86 - 94
XI	Regional Forecasting and Public Sector	95 - 103
A	Forecasting & Society	104 - 112
B	Industry & Technological Forecasting	113 - 121

On the following pages you will find a survey of the sessions held in each room.

Although the names of the sessions are indicative for the topics presented in these sessions some contributions that could not be combined into a separate session are spread over the existing sessions. Elsewhere in this programbook a complete list of sessions with all the relevant information is given. Below you will also find a condensed list of sessions with speakers and locations.

If one is not interested in a full session but only in some speaker(s) one may consult the alphabetical register of speakers with session indications. Both lists (of sessions and of speakers) are also on display at the registration desk. The lecture room "Grote Zaal" (GZ) is used for three kinds of events: keynote speakers, feature speakers and panels (see lists below).

LIST OF KEYNOTE SPEAKERS

Location: Grote Zaal

Arnold Zellner — Monday 09.15-10.00
Graduate School of Business
University of Chicago, USA

INTERNATIONAL FORECASTING USING BAYESIAN SHRINKAGE AND OTHER TECHNIQUES

Jan Tinbergen — Monday 10.30-11.15
Erasmus University Rotterdam
The Netherlands

THE IMPACT OF THE FORECASTING CAPABILITY OF ONE SCIENCE ON THAT OF OTHER SCIENCES

Everette S. Gardner, Jr. — Monday 11.15-12.00
College of Business Administration
University of Houston, USA

FORECASTING IN OPERATING SYSTEMS

William L. Ascher — Tuesday 13.30-14.15
Institute of Policy Sciences and Public Affairs
Duke University, USA

BEYOND ACCURACY: PROGRESS AND APPRAISAL IN LONG-RANGE POLITICAL-ECONOMIC FORECASTING

Location: Middenzaal

Riccardo Petrella — Tuesday 13.30-14.15
European Community
Brussels, Belgium

THE ROLE OF FORECASTING TODAY: ANALYSIS AND/OR ACTION

Location: Grote Zaal

William M. Stigliani — Wednesday 12.10-12.55
International Institute for Applied Systems Analysis
Laxenburg, Austria

FUTURE ENVIRONMENTS FOR EUROPE: SOME IMPLICATIONS OF ALTERNATIVE DEVELOPMENT PATHS

LIST OF FEATURE SPEAKERS

Location: Grote Zaal

Andrew C. Harvey — Monday 13.30-14.15
The London School of Economics and Political Science,
London, United Kingdom

STRUCTURAL TIME SERIES MODELLING ON AN IMB PC USING 'STAMP'

David E. Kanouse — Monday 15.30-16.15
The Rand Corporation, USA

IDENTIFYING POSSIBLE FUTURES OF THE AIDS EPIDEMIC

(discussion session) — Monday 16.15-17.00

Masanao Aoki — Tuesday 08.30-9.15
Department of Computer Science and Department of
Economics, University of California, USA

STATE SPACE MODELLING OF TIME SERIES AND APPLICATION TO TIME SERIES WITH RANDOM WALK COMPONENTS

Franz C. Palm — Tuesday 09.15-10.00
University of Limburg
The Netherlands

ECONOMETRIC MODELLING OF TIME SERIES

George Wright — Tuesday 14.30-15.15
Bristol Business School,
United Kingdom

JUDGMENT IN FORECASTING

Willem A. Wagenaar — Tuesday 15.15-16.00
University of Leiden,
The Netherlands

CALIBRATION OF EXPERTS

Richard T. Baillie — Tuesday 16.30-17.15
Department of Economics
Michigan State University, USA

TIME SERIES ANALYSIS OF FINANCIAL MARKET DATA

LIST OF PANEL SESSIONS

Location: Grote Zaal

The Future of Forecasting - Time Series Models and Beyond

Chair: Everette S. Gardner, Jr. Wednesdav 8.30-10.00

Location: Middenzaal

Survey data in economic forecasting

Chair: Lars-Erik Öller Monday 15.30-17.00

Methods in long term economic forecasting

Chair: F.J. Henk Don Tuesday 16.30-18.00

PRESIDENTIAL ADDRESS

The **Presidential Address** will be delivered by

Estela Bee Dagum

Statistics Canada, R.H. Coates Building, Ottawa, Ontario, Canada H1A 0T6

Title: **THE FUTURE OF THE FORECASTING PROFESSION**

Place: Restaurant

Time: Tuesday June 14, 1988 13.00-13.30

LIST OF SESSIONS

	PLENARY SESSIONS	METHODS & SOFTWARE	FINANCE & BUSINESS	PRACTICE, STATE SPACE & MISCELLANEOUS
	GROTE ZAAL (GZ)	MIDDENZAAL (MZ)	ROOM III	ROOM IV
Monday				
09.00- 9.15	Opening: **Peter B. de Ridder**			
09.15-10.00	S1: KN : **Arnold Zellner**			
COFFEE				
10.30-11.15	S2: KN : **Jan Tinbergen**			
11.15-12.00	S3: KN : **Everette S. Gardner, Jr.**			
LUNCH				
13.30-14.15	S4: F **Andrew C. Harvey**	}S14: **Software: Forecasting**	}S23: **Bankruptcy Prediction**	}S32: **Methodological**
14.15-15.00		} **Packages**	}	} **Foundations of Forecasting**
TEA				
15.30-16.15	S5: F **David E. Kanouse**	}S15: Panel: **Survey Data in**	}S24: **Exchange Rate**	}S33: **Economic Forecasting**
16.15-17.00	**Discussion**	} **Economic Forecasting**	} **Forecasting I**	} **in Practice**
Tuesday				
08.30-10.00	S6: F : **Masanao Aoki** F : **Franz C. Palm**	S16: **Comparative Review of Forecasting Software**	S25: **Stock Market Dynamics**	S34: **Experts Opinion**
COFFEE				
10.30-12.00	S7: **Sales Forecasting**	S17: **Automatic Forecasting Packages**	S26: **Financial Planning**	S35: **State Space Models**
LUNCH				
PRESIDENTIAL ADDRESS				
13.30-14.15	S8: KN **William L. Ascher**	S18: KN: **Riccardo Petrella**	S27: **Commodity Markets**	S36: **Quality Control**
PAUSE				
14.30-16.00	S9: F **Willem A. Wagenaar** F **George Wright**	S19: **Computational Methods & Software**	S28: **Financial Forecasting**	S37: Multivariate ARMA and State Space Methods
TEA				
16.30-18.00	S10: F **Richard T. Baillie**	S20: Panel: **Methods in Long Term Economic Forecasting**	S29: **Exchange Rate Models**	S38: **Management Support Systems**
Wednesday				
08.30-10.00	S11: Panel: **The Future of Forecasting**	S21: **Model Selection Methods I**	S30: **Forecasting Financial Prices**	S39: **Logit and Probit Models**
COFFEE				
10.30-12.00	S12: **System Dynamics**	S22: **Model Selection Methods II**	S31: **Business Forecasting**	40: **Exchange Rate Forecasting II**
12.10-12.55	S13: KN: **William M. Stigliani**			
12.55-13.00	Closing			

Legend: F = Feature Speaker
KN = Keynote Speaker

LIST OF SESSIONS

	MACROECONOMICS	MATHEMATICS & MODELS	MISCELLANEOUS	ACCOUNTING, MARKETING & LOGISTICS
	ROOM V	ROOM VI	ROOM VII	ROOM VIII
Monday				
13.30-15.00	S41: **Consumption & Investment**	S50: **Data Revision and Forecast Errors**	S59: **Risk Analysis**	S68: **Forecasting in Accounting**
TEA				
15.30-17.00	S42: **Labour**	S51: **Combining Forecasts**	S60: **Energy Forecasting II**	S69: **Econometric Time Series**
Tuesday				
08.30-10.00	S43: **Short term Macro-economics**	S52: **Estimation**	S61: **Macroeconomics Methods**	S70: **Judgmental Forecasting I**
COFFEE				
10.30-12.00	S44: **Economics Cycles**	S53: **Decision Making**	S62: **Game Theory**	S71: **Growth Functions**
LUNCH				
PRESIDENTIAL ADDRESS				
13.30-14.15	S45: **Inflation**	S54: **Classical Methods Revisited**	S63: **School Attendancy**	S72: **Modelling & Forecasting Port Traffic I**
PAUSE				
14.30-16.00	S46: **The World Economy in Medium Term**	S55: **Optimal Prediction**	S64: **Nonlinear Models**	S73: **Modelling & Forecasting Port Traffic II**
TEA				
16.30-18.00	S47: **Medium Term Country Forecasts**	S56: **Optimal Prediction II**	S65: **AIDS Forecasting and Estimation of the HIV+ Population Size**	S74: **Judgmental Forecasting II**
Wednesday				
08.30-10.00	S48: **Macroeconomic Policy**	S57: **Equilibra and Dynamics**	S66: **Implementation of Forecasting Models and Systems in Marketing**	S75: **Country and Political Risks II**
COFFEE				
10.30-12.00	S49: **Long Term Macroeconomics**	S58: **Mathematical Methods**	S67: **Bayesian Methods & Applications**	S76: **Marketing**

LIST OF SESSIONS

	DEALING WITH THE FUTURE	ENVIRONMENT, ENERGY AND ECONOMICS	REGIONAL FORECASTING AND PUBLIC SECTOR	FORECASTING & SOCIETY
	ROOM IX	ROOM X	ROOM XI	ROOM A
Monday				
13.30-15.00	S77: Telecommunications Demand Forecasting	S86: Environmental Trends and Discontinuities	S95: Regional Forecasting I	S104: Forecasting and Society I
TEA				
15.30-17.00	S78: Transport Forecasting	S87: Environmental Futures	S96: Regional Forecasting II	S105: Forecasting and Society II
Tuesday				
08.30-10.00	S79: Scenarios I	S88: Agricultural Forecasting	S97: Regional Forecasting III	S106: Country and Political Risks I
COFFEE				
10.30-12.00	S80: Scenarios II	S89: Weather Forecasting	S98: Regional Forecasting IV	S107: The Use of Gaming, Simulation, and Multi-scenario Analysis for Geostrategic Political-Military Planning
LUNCH				
PRESIDENTIAL ADDRESS				
13.30-14.15	S81: Unconventional Approaches to Forecasting the Far Future I	S90: New Product Forecasting	S99: Forecasting Postal Services	S108: Trend Methodology
PAUSE				
14.30-16.00	S82: Unconventional Approaches to Forecasting the Far Future II	S91: Electric Utilities and Demand	S100: Schools & Housing	S109: Multivariate and Structural Time Series Models
TEA				
16.30-18.00	S83: Uncertainty and Economic Policy	S92: Energy Forecasting I	S101: Forecasting in Health	S110: Forecasting and Society III
Wednesday				
08.30-10.00	S84: Trigg and Leach	S93: Cost & Use of Energy	S102: Military Expenditures	S111: Forecasting and Society IV
COFFEE				
10.30-12.00	S85: Holt-Winters	S94: New Developments in Demographic Forecasting	S103: Forecasting Models for Use in the United States Air Forces's EFMS	S112: Forecasting by Lattice & Other Statistical Algorithms

LIST OF SESSIONS

INDUSTRY AND TECHNOLOGICAL FORECASTING

ROOM B

Monday	
13.30-15.00	S113: The Past and Future of Forecasting
TEA	
15.30-17.00	S114: Improving Forecasting Accuracy
Tuesday	
08.30-10.00	S115: Industrial Commpetitiveness
COFFEE	
10.30-12.00	S116: Strategic Planning I
LUNCH	
PRESIDENTIAL ADDRESS	
13.30-14.15	S117: Strategic Planning II
PAUSE	
14.30-16.00	S118: Stocks, Earnings & Efficiency
TEA	
16.30-18.00	S119: Technological Forecasting
Wednesday	
08.30-10.00	S120: Forecasting Industrial Markets & Tourism
COFFEE	
10.30-12.00	S121: Technological Forecasting II

OPENING SPEECH

Peter B. de Ridder
Central Planning Bureau, Van Stolkweg 14, 2585 JR The Hague, The Netherlands

Peter B. de Ridder is the director of the Central Planning Bureau, the Dutch economic policy advisory body founded by Tinbergen in 1946. De Ridder studied at the Netherlands School of Economics (now Erasmus University) in Rotterdam. Before taking his current position in 1984, he worked in academics, government and business. His publications are in macro-economics with a focus on policy questions, exchange rates, international dynamics and modelling. He is a member of the Social Economic Council and advisory member of the Scientific Council for Government Policy.

INTERNATIONAL FORECASTING USING BAYESIAN SHRINKAGE AND OTHER TECHNIQUES

Arnold Zellner
Graduate School of Business, University of Chicago, USA

Arnold Zellner is currently Distinguished Service H.G.B. Alexander Professor of Economics and Statistics, Graduate School of Business, University of Chicago. He received his A.B. degree from Harvard U. and his Ph.D. degree from the University of California at Berkely. His research has been in the areas of theoretical and applied econometrics and statistics. His publications include works on Bayesian inference and decision techniques, econometric modeling and forecasting, and time series analysis. He has consulted with several governmental agencies and business firms and has been principal investigator under National Science Foundation grants since the 1960s. Zellner is a fellow of the American Statistical Association for the Advancement of Science and the American Academy of Arts and Sciences and a member of the American Economic Association and the International Statistical Institute.

After commenting on general approaches to the problem of modeling economics and forecasting, Bayesian shrinkage and other forecasting methods are applied in forecasting annual rates of change of 18 countries' output growth rates year by year for the period 1974-1984. Then Bayesian decision theoretic results for forecasting turning points in time series are described and applied in forecasting cyclical turning points in annual output growth rates for 18 countries. A summary of results and a brief description of future research will end the presentation.

Chair: **Lars-Erik Öller**
Department of Economics, Ministry of Finance, SF-00171 Helsinki, Finland

THE IMPACT OF THE FORECASTING CAPABILITY OF ONE SCIENCE ON THAT OF OTHER SCIENCES

Jan Tinbergen
Haviklaan 31, 2566 XD The Hague, The Netherlands

Jan Tinbergen (1903) received a Ph.D. in Natural Science from Leyden University in 1929. His thesis supervisor was Professor Paul Ehrenfest. He has done pioneering work in Economic and Econometric Sciences. His research interests cover problems in long and short-term economic cycles, development economics, economic policy, economic modelling and income distribution. His main work is his famous book 'Economic Policy: Principles and Design'. He received many Honorary Doctorates. In addition he has won numerous prizes and awards. The foremost among them being the first Alfred Nobel Memorial Prize in Economic Science which he shared with Ragnar Frisch.

Forecasting of an economic variable is partly based on the forecasting of variables which are the subject of other sciences, e.g. meteorology, biology, chemistry, physics. A concrete forecast is a combined forecast of many sciences. In order to test the forecasting capacity of economic science it is necessary to eliminate the forecasting capacity of the other sciences involved by substituting the observed value of their variables for the value forecast. For forecasts of physical variables economic forecasts are of minimal importance. Is there a structure in the relationship between the various sciences? What types of structures can be distinguished?

Chair: **B.M.S. van Praag**
Econometric Institute, Erasmus University Rotterdam, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands

Everette S. Gardner, Jr.
College of Business Administration, University of Houston, Houston, Texas 77004, USA

Everette S. Gardner, Jr. joined the University of Houston in 1987 as Associate Professor of Decision and Information Sciences. In 1978, he earned the Ph.D. in Production and Operations Management from the University of North Carolina at Chapel Hill. Dr. Gardner served twenty years in the Supply Corps of the U.S. Navy and retired with the rank of Commander in 1986. In addition to duty at sea, his Navy experience includes jobs in planning, inventory control, management information systems, and operations research. As Director of Operations Research for the Navy, he developed models used to manage more than one million inventory items. His publications include more than twenty refereed articles on forecasting, inventories, and production planning. Dr. Gardner is Director of the International Institute of Forecasters and a member of the editorial boards of Management Science, Interfaces, and the International Journal of Forecasting. He is coauthor of a textbook, Quantitative Approaches to Management (seventh edition), forthcoming from McGraw-Hill Book Company, and the author of Autocast, a popular forecasting system for the IBM PC published by Core Analytic, Inc. Dr. Gardner's column on forecasting and decisionmaking appears in LOTUS Magazine.

Academic research usually treats forecasting as an end in itself. The result is that little is known about how forecasts affect management decisions in operating systems such as production planning and inventory control. Using a case study in managing more than 70,000 inventory items, I will explain how forecasts of unit demands are used in decision-making. Then I will discuss the steps taken to improve forecasting: (1) choosing alternative forecasting models with potential for improving inventory performance, (2) evaluation of the models, (3) selling the results of the study to management, and (4) implementation of a new model. The bottom line in this case study is that better forecasting enabled management to reduce aggregate inventory investment by about 10% ($38 million) with no impact on the level of customer service provided or the stock replenishment workload. The main conclusion from this study is that mean forecast accuracy measures such as the mean-absolute-percentage error are largely irrelevant in operating systems. The variance and distribution of the forecast errors are much more important in determining system performance.

Chair: **Jan G. de Gooijer**
Department of Economic Statistics, University of Amsterdam, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

Everette S. Gardner, Jr.
College of Business Administration, University of Houston, Houston, Texas 77004, USA

Everette S. Gardner, Jr. joined the University of Houston in 1987 as Associate Professor of Decision and Information Sciences. In 1978, he earned the Ph.D. in Production and Operations Management from the University of North Carolina at Chapel Hill. Dr. Gardner served twenty years in the Supply Corps of the U.S. Navy and retired with the rank of Commander in 1986. In addition to duty at sea, his Navy experience includes jobs in planning, inventory control, management information systems, and operations research. As Director of Operations Research for the Navy, he developed models used to manage more than one million inventory items. His publications include more than twenty refereed articles on forecasting, inventories, and production planning. Dr. Gardner is Director of the International Institute of Forecasters and a member of the editorial boards of Management Science, Interfaces, and the International Journal of Forecasting. He is coauthor of a textbook, Quantitative Approaches to Management (seventh edition), forthcoming from McGraw-Hill Book Company, and the author of Autocast, a popular forecasting system for the IBM PC published by Core Analytic, Inc. Dr. Gardner's column on forecasting and decisionmaking appears in LOTUS Magazine.

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Chair: **Jan G. de Gooijer**
Department of Economic Statistics, University of Amsterdam, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

STRUCTURAL TIME SERIES MODELLING ON AN IBM PC USING 'STAMP'

FEATURE SPEAKER: **Andrew C. Harvey**
The London School of Economics and Political Science, University of London, London, UK

The way in which structural time series models may be formulated and estimated is described. It is then shown how these models can be used for forecasting, and for trend estimations and seasonal adjustment. The menu-driven STAMP program will be used to illustrate structural time series modelling using a number of applications. These will include energy consumption, purse snatching in Chicago, and rainfall in Brazil. Explanatory variables will also be introduced into models, with applications including the employment-output equation and the consumption of spirits in the UK. Intervention analysis will be discussed with respect to the UK seat belt law.

Chair: **Spyros Makridakis**
European Institute of Business Administration, INSEAD, Fontainebleau, France

IDENTIFYING POSSIBLE FUTURES FOR THE AIDS EPIDEMIC

FEATURE SPEAKER: **David E. Kanouse**
The RAND Corporation, 1700 Main Street, Santa Monica, California 90406-2138, USA

Projections of the future course of the AIDS epidemic often use curve-fitting or other approaches to arrive at best estimates regarding numbers of future cases. As a contrasting approach, this paper describes a dynamic simulation model of the spread of human immunodeficiency virus within and between various risk groups in the United States. The model is used to identify plausible combinations of parameters and alternative future scenarios that are consistent with current scientific knowledge and history of the epidemic to date. Specific results from the model are used to illustrate the approach.

QUESTION AND ANSWER SESSION

David E. Kanouse
The RAND Corporation, 1700 Main Street, Santa Monica, California 90406-2138, USA

This will be a question and answer session on the special invited presentation, "Identifying Possible Futures of the AIDS Epidemic.

Chair: **Bruce F. Goeller**
The RAND Corporation, 1700 Main Street, Santa Monica, California 90406-2138, USA

STATE SPACE MODELLING OF TIME SERIES AND APPLICATION TO TIME SERIES WITH RANDOM WALK COMPONENTS

FEATURE SPEAKER: **Masanao Aoki**
Department of Computer Science and Department of Economics, University of California, Los Angeles, USA

A recently developed algorithm for building time series models in balanced state space representation is described and its relation to the two-stage least squares and instrumental variables method is outlined. It is then shown that a two-step application of the algorithm can build state space models for time series with random walk components. Since many macroeconomic series contain some random walk components, this two-step procedure is illustrated on some time series drawn from macroeconomic and financial fields.

09.30-10.00

Grote Zaal

ECONOMETRIC MODELLING OF TIME SERIES

FEATURE SPEAKER: **Franz C. Palm**
University of Limburg, Postbus 616, 6200 MD Maastricht, The Netherlands

The lecture will be concerned with recent developments in the econometric analysis of time series and their implications for forecasting. In particular we will consider the structural econometric modeling time series analysis (SEMTSA) approach in which in a first step a simple time series model for a particular macroeconomic series is derived from economic theory, possibly formulated in terms of a stochastic intertemporal decision problem, and is checked against the serial correlation properties of the data. A next step in the process of constructing more elaborate models in SEMTSA and in generating more sophisticated forecasts, consists in taking into account the process of the exogenous variables. This can be done by formulating a conditional model for the variable of interest given the exogenous variables and/or by taking account of the impact of changes in the structure of the process of the exogenous variables for the properties of the endogenous variables. The approach will be illustrated using results for aggregate quarterly non-durable consumption and income in the Netherlands. The relationship with structural time series models, ARCH-structure in the disturbance and cointegrated variables will also be discussed.

Chair: **Arnold H.Q.M. Merkies**
Department of Econometrics, Free University of Amsterdam, De Boelelaan 1105, 1007 MC Amsterdam, The Netherlands

SALES FORECASTING

Chair: **Essam Mahmoud**
University of North Texas, PO Box 13677, Denton TX 76203-3677, USA

HOW'S BUSINESS? - HOW DO YOU KNOW
(Management Tools and Concepts for Effectively Assessing Business Forecasts)

Dwight E. Thomas Jr.
AT&T Network Systems, 595 Waughtown Street, Winston-Salem, NC 27107, USA

How's business? ... How do the orders look? ... Is the forecast on target? Often the answers to these questions are derived simplistically due to the urgency to respond or data limitations. A rapid response as well as one based on a thorough analysis of planning data is possible with deployment of the right concepts and planning tools. The key to assessing whether sales forecasts are on target are: * Relational measurement concept; * Measurement of demand velocity; * Use of computer graphics; * Availability of timely and accurate data. This paper will explore these subjects from a conceptual viewpoint and will present practical suggestions to business planners by describing the process used at AT&T Network Systems to forecast demand and sales of telecommunications products.

SALES FORECASTING IN RETAILING

Anna Papaioannou
Manchester Business School, Booth Street West, Manchester M15, JK

In Retailing forecasts are needed at both the market and the disaggregate level. The study investigates the development of medium term forecasting models of sales, at disaggregate level within the clothing sector of the Retailing Industry. A comparison of different techniques will be made including exponential smoothing, ARIMA models of Box and Jenkins, and VAR models. The effects of preliminary and revised data will also be considered.

MODELING SALES FORCE COMPOSITE FORECASTS

Thomas R. Willemain
Decision Sciences & Engineering Systems, Rensselaer Polytechnic Institute, Troy NY 12180-3590, US.

It is common to base sales forecasts on subjective assessments of individual sales prospects' probabilities of purchase. The performance of sales force composite (SFC) forecasts depends on the bias and precision of the probability assessments made by the sales force and the size and heterogeneity of the group of prospects. This analysis models SFC forecasts and compares them against exponential smoothing when purchase probabilities are stable and also when they shift suddenly.

FORECASTING THE SALES OF A BRAND OF MOTORCYCLES

Mete Sirvanci and **Patrick Keller**
University of Wisconsin, Whitewater, Wisconsin, USA

A motorcycle manufacturer's monthly sales data are analyzed to forecast the sales of various models of motorcycles. The data exhibits strong seasonality and in some cases cyclic characteristics. Both Box-Jenkins ARIMA and time series regression models are developed for three different motorcycle families. Economic variables and variables representing promotional activities are found to be significant factors in the regression models. Forecasts obtained by the two approaches, regression and Box-Jenkins, are compared.

EMERGING ISSUES IN SALES FORECASTING AND DECISION SUPPORT SYSTEMS a review and some results of a survey of forecasting practice

Gillian Rice
2207 Canterbury Court, Denton, TX 76205, USA
Essam Mahmoud
University of North Texas, PO Box 13677, Denton, TX 76203-3677, USA
Naresh Malhotra
Georgia Institute of Technology, Atlanta, Georgia 30332, USA

There are two distinct groups of emerging issues in the area of sales forecasting and decision support systems: methodological issues and implementational issues. This paper's examination of the methodological issues includes consideration of the relative superiority of forecasting methods and procedures, statistical versus judgmental methods, combining forecasting methods, and descriptive versus predictive validity in marketing models that might be used for sales forecasting. The discussion of implementational issues includes consideration of bias in forecasting, people's acceptance of the forecasting function, and the presentation of some results of a survey of forecasting practice.

BEYOND ACCURACY: PROGRESS AND APPRAISAL IN LONG-RANGE POLITICAL-ECONOMIC FORECASTING

William L. **Ascher**
Center for International Development Research, Institute of Policy Sciences, Duke University, Durham, North Carolina, USA

W.L. Ascher (1947) studied political science at the Universities of Michigan (B.A) and Yale (M.Phil., Ph.D.). He held positions as teaching and research assistant at Yale University Department of Political Science, as lecturer at University of Pennsylvania Department of Political Science, and as assistant and associate professor at John Hopkins University Department of Political Science. He was visiting researcher at the Facultad Latinoamericana de Ciencirs Sociales in Santiago (Chili) and belonged to the World Bank's Project Advisory Staff. He also was project director of the Forecasting & Governance project of the National Academy of Public Administration (Washington D.C.). W.L. Ascher currently is professor of Public Policy Studies and Political Science at Duke University, as well as Co-Director of the Center for International Development Research and Director of the Program in International Development Policy, both also at Duke University. He is member of the Editorial Boards of several Journals, including "Policy Sciences" and "Technological Forecasting and Social Change" and consultant to various institutes. Ascher published several books, including "Forecasting: An Appraisal for Policy-Makers and Planners" (1978) and "Strategic Planning and Forecasting" (1983), with W.H. Overholt). He also published many articles and chapters in books on forecasting, public administration, policy sciences and development policy.

Long-range political-economic forecasting cannot be appraised in terms of empirically-demonstrated accuracy. Yet as "scientific research programs", futures studies can be assessed in terms of methodological dependability and progressive problem shifts. The methodology of developmental constructs meets these criteria; policy debates and international conflicts can be viewed as competitions among developmental sequences, which progress best if cast as provisional rather than as general laws. Developmental constructs can incorporate historical lessons without the rigidity of single, dominant analogies. The approach applies with equal robustness to long-term economic growth futures studies and international conflict and mediation.

Chair: **Frans A. van Vught**
CHEPS, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands

BEYOND ACCURACY: PROGRESS AND APPRAISAL IN LONG-RANGE POLITICAL-ECONOMIC FORECASTING

William L. **Ascher**
Center for International Development Research, Institute of Policy Sciences, Duke University, Durham, North Carolina, USA

W.L. Ascher (1947) studied political science at the Universities of Michigan (B.A) and Yale (M.Phil., Ph.D.). He held positions as teaching and research assistant at Yale University Department of Political Science, as lecturer at University of Pennsylvania Department of Political Science, and as assistant and associate professor at John Hopkins University Department of Political Science. He was visiting researcher at the Facultad Latinoamericana de Ciencirs Sociales in Santiago (Chili) and belonged to the World Bank's Project Advisory Staff. He also was project director of the Forecasting & Governance project of the National Academy of Public Administration (Washington D.C.). W.L. Ascher currently is professor of Public Policy Studies and Political Science at Duke University, as well as Co-Director of the Center for International Development Research and Director of the Program in International Development Policy, both also at Duke University. He is member of the Editorial Boards of several Journals, including "Policy Sciences" and "Technological Forecasting and Social Change" and consultant to various institutes. Ascher published several books, including "Forecasting: An Appraisal for Policy-Makers and Planners" (1978) and "Strategic Planning and Forecasting" (1983), with W.H. Overholt). He also published many articles and chapters in books on forecasting, public administration, policy sciences and development policy.

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Chair: **Frans A. van Vught**
CHEPS, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands

CALIBRATION OF EXPERTS

FEATURE SPEAKER: **Willem A. Wagenaar**
Department of Psychology, Unit of Experimental Psychology, University of Leiden, P.O. Box 9509, 2300 RA Leiden, The Netherlands

(Abstract not available at time of publication)

JUDGMENT IN FORECASTING

FEATURE SPEAKER: **George Wright**
Bristol Business School, Coldharbour Lane, Frenchay, Bristol BS16 1QY, UK

This paper reviews current knowledge on judgmental forecasting by individuals. The role and validity of judgment in probability forecasting and in 'bootstrapping' research is reviewed. Special attention is paid to issues of expertise and real-world versus laboratory studies. The general conclusion is that holistic judgment is good. The paper turns next to the role and validity of judgment as a replacement for, or as an input to, statistical forecasting methods. Work-a-day forecasting practices of ex-post adjustment are described and then contrasted with scientific studies of the validity of judgment in this context. Given the multiple ways in which judgement can be incorporated with statistical models and given the generally good quality of holistic judgement, it follows that structures for interaction should be subjected empirical evaluation.

Chair: **Wiero J. Beek**
Unilever Research and Engineering, Postbus 760, 3000 DK Rotterdam, The Netherlands
Technical University of Delft, Delft, The Netherlands

TIME SERIES ANALYSIS OF FINANCIAL MARKETS DATA

FEATURE SPEAKER: **Richard T. Baillie**
Department of Economics, Michigan State University, East Lansing, MI 48824, USA

A brief survey is given of the types of issues that arise in analyzing stock returns, bond market data, exchange rates and forward and futures commodity prices and options data. Through using generalized ARCH models and vector time series methods, several stylized facts emerge across markets and across time periods that throw new light on issues such as (a) market efficiency, (b) risk and liquidity premia, (c) announcement effects and news in describing volatility, (d) forecasting future prices, including options.

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

PANEL: THE FUTURE OF FORECASTING - TIME SERIES MODELS AND BEYOND

Chair: Everette S. Gardner, Jr.
Department of Decision and Information Sciences, University of Houston, Houston, TX 77004, USA

The panel will lead a discussion on the future directions which research in forecasting should take and, in particular, what future developments in time series methods are desirable. The four panelists are all authors in the forthcoming special issue of the International Journal of Forecasting, on "The Future of Forecasting".

Panelists:

J. Scott Armstrong
Wharton School, University of Pennsylvania, Philadelphia, PA 19104, USA

Christopher Chatfield
Department of Mathematics, University of Bath, Bath, BA2 7AY, UK

Spyros Makridakis
European Institute of Business Administration, INSEAD, Fontainebleau, France

J. Keith Ord
Department of Management Science and Statistics, The Pennsylvania State University, University Park, PA 16802, USA

SYSTEM DYNAMICS

Chair: **R. Joel Rahn**
Faculté des Sciences de l'administration, Université Laval, Ste-Foy Québec, Canada G1K 7P4

CAUSAL MODELS IN CORPORATE STRATEGY ANALYSIS: EVALUATING THE MARKET PERFORMANCE OF NEW PRODUCTS

Peter M. **Milling**
Osnabrueck University, D-4500 Osnabrueck, Federal Republic of Germany

Forecasting and controlling the market performance of new products is a key task of corporate management. Most models used in this field lack, however, the crucial factors which are decisive for an innovation's success or failure; they do not include managerial decision variables like price, delivery delays, advertisement, quality, etc. A simulation model is presented which reflects the tight interrelationships between corporate actions and market response. It explains how the dynamics of a product life cycle are generated, and how structure causes behavior. Its use as a decision support tool will be demonstrated by analyzing and evaluating different innovation strategies.

A STUDY ON THE LONG-TERM COORDINATED DEVELOPMENT OF THE R & D AND THE SOCIO-ECONOMY OF A LARGE CITY IN CHINA

Qifan **Wang**, **Bingyi Yang** and **Yu Ding**
System Dynamics Group, Shanghai Institute of Mechanical Engineering, Shanghai, P.R. China

The current economic system of China is characterized by the mixed functioning of the traditional planned-economy mechanism and the newly injected market-economy mechanism. Under such a economic system, the long-term coordinated development of a large city in China differs mechanically and practically from the large cities of those developed countries. The coordinated development of a technological-economic-society system is a multiple-objective programming problem. By "coordinated" we mean a three-dimension concord - temporal concord, spacial concord and functional concord. The set of the objectives is composed of the objectives of the all-over coordinated development among technology sector, economy sector and society sector, and the sub-objectives of each sector. Because of the above-mentioned reason, the realization of such a multiple-objective is subject both to the various resource constraints such as the limitations of energy, transportation, raw material supplies and to the demand constraints. Since technology is now becoming a more and more important factor of production, this paper made a great number of efforts to study the mechanism of the technology progress, the input-output relations of the technology sector, and the economic and social evaluations of the technology progress. The whole model is primarily composed of three sectors: technology sector, economy sector and society sector, each sector is again composed of several subsectors.

ENTRAINMENT BETWEEN THE ECONOMIC LONG WAVE AND OTHER MACROECONOMIC CYCLES

Erik Reimer Larsen, **Erik Mosekilde** and **Steen Rasmussen**
Physics Laboratory III, The Technical University of Denmark, 2800 Lyngby, Denmark
John D. Sterman
Sloan School of Management, Massachusetts Institute of Technology, Cambridge Massachusetts, USA

We have studied a number of highly non-linear phenomena which arise when the economic long wave model developed at the Sloan School of Management is perturbed by a sinusoidal variation in the orders for capital to the goods sector. This modulation represents a coupling to more short term oscillatory modes in the macroeconomic system. As the period of the external forcing is changed, a complete devil's staircase of frequency-locked oscillations develops, with intervening intervals of quasi-periodic behavior. For sufficiently high amplitudes of the perturbing signal, deterministic chaos is observed.

FUTURE ENVIRONMENTS FOR EUROPE: SOME IMPLICATIONS OF ALTERNATIVE DEVELOPMENT PATHS

William M. Stigliani
International Institute for Applied Systems Analysis, A-2361 Laxenburg, Austria

William M. Stigliani is currently at the International Institute for Applied Systems Analysis (IIASA) leading the study on the Future Environments for Europe: Some Implications of Alternative Development Paths. He has come to IIASA from the U.S. National Academy of Sciences, where he was a study director for three reports on acid deposition in North America. He received his Ph.D. from Princeton University in physical chemistry. He has publisihed numerous papers and several popular textbooks on environmental chemistry. He also has served on several distinguished committees, including an advisory Panel of the U.S. National Science Foundation, reporting on state-of-the-art atmospheric research in the U.S.A.

The superposition of two major transformations in twenty-first century Europe will have a profound impact on the continent's capacity to support ecological and socio-economic sustainability. One transformation is the expected change in European Climate. The other is the passage of European societies from industrialism to a new technological age dominated by informatics, biotechnologies, and new materials. Accompanying such fundamental changes will be changes in how human development activities affect the environment. The question for discussion is how to manage the uncertain future of the European environment, considering both the constraints and the opportunities arising from the new conditions.

Chair: **Wim A. Hafkamp**
Institute for Environmental Studies, Free University of Amsterdam, De Boelelaan 1105, 1007MC Amsterdam, The Netherlands

SOFTWARE: FORECASTING PACKAGES

Chair: **Bob van Winkel**
STOA, Fazantlaan 4, 3613 CC Eindhoven, The Netherlands

(TITLE AND ABSTRACT NOT AVAILABLE AT TIME OF PUBLICATION)

Rudolf Lewandowski
Marketing Systems Hunsrückstrasse 9a, D-4300 Essen, Federal Republic of Germany

GRAPHICS: AN AID TO FORECASTERS

Hans Levenbach
Levenbach Associates, Suite 348, 301 Washington Street, Morristown, NJ 07960, USA

Business Forecasting is a form of numerical detective work. To be successful you must be able to look at data in a number of useful ways. Graphical software make it possible. At times plotting can reveal the unexpected. Graphics can help select an appropriate forecasting approach. A good PC-based forecasting package should have versatile graphical capabilities linked to the most practical forecasting techniques in a manner readily accessible by most business managers. This talk will show how graphical tools, conveniently packaged in microcomputer software, are becoming an invaluable adjunct to a better understanding of the forecast and the factors that influence it.

GRAPHICAL AIDS TO TIME SERIES ANALYSIS; THE TSG PACKAGE

Antony Unwin and **Graham Wills**
Department of Statistics, Trinity College Dublin, Ireland

The TSG package provides graphical tools for the interactive exploration of time series data. It is complementary to analytic time series methods and is especially useful for working with multivariate series. This paper describes the facilities which TSG offers and illustrates their use in forecasting.

E.M.S.: ECONOMIC MODEL SIMULATOR, A COMPREHENSIVE PROGRAM FOR IBM-PC OR COMPATIBLES

W. Meeusen and **P. Willeme**
University of Antwerp, Dienst Algemene Economie, Middelheimlaan 1, B-2020 Antwerp, Belgium

A comprehensive program-package for IBM-PC or compatibles is presented allowing the specification and simulation of alternative economic policies by means of various macroeconomic models. The program is menu-oriented and consists of 3 modules relating to the following tasks: the performance of experiments with previously defined models by changing one or more values of one or more exogenous variables, by changing one or more of the parameters, by dropping equations, etc. This module breaks up into 4 parts: a "setup" part, a "solve" part, a "output" part, and a "analyze" part; the specification of new models and their corresponding databases, or changing residing ones, and adding them to the model-library; the extraction of theoretical information from models initially supplied with the program; the information relates to text and logical diagrams. The simulation can be deterministic or stochastic, static or dynamic. The user has the possibility to chose between several solution algorithms.

ON THE CHOICE OF VARIABLES AND DATA ADEQUATE MODEL SPECIFICATIONS

R. Fahrion
Department of Economics, University of Heidelberg, Grabengasse 14, 6900 Heidelberg, Federal Republic of Germany

In multidimensional nonlinear regression problems spline functions yield optimal approximations to the observation data when the number of variables involved is low and the number of required knots will not lead to computational difficulties. Spline functions are optionally smooth with respect to the curvature of the regression spline function. As it is a priori not known which of the exogeneous variables should be active and what the functional shape of these variables should be, one could simply solve the regression problem for all possible subsets of variables and select a specification which obeys best to certain statistical criteria. This procedure is realized for linear models in the GLM procedure of the SAS software package. The procedure RSQUARE in SAS performs all possible linear combinations of independent variables, and a best one could be selected with respect to the multiple correlation coefficient or Mallow's C_p-statistic. A software system on a microcomputer will be demonstrated for an ex post analysis of a series of test problems using observation series of the West German VGR (Volkswirtschaftliche Gesamtrechtnung). Finally, experiences with forecasting properties of the model specifications are reported.

PANEL: SURVEY DATA IN ECONOMIC FORECASTING

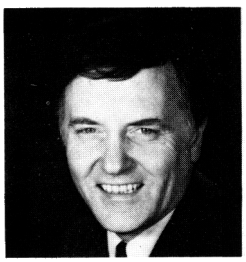
Chair: **Lars-Erik Öller**
Ministry of Finance, P.O. Box 295, SF-00171 Helsinki, Finland

The panel will debate, among others, on the following topics: experiences of survey data in various countries and institutions, comparisons with forecasting techniques, combining survey data and other methods and relating such data to the literature on expectations.

Timo Teräsvirta

Timo Teräsvirta is Senior Research Fellow, Research Institute of Finnish Economy (ETLA), Helsinki. His Ph.D. is from the University of Helsinki. He is currently leading a team of researchers working on econometric and time-series problems and financed by the Yrjö Jahnsson Foundation, Helsinki. He has also been Professor of Statistics at the University of Helsinki. He has written articles in Econometrica, Journal of Econometrics, International Journal of Forecasting, Scandinavian Journal of Economics, Scandinavian Journal of Statistics and other professional journals. He is an associate editor of the two last-mentioned journals.

Gernot Nerb



Gernot Nerb is head of the Department "Business Surveys and Behavioural Economics" at the IFO Institute in Munich. He is also heading the CIRET-Secretariate at IFO; CIRET is an international organization of research fellows in the field of short term economic analyses and forecasting. His Ph.D. is from Munich University. He has consulted in many countries, primarily Latin American, in the area of business surveys. From 1984 to 1987 he was economic adviser in the Directorate General of Economics and Finances (DGII) of the European Commission in Brussels. He has held teaching positions with University in Augsburg and Stuttgart. His publications (more than 100) are mainly on business cycle, short term forecasting, consumer and labour market research.

Marc Nerlove

Marc Nerlove is University Professor of Economics at the University of Pennsylvania. He is the author, with David Grether and Jose L. Carvalho, of Analysis of Economic Time Series: A Synthesis, published by Academic Press in 1979. His most recent book, Household and Economy, was also published by Academic Press in 1987. He has worked on agricultural supply, time series analysis, econometric methods for dealing with categorical and other types of data from economic surveys, and on business expectations, plans and behavior. Recently he has begun a new quarterly survey of U.S. manufacturing firms in collaboration with the Dun and Bradstreet Corporation. Nerlove is a member of the U.S. National Academy of Sciences, a fellow of the American Academy of Arts and Sciences, fellow and past president of the Econometric Society, fellow of the American Statistical Association, and fellow of the American Association for the Advancement of Science.

Victor Zarnowitz

Victor Zarnowitz was born in Poland. In 1949 he received his Ph.D., summa cum laude, from the University of Heidelberg, Federal Republic of Germany. Currently he is Professor of Economics and Finance, Graduate School of Business, University of Chicago. He is member of The American Economic Association, the American Statistical Association, the Econometric Society and member of the coordinating committee of CIRET (Centre for International Research on Economic Tendency Surveys). His other activities include: member of the editorial board and contributor to Economic Outlook USA; co-editor of the Journal of Business; editor of Economic Prospects; and contributor to the ASA-NBER Quarterly Survey of the Economic Outlook (a nation-wide survey of economic forecasts).

Pierre M. Vanden Abeele

Pierre Vanden Abeele is professor of Marketing and Economic Psychology at Louvain University and a regular lecturer at the Graduate School of Management, UCLA. Trained as an economist, a psychologist and a statistician, he holds a Ph.D. degree in marketing from Stanford University. His research interests cover consumer psychology, market share modeling and forecasting, and economic psychology (the formation and predictive record of economic agent's expectations; fiscal psychology). In the area of expectations formation and of forecasting, Dr. Vanden Abeele lists publications in the Journal of Economic Psychology and in the Journal of Business and Economic Statistics. He is a member of the Board of the International Association for Research in Economic Psychology (IAREP) and of the Editorial Board of the Journal of Economic Psychology.

COMPARATIVE REVIEW OF FORECASTING SOFTWARE

Chair: **Floor van Nes**
Netherlands Central Planning Bureau, Dpt. of Applied Math. & Computer Science, Van Stolkweg 14, 2585 JR The Hague, The Netherlands

FORECASTING SOFTWARE AND PRACTICE - a personal perspective

Chris D. Beaumont
London Business School, Sussex Place, Regents Park, London NW1 4SA, UK

This paper surveys recent developments in micro-computer based forecasting software and assesses their impact on forecasting practice. Significant improvements have occurred, yet at the same time there are some disturbing trends in the marketing and consequent use of professional software. It is argued that to date few packages have explicitly addressed the fundamental, communication vacuum between analyst and manager which typically inhibits 'useful' forecasting. In this respect it is mooted that the conventional, generic, software evaluation criteria have found to be lacking. Taking one significant development in detail; the extent to which 'automatic' systems offer a possible solution is considered within a framework which is customer (solution) orientated rather then technology (computer) driven.

MICROCOMPUTER SOFTWARE FOR THE SIMULATION OF ECONOMETRIC MODELS

Robert S. Rycroft
Department of Economics, Mary Washington College, Fredericksburg, Virginia 22401, USA

A profusion of microcomputer-oriented software for econometric analysis and forecasting has been made available in recent years. A substantial review literature has also come into existence. Much of this software is capable of simulating multi-equation econometric models, yet relative performance in this area has not received much attention from reviewers. This paper will evaluate comparatively the simulation performance of several software brands. Scheduled for inclusion in the review are Micro-TSP, Rats, Soritec, ESP, and ySTAT. Other software may be included in the final version.

ECONOMETRIC MODELLING ON MICRO-COMPUTERS: A SURVEY

Jean-Louis Brillet
I.N.S.E.E., Institut National de la Statistique et des Etudes Economiques, 18, boulevard Adolphe Pinard, 75675 Paris, France

The recent development of the use of micro-computers in the economic field has led to the production of several modelling software packages, more or less adapted from mainframe systems. This presentation will give the main conclusions of a survey conducted for the French Administration, and due for publication in the Journal of Applied Econometrics. It shows the way in which the software available on micro-computers (in practice on PC compatible ones) answers the needs of the modeller, whether he is a research scientist or a forecaster. The panel includes, in alphabetical order: AREMOS, ESP, Micro-TSP, MODLER and SORITEC. This test is based not on written documentation, but on the actual production and simulation of a small model of the French economy, which reproduces rather closely the properties of models used in actual forecasts. Of course, additional features are also considered. The series of tests these software had to pass allowed to produce Yes/No tables, as well as a general evaluation for each product. Although the full paper might not be available as a written document, for copyright reasons, it will be presented, and its main conclusions will be given, with additional information on computer performances. At least two more software packages will be included, G and the micro version of TSP (different from Micro-TSP).

AN EVALUATION OF ECONOMETRIC AND FORECASTING SOFTWARE FOR THE PC

Floor van Nes and **Arie ten Cate**
Netherlands Central Planning Bureau, Dpt. of Applied Math. & Computer Science, Van Stolkweg 14, 2585 JR The Hague, The Netherlands

A survey is presented of the major econometric and forecasting computer programs for the IBM PC and compatibles. These 13 programs can estimate models on time series data (regression, Box-Jenkins, etc) and compute forecasts with such models. A general introduction to the programs is given, including information about prices and hardware requirements. Several tables are presented to compare the estimation and forecasting properties of the programs. Special attention is given to the solution of nonlinear simultaneous models. The paper contains a list of manufacturer's adresses.

AUTOMATIC FORECASTING PACKAGES

Chair: **Hans Levenbach**
Levenbach Associates, Suite 348, 301 Washington Street, Morristown, NJ 07960, USA

A PROGRAM FOR TIME SERIES ANALYSIS FOR THE IBM PC

Slaven Mickovic
Institute Jozef Stefan, Jamova 39, 6111 Ljubljana, Yugoslavia

PC-TSA is a statistical program for the time series analysis. It is a command based system designed for interactive work. Identification of univariate ARMAG models (ARMA models in which some parameters may be constrained to zero) in PC-TSA is based on generalized Cepar-Dekleva's method. The criterion for model selection is of the form $C(p,q) = S + A*(p + q)$, where S is a function of residuals and A is a function of the form $g(N)/N$ where N is a time series legnth and $g(N)/N \to 0$. The term $A*(p + q)$ can be considered as a penalty term for the complexity of the model. User has several possibilities to choose S and A. PC-TSA allows also visual selection of the model. This is possible by moving the cursor over the graph which represents the set of ARMA models. PC-TSA offers other commands which are important for time series analysis. The description of the program is supported by examples illustrating its usefulness.

MAMDRAKE: AN EXPERT SYSTEM FOR MODELLING IRREGULAR TIME SERIES

R. Azencott and **Y. Girard**
University Paris XI, 91405 Orsay Cedex, France

Modelling and forecasting irregular time series by stochastic models requires quite skilled statistical expertise. We have focused on ARIMA models. One of the main problems was to automatize completely the sophisticated choice of ARIMA model type. Extracting the expertise thus required serious mathematical technicity. A body of about sixty rules incorporate the heuristics and manipulate about fourty five algorithms to achieve autonomously the modelling task. Running on IBM-PC compatible micro computers the system can handle series of 300 observations in less than 25 minutes. Menu driven interaction, graphic displays, and an efficient tool box create a user friendly environment.

AIDA - SOME NEW DEVELOPMENTS IN AUTOMATIC ARMA-FORECASTING

Walter Mohr
F.H. Flensburg, University of Kiel, Wippen 6, 2300 Kiel, Federal Republic of Germany

In comparison to other automatic forecasting software packages for ARMA-modelling (e.g. Autobox, Sift) our program AIDA offers a more complete menu of identification strategies including recent developments. In particular we implement an idea by Parzen to use quasi-nonstationary filters the roots of which lie close to unit circle boundary. For modelling the stationary and nonstationary part we use for example the corner-method and exploit duality theorems for inverse characteristics. AIDA has proven to be a useful tool in many simulations and comparative forecasting studies and now is being used in practice.

HOW AUTOMATIC DO WE WANT FORECASTING SOFTWARE TO BE

Leonard J. Tashman
Department of Business Administration, University of Vermont, Burlington, Vermont 05405, USA

Such great strides are being made in simplifying forecasting software that some programs now claim to enable those who "slept through their statistics course" to achieve good forecasting performance. This may be too much of a good thing: Can an untrained user rely on the software's internal expert to provide reasonable forecasts? Does automatic software facilitate or impede "combined forecasting"? This presentation will examine the virtues and pitfalls of automatic forecasting when used by the non-statistician.

Riccardo Petrella
European Community, Brussels, Belgium

Riccardo Petrella, born 1941, is the director of the FAST-programme (Forecasting and Assessment in Science and Technology) at the European Commission in Brussels, since 1978. Before joining the European Commission, he was the director of the European Research Center in the Social Sciences, in Vienna, Austria. During that period, he was visiting professor in Economic Policy at Namur University, Namur, Belgium.
Petrella was awarded a Ph.D. Honoris Causa by the University of Umeå, Sweden, in 1975.

The role of forecasting ("Prospective" in French), be it in private or public organizations, cannot be longer restricted to being an analytical tool with the aim to increase the "Knowledge on the future" (awareness, assessment) that will be useful to and useable by decision makers because it will reduce uncertainty, will simplify complexity and will legitimize already made choices. Four reasons will be given that militate in favour of a Strategic Oriented Forecasting (SOF). By SOF is intended Forecasting that 1) will primarily focuss on - people needs, perceptions, visions and conflicts; - processes, and control and regulatory mechanisms; - strategies on the concerned operators; - identification of alternative solutions; 2) is based on the involvement and participation - to the largest possible extent - of all concerned people; 3) is not aimed at predicting the future; 4) is carried out on a permanent basis.

Chair: **Jean H.P. Paelinck**
Erasmus University Rotterdam, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands

COMPUTATIONAL METHODS & SOFTWARE

Chair: **Hans M. Amman**
University of Amsterdam, Faculty of Economics, Department of Macroeconomics, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

EVALUATING THE STATISTICAL SOFTWARE FOR THE IDENTIFICATION, ESTIMATION AND PREDICTION OF TIME SERIES

Joseph Plasmans
University of Antwerp (UFSIA), Prinsstraat 13, B 2000 Antwerp, Belgium

A precise description of statistical procedures and an evaluation of various recent computer packages for time series on the basis of 3 criteria (residual standard error, parameter significance and forecast performance) is presented.
ARIMA - and transfer function models are estimated for: 1) monthly individual turnovers of a large Antwerp port enterprise (1980^{I} - 1986^{VII}), 2) quarterly market shares of German, French and Japanese cars in Belgium (1968^{II} - 1986^{IV}), 3) 200 simulated replications of 200 generated observations each. The following computer packages are mutually compared: Least Squares (LS) by TSERS and PACK-SYSTEM-AFS, 3 SAS-mainframe procedures: conditional and unconditional LS and ML and 2 SCA-PC-procedures: conditional and exact ML.

A FORTRAN GENERATOR FOR ECONOMETRIC MODELING

Götz Uebe
Fachbereich Wirtschafts- und Organisationswissenschaften, Institut für Statistik und quantitative Ökonomik, Universität der Bundeswehr Hamburg, Postfach 700822 D-2000 Hamburg 70, Federal Republic of Germany

For the general nonlinear econometric model of n equations the main ideas of a Fortran source generator are outlined. The system - completely coded in Fortran - is implemented on a mainframe (UNIVAC 1180). There are five interrelated programs. 1. the Fortran-source generation for the iterative Gauss Seidel computation, 2. the Fortran-source generation for the iterative Newton-Raphson computation, 3. the analytic linearization of the nonlinear system of equations (by Taylor approximation), 4. the computation of eigenvalues of the linearized system of equations, 5. the quadratic-linear optimization according to the dynamic programming approach of Chow.

LS, THE FAST SIMULATION PROGRAM FOR PCs

György Barabas
University of Hagen, Statistics and Econometrics Division, Postfach 940, D-5800 Hagen 1, Federal Republic of Germany

The program I developed is called LS (Large Simulation System). It solves (simulates) large, nonlinear econometric models rapidly on a PC. Experiences have been made already by models up to 1400 equations. This model size is far below the upper limits of the capacity of the program. Models can be written in a user-friendly form by text editors, like Kedit. Simulation can be carried out for up to 60 periods. Tables can be printed for various purposes, like fast printing for the user, formatted printing for publishing or printing in a format which fits to the requirements of loading time series back to the databank. A databank program has been combined with LS. LS takes automatically the required time series from the databank. For the simulation of different scenarios values of the time series from the databank can be substituted by values taken from the so-called 'variant' file. The whole process, beginning with the reading of the model file and ending with printing the results, runs in one step (job) in 2-3 minutes on a fast AT with coprocessor for a model with ca. 1000 equations and for four periods. There are some algorithms in the LS which may be of special interest: - The fast and memory saving algorithm, which finds the smallest simultaneous blocks in the model; - A fast algorithm which identifies (finds and stores) the variables; - The method how the model is translated (compiled) for the computation. This year in Hagen the LS is developed so that multiple criteria decision problems (vector optimization) based on econometric models can be solved by the reference point approach.

SUPERCOMPUTING IN ECONOMICS: NEW POSSIBILITIES FOR SIMULATION

Hans M. Amman
University of Amsterdam, Faculty of Economics, Department of Macroeconomics, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

In this paper some recent developments in supercomputer architecture are discussed. It is pointed out to what extent these developments can facilitate scientific computation in economics. With the help of an example of adaptive control simulation it is pointed out that with the current computation speed available, the possibilities for economic simulation are increased considerably and give rise to new fields of application. To assist the reader an extended bibliography is added.

PANEL: METHODS IN LONG TERM ECONOMIC FORECASTING

Chair: F.J. Henk Don
Central Planning Bureau, Van Stolkweg 14, 2585 JR Den Haag, The Netherlands

The panel will try to answer the following questions: What do we hope to learn from Long Term Economic Forecasting? What information is needed for policy decisions or otherwise and how can it be provided? What are the important issues in the Long Term Economy and the proper methods to deal with them? The role of models, the use of scenarios and the need for vision will be put in perspective. The relative importance for the Long Term Economic prospects of social structure, political power, technology, capital formation and international trade will be assessed.

Daniel Bachmann

Daniel Bachmann is in charge of long term macroeconomic projections in the Projection and Programming Division of the UN Economic Commission for Europe. Born in Geneva, 1946, he obtained his degree in economics and econometrics from the University of Geneva. Prior to his current position he worked with the econometric department of that university. At the ECE he has worked on the 1978 scenarios for the Overall Economic Perspective for the ECE region up to 1990, and on the current Perspective to the year 2000.

Olav **Bjerkholt**

Olav Bjerkholt is head of the research Department of the Central Bureau of Statistics which has major responsibilities for macroeconomic modelling in Norway. He also holds the position of professor of Oil and Energy Economics at the University of Oslo.

Vladímir **Dlouhy**

Vladimír Dlouhy was born in Prague, Czechoslovakia, where he graduated in 1977 from the Prague School of Economics, in 1983 he earned his Ph.D. with a thesis on disequilibrium modelling of centrally planned economies. His research and publications are mainly related to macroeconomic modelling of centrally planned economies, and recently to the problems of economic reform and economic policy making in the socialist economies. After a scholarship in Leuven, Belgium he served as a lecturer at the Prague School of Economics. Currently he is head of the Department of Macroeconomic Forecasts of the Institute for Forecasting, Czechoslovak Academy of Sciences. He contributed to the extensive work in preparation of the long term development strategy of the Czechoslovak economy for the next 25 years.

Kees **van Paridon**

Kees van Paridon (1952) graduated from the Erasmus University Rotterdam in spatial economics in 1979. His master's thesis was on 'Long Waves', with J. van Duijn as supervisor. In 1987 he received his Ph.D. from Erasmus University, with A. van der Zwan as supervisor. His Ph.D. thesis 'Changing for Growth. A study on the Long Term Economic Development of Open and Industrialised Economies', was published by Eburon Delft. He published several articles as well as a study for the Dutch Scientific Council for Government Policy. From 1979 till 1987 he worked as Lecturer at Erasmus University. He also worked at IIASA and at MIT. Since 1987 he is with the Central Planning Bureau, in the Long term Analysis Project.

Joop **L. de Vries**

Joop L. de Vries is Head of Business Environment in the corporate planning division of the Royal Dutch/Shell Group. The task of his team is to monitor and analyse the long term developments of the Group's international business environment, which includes socio-economic, technological and oil/energy trends. He studied chemistry in Nijmegen, the Netherlands, and received his Ph.D. in 1972 after postgraduate research in Nijmegen and at Rugers University. After a subsequent period in the Air Force Information Service, he joined Shell in 1974, in the Fundamental Research group in the Amsterdam laboratory. Thereafter he worked in the planning department of Shell Nederland in Rotterdam, in Oil Pricing and Economics in London, and in the socio-economic section of Group Planning. Prior to his current position, he spent four years in Shell International Trading company, where he was manager Products Trading (West).

MODEL SELECTION METHODS I

Chair: **Jan G. de Gooijer**
Department of Economic Statistics, University of Amsterdam, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

CARTESIAN ARIMA SEARCH ALGORITHM

Ralf Östermark
Department of Business Administration, Henriksgatan 7, 20500 Abo 50, Finland
Rune Höglund
Department of Statistics, Fänriksgatan 3 B, 20500 Abo 50, Finland

In the present study we present an automized Box-Jenkins algorithm, based on the following idea: For a given set of time series and a performance criterion space F, determine suitable search intervals of standard ARIMA model parameters. Solve the maximum likelihood estimation problem for each cartesian combination of model parameters. Of the produced set of model contenders M, retain the subset N that is nondominated in the space F for each individual series. The method produces a set of nondominated models for each tested series. The parametric search intervals are assessed heuristically using standard analysis of the autocorrelation and partial autocorrelation functions for the series. Prior to maximum likelihood estimation, each series may be subjected to variance stabilizing Box-Cox transformation and to difference pattern search using standard benchmark criteria. The algorithm has been tested against BMDP output for known models, and 21x1000 simulated series for 21 of the models tested by David P. Reilly.

AVOIDING MODEL ORDER DECISIONS WITH VERY LONG AUTOREGRESSIONS

Fernando Tusell
Departamento de Análisis Económico and Instituto de Economía Pública, Universidad del País Vasco, Bilbao, Spain

Model order identification is the most difficult step when trying to fit a data set. Most techniques proposed rely heavily on subjective decisions to be made by the analyst. This paper describes the relationship between order determination and raw periodogram smoothing, and proposes to use long autoregressions obtained by factoring optimally smoothed spectra. Several procedures for the adaptive smoothing of periodograms are described, and examples are shown which demonstrate the performance of the technique.

A COMPARISON OF BOX-JENKINS AND AUTOMATIC ARIMA-ORDER DETERMINATION PROCEDURES

Stephen Beveridge and **Cyril Oickle**
Department of Finance and Management Science, Faculty of Business, The University of Alberta, Edmonton, Alberta, Canada

The Box-Jenkins approach to time series modeling is based primarily on pattern recognition and hypothesis thesting. Numerous alternative procedures have been proposed to eliminate the subjectiveness and inherent uncertainty in discriminating between competing ARIMA models. Forecast accuracy is employed as the benchmark in comparing all popular automatic and/or objective modeling selection techniques with the Box-Jenkins approach. Real series modeled by textbook authors are used.

COMPARATIVE EFFICIENCY OF CRITERIA FOR LAG-LENGTH SELECTION IN TIME-SERIES ANALYSIS

Nozar Hashemzadeh
Department of Economics, Radford University, Radford Va. 24142, USA

This paper compares four different criteria for "selecting" an appropriate lag-length in dealing with the question of causality in the analysis of time series data. The paper extends earlier works by Thornton and Batten (1985), Guilkey and Salemi (1982) and Hocking (1972) and argues that the consistency of any particular criteria used for lag selection can best be determined by cross validation (application to new data) as opposed to rules of thumb.

MODEL SELECTION METHODS II

Chair: Adi Raveh
School of Business Administration, Hebrew University, 91905 Jerusalem, Israel

A GOODNESS-OF-FIT TEST BASED ON A FEW ORDER STATISTICS

M. Masoom Ali
Department of Mathematical Sciences, Ball State University, Muncie, IN 47306, USA

A large sample goodness-of-fit test for continuous location-scale distributions with finite second moment will be discussed. The test statistic is a ratio of a quadratic forms involving a few selected order statistics and the usual sample variance. The test statistic has a limiting chi-square distribution under the null hypothesis. This statistic is specifically useful for testing goodness-of-fit hypotheses when the location and scale parameters are unknown. Some power considerations will be made with various choices of spacings. An example will be given to indicate computational procedures.

MODEL SELECTION IN TIME SERIES

H.L. Juneja
The Polytechnic of Central London, 32/38 Wells Street, London W1P 3FG, UK

A decision-theory approach to model selection in time series is developed. Several autoregressive models are simulated. It is shown that 'weighted mean regret' criterion leads to a consistent estimate of the order of autoregression provided the order is finite. Simulation results comparing several automatic order estimation criteria including Minimax Regret, Mean Regret, AIC and BIC are reported

A STUDY ON IDENTIFICATION OF TRANSFER FUNCTION MODELS BY BIASED REGRESSION METHODS

Per-Olov Edlund
Stockholm School of Economics, Box 6501, S-113 83 Stockholm, Sweden

This paper investigates a biased regression approach to the preliminary estimation of the Box-Jenkins transfer function weights. Using statistical simulation to generate time series, fourteen estimators are compared in terms of MSE and standard error of the weights. The results show that the ridge estimators nearly always give lower MSE than the OLS estimator, and in the computationally difficult cases give much lower MSE than the OLS estimator. The principle components estimators can give lower MSE than the OLS, but also higher values. All biased estimators give much lower estimated standard error of the weights than OLS.

A NEW APPROACH TO STATISTICAL FORECASTING

Spyros Makridakis
European Institute of Business Administration, Boulevard de Constance, 77305 Fontainebleau, France

Available approaches to statistical forecasting suffer from several deficiencies that can render their predictions for real-world economic/business series inappropriate. In this paper I illustrate such deficiencies, with real-life data and propose an approach that corrects their negative impact. The proposed approach is based on three premises: First, model selection is not based on historical information but rather on accuracy measures computed from out-of-sample data. Second, two types of model selection are done on out-of-sample data the first chooses the best model from those available within a single method, while the second selects the best among four methods run in parallel. Third, the within method or among methods model selection is done for each forecasting horizon separately, making it possible to have different models and/or methods to predict each of the m horizons. In addition to being theoretically appealing, this new approach outperforms the best method of the M-competition by a large margin when tested empirically.

BANKRUPTCY PREDICTION

Chair: **Harlan D. Platt**
College of Business Administration, Northeastern University, 360 Huntington Ave., Boston, MA 02115, USA

DOES THE NEW BANKRUPTCY CODE ENCOURAGE CORPORATE FAILURE?

Christine V. Zavgren
School of Management, Clarkson University, Potsdam, New York 13676, USA

The new U.S. bankruptcy Code, effective in 1979, has often been seen as too lenient. A logit model whose dependent variable is the time period during which bankruptcy occurs shows that firms filing after the Code change are in poorer condition than those filing before and also that business conditions have seriously declined. Both factors have increased the likelihood of failure. Thus, it is not solely the new Code which is responsible for the increasing failure rate, nor are reforms indicated to restrict the use of bankruptcy. These structural differences underscore the need for care in designing bankruptcy tests.

IMPROVING EX ANTE BANKRUPTCY CLASSIFICATION USING STABLE PREDICTIVE VARIABLES

Marjorie A. Platt
College of Business Administration, Northeastern University, 360 Huntington Ave., Boston, MA 02115, USA

One explanation for the lower accuracy of bankruptcy classification models with out-of-sample data compared to within-sample results is that the data used to build models has not been stable. A better approach may be to impose data stability on underlying financial ratios while maintaining their intrinsic meanings. Industry relative ratios, created by dividing a firm's ratio by the industry's average ratio, are more stable then unadjusted financial ratios. A bankruptcy classification model using industry relative ratios classifies firms into failed and nonfailed groups as well as previous studies; however, out-of-sample results with industry relative ratios are superior to most prior research.

PREDICTING BANKRUPTCY FOR FIRMS IN FINANCIAL DISTRESS

Lisa R. Gilbert, **Krishnagopal Menon** and **Kenneth B. Schwartz**
Boston University, Boston, Massachusetts, USA; Boston College, Chestnut Hill, Massachusetts, USA

In this study, bankruptcy models are developed using a sample of bankrupt and randomly selected nonbankrupt firms, and a sample of bankrupt and distressed firms. We demonstrate that financial ratio-based models are unable to distinguish bankruptcies from other distressed firms. Further, the variables that show any ability to discriminate between bankrupt and distressed firms are different from those that discriminate between bankrupt and randomly selected nonbankrupt firms. The overlapping financial characteristics of bankrupt and distressed firms suggest that the resolution of distress is influenced by other, perhaps nonfinancial, factors. Bankruptcy is only one of the strategic options available to financially distressed firms.

METHODS, ERROR RATES AND SELECTING A BANKRUPTCY PREDICTION MODEL

Daniel L. McDonald and **Kooi Ong Tong**
Faculty of Business, Simon Fraser University, Burnaby, Canada V5A 1S6

Several problems in predicting bankruptcy are identified. The "peeking problem" involves using prediction models which could not have been known at the time they are applied. The others are citing overall accuracy rather than accuracy by specific prediction; citing accuracy relative to outcomes rather than relative to predictions; and finally the selection from among competing prediction models. An empirical test used both multiple discriminant analysis (MDA) and naive prediction applied to US manufacturing firms for 1975-79. Over the 5949 predictions the MDA analysis was only marginally superior and would be preferred to the naive "predict all not bankrupt" only under limited cost of error conditions.

EXCHANGE RATE FORECASTING I

Chair: **Henk Jager**
Department of Macroeconomics, University of Amsterdam, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

EXCHANGE RATE FORECASTS AND RISK PREMIA IN FOUR FOREIGN EXCHANGE MARKETS

Ronald MacDonald
Department of Economics, The University, Aberdeen, AB9 2TY, UK

In this paper we utilise a data base consisting of the exchange rate forecasts of thirty major European banks for four major currencies, namely, the British pound, the German mark, the Japanese yen and the Swiss franc (all against the US dollar). The main purpose of our research is to determine whether foreign exchange market forecasters form their expectations rationally or use some other expectations generating mechanism. This has an important bearing on whether the often cited result that the forward premium on foreign exchange is an inefficient forecaster of the change in the exchange rate is due to the irrationality of market operators or risk aversion (which in turn has important theoretical and policy implications).

RISK PREMIA IN THE FOREIGN EXCHANGE MARKET AND IN THE STOCK MARKET

Kees G. **Koedijk** and **Clemens J.M. Kool**
Erasmus Universiteit, Vakgroep Monetaire Economie, Postbus 1738, 3000 DR Rotterdam, The Netherlands

Recent research suggests that movements in returns in the stock market and the foreign exchange market are highly correlated and that risk premia in these markets tend to move together over time. The present paper provides tests of these hypotheses by investigating movements in risk premia in both markets and especially their macroeconomic causes. We develop an international asset pricing model which allows us to derive expressions for the risk premium in the foreign exchange markets and the stock market simultaneously. The model is implemented empirically for returns in the foreign exchange market and stock market of the United States, the United Kingdom, Japan and Germany for the 1977-1987 period. We evaluate the impact of the current state of the economy on risk premia by linking them to macroeconomic variables like inflation and interest rates.

HAS THE RATIONAL EXPECTATION PROXY BIASED TESTS ON RISK PREMIA IN FORWARD EXCHANGE MARKETS?

Jeanette J. Capel and **Eelke de Jong**
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In almost all studies of a risk premium in forward exchange markets, the subsequently realized spot rate has been used as a proxy for prior expectations. In the present paper we investigate whether the use of this rational expectation proxy systematically biases the results obtained in previous studies. The paper indicates that this proxy biases tests on the existence of a risk premium towards acceptance of the null hypothesis of no risk premium if compared to some alternative proxies. Although this bias seems to be less severe than is suggested in Jacobs (1982). Fama (1984) found that the covariance between the risk premium and the expected change in the exchange rate is negative and that the variance of the former exceeds that of the latter. Using some alternative expectation proxies we corroborate this result for about 50 percent of the variants distinguished. There is some evidence that the rational expectation proxy biases the results towards concluding in favour of a negative covariance between the two components of the forward rate.

STOCK MARKET DYNAMICS

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FRACTALS, CHAOS THEORY AND STOCK AVERAGES

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Classical models of stock averages, such as random walks with normal or log-normal increments, often fit real-world data poorly. In the 1960's Benoit Mandelbrot gave evidence to consider models with sharp discontinuities (remember October 19, 1987), increments with hyperbolic distributions (and possibly infinite variance), and statistically similar behavior over various time scales. These fractal ideas lead naturally to recent applications of chaos theory, which seeks orderly structures, e.g. strange attractors, in apparent disorder. This paper presents more evidence to support fractal/chaos theory approaches to stock averages, and describes some tools for further investigations.

SIGNALS OF MAJOR STOCK PRICE MOVEMENTS, EIGHT COUNTRIES

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Peaks and troughs in lagging economic indicators such as interest rates, labor costs and inventories lead the opposite turns in business cycles by long intervals. Since stock prices are influenced by interest rates and factors affecting profits, some of the lagging indicators have an inverse impact on share prices. This paper tests whether lagging indicators provide warnings of emerging bull or bear markets in stocks. Using smoothed growth rates of composite lagging indexes to define signals of cyclical movements in eight countries, we measure changes in stock price indexes between these signals dates. The results reveal a promising technique for investment decision-making.

A STUDY OF NEW YORK STOCK EXCHANGE VOLUME AND INTEREST RATES USING AUTOMATIC INTERVENTION DETECTION AND TRANSFER FUNCTIONS

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Box and Jenkins specified a procedure for the development of what they called a "transfer function model". This is a model which expresses the interrelationships between two or more time series. The intent of this study is to answer the question "what effect, if any, do interest rates have on trading volume .. or vice versa". In order to answer these questions we will employ the methods of transfer functions on the NYSE depend on interest rates and measured by the MOODY's AAA RATE.

ESTIMATING TIME VARYING RISK PREMIA: THE CASE OF BELGIAN SECURITIES

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The analysis concerns monthly data from 1951 through 1987 on excess returns based on the Brussels stock exchange index. Since a direct measure of risk is methodologically impossible, a time series model is estimated for the risk premium allowing to compare various hypotheses on the risk structure concerning the evolution of risk and the way economic agents take it into account.

ARE INDEX FUNDS PREDICTIVE ENOUGH?

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The rise of enthusiasm for "index funds" shows, if needed, the interest of looking for a subset of elements (in this case, a portfolio) being the most representative of an aggregate (in this case stock exchange index). In such a problem, we are interested in finding the smallest subset of the components of the aggregate that follows as best as possible its pattern (e.g. in the case of the "index funds" we look for the smallest "portfolio" with the highest correlation with the stock exchange index). We also consider the predictive power of the subset selected. This paper presents a two-step method to find the most representative subset of the evolution of an aggregate, - using cluster analyses to select the best subset, - using multiple regression to weight the selected components. We apply the method to the Belgian stock exchange index.

FINANCIAL PLANNING

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APPLICATION OF ECONOMIC ANALYSIS IN THE EXAMINATION OF FINANCIAL FORECASTS ISSUED BY U.S. BUSINESS ENTITIES

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The Guide for Prospective Financial Statements requires the independent Certified Public Accountant to evaluate the selection of key factors and their underlying assumptions used by management in preparing a financial forecast. The Guide, issued by the American Institute of Certified Public Accountants, does not outline a specific methodology in performing an examination engagement. This paper presents an analysis of various economic measurements and how they can be used by a practicing accountant in examining prospective financial statements.

COPING WITH THE EFFECTS OF UNCERTAINTY IN FINANCIAL PLANNING

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1. Defence projects in the UK and elsewhere make use of the latest available technology. It is perhaps not surprising therefore that large over-runs in cost have been experienced for some projects. These large uncertainties in the cost of defence projects can make financial planning very difficult. This is particularly so in the context of a funding system in which expenditure is approved only on a year by year basis and which makes little provision for carrying over funds from one year to the next. The consequences of poor financial planning can be serious. On one hand, the fear of overspend can bring about a moratorium on new contracts which is intended to contain in-year costs albeit at the expense of large increases in overall costs. On the other hand, overly conservative financial management can result in funds not being committed until late in the financial year and thus resources cannot be allocated as effectively as they would be otherwise. Either way the result is the same - less defence for the same money. 2. This paper discusses the evolution in the predictions of the costs of major defence projects. It then goes on to describe a model designed to make use of generalised information of this sort in order to produce long term budgetary forecasts which form the basis of strategic planning.

BUSINESS PLANNING UNDER UNCERTAINTY - QUANTIFYING VARIABILITY AND PLANSTAD

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In business, planning often starts with a predeterminent annual target. As the year progresses the attainability of this target becomes the focus of planning and control groups. This talk summarizes several years of research, using case studies, into ways to understand and quantify the uncertainty present in such a planning process. We will discuss two aspects of uncertainty in business volumes: the inherent variability and the accuracy in planning these volumes. We will also discuss methods for estimating them, and how they are used to assess the attainability of targets and make annual business risk outlooks.

APPLYING THE MARKOV PROCESS MODEL IN FORECASTING LOAN PORTFOLIO QUALITY AND PROFITABLITY CONSEQUENCES IN TANZANIA

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Development Finance Institutions have to continue issuing new loans, with the additional costs of participatory - management training to raise portfolio quality; or discontinue issuing new loans, resulting in portfolio losses. Consequences on DFIs cashflow, and profitablity, are related to states, or events, existing in a chance process (Markov Process), and the probability of occurence of each event dependent on the state immediately preceding. The Markov Process Model is applied under Tanzanian rural conditions to forecast DFIs profitability, using transitional probabilities of attaining states of 'good' or 'poor' loan repayment, derived from prior relative frequencies. Rural-training policies are then determined.

FINANCIALLY ORIENTATED FORECAST-PUBLICITY

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(Abstract not available at time of publication)

COMMODITY MARKETS

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LONG RUN AREA DECISIONS AND SUPPLY RESPONSE MODELS FOR INDIAN TEA

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Tea is an international commodity. In India, it is a major export earner. India takes the pride of being the largest producer, exporter and consumer in the world. This is an unique hatric position. Inspite of this pride, share of Indian Tea export had slided down from 37% in 1960 to 22% in 1985. The steep imbalance of demand-supply causes the rise of prices in both internal as well as export prices to the extent of 11.64% and 16.88% during 1974-84. Inspite this price rise consumers have shown a monotonic increasing taste and acceptance of tea. This has probably reflected in total reversal of ratio of domestic retention and export of Indian Tea from 34:64 in 1950 to 60:40 in 1977. Thus it appears that the overriding factors to increase demand is taste and preference rather than market conditions. The dynamics of domestic monotonic increased demand and export requirement of Tea in India is the present concern of Indian tea industry. The paper addresses two major issues. Firstly what is the present state of art of production and consumption of Tea and its dynamic role in International market. Secondly to identify the determinants of production possibility of Tea and its response behaviour.

SHORT-TERM AND LONG-TERM OUTLOOK FOR THE RUBBER MARKET IN THE PRESENCE OF A BUFFERSTOCK

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A quarterly model of the market for natural rubber, based on long term vintage models of supply of natural rubber and of demand for car tires is used to assess the impact of the bufferstocking arrangements made under the International Natural Rubber Agreement since 1982. Its effect has been to raise revenues by up to 20% in some quarters and by 3% on average over the past years. Various scenarios for the rest of the century indicate that prices may fall in the near future without, however, endangering the viability of the Agreement.

FINANCIAL FORECASTING

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FORECASTING THE FINANCIAL EFFECTS OF DISCONTINUING AN INTERCOLLEGIATE SPORT

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The cost of intercollegiate athletics has risen dramatically in recent years. Very few intercollegiate sports programs break-even let alone earn a profit. Yet many institutions would be financially worse off if an unprofitable sport were dropped. One reason is many seemingly non-sport specific revenues and expenditures are affected by specific sports programs. Additionally, some athletics department expenditures do not affect total institutional expenditures to the same magnitude. A model is presented to forecast the marginal impact of discontinuing a specific sport on the total institution's financial condition by demonstrating rational revenue and expenditure allocations and effects of internal transfer payments.

FORECASTING OPERATING CASH FLOWS: THE LAGGED RESPONSE TO REVENUE AND EXPENSE CHANGES

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Adequate operating cash flows are essential to the continued health of an enterprise. Cash flow forecasts form the basis for most lending and many equity investment decisions. Research has focused recently on cash flow generation processes and forecasting techniques. This research examines the response over time of operating cash flows to changes in revenues and expenses. Expenses are, in general, a direct function of revenues. However, the ability of a firm to control expenses in response to rapidly changing revenues varies considerably across industries. Three forecasting models based upon the response function are compared for three separate industries.

FORECASTING OF RATIOS OF PROFITABILITY TO THE BANKS

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We consider the data of the different variables which are used to analyse the profitability of the bank. Eliminating the outliers, we determine through cluster analysis two groups of variables: those that measure profit and those that measure solvency. Employing principal components analysis, we create two indices signifying the above measures. Then we elaborate an error components model from the data of the previous period to forecast the above mentioned indices.

HOW QUICK AND ACCURATE ARE THE CAPITAL COST FORECASTING METHODS (CCFMs) IN USE?

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The increasingly and diversified use of computers in engineering, has made possible an intensive exchange of updated information among designing teams. CCFMs, an important tool for fast economic evaluation of projects, should in this context, present a higher degree of integration with the development of the project. Although at the expense of precision, as compared to data, they are quite simple to use, but results cannot, in general, be further refined. The scope of this study is to analyse existing CCFMs in order to determine which kind of method feets better to a fully computerized managed project.

CORPORATE EARNINGS FORECASTS IN GLOBAL INVESTMENT MANAGEMENT

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(Abstract not available at time of publication)

EXCHANGE RATE MODELS

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CONTROLLED DIFFUSION AND EXCHANGE RATE FORECASTING

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This paper develops a prediction model for exchange rates in the presence of governmental monetary control. The exchange rate is modeled as a diffusion process subject to a stochastic driving force comprising governmental actions of selling and buying local currency when the process reaches a specific upper or lower bound set by the monerary authority. The stochastic properties of the model are discussed and a resulting forecasting model developed. The Singapore dollar vs. US dollar exchange rate is used as an example demonstrating the effectiveness of the estimated forecasting model.

EXCHANGE RATE FORECASTING IN THE PHILIPPINES

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This paper presents a technique for forecasting the exchange rate with an econometric model. The model takes into account some nuances of exchange rate determination in a managed-floating regime where a parallel market exists. Three sets of factors are included explicitly in the model: (1) market forces as measured by price differentials between the Philippines and the United States, (2) speculative forces as indicated by the exchange rate variance and the black market rate, (3) and government's ability to intervene as represented by the Central Bank's gross international reserves. The model is tested historically and implications for the business forecaster are drawn out of the results.

THE OUT-OF-SAMPLE FORECASTING PERFORMANCE OF EXCHANGE RATE MODELS: A SURVEY OF THE RECENT EVIDENCE

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This paper wil critically appraise and survey the growing literature on the out-of-sample forecasting performance of reduced form models of the exchange rate. It is shown that the class of exchange rate models 'tested' is rather narrow and the exchange rates which are forecasted are nearly always the bilateral, nominal rates. Three main forecasting techniques are used: the fixed coefficient model, the sequential estimation method and, more recently, the time-varying coefficient method. It is, however, only the latter methodology that produces forecasts of the exchange rate that consistently out-perform a random walk model of the exchange rate.

TESTABLE RESTRICTIONS AND THE FORECASTING PERFORMANCE OF EXCHANGE RATE DETERMINATION MODELS

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Asset markets models of exchange rate determination enjoyed a good degree of success over the seventies. Until the early eighties there had been almost no attempt of assessing the forecasting capability of those models. The Meese, Rogoff (1983) paper, showing the poor forecasting performance of asset market models, came to many as a nasty surprise. Over the last four years several studies have supported the Meese-Rogoff's conclusion, eg: that both 'structural' and time series (VARs and ARIMAs) models do not outperform a random-walk rule in forecasting the major exchange rates. Only slightly more comforting results were obtained by allowing parameter estimates to vary over time, as done in Schinasi-Swamy (1987), or by introducing some dynamics both in monetary and portfolio-balance models. However, on the one hand, us of time-varying estimation techniques imply recognition that we lack a sound theory of exchange rate determination. On the other hand, introduction of dynamics in the 'structural' models is done on a purely ad-hoc basis, ie., without testing the validity of the chosen dynamic representations (restrictions) against a more general (unrestricted) maintained hypothesis. This paper shows the gains accruing from not imposing either dynamic or cross-country untested restrictions. The empirical analysis uses monthly data, over 1974:1 to 1987:9, on the DM/$ and yen/$ exchange rates. The latter are based on dynamic forecasts using realized values of the explanatory variables. Both 'structural' and VAR models are considered.

FORECASTING FINANCIAL PRICES

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FORECASTING OF STOCK PRICES WITH R^2=1

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The interest rate, taxation, and the debt leverage have nonlinear impacts on the investment environment and effective demand. These constitute fundamental determinants of stock prices. The real interest rate has a positive impact on the rate of return on stocks, stock prices, investment and output growth when the inflation rate is low; and vice versa when inflation is high and output growth is low. These limit the bubbles or psychological fashion of stock prices. Further, both expected and past returns and the rankings of asset structures can be used for forecasting stock prices. The results of forecasts and rankings are consistent Under such nonlinearity, optimal macro policy and tax rates should be used for attaining an optimal inflation instead of inflation-neutrality

A LEADING INDEX FOR THE LONG-TERM SWINGS IN THE DOLLAR EXCHANGE RATE

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Paper will describe efforts at creating a leading index for the long-term swings in the dollar exchange rate. Unique Center for International Business Cycle Research (CIBCR) series will be used in an attempt at forecasting exchange rate movements. Major turning points will be identified both in the leading index and in the dollar exchange rate.

LUXEMBURG AND THE EUROCURRENCY MARKET

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During the last decade the banking sector in Luxemburg has developed into a major sector for the Luxemburg economy. Apparently Luxemburg offers an attractive environment to foreign banks. The Luxemburg government has proven to be able to influence this environment. In view of the importance of the banking sector for the Luxemburg economy, in order to conduct policy analysis and forecasting, the government needs insight in the factors that determine the role of Luxemburg in the financial world. This paper presents an empirical model, describing these factors. The model consists of two parts: the volume model and the share model. In the first the volume of the eurocurrency market is explained. In the second we explain the relative shares of the market of some financial centres, including Luxemburg.

THE SHORT-TERM EXCHANGE RATE FORECASTING BY TIME SERIES MODELS BASED ON SURVEY DATA

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Good short-term forecasts of exchange rates are supposed to be performed by means of aggregate econometric models that represent the detailed dynamic structure for a set of economic systems. Thus, monthly time series models composed of transfer function equations, which are established on a well specified economic theory and on a rigorous check of the causality relationships, should produce careful projections of exchange rates. These conceps are applied to the construction of monthly economic models for West-Germany, France, Italy and the United Kingdom, in order to forecast the domestic currency-ECU rates. Furthermore, some exogenous variables for the USA economy are added with the aim of forecasting the US. dollar-ECU rate. A peculiar aspect of the models rests on the use of the EEC survey data for each Country: these data, properly quantified, turn out to have valuable information contents for the exchange rate forecasting.

BUSINESS FORECASTING

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BEHAVIOUR MODELING AND FORECASTING OF FAST CHANGING BUSINESS FUNCTIONS

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When a company has to deal with fast growing or declining business functions the normal approach for modeling and forecasting is not useful. This is mainly because it cannot cope with isoperimetric constraints, e.g. if in a freight railroad system for the next 3 years every year 25% of all service points are to be closed, the manpower demand will also be brought down by an amount corresponding to the total reduction of service points but definitely not along the same trajectory. When modelling that sort of behaviour one has to bear in mind that appropriate historical data will not normally be available. What one may get are accounting data characterizing the variability of manpower costs of that business before the reductions take place and some "intelligent guesses" as to how that variability could be increased. We will show that based only on this information, behaviour procedures can be developed which are intuitively understandable, produce plausible results and can be combined with the normal elasticity-oriented approaches into a corporate model.

NEED, LOGIC AND NECESSITY IN BUSINESS FORECASTING

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Management decisions are almost always about the future and forecasts are therefore an essential part of business life. Many investments have long lead times and this introduces inevitable risk. Forecasts are always going to be wrong, but this does not mean that they are useless. The test is whether the forecaster is able to reduce uncertainty. The planners job is to accept and plan for it. It can be fruitful to consider the relationship between the model or concept and the real world. Models usually imply some continuity between past and future, yet there are situations where critically this does not hold. Financial markets offer some interesting examples, both in the debate about short/long-termism and in the use of mathematical models in options and futures markets. Models of the macro-economy are always in a sense models of the past rather than the future. How robust are they against changes in parameters? The paper will discuss these conceptual problems against the background of actual forecasting needs in business and give examples.

IMPLICATIONS OF CHAOS FOR BUSINESS FORECASTING

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The discovery that deterministic systems can have random, unpredictable behavior (i.e. "chaos") has recently led to new mathematical methods which have important implications for the practice of forecasting. This paper will give a critical review of two of these methods, summarizing recent attempts to apply these methods to business forecasting. This paper will also present preliminary results of an experiment to forecast exchange rates using these methods.

FORECASTING IN INVENTORY CONTROL

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Forecasting is an integral part of decision-making and helps in better planning, decision-making and control. To decrease total dependence on changes through scientific methods, managements find the need for forecasting everyday. Forecasts help managers of an organization in various ways. For the materials manager, they help in setting inventory levels, planning purchase and allocating inventory investments, choosing between alternative strategies, etc. Hence, an attempt is made to explain the need for, and the benefits from forecasting with particular applications in inventory control, and also to identify forecasting systems and the criteria in choosing techniques.

FORECASTING FOR INVENTORY CONTROL IN THE PRESENCE OF STRUCTURAL SHIFTS

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Both adaptive and conventional forecasting methods have been studied in inventory settings where series contain structural shifts. Due to the large number of stock keeping units (SKU's) typically found in inventory control situations, automatic modelling techniques are often utilized. This paper investigates the use of automatic Box-Jenkins models and the degree of accuracy with which they estimate demand and its variability. In particular, intervention analysis is applied to simulated inventory situations and compared with other previously tested methods.

METHODOLOGICAL FOUNDATIONS OF FORECASTING

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FORECASTING METHODOLOGY AND POLICY DECISIONS

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Methodology in forecasting (FM) requires further improvements. On the other hand the utilization of forecasts in policy decisions is less than it should be. In the paper the underutilization of forecasts in policy decisions is linked to (a) imperfections in FM, and (b) lack of understanding of FM by policymakers. Two closely related projects are discussed. On the one hand an attempt to improve FM based on ex post evaluation of "old" forecasts. On the other hand an attempt to instruct policymakers with regard to handling forecasts.

THE FOUNDATIONS OF INFERENCES IN FORECASTING TECHNIQUES

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In discursive forecasting techniques inferences of deductive, inductive and statistical character can be distinguished. These main types of inferences are based on logical and probabilistic foundations. These foundations appear to be the object of persistent controversies. The arguments seem to be extremely relevant for forecasting techniques and of interest for forecasters as well as policymakers. In this paper the various theories and interpretations of these inferences and foundations will be discussed. The inferential elements in discursive forecasting techniques based on time series, regression and modelling will be analysed. The techniques are finally evaluated by confrontation with the findings of the debate on foundations.

THE HISTORICAL EVOLUTION OF FORECASTING CONCEPTS AND FORECASTING METHODS

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In the context of management and planning, belief in the possibility and usefulness of forecasting has had a short history. Starting with the writings of W.S. Jevons in the mid-nineteenth century, this paper will explore some of the major shifts in forecasting thought and practice which have occurred over the last 130 years.

COMBINING: THE STATE OF THE ART AND FUTURE DIRECTIONS

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Combining has become an important issue in the effort to improve forecasting accuracy. Recently, numerous studies have shown the potential improvements that can be made whether using simple or weighted combining approaches. However, there are still many questions that remain to be answered. In this paper, we discuss the state of the art of combining forecasts, future directions for research, and the importance of combining both quantitative and qualitative forecasts. Some results of an empirical investigation will be presented.

THE SAATY METHOD: PROBLEMS AND PERSPECTIVES

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Usually it is hard for a decisionmaker to take the right decision in a world, often characterized as turbulent and complex. Which alternative should be chosen? In this paper the authors discuss two forecasting techniques, which can facilitate decisionmaking under uncertainty. The first technique is the so-called 'Analytic Hierarchy Process' (AHP), developed by Thomas Saaty. The second technique is the well-known Delphi-technique. The basic elements of the AHP are: - decomposition of the complex reality into a hierarchy; - synthesis of the selected elements from the hierarchy. In this technique first the experts have to bargain to develop a consensus concerning the hierarchy. Secondly, pairwise comparisons are necessary to determine the priorities of the elements in the hierarchy. The authors take the point of view that, instead of a process of bargaining, the Delphi-technique is an interesting instrument to create consensus concerning the hierarchy. From this perspective both techniques are analysed and evaluated. Finally, an integration of both techniques is proposed.

ECONOMIC FORECASTING IN PRACTICE

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PROMPTLY AVAILABLE LEADING AND COINCIDING COMPOSITE INDEXES FOR THE UNITED STATES

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Business cycle indicators are evaluated according to a number of major characteristics. One of these is prompt availability. This paper describes the construction of promptly available, broadly representative leading and coinciding composite indexes for the United States. These new series have better currency than presently available comparable indexes. The U.S. Commerce Department's leading and coincident indexes for November 1987 were released on January 6, 1988. The new promptly available indexes could have been constructed and released by December 7, 1987, one month beforehand. The paper describes the cyclical behavior of the new indexes and compares their movements to those of the Commerce series.

FORECASTING BY VECTOR AUTOREGRESSIONS: COINTEGRATION IN A TYPICAL ECONOMIC SYSTEM

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Within the last few years, the phenomenon of cointegration within time series models has received growing attention. It is, however, still unknown whether inclusion of cointegrating restrictions will lead to an overall improvement in time series forecasting. It is this paper's aim to check on this problem on the basis of a typical macroeconomic model of the Austrian economy. After identifying the nature of the time series data the number of cointegrating vectors is identified and the vectors are estimated by Maximum-Likelihood. A forecast based on these vectors is compared to two conventional vector AR forecasts: the unrestricted differences model and the subset differences model.

A COMPARATIVE STUDY FOR MODELLING AND FORECASTING MULTIVARIATE TIME SERIES

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If the target of the expert is to forecast the multivariate series with some dominant pattern, such forecasts, in a time series context, can be obtained through either the aggregate series for which the forecasts are obtained from a model built up on the aggregate series or from the component series for which an individual forecasting model is built for each component and the forecast of aggregates is then obtained by adding up the forecasts from all components. For the first category the Box-Jenkins approach has been the most popular and for the second the Process Component Method which is one of the most recent developments that enables the user to model not the multivariate series themselves but their underlying structures, namely components, has been proposed by Crookes et al. (1980) and Akman (1984). In this paper the performance of both approaches for modelling and forecasting multivariate series are compared and demonstrated using simulated series.

VECTOR AUTOREGRESSIVE FORECASTS FOR THE UK

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Traditional econometric modelling starts from economic theory and relies on the restrictions from this theory giving suitable models for estimation. The VAR approach starts with the selection of variables of interest and the formulation of a system in which each variable in turn is related to all the other variables. Because of degrees of freedom limitations, a model selection procedure is needed to reach a suitably parsimonious model. Problems of variable and model selection are discussed. Estimated VAR models for the UK economy are reported and their forecasts compared with forecasts from macroeconomic models.

JUDGEMENT AND IDEOLOGY IN ECONOMIC FORECASTING

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Economists have notorious differences of opinion over what conceptual model best describes the functioning of the economy, and how best such models should be used in forecasting. Conventional wisdom is that Monetarists are relatively better at forecasting nominal variables, Keynesians better at forecasting real variables; and that econometric models are better at forecasting medium term developments in goods and labour markets, time series and judgemental methods better in short term financial markets. This paper uses a special survey of 50 US economic forecasters to assess these propositions, and more generally whether particular ideologies or forecasting techniques confer comparative advantages in economic forecasting.

EXPERTS OPINION

Chair: **Wiero J. Beek**
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OPTIMAL SELECTION OF EXPERTS AND FORECASTING MODELS

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The forecast combination literature deals with assigning optimal weights to the information produced by n experts or forecasting models. This paper presents models for optimally selecting m(< n) forecasters for the purpose of combining their information. The models deal with both continuous and discrete phenomena, and independent and dependent forecasters. The emphasis is placed on using organizational theory to design information transfer mechanisms that would reduce the cost of contracting with forecasters while maximizing the usefulness of the information produced.

FILTERING EXPERTS' FORECASTS: A BAYESIAN APPROACH

Peter J. **Kempthorne** and **Max B. Mendel**
Man-Machine Systems Laboratory, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, **USA**

A decision maker interested in some 'quantity' may consult a panel of experts and obtain their forecasts of its value. A filter adjusts and combines the forecasts into a single estimate based on a description of the experts' characteristics such as biases and interdependencies. In many applications, this process is repeated for a sequence of quantities. We propose a framework for designing filters that learn about the characteristics of the experts from experience with their forecasts on previous quantities, i.e., filters which 'calibrate' the experts automatically. To achieve this, we generalize on existing work by making calibration an integral part of filtering. The development of the necessary theory uses a Bayesian perspective exploiting the Finetti's principle of exchangeability. As a result, assumptions underlying the filters can be stated in terms of observable and physically meaningful variables, and uncertainty in characteristics of experts is formally updated when relevant information becomes available.

UNDER WHAT CONDITIONS IS FORECASTING ACCURACY ACHIEVED?: EXPERT OPINION AND EMPIRICAL EVIDENCE

Fred Collopy
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Empirical research makes clear that no single extrapolation method is best across all types of data and forecast horizons. The research raises the question "under what conditions does a given method outperform the alternatives?" This paper presents some propositions about the characteristics of time series that effect the accuracy of various extrapolation methods. Then a survey in which forecasting experts were asked to indicate the extent of their agreement with each of the propositions is discussed. Finally an approach to investigating the validity of the propositions is described.

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STATE SPACE MODELS

Chair: **Celal Aksu**
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USING STATE SPACE METHODS TO DETECT WHEN A FORECAST BEGINS TO GO OUT OF CONTROL

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It is important to know early on when a forecast begins to deviate from the actuals. When it is the locus of a life cycle curve which is being forecasted, information about such deviations becomes vital because it may signal that a life cycle turning point is in the making or that the forecast will have to be recalibrated. This paper develops a state space model which is capable of making such detections.

SOME RECENT THEORETICAL ADVANCES AND APPLICATIONS OF STATE SPACE FORECASTING

Raman Mehra
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AN A
Jack

Closed loop unstable systems are commonly found in engineering and economic applications. The paper discusses applications of state space forecasting to the identification of such systems, and presents modelling and control results from an engineering application.

COMBINATIONS OF N-STEP-AHEAD FORECASTS USING A STATE SPACE TECHNIQUE

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Celal Aksu
Accounting Department, School of Management, Syracuse University, Syracuse, NY 13244-2130, USA

Combinations of forecasts are typically obtained by weighing forecasts obtained from different techniques either based on various measures of their accuracies or by using OLS combinations. It is natural to expect multivariate ARMA or State Space techniques to yield more accurate combined forecasts than those provided by conventional aggregation techniques. In this paper, a state space procedure is used to obtain combinations of 1-8 period ahead forecasts of quarterly GNP. The predictive accuracy of these combined forecasts are evaluated relative to those provided by unrestricted and restricted regression, and simple average techniques using MSE, MAE, MSPE, and MAPE metrics.

QUADRATIC ENTROPY OF A MARKOV CHAIN

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This paper employs the quadratic entropy function to measure the uncertainty (information) content of a Markov Chain. The purpose is to offer a method by which the effect(s) of transitions and/or additional observations can be consistently evaluated.

QUALITY CONTROL

Chair: **Jack Prins**
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ADAPTIVE FORECASTING FOR PROCESS QUALITY CONTROL

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E.T.S.I. Industriales, Cátedra de Organización, Carretera de Viesques s/n, (Gijón) Asturias, University of Oviedo, Spain
C. Hernández Iglesias
E.T.S.I. Industriales, University of Valladolid, Spain

Box-Jenkins models can be used to extend and improve the traditional techniques for process quality control. A major problem in practical applications is that it is an off-line approach. In this paper we preserve the conceptual advantages of time series models in PQC, versus the traditional IID techniques, but we extend it to real time applications by using a general adaptive forecast. It is based on a lattice filter model and allows for parameter instability analysis and fault detection in process quality control.

AN APPLICATION OF STEPWISE AUTOREGRESSION TO STATISTICAL PROCESS CONTROL

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

MULTIVARIATE ARMA AND STATE SPACE METHODS

Chair: **Raman Mehra**
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INTEREST RATE FORECASTING BY VECTOR AUTOREGRESSION IN THE STATE SPACE

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This study deals with simultaneous statistical analysis of several economic variables. It employs the well-known linear stochastic framework of state space theory. The analysis presented here differs from some other applications of this theory in many respects. As an illustration a case study of forecasting the interest rate in the short run is included. Since demand and supply of money affect the interest rate, these three variables are examined together. The relative lag-lead pattern in the movements of such key indicators is important for forecasting and decision-making. This aspect is specifically taken care of. A fifth-order state space model having the three monetary variables as observations is estimated. Furthermore, the distinction between process noise and observation noise has been retained.

THE EFFECTS OF PARAMETER SUPPRESSION ON THE FORECASTING ACCCURACY OF ARMA AND STATE SPACE MODELS

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Emily Murphree
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A state space model of order p for a univariate time series is equivalent to an ARMA(p,p) model. However, one may identify an ARMA(p,q) model as more appropriate where $p \neq q$. Also, some of the intermediate AR and/or MA terms may not be significant. We investigate the impact of fitting a full ARMA(p,p) model when a more parsimonious model is deemed appropriate. Using several different forecasting packages, some with and some without the ability to suppress parameters, we model and forecast the same univariate series. Models are compared on the basis of forecasting accuracy.

FORECASTING WITH MULTIVARIATE ARMA AND STATE SPACE METHODS

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The theory and practice of modeling with multivariate ARMA and State Space methods are reviewed. Currently available computer software packages for these techniques are discussed and compared. Further, each one of these packages is used to obtain univariate and multivariate 1-step-ahead out-of-sample forecasts of 90-days treasury bill rates. The performance of these packages are evaluated. The results indicate that in each case, the multivariate forecasts are superior to their univariate counterparts.

FORECASTING MULTIVARIATE TIME SERIES WITH STATE SPACE MODELS: A STOCHASTIC REALIZATION APPROACH

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The use of state space representations for modelling and forecasting multivariate time series has been proposed more frequently during recent years. Existing algorithms that employ stochastic realization theory for deriving linear time-invariant state space models in innovations form are based on autocovariances estimated from observed data. This paper presents an alternative realization procedure which is based on estimated Markov parameters rather than sample autocovariances. The advantages and disadvantages of this method are discussed and it is applied to macroeconomic forecasting problems.

MANAGEMENT SUPPORT SYSTEMS

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BUSINESS FORECASTS USING A FORECASTING EXPERT SYSTEM

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The lecture will present the architecture of the Expert System. It will introduce the forecasting methods and forecasting programming language used by the Expert and will give details of how the Expert produces knowledge about a given problem. The way the Expert interacts with the user will be demonstrated, as well as the opportunity of the user to propose solutions. The Expert System will then be applied to empirical sales data taken from industry (a publishing company). We will describe how a suitable model is developed and transformed into a turn-key application for users inexperienced with forecasting methods.

SCORING SYSTEM TO EVALUATE COMPANY PERFORMANCE

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This paper describes a method to develop a scoring system to evaluate company performance (entreprise positioning). Basically, two methods are existing to position companies and/or products: - Boston Consulting Group (BCG) which compares the growth of the industry and the market share of the entreprise; - McKinsey (General Electric) which concentrates on the position of a company and the appeal of the industry. The method of this scoring system to evaluate the company performance (Entreprise Positioning) wants to combine the advantages of both methods and expand the system to carry an instantaneous analysis of the situation of the company. At the same time, the system makes it possible to select companies on the basis of various criteria. Entreprise Positioning uses both qualitative and quantitative information to establish the situation of an entreprise, or several entreprises on its market. The decision support is based on the one hand on the prospective and relative knowledge of the entreprises in the portfolio of the bank, and, on the other hand, on the possibility offered to simulate a new portfolio in response to a modification of the bank's policy on financial aid to entreprises.

A FRAMEWORK FOR FORMALLY ASSESSING THE BENEFITS OF MANAGEMENT INFORMATION SYSTEMS QUALITY: A CRITIQUE ON THE PRACTICAL FEASIBILITY

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This paper presents control problems and more specifically quadratic control problems as a feasible framework for repetitive, time-interdependent decisions. When the quadratic problem formulation fits to a particular decision situation, the financial impact of change in the quality of information measured in terms of their age and exactness may be mathematically derived. The following practical considerations are adressed: the implications of the proposed framework, the recognized importance of MIS benefits assessment and the need for a dynamic framework; finally, the advantages and limitations of our method are discussed in relation with existing alternative methods.

LOGIT AND PROBIT MODELS

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FORECASTING INDUSTRIAL PRODUCTION USING LOGIT-TRANSFORMED BUSINESS SURVEY DATA

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A logit function is used to transform business survey answers given in the form "larger than, the same as, smaller than". Thus transformed, some survey questions help in forecasting the components of industrial production, while others are of more doubtful value. We also address the problem of forecasting the total either as a sum of forecasts for the components or by working directly with the aggregate.

GENERALIZED LOGIT MODELS WITH AN APPLICATION TO CONSUMER CREDIT BEHAVIOR

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Many models of consumer credit behavior have been considered in the past including: discriminant analysis, linear probability formulations as well as such qualitative response models as probit and logit models. In this paper a qualitative response model which generalizes the probit and logit formulations is presented. The success of these models in predicting whether an application for a credit card will be a good risk will be considered. The profitability is seen to depend upon the decision rule and the specification of the models.

PREDICTING VACATION MODE CHOICE

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This paper will present an econometric model to determine tourists' choice of vacation mode, where the mode choices are (1) independent travel, (2) travel on a basic tour package (transportation and accommodation only), and (3) travel on a fully inclusive tour package. The model includes modal attributes, trip attributes and consumer attributes and is tested using logit analysis and survey data on 1292 visitors to the Hawaiian Islands. The results of the research and their implications for the industry will be discussed.

CAN SMALL FIRM FLOTATION BE FORECAST?

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Flotation on the Unlisted Securities Market is usually interpreted as an indication of the success of a small firm. A venture capital industry has recently developed to enable such firms to achieve flotation. This paper will examine the factors associated with flotation, and whether flotation can be predicted. Specifically it will establish: - how small firms that were floated on the USM compared in terms of various financial factors with those that remained private; - which financial factors had the strongest relationship with whether or not a small firm achieved flotation; - whether any differences occurred between the types of small firms that were floated on the USM during the early 1980's and those floated on the Stock Exchange ten years earlier; - if it is possible to predict which small firms will eventually be floated. In order to achieve these objectives, data has been collected on samples of small companies floated during the two periods and on samples of similar firms that remained private. Probit was employed as an estimator. The results suggest that major changes have occurred in the variables which influence the probability of flotation, but that the model possesses reasonable predictive power.

EXCHANGE RATE FORECASTING II

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PERSISTENCE AND THE FORECASTIBILITY OF REAL EXCHANGE RATES

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Evidence is presented on the application of multivariate time series techniques to decompose real exchange rates of several major currencies into permanent and temporary components. The analysis extends the recent work of Huizinga (1987) and Cumby and Obstfeld (1984) which suggests that, despite the relatively good fit of univariate random-walk models, predictable movements in real exchange rates do exist. The hypothesis that permanent exchange rate movements are the response to both nominal and real shocks is also investigated. This hypothesis is compared to the alternative that only real disturbances have lasting effects.

EFFICIENCY, SUNSPOTS AND PREDICTABILITY IN THE FOREIGN EXCHANGE MARKET

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While the volatility of exchange rates has encouraged the development of a growing 'forecasting' industry, academics have repeatedly questioned FE predictability on account of the efficient market hypothesis. Filter rules, arbitrage conditions and spot/forward relationships have thus been extensively tested to provide evidence on this important issue.
The traditional methodological ground of efficiency tests has however been recently challenged in stock and bond markets by contributions such as Schiller's work on excess volatility, Summers' analysis of efficiency tests, or the rational expectations bubble school. In this paper we review the definitions of efficiency that have been used to evaluate FE markets and discuss the implications of this recent literature on the predictability of exchange rates.

AN EXAMINATION OF SIMULTANEOUS EQUILIBRIUM CONDITIONS ON FOREIGN EXCHANGE AND EUROCURRENCY MARKETS

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This paper represents the first empirical attempt to examine the frequency of attaining simultaneous equilibrium on spot and forward exchange markets as well as on domestic and foreign securities markets. The empirical results indicate that some segments of the markets are frequently in disequilibrium, thus opening the door for profitable one way arbitrage. Although one way arbitrage profitability is substantially greater than covered interest arbitrage profitability, it is not sufficiently large enough to overturn market efficiency in the four relevant markets.

(TITLE AND ABSTRACT NOT AVAILABLE AT TIME OF PUBLICATION)

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CONSUMPTION & INVESTMENT

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WEALTH EFFECT ON THE CONSUMPTION BEHAVIOUR OF FRENCH HOUSEHOLD DURING THE RECENT PERIOD (1972-1987)

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This communication explains the estimated econometric relationship, between the French household saving ratio and household wealth, on the recent period. After a theoretical introduction of this relationship, estimations are led on available aggregate time series data. It is shown, that both wealth's increase (due to the sharp increase of stock exchange markets and the slowing down of inflation) and high level of interest rates (which have increased permanent income from assets) are responsible for the recent evolution of saving rate. In the last part of this communication, implications on effects of economic policy are studied. Effects of recent "Financial Crash" on consumption are, then, evaluated.

SIMULATING CONSUMPTION, INCOME AND WEALTH AGGREGATES

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An overlapping generation model is developed with life-cycle consumption & saving of individual agents. Various simulation experiments are analysed. It can explain the following phenomena: the high saving ratios of old-aged people and declining aggregate saving rations with declining aggregate income. The impact of an ageing population on aggregate income, consumption and wealth formation is shown, as well as the conditions under which liquidity constraints arise. The model can easily be adapted to a multi-cohort model appropriate for empirical policy-analysis. The sections of the paper deal respectively with setting out the basic model, modelling the adjustment process to periodically changing income expectations and describing in what way bequeathed wealth can be incorporated in the model. In the final section the results of simulation are presented.

APPLICATION OF THE EULER RULE TO INVESTMENT EQUATIONS

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Recently, a very common way to estimate rational expectations equations has been to use Euler equations instead of closed-form decision rules. A greater amount of information is used in estimating the decision rules. The gain in efficiency is nevertheless costly if one has to restrict the rate of return to be constant and to make strict assumptions about technology. In spite of this there as a rule remains a gap between theory and empirical work in the standard models of investment. Estimating Euler equations offers plausible estimates of investment dynamics that are consistent with a structural model. The investment model is neoclassical by nature. The objective function of the firm is to maximize the expected present value of the cash flow. This goal is described by minimizing the expected present value of a quadratic loss function. The estimations are made with a nonlinear two-stage least-squares method. The procedure used does not require an explicit representation of the economic environment or strong a priori assumptions about the nature of the forcing variables.

LABOUR

Chair: **R. Humer**
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A COMPARISON OF ALTERNATIVE APPROACHES TO FORECASTING LONG DURATION UNEMPLOYMENT IN GREAT BRITAIN

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Recent trends have witnessed a growth in the numbers of long term unemployed and the average duration of unemployment. Three alternative approaches to modelling long duration unemployment are examined; autoregressive, leading indicator and behavioural time series models. Further, different specifications of the dependent variable (the number of unemployed; the inflows or outflows between various durations of unemployment and a set of transitions proportions between durations of unemployment) are considered. The results from each approach are compared using aggregate data for Great Britain.

A QUARTERLY ECONOMETRIC MODEL OF THE AKRON, OHIO LABOR MARKET

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We built the Akron model in 1983 for the purpose of forecasting employment, manhours of work, weekly wages and the wage bill for two digit S.I.C. sectors as an ongoing project. The model contains ninety-six equations of which fifty-four are behavioral and the rest identities. In this paper, the structure of the model is revealed by use of a flow chart and the theoretical basis for blocks of equations is explained. In addition, the exante forecasting performance is evaluated using root-mean-square percent forecasting error statistics.

MODELLING AND FORECASTING SCIENTIFIC AND TECHNICAL MANPOWER DEMAND

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The demand of scientific and techical manpower is one of the foundations for a country to planning its educational development strategies. This paper derives a mathematical formula for describing the functional relationship between demand and economic factors by analyzing the related phenomena. We also construct an econometric model and estimate its parameters with international data. The forecasting results of the short-middle-long term demand given by the model proves relevant. The paper proposed a two-stage algorithm for nonlinear parameters estimation, and it proves to be effective.

SPECIFICATION AND ESTIMATION OF AN ECONOMETRIC LABOUR MARKET MODEL WITH TIME-VARYING PARAMETERS

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Since the mid-seventies the labour market of the Federal Republic of Germany is being marked by a persistent high unemployment rate. This is not only due to a growing labour supply, but is also a sign of changing demand structures. When constructing econometric models this has to be considered, particularly in view of their forecast performance. Models, which allow time-varying structures, are to be formulated. As examples this paper presents and compares econometric switch models, the Kalman filter-model as well as a disequilibrium model of the labour market.

ENVIRONMENTAL SCANNING FOR ORGANIZATIONAL POLICY DEVELOPMENT: Analysis of Trends Affecting Scientific, Technical and Professional Human Resources Training, Development and Requirements

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This paper builds on a number of earlier monographs and papers in which I have dealt with various aspects of the supply of and demand for various types of scientifically and professionally trained workers. In several western industrial countries in recent years, governments have extended their intervention into the operation of labour markets via such policy vehicles as affirmative action, pay equity, and the direct regulation of professional standards. In addition to such forms of government intervention, several other factors influence the operation of labour markets. Although these factors are clearly influential in the operation of labour markets, several are not easily captured in terms of traditional, quantitatively oriented approaches to human resources forecasting. The answer, however, is not to abandon the quantitative methods but rather to develop models and methodologies that allow them to be supplemented by qualitative types of information. This paper will present a model I have developed for accomplishing this objective.

SHORT TERM MACRO-ECONOMICS

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EXPERIENCES IN MACROECONOMIC FORECASTING IN THE FEDERAL REPUBLIC OF GERMANY 1976-1987

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Research group on the short-term business outlook of the Kiel Institute of World Economics, Düsterbrooker Weg 120, D-2300 Kiel 1, Federal Republic of Germany

The paper deals with the problems and accuracy of macroeconomic forecasting in Germany. It describes the different results and approaches of the main forecasting institutions (council of economic advisers, joint forecast of the five leading research institutes) as compared to the Kiel Institute's. Special concern is given to exogenous factors affecting macro forecasts. It is analysed how revisions in the official national accounts statistics and weather effects have contributed to forecasting errors. Finally, the paper deals with the problem how the accuracy of the underlying assumptions on monetary and fiscal policy, the development of the world economy, and the exchange-rate influenced the outcome of the Kiel Institute's forecast.

FORECASTING QUARTERLY NATIONAL ACCOUNTS: SOME EMPIRICAL RESULTS FOR THE EEC COUNTRIES

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The cyclical analysis requires disponsibility of data for the current forcast for some future periods. Often, on the contrary, quarterly national accounts data are available only with a certain time-lag. This paper analyzes some different forecasting schemes for principal agreggate data of the national accounts and compares these in terms of goodness of efficiency of the forecasts. It is demonstrated how using monthly indicators in these schemes (e.g. survey data) increases forecast performance.

THE ACCURACY OF THE SWEDISH NATIONAL BUDGET FORECASTS 1955-85

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In connection with the presentation of the budget in early January each year, forecasts are presented for a number of important macroeconomomic variables, the PNB (Preliminary National Budget) forecasts. A revised set of forecasts is presented about three months later, the Revised National Budget (RNB) forecasts. The accuracy of these forecasts is analyzed for the period 1955-85 using simple descriptive measures and regression models for the connection between forecasts and actual values. Tests for unbiasedness and efficiency are performed and comparisons with various naive forecasting techniques are included. Use of the Box-Jenkins methodology as an alternative forecasting method is discussed. The results indicate that for many variables the PNB forecasts on the average are correct but the variability is too small (the forecasts are too cautious). The PNB forecasts are better than naive forecasts. The wage and price variables are systematically underestimated. The RNB forecasts in general are better than the PNB forecasts.

EVALUATION OF SHORT-TERM FORECASTS OF SOCIAL PRODUCT

E. Nikolic-Djoric and **S. Hadzivukovic**
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The paper deals with the comparison of some short-term forecasts of the social product of Yugoslavia and its six republics and two autonomous provinces. The following univariate methods were applied: two naive methods, step-wise autoregression, exponential smoothing and exponential smoothing with adaptive response rate. The inclusion of the following economic variables: fixed assets, investment and productivity, improved the precision of forecasting. The investigation was based on the period 1952 - 1980, while the ex-post evaluation was done for 1981 - 1985. Linear combination of univariate and econometric forecasts with weights chosen according to the procedure proposed by Bates and Granger in this case did not improve the quality of forecasting.

SHORT-TERM FORECASTS IN HUNGARY

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Regular short-term forecasts have been prepared since 1968 when the first attempt was made to change our economic management system and to substitute indirect means for direct ones. That's why the demand for short-term economic forecasts emerged. Nowadays the reform has revived so the importance of short-term forecasts has been increasing again. The purpose of this paper is to present the various type of forecasts prepared in Hungary. There are different institutions engaged in forecasting. Methods are different: some of them are based on business survey or Delphi-technique, the others use time-series and econometric models. Results often differ. These methods should be improved and new ones should be found. The question is what can be done to increase the value of forecasts for users.

ECONOMICS CYCLES

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IDENTIFYING AND FORECASTING MACROECONOMIC CYCLES

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The traditional literature on "Business Cycles" refers to an inventory cycle of about four and an equipment cycle of about eight years duration. We demonstrate that these cycles can be clearly identified in contemporary macroeconomic data using spectral and related methods. We also show how medium term forecasts can be based on these results.

A TIME SERIES APPROACH TO TESTING THE POLITICAL BUSINESS CYCLES IN THE UNITED KINGDOM

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The purpose of this paper is to test several political and economic cycle hypotheses, in the United Kingdom, framed around two variables - income and unemployment - in an ARIMA format. Through the application of intervening variables, such as political regimes, war periods, and election and re-election campaigns, the impact of these variables on income and unemployment can be statistically tested. The hypotheses that presently exist regarding these cycles can then be supported or rejected.

SYNTHESIZING SHORT-RANGE, MEDIUM-RANGE, AND LONG-RANGE FORECASTS OF CYCLIC PHENOMENA

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When studying cyclic phenomena, cyclic patterns are most significant in the short-run, but overall trends tend to be of dominant importance in the long-run because of uncertainties about the cyclic patterns. In this paper, we show how a model which incorporates noise into an independent variable rather than only the dependent variable can have exactly the above effect and thus can be used for forecasting over any time horizon. The model builds uncertainty into the period of the cycles, land models serial correlation of position in the cycle (relative to the expected position) for consecutive time periods.

ON BUSINESS CYCLE FORECASTING AND THE PROBLEM OF VARYING DYNAMIC STRUCTURES

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Business cycle forecasting is in general based on some assumptions of structural stability, although there are several theoretical and empirical evidences against such assumptions. One essential assumption concerns the stability with respect to dynamic properties. The paper emphasizes the importance of considering possible variabilities of dynamics in order to achieve reliable business cycle forecasts. The variability analysis involves verification by statistical test procedures, characterization and re-estimation. The arguments are empirically illustrated by an analysis of the variability of dynamics among Swedish business cycle leading indicators modelled by transfer function analysis.

INFLATION

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EXCHANGE RATE PASSTHROUGH TO AGGREGATE PRICES

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Forecasts of international inflation must include the passthrough of exchange rates to aggregate prices. While some micro-economic studies have explained why traded goods prices at the individual industry level do not reflect recent exchange rate movements, little evidence of diminished passthrough at the macroeconomic price level exists. Macroeconomic price models will lose forecast accuracy accordingly. Using both fixed and flexible coefficient estimation techniques, this study investigates industrial country aggregate price equations in an attempt to isolate the changing effects of exchange rate passthrough.

ENTREPRENEURIAL CONFIDENCE AND MONEY ILLUSION

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A well-known hypothesis in economics suggests that wage earners may be subject to 'money illusion'. Could the same hypothesis be applicable to entrepreneurs? This paper attempts to answer this question by examining the fluctuations in an index of entrepreneurial confidence in the United States as well as in several major European economies over the course of recent business cycles. It will use correlation techniques to consider whether entrepreneurial confidence is more closely related to cyclical fluctuations in real or nominal magnitudes.

THE WORLD ECONOMY IN MEDIUM TERM

hair: F.J. **Henk Don**
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ORECASTING THE WORLD ECONOMY 1988-1992

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sing the CPB World Model, real GNP of industrial countries is projected to grow at a steady non-inflationary rate of 2 to 2 /2 per cent a year. World trade could expand by some 5 per cent a year. Since downward risks seem to dominate, a low-rowth scenario is considered as well. Game theoretic techniques are employed to deal with the complexity of international olicy interactions. According to this second scenario, the dollar loses at first one quarter of its end-1987 value, real GNP-rowth of industrial countries is depressed during 1988-1990, and a global recovery takes place only after 1990.

EFLECTIONS ON MEDIUM TERM FORECASTING OF THE WORLD ECONOMY

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t the risk of unwarranted simplification, we divide formal forecasting of the world economy into three groups. The first we rm General Equilibrium (GE) and is associated with the names of Whalley, Deardorff and Stern. Theoretical consistency, lative prices and factor mobility are emphasized. Being concerned with comparative statics they enter our interest area of the edium term. The second we term Simulation (S) by which we mean dynamic systems usually heavily influenced by simulation ethodology. The most well known of these is the old Club of Rome work of Meadows but there are many derivatives. Finally, ie third group we term Econometric (E) by which we mean econometric systems such as Interlink and the Federal Reserve ulti Country Model. Each group has its particular strengths and weaknesses which we discuss. However, two problem areas ppear to be common to all. Firstly, the construction of the models and the presentation of results do not adequately bring out ie point that what is often of greater interest for medium term work is not the outcome of a scenario, but rather the nsions they illustrate. This is closely related to the question of sustainability. Secondly, the models are mostly flow oriented ven though investment "cumulates" into capital stock. This is a major problem if one considers that medium run forecasting ncerns sustainability in the sense of the international allocation of savings and investment in an international economy aracterised by different demographic development. Issues as to the "sustainability" of the US deficit and Third World velopment and debt problems naturally arise under this heading. What is necesssary is no less than the integration of real ade with monetary theory.

ORECASTING THE BELGIAN ECONOMY FOR THE NEXT FIVE YEARS; ANALYSIS WITH THE MACROSECTORAL MODEL ERMES

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is paper is aimed at presenting the results of an economic forecast made for Belgium with the macrosectoral model Hermes, the period 1987-1992. This first part of the paper discusses the main assumptions selected for this exercise (international vironment, demographic factors,...) and points out the outstanding evolutions which would characterize the Belgian Economy middle term. The second part of the paper proposes to test the consequences of the application of the fiscal proposals made the European Economic Commission in the context of the completion of the internal European Market, planned for the year 2.

PLOYMENT POLICIES IN EEC COUNTRIES: SIMULATION AND FORECAST IN THE BELGIAN CASE BY USE OF THE CROSECTORAL MODEL DRY

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e increase of unemployment in most of European countries has led the public authorities to imagine a lot of employment icies. These try to influence either the supply, or the demand for labour, or the sharing of the existing demand for labour. r paper investigates the possibility of modelling these policies inside a macroeconomic model. The effects of these various ployment policies on aggregate and sectoral employment and on the other macroeconomic variables will be examined by using acrosectoral model of the Belgian economy, the model DRY, which is being now estimated at the DULBEA.

MEDIUM TERM COUNTRY FORECASTS

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PROJECTION OF THE TRADE AND SAVING GAP IN EGYPT

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The purpose of this exercise is to project both the trade gap and the saving gap for Egypt through 1992. Such projections are fairly important from a policy viewpoint, since the country has just embarked on a new plan for economic and social development with 1992 as the target year. The 5-year plan, 1987/88-1991/92, fixes a balance-of-payments target which implies some 40% drop in the trade gap. This paper will examine more explicitly such target of the plan. It will be shown that some of the implicit projections are widely off the mark, in view of both the world economic prospects and the policy instruments at hand.

FORECASTS OF INCOMES AND EXPENDITURES OF POLAND'S POPULATION IN THE 1988-1992

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The main purpose of the article is to present the short and medium-term forecasts of financial incomes and expenditures of population calculated from an econometric model constructed on the basis of balance of incomes and expenditures of Poland's population. Our model consists of four blocks of equations, i.e.: block of personal incomes (disaggregated into wages of production and nonproduction sectors of the national economy) and other components of incomes, block of expenditures on buying goods and services and expenditures of financial nature, block describing the inflation loop and block of real processes.

FORECASTING WITH THE ZAMBIAN MACROECONOMETRIC MODEL

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A structural macroeconometric model is developed to forecast the Zambian macroeconomic outlook for 1990 under three alternative economic assumptions, low and high exchange rates and with low interest rates. The Zambian currency (kwacha) has fallen considerably over the 1980-85 period with its value in 1985 being less than 20 percent of the 1980 value in terms of the U.S. dollar. The simulation results under three assumptions: low exchange rate, high exchange rate and low interest rates show that the Zambian economy will perform poorly over the five year period 1986-90, unless there is an exogeneous shift in real exports or a sharp drop in nominal interest rates. A strengthening of the kwacha without a change in other conditions would send the economy into a severe recession. The government would be forced to expand spending well beyond that assumed in the forecast in order to maintain strong economic growth.

PROJECTION OF THE ECONOMIC SECTORS DEVELOPMENT BY METHOD OF THE MATRIX OF GROWTH

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In our paper we shall consider the possibilities of the economic sectors development planning by using the dynamic models of the matrix of growth. Starting from the assumption of the examined sectors developed interdependence, presented through the corresponding matrices of growth, we shall define the dynamic system setting the connection between the value of the indices of the sectors' economic development level in various time periods. The flexibilty of such a concept of anticipation consists in the possibility to include various assumptions of the examined sectors development interrelations in the period of anticipation through various forms of the matrix of growth that may be used as elements of the dynamic system. On the basis of data regarding the movement of the economic sectors' social product in Yugoslavia in 1975-85, in our paper anticipations will be presented by using the average matrix of growth.

MACROECONOMIC POLICY

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THE "TWO-HANDED-APPROACH": WHEN TO USE WHICH HAND?

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Regarding stabilization policy in the whole of western Europe, the most urgent problem is to reduce unemployment. To solve this problem one outstanding proposal is the so-called "two-handed-approach" introduced by prominent European economists: a combination of demand and supply policies should be used to change factor prices in order to reduce classical unemployment and to raise demand in order to ease the frictions during structural changes. This paper is concerned with the question of timing the two hands. Should both policies be introduced at the same time or which one has to follow the other? We deal with macroeconomic developments like factor substitution, the path of potential output and the creation of jobs in a highly open economy but not with structural problems within an economy; the analysis is basically macro.

AN APPROACH TOWARDS CONTROL OF THE PRODUCTION PLANNING PROCESS IN MARKET PLANNED ECONOMY

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The simultaneous influence of market and socio-regulated production and business laws (in Yugoslavia today) makes it necessary to determine the essential role and planning possibilities. In order to fulfill these conditions, it is necessary to control planning, i.e. to determine: the elements of the planning system, their relations and attributes (elements and relations), as well as objectives, resources, limitations, models and methods. By determining the control planning mode and by its realisation (in practice), corrections of the planning system occur. All the time, we should be aware of the fact that planning is a step (stage, subsystem) of the global control system of the production (business) system.

HOW TO IMPROVE THE FORECASTING ACCURACY OF ECONOMETRIC MODEL

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The economic structure, mechanism and policy in China are changing very quickly. So you can not get the high accurate forecasting result using general econometric models because its coefficients are constant. How to improve the forecasting accuracy of econometric model is the key problem that should be solved quickly in order to develop the econometric method further in China. This article has done some study about the question from two aspects. First, make a twofold model, that is, using the moving (in turn) combinations sample of observations or the group sample according to the time of observations, build a time series of econometric model. Than serve the time series of coefficients as the new observations, make a regression model of the coefficient to time. Finally, we can get the change law of coefficient with time. Thus a new model with variable coefficient is built. It has a good responding for the change of economy and can improve the forecasting accuracy. Second, use the joint forecasting model instead of the econometric model alone. That is, combine the econometltric model and the subjective forecasting method together. Using the subjective valuation to modify the model. The quantity-quality joint model can give you rational future value. From long run the article also provides an important method to improve the forecasting accuracy of econometric model, that is, each economic system has to have a relatively static forecasting group and build a perfect statistics data bank gradually.

PRICE INERTIA AND POLICY INEFFECTIVENESS IN THE UNITED STATES, 1890 - 1984: A REAPPRAISAL

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This paper presents a reappraisal of Gordon's (1982) empirical evidence for price inertia in the United States. Using his extended quarterly data file, updated and revised, separate short-run and long-run output - inflation relationships are estimated. Estimation over several samples generally reveals no price inertia. Moreover, the pre- and post-war periods appear to differ significantly. However, lagged unanticipated aggregate demand shocks influence output growth with fairly long lags. There is also some evidence that, for post-World War II data at least, the anticipated-unanticipated distinction may be irrelevant. Finally, it appears that anticipated policies do not influence output growth generally after 1945.

LONG TERM MACROECONOMICS

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WEST GERMANY'S ECONOMIC PROSPECTS TO THE YEAR 2000

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Different scenarios in quantitative form of the West German economy up to the year 2000 are presented. These scenarios are based on the results of the DIW's (Deutsches Institut für Wirtschaftsforschung, German Institute of Economic Research) long-term model, a large aggregate econometric model, supplemented and modified by information based on expert knowledge. If current trends prevail it is likely that unemployment will not be much below 1 million in the year 2000. Taking into account the uncertainties of the reference scenario shows that the imbalances in the labour market could be even greater. These prospects call for a strategy to combat unemployment. As a result of its implementation the number of people out of work would be only about half that in the reference scenario.

PROBLEMS AND RESULTS OF LONG-RANGE FORECASTING ON A NATIONAL MACRO-REGION LEVEL (the case of Slovak Socialist Republic)

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In the first part of the paper the author explains the approach to the long-range forecasting of development of the Slovak Socialist Republic to the year 2010. The approach cannot be "objectivistic" but participative, because the forecaster itself is a part of the investigating object. The long range forecast of Slovakia is elaborated on the base of synthesis of scientific, technical, economic, social and cultural processes. Important tool for mentioned synthesis is the methodology of interface teams. There are too much results of the forecasting work in Slovakia for presenting in a short paper. Therefore in the second part the author selects from the results only a few of them. First of all: 1) the rise of role of open national societies in modern world, because these societies are generators of world's information and cultural variety; 2) Slovakia comes in forecasted years to the necessity of a break in the whole social development, comes to the necessity of a qualitatively new period of national development; 3) Slovakia needs to overcome the traditional industrial pattern of development and must step forward to informatization and intellectualization of the whole social reproduction process; 4) All development problems of Slovakia are soluable only by assumption of "perestroika" of economic and social mechanisms, which is a long-range social process. This these will be in paper briefly argumented.

ITALIAN FOOD HABITS IN THE YEAR 2000: EXAMPLE OF INTEGRATING THE DELPHI METHOD WITH CREATIVITY TECHNIQUES

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The positive economic trends in the 80's have stimulated companies to make plans for their development over the medium/long term. The aim has been to help companies identify how consumer value-systems will change over the next years, and what changes will occur in food habits, and then to select markets and products which offer the best opportunities for development. The report describes the research objectives, the criteria for choosing the expert groups, the sequence for the questionnaires and how the classic Delphi method based on the consultation of a panel of experts was integrated with creative groups of consumers.

THE CHANGING AMERICAN MELTING POT: THE CHANGING DEMOGRAPHICS OF THE AMERICAN POPULATION AND ITS EFFECTS ON MARKETING OF CONSUMER GOODS

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Recent population surveys show a remarkable phenomenon within the American population. The numbers of the ethnic groups are growing at a fast rate. The success of the marketing campaigns depend, to a large degree, on how they use the cultural characteristics of the target market. Therefore, the companies aspiring to be successful in the American market should take note of these changing demographics. However, the marketer's job is expected to get harder as starting in 1990, the U.S. census will list many minorities under general headings such as "Asian Americans" rather than specific headings such as Chinese, Japanese, etc.

DATA REVISION AND FORECAST ERRORS

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ECONOMIC DATA REVISIONS AND ALTERNATIVE WAYS OF USING PROVISIONAL DATA IN MACROECONOMIC FORECASTING

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Timely economic forecasts by means of dynamic models rely on updated time series, the last figures of which are provisional, and will be typically subjected to revisions. A general approach to the efficient use of provisional observations in forecasting with dynamic models is presented, based on the state-space methodology and the Kalman filter. This approach is compared with more traditional procedures, which ignore the distinction between provisional and final data or simply do not use provisional data at all. Some applications are carried out for Italy, concerning: (a) the monthly index of industrial production; (b) a dynamic simultaneous equations model of the aggregate economy.

DATA REVISION AND FORECAST ERRORS

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This paper considers the implications of using preliminary data as an input in generating a forecast. Most economic data is issued in a preliminary form that is later revised. The fact that these preliminary estimates contain an unknown error component should be taken into account when calculating confidence intervals for forecasts. Using the errors-in-the-variables model and past information on the size and bias of the revisions of the preliminary data the confidence intervals for forecasts can be adjusted. A simple single equation econometric model for sales of a company is used to illustrate the concept.

FORECAST UNCERTAINTY DUE TO UNRELIABLE DATA

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Lagged variables tend to abound in empirical macroeconomic models. In preparing a forecast, the most recent data available are used to set the model off. Such data are usually preliminary and subject to errors and revisions. This paper tries to assess the forecast uncertainty due to unreliable data for a particular non-linear macroeconomic model of the Dutch Central Planning Bureau. The results indicate that, at least for this model, uncertainty in growth rates tends to decrease with the length of the horizon, while the government deficit and the balance on current account (both as ratios to income) tend to show increasing variability. The required Monte Carlo experiments were performed on a Cray supercomputer. Some attention is paid to variance reduction techniques, convergence criteria and computer program structure.

IRREGULAR DATA REVISIONS: THE GAIN IN FITTING FINAL VALUES BY A TRANSFER FUNCTION MODEL

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Many economic time series are subject to revisions. Ignoring the provisional nature of most recent observations may affect the accuracy of forecasts of future values of the series. However, it is possible to combine all previous preliminary series and the final one appropriately. This can be achieved by the Kalman filter. Indeed, efficient use of preliminary observations is made possible by using this technique: All we need is a suitable state space representation of the dynamic model and the observation model. The flexibility of the Kalman technique is emphasized by the fact that it allows one a generalization to problems where there are more than one revision in both endogenous and/or exogenous variables, Harvey (1983). The major contribution of this present paper is that it shows the possibility to model the structure of data revisions occurring at a regular interval by means of two different approaches related to the Kalman filter. 1) Available final values are fitted by an ARMA model; 2) Available final values are fitted by a transfer function model. The performance (from a forecasting point of view) of these two approaches along with more naive ones are compared.

COMBINING FORECASTS

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STABILITY OF WEIGHTS WHEN FORECASTS ARE COMBINED: A Monte Carlo Study

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The optimality of combining forecasts instead of selecting the single best forecast, when different forecasts are available, has been shown. As combination weights in general must be estimated, that optimality is not certain. It has been advocated that instability of estimated weights is such a problem that only a simple average should be used, or rather a composite forecast, when possible. This weight instability problem depends on the estimation technique applied, however. This study tries different decreasing weight functions in the estimation of weights. The stability of weights from the alternative specifications is studied with a series of Monte Carlo experiments.

POWER TRANSFORMATIONS AND COMBINING ANTITHETIC FORECASTS

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When a time series produces forecasts which are correlated with the starting point of the forecast, it is difficult to select a best starting point. The sensitivity to starting point can be reduced significantly by combining the forecast with another forecast which is produced from a time series which is antithetic to the original time series. The antithetic time series can be generated by a power transformation applied to the original series. The combined forecast may be a simple arithmetic average.

MONTHLY FORECAST OF POPULATION RECEIVING OLD AGE SECURITY PENSIONS IN CANADA

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The paper will outline the methodology used to prepare monthly forecasts of Old Age Security pension beneficiaries in Canada. The methodology uses a combination of an annual and a monthly model for projecting population taking into account seasonal and irregular variations. A computer program is then used to "force" the monthly forecasts to agree with the annual forecasts.

ESTIMATING AND FORECASTING QUARTERLY TIME SERIES BY RELATED INDICATORS

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Quarterly figures may be required when only annual data are available. In such a case, it can be appropriate to use related series for estimating missing data. According to the BLU approach developed by Chow and Lin (1971), the random walk-Markov model developed by Litterman (1983) is extended to distribute annual flows on a quarterly basis. The problem of extrapolating quarterly figures when the annual total is unknown is then discussed and the solution to the extrapolation problem is made explicit for AR(1), random walk (Fernandez, 1981) and random walk - Markov models.

ESTIMATIO

Chair: **M. Masoom Ali**
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SINGLE EQUATION ESTIMATION TECHNIQUES OR RATIONA XPECTATIONS MACRO MODELS: SOME MONT ARI EVIDENCE

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In a recent paper, Hasan found out that the differences in the performance of the small sample properties of the single equation estimation techniques vis-à-vis the full information methods in the context of a Rational Expectations macro models were, in general, not very pronounced. His Monte Carlo results indicate that the gains of efficiency of the full information methods over the simple single equation methods are relatively modest. This finding is of great interest to empirical researchers in the area of Rational Expectations. In recent years a number of single equation techniques have been proposed to estimate Rational Expectations macro models. The large sample properties of the alternative single equation methods proposed for Rational Expectations macro models have been well investigated elsewhere. However, not much is known about their small sample properties. The objective of this study is to evaluate and compare the advantages and disadvantages of the alternative single equation methods by a Monte Carlo approach, for various Rational Expectations Macroeconomic Models.

A SIEVE ESTIMATOR FOR THE MEAN OF GAUSSIAN PROC

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A simple estimator has been developed for the mean function of an arbitrary Gaussian process of given cova Grenander's "method of sieves" (see Beder, Ann. Statist., 1987, 15: 59-78). In this talk we will describe the estimato review its distribution theory and asymptotic properties, and discuss some recent simulation studies.

ESTIMATING "BETA" WITH A "MEDIA MATOR XPLORATORY JDY

Laxmi Bhandari and **Prem P. Talwar**
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The ordinary least squares (OLS) estimator is routinely used in finance to estimate an important parameter in the modern portfolio theory, the Beta. The use of OLS estimator is justified on the gounds of its desirable properties under certain "ideal" conditions and its ease of computation. The "non-parametric" alternatives which may be better when these "ideal" conditions are not met have usually been ignored due to their computational requirements. In the case of Beta, there is evidence that the security returns are not quite normally distributed [e.g., Fama (1965)], but are somewhat skewed and leptokurtic. The particular alternative estimator we consider in this paper is sometimes referred to as Theil's estimator or the Median estimator. We compare the efficiency and robustness of the OLS and the Median estimators of Beta. Since the final use of these estimates is typically to predict the future Betas, we also compare their predictive ability in this regard.

PREDICTIVE AND PRECISION PROPERTIES OF REGULARIZING ESTIMATORS

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The main purpose of this paper is to show main predictive and precision features of regularizing estimators. The main motivation of introducing these estimators is to decrease negative effects of existing bad-conditioning in the matrix X'X of the so called normal system of equations, i.e. $X'X\beta = X'Y$, obtained by minimizing the functional $\varphi_0(\beta) = ||Y - X\beta||^2$, where $||.||^2$ is the square of Euclidian distance between random vector Y of observations and $X\beta$ i.e. its linear model approximation, X is the real nxk matrix of observations on k variables, β is the real kx1 vector of parameters to be estimated. We present some new results of simulation studies.

INTERCEPTS, LAGGED ENDOGENOUS VARIABLES AND FOR ASTING

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The focus of the study is to develop a methodology to ascertain how the magnitude and direction of intercepts and lagged endogenous variables affect current endogenous variables within the framework of forecasting. The results show that when the estimated coefficient of the lagged endogenous variable is greater than unity and the intercept positive and large, the current endogenous variable increases by increasing amounts, or explodes towards plus infinity over time. If it is less than unity but greater than zero, and the intercept negative, the endogenous variable increases at an average rate of 5.9 percent over time. Identical values obtained from simulation and forecasting with the structural model are 6.2% and 6.3% respectively.

DECISION MAKING

Chair: **Alan E. Singer**
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DECISION MAKING AND FORECAST KNOWLEDGE

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All decision-making involves making choices based upon predictions of future events, hence all decisions use forecasts. The paper concentrates on the role of forecasts in non-routine decision-making which tends to use, it is argued, forecasting as metaphysical rather than scientific knowledge. Further, the type of knowledge produced in forecasts is open to validation or falsification through powerful action of key actors. A case study from the author's work on managerial decision-making is used to illustrate this process.

TOWARDS A THEORY LINKING FORECASTING AND INDIVIDUAL DECISION MAKING

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The empirical research on both forecasting and decision making has reached a critical mass such that useful and practical generalizations can be made about each. And the linkage between the two is becoming apparent. In this paper key elements from each of the research domains are presented and linked. From this general model, both practical generalizations and testable hypothesis can be made about improving decision making through forecasting.

CORPORATE STRATEGIC PLANNING IN AN UNCERTAIN ENVIRONMENT

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This paper analyzes the different approaches in forecasting within an uncertain (telecom) environment. Some strategic planning capability is developed, as well as the different forecasting techniques. A symbiosis of forecasting and strategic planning is discussed from a theoretical and practical point of view. Evidence of this is given in the example of the Belgian Telephone Company (RTT). The Belgian Telephone Company (RTT), as all other telecommunications administrations, deals rather directly with the introduction of new technologies. Because of the financial impact of the decisions to be taken in this field it is of the outmost importance to develop a good decision support system. This paper has attempted to analyse the issue of integration of forecasting with strategic planning in a real world application.

DECISION CONTENT, DECISION PROCESS AND STRATEGIC RATIONALITY AT CORPORATE LEVEL

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A quasi-comprehensive set of factors having normative importance for corporate-level decisions is described. The typical potential for bottom-up information enhancement is assessed for each factor. This is related to the selection of a decision method. The feasibility of forecasting the impact of each factor on key performance-parameters is also examined. Factors that admit an analysis based on game theory (strategic rationality) are identified and contrasted with those for which non-strategic (parametrically rational) models are normally employed. These factor-classifications might assist corporate forecasters to assess forecast-leverage in the context of strategic option evaluation.

CLASSICAL METHODS REVISITED

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ORANGES AND MEAN SQUARE ERROR

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is important to compare like with like. Mean square error (MSE) is a widely used criterion for assessing model-fit and ecast-accuracy. However when averaged across different time-series, the resulting measure is not scale-invariant. The table mean square errors reported in the M-competition results is obtained by averaging across series with widely different vari-bilities. The results do not demonstrate that Bayesian forecasting is 'best' for all 1001 series, but rather that Bayesian fore-sting happens to give the best forecasts for the 3 or 4 yearly series with the largest variability! The 'hideous' format of the blished table has hindered the recognition of this important finding, and as a side-issue some guidelines for presenting clear aphs and tables are presented.

Y OLS HAS BEEN THRIVING WHERE MONEY MATTERS - THEORETICAL JUSTIFICATIONS

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e ordinary least squares estimator (OLS) has been condemned by academic econometricians as an undesirable estimator when n econometric model is plagued by any of the following: simultaneity, errors-in-variables, lagged dependent variables with utocorrelated disturbances, and censored or truncated samples, all of which make OLS inconsistent under the conditions norm-lly assumed. In spite of this deficiency, OLS has been widely used by practitioners in business and government, though not by cademic researchers who are publication maximizers. For example, a macroeconometric model is likely to be plagued by all the actors mentioned above except for the last one, and, yet, about eighty-five percent of the macroeconometric models currently sed in practice are estimated by OLS.

OPTIMAL PREDICTION I

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FINDING PREDICTED VALUES WITH MINIMUM PROBABLE ERROR

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The paper is concerned with the problem of finding the linear prediction model with the minimum probable prediction error. It specifically adresses problems where a response variable is given in terms of a number of variables which may or may not be significant in choosing the appropriate prediction model. Classically the solution is sought in a cost function selected in terms of the fit one obtains from an arbitrary combination of variables. The paper indicates which cost function ought to be used in selecting the combination used for the 'best' linear prediction model.

THE EXISTENCE OF WIENERIAN OPTIMAL PREDICTORS

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Assume that a function $f : R \to R$ represents a time series. Then some of the optimal prediction problems can be reduced to the extremal problem: ($\alpha > 0$)

$$\underset{K}{\text{Minimize}} \quad \lim_{T\to\infty} \int_{-T}^{T} \left| f(t+\alpha) - \int_{0}^{\infty} f(t-\tau)\,dK(\tau) \right|^2 dt,$$

where minimum is taken over all the functions $K : [0,\infty) \to R$ of bounded variations. The main purpose of this paper is to find a sufficient condition which assures the existence of solutions for this extremal problem in a generalized framework.

APPLICATION OF THE LEAST ABSOLUTE VALUE TECHNIQUE FOR ECONOMIC FORECASTING

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There is considerable evidence that econometric modeling often involves dealing with data outliers and "heavy-tailed" error distributions. These situations can obviously affect economic forecasting. The Least Absolute Value (LAV) technique is particularly advantageous for cases of nonnormal error distributions. In this paper, attention is focused on the development and application of various LAV techniques. The fluctuating U.S. agricultural market provides an appropriate setting for testing the robustness of LAV procedures. The flexibility of LAV procedures in commodity modeling is also discussed and compared with standard regression techniques.

OPTIMAL CONDITIONAL ARIMA FORECASTS

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An optimal univariate forecast, based on historical and additional information about the future, is obtained in this paper. Its statistical properties, as well as some inferential procedures derived from it are indicated. Two main situations are considered explicitly: (i) when the additional information impose a constraint to be fulfilled exactly by the forecasts and (ii) when the information is only a conjecture about the future values of the series, or a forecast from an alternative model. Theoretical and empirical illustrations are provided, and a unification of the existing methods is also attempted.

MSE SUPERIORITY OF FORECASTS

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A well-known criterion for comparing two (vector) forecasts is the difference of the mean-squared-error matrices of their errors. In the last few years several papers have been published on what is called MSE superiority of estimators; see, e.g., Trenkler and Trenkler (1983) and Trenkler (1985). Although the papers deal with estimators, their methodology can easily be applied to forecasts as will be shown in this paper.

OPTIMAL PREDICTION II

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COHERENT FORECAST WITH NONLINEAR ECONOMETRIC MODELS

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The forecast of the future status of an economic system, obtained with the usual deterministic solution of a system of stochastic equations, has several well known drawbacks, when the system is nonlinear. Most of the therapies proposed in the literature are based on some estimation of the conditional mean of the endogenous variables in the forecast period. This however provides a solution to the problem which does not respect the internal coherency of the model, and in particular does not satisfy nonlinear identities. At the same time, for analogy with univariate skewed distributions, the conditional mean may be expected to lie on the wrong side of the deterministic solution, meaning that it moves towards values of the variables which are less likely to occur, rather than towards the most probable values. Estimation of the most likely joint values (mode of the joint distribution) of all endogenous variables is proposed as an alternative optimal and coherent predictor.

SOME RESULTS ON ROBUST PREDICTION

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Given a random sample it is often the case that we wish to predict some characteristic of a future random sample from the sample population. This is often the case in Quality Control where given a random sample a prediction interval for a single future observation or a future sample mean is desired. The problem becomes rather difficult if the data are not Gaussian, but heavier-tailed than Gaussian. In such cases we would like to use robust estimators to help characterize the population. However, if any reasonably large level of prediction is required, then the robust estimators will be put in a precarious position since much of the relevant information will lie in the extremes of the sample. Unfortunately, this is the part of the sample that the robust estimator is designed to resist. In this paper, we discuss ways of approaching this problem. A variety of applied situations will be discussed.

FORECASTING NON-NORMAL TIME SERIES

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Autoprojective methods of the Box-Jenkins type encounter severe problems when applied to time series which are non-normal and relatively short. We propose a technique which constructs an underlying normal series from the original data. This may then be analysed using conventional methods for estimation and diagnostic checking, so minimising software investment. Forecasts of this underlying series can be used to construct forecasts of the original data. An advantage of this approach is that it enables us to model both the original marginal distribution and the correlation structure simultaneously via likelihood.

LOOKING FOR OUTLIERS IN FREQUENCY DOMAIN

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The paper extends to the frequency domain methods which are now commonplace in the time domain. We consider the linear model $Y = X\beta + \varepsilon$ in which $\underset{\sim}{\varepsilon}$ is white Gaussian noise, except for, perhaps, a periodic disruption (a frequency domain outlier). We analyse the model $Y = X\beta + \tilde{\varepsilon}$, the tilde denoting Fourier transformed entities, and find the distribution under the null hypothesis of no disruption of the largest squared modulus of the (complex) residuals. Finally, we provide an example illustrating the usefulness of the method.

EQUILIBRIA AND DYNAMICS

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CRUDE EXPECTATIONS IN A GENERAL EQUILIBRIUM MODEL

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Crude expectations are formed from a view on the long run growth path of the economy and on the average medium term path the economy will follow to get there. A model incorporating these expectations solves simultaneously for short term, expected medium and expected long term variables. The actual time path of the economy consists of the sequence of short term variables. A crude expectations model exhibits forward looking expectations, intertemporal optimization of agents and short run partly disequilibrium dynamics embedded in a long term growth model. For comparison the crude expectations model in this paper has been formulated along the lines of the Bruno and Sachs (1985) perfect foresight model. Simulation experiments illustrate the working of the model and forward looking behaviour. Furthermore the consequences of misjudged expectations are analysed.

ON THE CALIBRATION OF COMPUTABLE GENERAL EQUILIBRIUM MODELS

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The rapid proliferation of computable general equilibrium (CGE) models in research and policy use has focused attention upon their empirical veracity. These models have evolved during the last fifteen years from academic curiosa to policy research tools supported by extensive data gathering and computer resources. As their sophistication and scope of application have grown, the empirical properties of CGE models are receiving greater scrutiny. In the construction and maintenance of a CGE model, empirical or forecasting performance is usually treated under the rubric of model calibration. Proper calibration of a complex simulation model is essential if it is to forecast reliably. This paper uses differential methods to evaluate the robustness of CGE models to changes in parametric and exogenous values. Secondly, optimal parameter adjustment rules are developed to maximise the historical goodness of fit for these models. The paper concludes with an example of the calibration methodology applied to a new CGE model of the United States.

FORECASTING THE EQUILIBRIUM BEHAVIOUR OF AN ECONOMY BY THE NONLINEAR DYNAMIC INPUT-OUTPUT MODEL

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This paper reports on some mathematical and analytical properties of a dynamic nonlinear model of a multisectoral economy as the framework for forecasting its equilibrium behaviour. Our model is a nonlinear version of a dynamic input-output model so that production functions can exhibit a mixture of returns to scale and the investment functions, specifying dynamic features of the economy, can exhibit variable efficiency. Conditions for the existence of the economically meaningful solution of the model are given and the property of stability of solution is analyzed. Attention is also focused on the several other properties of the model which give a good framework for forecasting and planning. The possibility of its applications is also considered and some theoretical results are empirically verified.

DYNAMIC PRICECAP SIMULATION MODEL

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On August 21, 1987, the FCC released its Notice of Proposed Rule Making (NPRM) which requested comments and recommendations on the concept of price cap regulation as an alternative to the current rate base rate of return system. Direct comments were filed with the FCC on October 19, 1987. This paper discusses a simulation model developed for the purpose of evaluating alternative regulatory forms on the operations of a local exchange carrier. The evaluation is in terms of the effects of alternative regulatory systems on the time paths of the firm's revenues, costs, capital investment and prices. The model structure is aggregate in that it examines four kinds of network services: local, intralata toll and intrastate access combined, interstate switched access and interstate dedicated access. Econometrically estimated cost functions for broadly grouped expense categories and aggregate investment are combined with demand functions to search out optimal prices under different regulatory scenarios, employing the method of Hookes & Jeeves. Policy implications are then derived on the basis of the simulations. The model can be run under alternative assumptions regarding macroeconomic activity, i.e., real GNP and the GNP deflator.

MATHEMATICAL METHODS

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ON MATHEMATICAL METHODS OF PROFIT FORECASTING

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Consider a company where the income and outcome in the interval [0,t] are x(t), y(t) respectively. The dynamical behavior of x(t) and y(t) is determined by the following system of differential equations and initial conditions, (1) $\dot{x}(t) = \alpha[y(t) - x(t)] + \xi(t)$; (2) $\dot{y}(t) = \beta[x(t) - y(t)] + \eta(t)$; (3) $x(0) = x_{01}$; (4) $y(0) = y_{01}$; where x_{01}, y_0 are given positive constants, α, β are stochastic variables and (5) $\xi(t) = \Sigma_{k=1}^{n} \xi_k e^{-\mu_k t} \cos(\nu_k t+\varphi_k)$, (6) $\eta(t) = \Sigma_{k=1}^{n} \eta_k e^{-\mu_k t} \cos(\nu_k t+\varphi_k)$ are stochastic perturbations. Consider the x(t) - y(t) profit function. In this lecture we shall give a method to determine the probability of the event $x(t) - y(t) \geq K$, where K is an arbitrary constant. The results have many applications in the theory of profit planning.

FORECASTING BY CONVOLUTION OF FUZZY RANDOM VARIABLES - WITH APPLICATIONS

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The convolution of random variables is an essential problem in the organization, planning, and control of business decisions. Such decisions frequently result in sums of random payoffs, either over multiple objectives (profit, liquidity, stability) or over time. However, both values and weights entering such an aggregation are frequently fuzzy. Therefore, the convolution of fuzzy random variables is of great importance for forecasting and optimal decision making. In this paper, Linear Partial Information (LPI) analysis is used to exploit the fuzzy information available on probabilities, values, and weights. Some theorems on a priori and a posteriori forecasting of the resulting distribution function and optimal decisions are proved and illustrated by examples.

FORECASTING AND CONTROL FOR STRATEGIC MACROECONOMIC PLANNING

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Using a fundamental theorem in control theory, which specifies the degree to which a feedback control law can relocate the open-loop poles to new positions in the complex plane, a control model is transformed into a forecasting model capable of providing insight into the question of how much a developing economy ought to save if it plans to strike a perfect intertemporal balance between present and future consumption. In the process a performance integral is derived endogenously from the model's dynamic responses, thereby solving a problem which has long interested researchers concerned with the optimal design of forecasting systems.

NONLINEAR GOAL PROGRAMMING MODEL APPLICATION IN OPTIMAL ECONOMY DEVELOPMENT POLICY CHOOSING

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In this paper a new nonlinear goal programming model (NGP) and a new interactive goal programming methodology (MINGP) has been developed which are more applicable then existent. A gradient nonlinear programming algorithm, based uponb feasible directions method, built in an optimal step length routine, has been used to develop an algorithm for NGP model solving, especially those in which nonlinear functionqs are of Cobb Douglas type. MINGP is an effective means to consider models which involve multiple often conflicting goals. Tests of these methodology in real optimal economy development decision situations was affirmative

VARIATIONAL PROBLEMS GOVERNED BY A MULTI-VALUED EVOLUTION EQUATION

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Let X be a real Banach space and a multi-valued mapping $\Gamma : [0,T] \times X \to X$ be given. Define $\Delta(a)$ as a set of all elements x of $W^{1,2}([0,T],X)$ that satisfy $\dot{x}(t) \in \Gamma(t, x(t))$ a.e. $x(0) = a$ (given). We shall first show the non-emptiness of $\Delta(a)$ as well as some topological properties. Assume next that a function $u : [0,T] \times X \times X \to R$ is given. Our main concern is to find a sufficient condition which assures the existence of optimal solutions for the extremal problem:

$$\underset{x \in \Delta(a)}{\text{Maximize}} \int_0^T u(t, x(t), \dot{x}(t))dt$$

RISK ANALYSIS

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THE EFFECT OF PROPERLY ANTICIPATED FINANCIAL ASSET RETURNS ON PORTFOLIO ANALYSIS

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Financial asset returns are characterized by a wide variety of ARIMA time series models, the simplest of which is the pure random series usually identified for short return interval common stocks. Other assets, such as short term bills and bonds exhibit significant AR or MA parameters in the nonseasonal and seasonal components. In rational financial markets, it is the unforecastable component of returns that is priced and therefore appropriate measures of asset risk should be derived from the unexpected component of returns. The effect in modern portfolio theory, of utilizing the unexpected component rather than the original return series, is investigated. Time homogeneity of the risk measures is considered.

RISK ASSESSMENT IN THE CHOICE OF SILVICULTURE - (Forest Management) Investment Strategies

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Investments in forest management are extremely risky. Immediate risks include a variety of natural hazards and uncertainties with respect to treatment-response relationships. Long-term risks stem from changing technologies, market conditions and regulatory regimes. Traditionally, risks were ignored in choices among alternative silvicultural investments despite the magnitude of these investments. Recently, techniques such as sensitivity analysis and the use of multiple scenarios have been introduced to policy analysis exercises to permit an informal trade-off between risk costs and benefits. In this paper a comprehensive methodology to assess risks for silviculture investments is developed. The methodology has the following features: 1) it explicitly separates diversifiable from non-diversifiable risks as a function of referent system definition; 2) it sorts risk types by response modes (e.g. screening for acceptable risk levels versus risk-benefit trade-off opportunities); 3) for each risk type, an appropriate methodology for risk articulation and/or measurement is identified. Thus the methodology explicitly relates risk assessment methods to potential risk management actions and provides an efficient decision support system.

MANAGERIAL RISKY CHOICE BEHAVIOR UNDER FINANCIAL STRESS

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The recent spate of bank failures or near-failures in some parts of the United States gives an unprecedented opportunity to study the risky choice behavior of bank managers as their institutions move from strong solvent positions through periods of increasing financial stress to positions in or close to bankruptcy. This study compares asset decisions made over time as the bank's financial position erodes with decisions during the same period made by otherwise similar but still strong banks. The hypothesis is that during the early stages of deterioration, riskier assets will be added to the portfolio, but soon after the bank is classified as seriously troubled, ruin considerations reverse the choice behavior and managers become increasingly risk averse.

THE RELATIONSHIP BETWEEN RISK PROPENSITY, AND INDIVIDUAL AND JOB ENVIRONMENT VARIABLES

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Research examining correlates of risk-taking is ambiguous. Employees representing all levels of a medium sized technical/manufacturing company completed measures of risk propensity, locus of control, job burnout, job involvement, role ambiguity/conflict /overload, health status, trust/influence/mobility and demographics. The association among risk propensity and individual and job related variables was investigated. The study examined the relationship between the match of risk propensity with organizational variables and the variables health status and burnout, locus of control being treated as an intervening variable; e.g. the association among risk-taking, role uncertainty and trust level was investigated.

ENERGY FORECASTING II

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COMPOSITE VERSUS INTERACTIVE SPOT PRICE FORECASTING IN THE INTERNATIONAL PETROLEUM MARKET: AN APPLICATION OF THE RATIONAL EXPECTATIONS HYPOTHESIS

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This paper utilizes the conventional statistical tests associated with the rational expectations hypothesis so as to compare the relative accuracy of individual versus group forecasting within the organization. In order to maintain comparability between forecasting regimes the study employs like information sets for the two prediction methods. Using rational expectations tests as criteria, the statistical results show group forecasts inferior to individually produced predictions. These findings imply that group-produced forecasting accuracy may be hampered by the psychological interaction associated with consensus behavior. Conversely, we find forecasting accuracy improves when predictions are elicited from individuals in an isolated laboratory-like setting

TRADE WITH IRAN: THE OPPORTUNITIES IN THE FUTURE

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Ever since the Islamic Revolution of 1979, trade with Iran has been a dilemma for western companies. The revolutionary rhetoric and unstable political situation has made many companies wary of trade with Iran. However, Iran has continued to import billions of dollars worth of agricultural and industrial materials. This has encouraged many western companies to reenter this market. All the classical economic trends point to a promising market in the future. With the stabilization of the political situation in Iran, it becomes imperative for the western companies to have some footholds in this market.

MACROECONOMIC METHODS

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PRODUCING AND USING MACROECONOMIC FORECASTS

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Producing macroeconomic forecasts requires a clear statement of objectives. Different economic variables and forms of presentation (e.g. scenarios or sensitivities as opposed to just a central case) are required for various purposes. In addition, the methodology used will in general depend upon the objectives and constraints faced. Examples from public and private sectors are discussed. Effective presentation and communication of forecasts are essential. The use of forecast material and track record needs to be monitored, feedback obtained and the effectiveness of the process examined. Again examples are used to illustrate these points.

THE NATURE AND SCOPE OF MACROECONOMIC FORECASTING IN THE UNITED STATES: AN ANALYTICAL STUDY

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Although there is still much justification supporting the view that general economic forecasting is more of an art than a science, there is also comfort in the knowledge that we know not only a great deal more about forecasting than we did even a few years ago, but also that we know a great deal more about the limitations of forecasting. The rather crude forecasts of a generation past were the product of inadequacies in data and lack of experience in its treatment. Major strides have been made in recent years on both counts. In view of this, an attempt will be made in this paper to critically evaluate the development of new methodology and the degree of its efficacy in forecasting economic trends.

A COMPARISON OF MODEL FORECASTS UNDER COMMON CONDITIONING ASSUMPTIONS

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This paper describes an experimental project analyzing ex ante model-based forecasts under common assumptions. The project is designed to distinguish between the roles of the model and the model user in generating forecasts. The role of the model user is decomposed into three part: (1) assumptions with regard to the external sector, or "rest-of-the-world", (2) assumptions with regard to macroeconomic policy, and (3) constant adjustment to the mechanically generated model forecast. On an ex ante basis (i.e., before the actual outcome has become available), these data help to explain why forecasts differ. The data help to explain the reasons for the dispersion of macroeconomic forecasts. Very preliminary results suggest that external assumptions affect dispersion among forecasts differently than policy assumptions or constant adjustment. The paper concludes by comparing the standardized model forecasts with the actual data for 1986 and 1987. The data are used to decompose forecast errors into parts attibutable to policy assumptions, external sector assumptions, constant adjustments, and the models themselves.

MICROSIMULATION AS A FORECASTING INSTRUMENT

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In recent years, simulation models and especially microsimulation models have been increasingly applied in quantitative analyses of economic and social policy problems. Since microsimulation models are concerned with the behavior of microunits (like persons in a family/household, firms etc) they are especially suited for distributional policy impacts. After an overview of recent developments and applications, the special advantages of the microsimulation approach as a forecasting instrument is demonstrated first on the principles of the three general microsimulation approaches: dynamic microsimulation, life cycle microsimulation, and static microsimulation. Special emphasis is laid on dynamic adjustment procedures for steering and forecasting within the static microsimulation case (optimal control/Kalman filtering and simultaneous adjustment based on the minimum information loss principle). Second, to demonstrate some power of empirically based forecasting with the microsimulation approach, examples concerning the German old age pension reform, educational developments and market and non-market activities of private households are presented based on extensive microsimulation models of the Sonderforschungsbereich 3 'Microanalytic Foundation of Social Policy'.

GAME THEORY

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FORESIGHT EQUILIBRIA IN 2X2 GAMES

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The recent development of various stability concepts in non-cooperative game theory has great value in allowing the assessment of how different behavioral assumptions can affect people's actions in social conflict. Some of the stability concepts are derived from various assumptions concerning a player's foresight in anticipating future moves. These stability concepts are particularly important in describing and forecasting the behavior of individual or groups in different competitive circumstances. A comprehensive data base has been developed which contains all known stability properties of every outcome in all 726 general ordinal 2x2 games. As an example of the use of the data base, this paper models arms control verification as a 2x2 game. The model is analyzed using different stability concepts in order to discover the fundamental strategic relationships between the players and to predict their resulting behavior.

TOWARDS CONFLICT PROGNOSTICS

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A conflict is defined as a pair of rules leading to different states. To forecast a conflict means to recognize the actuality of a pair of state-transition rules leading to two different states simultaneously. While two conflicting states can never make a new "conflict-state" then, two conflicting rules do produce a new rule. In the paper the formal logical aspects of this are elaborated

ISRAEL AND THE PLO: A GAME WITH DIFFERENTIAL INFORMATION

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An application of a game with differential information to the conflict between Israel and the PLO is presented. There are two possible types of player - minimalist and maximalist - for each side. Starting from basic assumptions a set of reasonably probable outcomes and cardinal utilities of each type of each side are constructed. Nash Equilibria with pure strategies predict high probability for a continuing status-quo and low probabilities for a comprehensive settlement or armed conflict. The paper clarifies the underlying structural components of the Israeli-Palestinian conflict and offers directions for future research. Particular attention is paid to the correlation between the tyupes of players and the ability to predict their patterns of behavior. In contrast to the minimalist policy, the resilient and thus the predictability of the maximalist policy is sensitive to information about the type of the other side. Such information is assumed to be incomplete if not scarce.

SCHOOL ATTENDANCY

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CURRENT METHODS IN FORECASTING PUPIL NUMBERS IN BRITISH SCHOOLS

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The paper presents and analyses the results of a recently completed study of the methods currently used in forecasting pupil numbers in the 120 education authorities in Britain. The aims of the study, which was funded by the Ministry (the Department of Education and Science), were to identify good practice in current forecasting methods and to produce recommendations for improving methods. The paper describes and evaluates existing methods, data sources and the inaccuracies in forecasts, and discusses the incorporation of local knowledge within the forecasting method and the organisation of responsibility for such forecasting processes.

A DEPARTMENT ENROLLMENT PROJECTION MODEL

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The development of miniaturization, increased processing speed and larger memory capacity have revolutionized computer technology. The proposed model is an attempt to incorporate to the educational planning arts the latest computer technology, providing academic managers with a microcomputer-based technology for making a variety of decisionqs about academic standards, student recruitment, course and program expansion and contraction, instructional staffing, faculty retraining and reassignment. The model assumes that enrollments are influenced by economic and social forces so that supply factors, rather than demand or economic growth factors, are expected to be essentially accommodating. It uses a structural, multiple-equation approach to forecast enrollment based upon analysis of local and regional occupational needs and opportunities. The model allows managers to test the sensitivity of the system to changes in their own actions or those of others beyond their control.

NONLINEAR MODELS

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ASPECTS OF NON-NORMALITY IN ARMA FORECASTING

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If the errors in ARMA forecasts are assumed to be normally distributed, when the time series or the noise terms in the model are not, this paper will demonstrate that forecast prediction limits are misleading. Comparisons are made of results obtained assuming normality with those determined by fitting one of the Pearson family of distributions. The methods and some of the problems associated with them are demonstrated in case studies.

EMPIRICAL BAYES ESTIMATION AND FORECASTING OF RANDOM COEFFICIENT AUTOREGRESSIVE PROCESSES

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Li and Hui (1983, JTSA) developed an empirical Bayes procedure for estimating parameters in panel data generated by linear autoregressive processes. It is shown that the same procedure can be used to estimate the parameters of nonlinear autoregressive processes. Specific applications to the STAR processes of Chan and Tong (1986, JTSA), and to exponential autoregressive processes are considered. Three approaches to forecasting are developed: (i) a naive approach using the empirical Bayes estimator; (ii) a bias-corrected version of the forecasts from (i): (iii) direct computation after first estimating the prior distribution. The performances of these estimators and forecasts are studied using real and simulated data.

SOME RECENT RESULTS ON FORECASTING WITH NON-LINEAR AUTOREGRESSIVE TIME SERIES MODELS

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An exact equation for the conditional distribution of X_{t+m} given $X_t, X_{t-1}, \ldots$, has been derived for a k^{th} order nonlinear autoregressive process using the Chapman-Kolmogorov equation. Numerical solutions have been obtained for the probability density, cumulative distribution function, mean, variance and median of this distribution using a recursive computer program. This has enabled a direct comparison of both the mean and median as forecasts with the forecasts obtained when using a linear autoregression. We report the results of our findings for both simulated and real data and discuss some surprising features that have been observed.

A RANDOM SWITCHING MODEL IN NON-LINEAR TIME SERIES ANALYSIS

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This paper describes a way of making predictions in a class of non-linear time series. Oscillatory behaviours, not constrained to be sinusoidal, are considered and a two-state model is proposed for representing the changes in pattern. The dynamics between states are then formulated as a semi-Markov process and the state probabilities are assessed with respect to a set of observables, namely the state sojourn times and the threshold values of the series. Suitable hazard functions are further introduced to describe the random switching rule, with the observables being considered as the system's covariates.

DETECTING NONLINEARITY, NONNORMALITY AND OUTLIERS IN TIME SERIES USING MINITAB

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We review the latest techniques for detecting 'unusual' behaviour in time series data. The methods are demonstrated in practice by employing some specially designed macros written for the widely available statistical package, Minitab.

AIDS FORECASTING AND ESTIMATION OF THE HIV$^+$ POPULATION SIZE

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APPLICATIONS OF CHANGE-DETECTION METHODS TO AIDS FORECASTING

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A linear regression model is formulated for the logarithmically transformed data on the incidents of AIDS from the United States. Change detection statistics including Bayesian-type, likelihood ratio and those based on recursive residuals were then applied to detect parameter changes at unknown times. All tests showed overwhelming evidence towards a change in the regression parameters with a significant reduction in the slope. Various likelihood methods used for estimating the unknown change-point uniquely showed a change occuring in January, 1984. This finding is most valuable for any reasonably accurate forecasts of the AIDS epidemic. Several comparisons among various subgroups were also carried out.

SELECTION AND FORECASTING OF NONLINEAR MODELS WITH APPLICATIONS TO AIDS DATA

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Nonlinear models are often employed in the modelling and prediction of natural phenomena, especially those displaying sustained growth patterns (e.g. biological or chemical populations, plants sized, economic indicators, etc...). There are, however, two major difficulties attached to this modelling exercise: the choice of the mathematical form of the functional relationship which describes the system, and the specification of the error distribution. This paper suggests an unifying approach to both problems by using Model Selection Criteria (e.g. AIC). Forecast performances are then used to validate the model choice. The approach is illustrated on the problem of forecasting AIDS incidences in Canada. Computational problems related to nonlinear parameter estimation and forecasting are also discussed.

ESTIMATION OF THE SIZE OF THE HIV$^+$ POPULATION

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Reports from the Surgeon General of the USA (1986) and from the Centres for Disease Control (CDC), Atlanta, USA, contained estimates that in 1985 between one and 1.5 million citizens in the USA would test HIV positive; these estimates were based on small samples of the general population. Estimates of Cowell and Hoskins (1987) place the HIV positive population in 1987 in Canada at between 50,000 and 75,000. Difficulties in obtaining reliable sample survey data probably make these estimates highly speculative. This paper uses survival results based on the study by Brodt et al. (1986) of the rates of progression of the HIV infection to AIDS and the data regarding the number of diagnosed cases of AIDS in Canada and the USA to obtain alternative estimates of the numbers of HIV positives in these two countries. These alternative estimates place the size of the HIV positive population at approximately 10% of that given by the Surgeon General and by Cowell and Hoskins.

IMPLEMENTATION OF FORECASTING MODELS AND SYSTEMS IN MARKETING

Chair: **Randall L. Schultz**
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MARKETING'S USE OF FORECAST COMBINATIONS; A SYNTHESIS OF ISSUES

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Marketing managers charged with the responsibility of developing sales forecasts have access to predictive data from a variety of sources. Typical sources would be data from the salesforce and from product management's quantitative forecasting models. Such information is usually aggregated informally to give a weighted predictive estimate of sales for the next planning period. While such a process works for many situations, controls for the integration of the componbent information inputs may be absent. This paper will examine such controls in the context of a four part study: (1) to develop the background literature which is pertinent to the manager's forecasting problem in the presence of multiple forecast inputs; (2) to infer the key criteria for choosing combination mechanisms based on the literature; (3) to illustrate empirically the utilization of such criteria; and (4) to provide recommendations for implementation of such combinations.

CROSS-CULTURAL BIASES IN FORECASTING AND PLANNING

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The recent interest in behavioral biases in forecasting and planning suggests that personal and background factors may influence how forecasts are made or interpreted. The influence of one such background factor, namely culture, has gone virtually unexplored. This paper reports on a study in which managers from different cultures must allocate resources between two ventures forecasted to have very different profitability levels. However, to achieve the higher profitability requires the cooperation of a partner. It is hypothesized that the allocation will depend on the cultural backgrounds of the manager and the partner.

IMPLEMENTATION OF MODEL-BASED PLANNING AND FORECASTING SYSTEMS IN MARKETING

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Forecasting models that are integrated with planning systems present special problems and opportunities for effective implementation. Among the problems are those associated with any implementation, namely management support, involvement, personal stake, system characteristics and implementation strategy and those especially connected with model-based planning such as the logical order of goal-setting, planning and forecasting. The opportunities include changing the organization to improve both its planning process and its performance. This paper discusses these concepts as reported in a new book.

BAYESIAN METHODS AND APPLICATIONS

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MAXMIN EXPECTED UTILITY WITH A NON-UNIQUE PRIOR

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Acts are functions from states of nature into finite-support distributions over a set of "deterministic outcomes". We characterize preference relations over acts which have a numerical representation by the functional $J(f) = \min\{ \int u\,dP \mid P \in C\}$ where f is an act, u is a von-Neumann-Morgenstern utility over outcomes, and C is a closed and convex set of finitely additive probability measures on the states of nature. In addition to the usual assumptions on the preference relation as transitivity, completeness, continuity and monotonicity, we assume uncertainty aversion and certainty-independence. The last condition is a new one and is a weakening of the classical independence axiom: It requires that an act f is preferrred to an act g if and only if the mixture of f and any constant act h is preferred to the same mixture of g and h. If non-degeneracy of the preference relation is also assumed, the convex set of priors C is uniquely determined. Finally, a concept of independence in case of a non-unique prior is introduced. This research has been partially financed by a funds granted to the Foerder Institute for Economic Research by the John Rauch Fund.

A BAYESIAN FORECASTING MODEL OF DEPENDENT DEMAND

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In this paper a Bayesian Forecasting model is proposed for production and materials requirement planning purposes. The specific model revolves around the multinomial distribution and a multivariate Beta prior. The model is used for forecasting demand for several components or features which, when combined in various fashions, constitute different end products for a given firm.

ESTIMATION, TESTING, AND FORECASTING IN DEMAND SYSTEMS WITH CONCAVITY CONSTRAINTS

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A method for imposing or testing curvature restrictions in demand systems is suggested using Bayesian inference and inequality constrained estimation. The approach makes use of Monte Carlo integration and the approach suggested by Geweke (1986). The result is an inequality constrained estimate of the parameter vector for a demand system, plus and estimate of the probability that the inequality restrictions hold. This allows forecasts to use the inequality constrained regression estimates rather than the unconstrained ones so that forecasted observations fit the restrictions imposed by demand theory. Application to the U.S. manufacturing data of Berndt and Wood using the translog cost function illustrates the method.

RIVER FLOW FORECASTING BY MEANS OF A PURE RUNOFF MODEL. CASE STUDY OF THE MEUSE IN LIEGE (BELGIUM)

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A pure runoff model is defined, which takes account of sharp risen and slow decreases appearing in any pure runoff time series with a small enough time base. This is realized by first subtracting exponentially decaying recession and baseflow terms from total runoff. The remaining part is deseasonalized by a truncated Fourier series multiplicator and then modeled as a second order Markov stationary series. The model is calibrated on the weekly flows of the Meuse river at Liège (Belgium), and is checked in a number of ways. Forecasts with horizon up to eight weeks proved to be completely satisfactory, When comparing with observed flows.

FORECASTING IN ACCOUNTING

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AUDITOR CHANGES, INFORMATION SUPPRESSION AND BANKRUPTCY PREDICTION

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In periods of financial distress, management may attempt to compromise the flow of information to creditors and investors. The auditor's role in this context is to ensure that such compromise does not take place. If the auditor does not permit certain accounting treatments, the company may choose to switch to another auditor who will. We hypothesize that managers of failing companies have incentives to suppress negative information, and that auditor switches are more likely to take place if the incumbent auditor does not facilitate information suppression. Diminished information quality is expected to result from two forms of information suppression: undisclosed changes in accounting methods and procedures; and unwarranted audit qualification avoidance. Empirical evidence relating expected levels of information quality (based on auditor change behavior) to the quality of comparative bankruptcy prediction models provides support for the hypothesis. A leading alternative explanation for the differentially predictive bankruptcy prediction models, that the timing of auditor change is tied to the onset of financial distress, is not empirically supported.

MANAGERS' EARNINGS FORECASTS AND INTRA-INDUSTRY INFORMATION TRANSFERS

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The effect that voluntarily disclosed managers' earnings forecasts have on the security prices of the announcing firms and other firms in the same industry is examined. The results are consistent with information content in managers' forecasts and with information transfer between the forecast firms and other firms in the same industry. Interestingly, inferences are different once industry effects are removed from firms' security returns. Specifically, the forecast information (good vs. bad) is inversely related to the abnormal returns of other firms in the same industry. We also examined and find support for some determinants of information transfer including the number of firms in an industry and forecast horizon.

BIAS IN TWO-STAGE REGRESSION USED IN MARKET-BASED ACCOUNTING RESEARCH

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This study investigates the bias in two-stage regression approach, frequently used in market-based studies. The study analytically shows that such a two-stage approach not only leads to a downward bias in the second-stage coefficient estimate, but also this bias is a function of the correlation between the first-stage and second-stage variables. Furthermore, an additional bias in the estimate of the second-stage error variance leads to indefinite conclusions regarding the bias in the second-stage t-statistic. The empirical evidence suggests that the effect of the bias, at least in the context of unexpected earnings, may be trivial. The study also suggest bias-correction procedures, in situations where the effect of the bias is expected to be severe.

RELATIONSHIP BETWEEN DISPERSION IN SECURITY ANALYSTS' EARNINGS FORECASTS AND IMPROVEMENT THROUGH COMBINATION

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This study examines the relationship between the accuracy of mean earnings forecasts made by security analysts and dispersion of those forecasts. Then, it investigates the improvement in forecast accuracy that can be obtained by combining security analysts' forecasts with forecasts from time series models using simple combinations. The relationship between forecast dispersion and improvement in forecast accuracy through combination with time series model forecasts is studied.

ECONOMETRIC TIME SERIES

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IMPROVING ARIMA MODEL FORECASTING BY PRIOR ADJUSTMENT OF THE DATA
A case-study for the Austrian Industrial production

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Compared to other countries, we enjoy in Austria an unusually large number of legal holidays. In May or June, these holidays fall on Thursdays, so that a substantial portion of the working population prefers to take off the adjoining Fridays also. These calendar effects may cause substantial erratic fluctuations in the monthly index of the industrial production. As a consequence, any attempts to apply ARIMA models in forecasting or seasonal adjustment of this series, prove unsuccessful. In the present study, however, it is shown that prior adjustment of the original series for these calendar effects results in a substantial improvement of the quality and forecasting performance of estimated ARIMA models.

ECONOMETRIC VERSUS TIME SERIES FORECASTING: A CASE STUDY

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The paper compares the performance of the forecasts generated from the Youngstown Quarterly Econometric Model with the forecasts produced from the time series models (mainly the ARIMA models). A total of seventy-four quarterly time series data was used for the comparison. These data are dealing with the Youngstown, Ohio metropolitan area labor market. Results of this study show that performance of different forecasting procedures depends upon the type of activities involved, and that there is no single forecasting procedure which will consistently outperform other forecasting procedures under all situations.

AN ASSESSMENT OF THE ACCURACY OF ECONOMIC FORECASTS

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Economic forecasts of German forecasting organisations are compared with time series forecasts which have been made by the authors. The time series methods include the Box-Jenkins approach and exponential smoothing. It is shown that the accuracy of the forecasting organisations is superior to the accuracy of the time series methods. Comparing the accuracy of the time series methods, it can be observed that exponential smoothing beats the Box-Jenkins approach all the time.

ARMA ERRORS: SPECIFICATION AND ESTIMATION

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Exact expressions for the covariance matrix of ARMA distributed errors are derived. For AR and MA distributed errors more results are obtained. In these cases simple and computationally efficient methods are presented for the inverse and the determinant of the covariance matrix. For the linear regression model we give first and second order derivatives for the quadratic form to be minimized. Applied to AR and MA covariance matrices (conditional) solutions are obtained for the parameters to be estimated. Though second order conditions are found, it seems not possible to reach strong conclusions about the uniqueness of the estimator. One consequence is a -slightly- better expression for the AR(1) parameter as used in the well-known Cochrane-Orcutt method.

JUDGMENTAL FORECASTING I

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A BEHAVIORAL APPROACH TO HUMAN BIAS RESEARCH IN JUDGEMENTAL ECONOMIC FORECASTS

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The psychological theory of information processing holds that human beings use heuristics or rules of thumb in searching a data set. Three such heuristics have been identified. According to the availability heuristic, people depend upon salient information which is more easily retrievable from memory than less easily retrievable information. According to the representativeness heuristic, people act as if stereotypes are more common than they actually are in the real world. According to the anchoring heuristic they rely upon some initial anchoring values and then make some adjustment to the initial value. In this paper, the three major heuristics are presented together with a catalogue of the biases and errors resulting from the use of each heuristic as they might occur in the context of a business tendency survey where respondents are asked questions regarding the direction of change expected for given economic variables such as inventories, production, etc. Next the problem of transference of a body of theory developed in the experimental laboratory to the context of the business tendency survey environment is explored. Essentially, this involves constructing a suitable normative standard by which bias and error can be measured and the selection of a subset of respondents who share a common frame of reference. The resolution of this problem is generally described, but the operational details of developing a viable and operational research agenda are to be developed as part of an ongoing research program. While this paper does not present any hard empirical results, it does open the avenue for a potentially fruitful path for research into psychological aspects of forecast formulation actually utilized by real human beings.

ESTIMATING INPUTS TO EFFORT FORECASTING MODELS FOR SOFTWARE DEVELOPMENT

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Accurate project size prediction is vital to the usefulness of effort forecasting models used in software engineering. These forecasts of personnel requirements and project duration are the basis for feasibility studies, cost estimates, project schedules and for technical and managerial decision. Most forecasting models of effort use an estimate of thousands of delivered source instructions (KDSI) as the primary input variable, but little research has been reported on improving estimates of KDSI. This paper proposes a variation of the "PERT-type" approach presently in use, together with a factor to adjust for the optimism bias common to such estimates.

GROWTH FUNCTIONS

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LOCAL NONLINEAR TRENDS

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This paper examines ways in which nonlinear local trend models can be modelled. The main purpose is to derive the forecast function for these nonlinear local trends. Although it is focussed on the logistic trend function, the methodology could be extended to other cases. An application to "Tractor in Spain" data is also provided.

A SIMPLE CLASS OF NSRL DIFFUSION MODELS

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A simple class of NSRL diffusion models is defined, analyzed, and applied. Its logistic type differential equation (growth rate) has always a solution (growth curve), what is not guaranteed by the conventional NSRL-class (Easingwood/Mahajan/Muller 1981, 1983, 1987) and the modified NSRL-class (Skiadas 1985). Its growth rate and shape are as flexible, but its growth curve is appealingly simpler than that of the GRM-extensions (Skiadas 1985). Shape characteristics and formal properties with substantial interpretations are given and illustrated. An empirical application to the series (short/medium/long) of three product innovations evaluates fits and forecasts by statistical criteria.

GROWTH FUNCTIONS AND FORECASTING IN LARGE SYSTEMS: THE GREEK ELECTRIC ENERGY CASE

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The use of growth functions to estimate some parameters of large systems is discussed and forecasting techniques are proposed. Related models are applied to the data expressing the consumption of electric energy in Greece. A basic parameter- the saturation level - is analysed and correlated to some socioeconomic variables.

SATURATION AND LOGISTIC GROWTH MODELS: A CRITICAL PERSPECTIVE

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The author reviews and characterizes some of the better-known models and estimation techniques that have been used to predict logistic growth and saturation. Using Influence Diagrams we carefully distinguish between the models of consumable and durable products; the growth models used to predict market share and consumption rate of consumables are deceptively similar in structure to those used to predict cumulative sales of durables while the structure and underlying modelling assumptions may be very different. There now appear to be a few important special cases which are well understood but a substantial amount of theoretical research and experimental testing needs to be done before we can fully understand how consumer choice influences the underlying patterns of logistic growth, saturation and product preference.

MODELLING & FORECASTING PORT TRAFFIC I

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A COMPARATIVE STUDY OF MARITIME TRAFFIC FORECASTING APPROACHES USED IN THE SEAPORTS OF ANTWERP AND ROTTERDAM

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In this paper, the maritime traffic forecasting approaches used in the seaports of Antwerp and Rotterdam are contrasted. The first two sections describe the forecasting approaches used in both sea ports. In the third section, each approach is analyzed in terms of a general decision model. The last section discusses the effectiveness of the different forecasting approaches and provides policy recommendations for the seaport planner, as to the design of an optimal long term forecasting system.

SHIPPING MARKET ANALYSIS AND FORECASTING

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Presentation of a synoptical review of recent forecasts on shipping market developments in respect to seaborne trade of various commodities or commodity groups. The underlying assumptions are critically compared and evaluated. The synopsis is supplemented by ISL's own forecast results. The theoretical background of the ISL's forecasting model and the status of its software development will also be presented.

MODELLING & FORECASTING PORT TRAFFIC II

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SHIPPING FREIGHT RATE ADAPTIVE FORECASTING: AN APPLICATION OF KALMAN FILTER TECHNIQUE

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Shipping freight rates have always been the most interesting objects to forecast in shipping markets. However the forecasting models commonly used in shipping practice have two major defects. Firstly, they cannot offer information on the variance-covariance of forecasts which is important to strategic planning. Secondly, they are not adaptive to new data available. This paper discusses the necessity and feasibility of Kalman Filter which can solve the above problems in shipping freight rate adaptive forecasting satisfactorily. A numerical example is also given. As far as the author knows it is the first attempt in the literature at applying this new technique in shipping market research.

SHORT-TERM FORECASTING OF THE ANTWERP MARITIME STEEL TRAFFIC

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This paper uses multivariate time series models to specify the maritime steel traffic flow in the port of Antwerp. The obtained time series models provide useful insight in the general behaviour of the maritime steel traffic flow during the period 1971-1982. In particular, they provide a quantitative interpretation of important changes which took place in the European steel industry during that particular period. Also these multivariate time series models produce forecasts which are a substantial improvement over forecasts obtained by univariate time series models.

A NORMATIVE SCENARIO AS A FORECASTING TECHNIQUE FOR MARITIME COASTAL TRANSPORT PLANNING IN BRAZIL

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The study has as its main objective the discussion of some forecasting methods for the selection of an adequate one to be applied to the present context of maritime coastal transport in Brazil. From the analysis it was concluded that a forecasting technique based on the generation of normative scenarios would produce the most appropriate results. Assuming that the problem of coastal transport in Brazil is a complex one, partly due to the competition between transport modes and the conflicts originated by the particular interests of each group involved with this type of transport, it was also concluded that only a "macro-solution" within a long term planning context could provide positive results.

SIMULATION OF A PORT LAYOUT AND ITS APPLICATION IN PREDICTION

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The paper concentrates on the development of the methodology and technique of simulating a port layout which includes arrival of different ship types in the port bay, pilotage to berths, service times at berths, pilotage for departure and estimates the waiting times and queues at different stages. The port model is translated into a simulation language and the development of the program is described. The simulation program is run to reveal some of the results on the operations of the port model. Analysis of the results is based on five simulation experiments using different policies and parameters for the port. These experiments relate to changes in ship arrival patterns, service times at berths, different numbers of berths, pilotage and berthing policies. The usefulness of simulation models in the prediction of port traffic and layout is considered in the conclusion.

FREIGHT-FLOW FORECASTING IN THE PORT OF ROTTERDAM; Steering a middle course between theory and praxis

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The short-term forecasting system consists of two parts: a model consisting of a small set of regressions and an adjustment procedure, based upon common-sense and consultations of experts in the field. The Port of Rotterdam also makes model-steered long-term forecasts. Since requirements and possibilities of both models differ, they are only vagely resemblant. These requirements and possibilities determine the choice of the models. Factors to be taken into account are: the users, who although specialists in their field, are laymen in forecasting; required accuracy of the results; quality of the statistical information on the freight-flows; availability of information on exogeneous variables. The differences between the short-term model and the long-term model will be used to illustrate the above.

JUDGMENTAL FORECASTING II

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VISIONS OF THE FUTURE AND THEIR ROLE IN JUDGMENTAL FORECASTING, DECISIONS MAKING AND PLANNING

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Most personal and organizational action is future-oriented. In this paper it is argued that such action necessarily is guided by a 'vision' of the future. Different ways in which such vision has been characterized are examined. It is concluded that to be adequate, the characterization must include the actor's goals and plans represented both verbally and nonverbally. Because different disciplines tend to focus upon one aspect of vision to the exclusion of others, the understanding of vision, as well as its role in judgmental forecasting, decision making and planning, is fragmented and incomplete. In an attempt to remedy this, a unifying framework is presented and its implications for research are discussed.

INTEGRATING GROUP JUDGEMENTS IN SUBJECTIVE FORECASTS

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The aggregation of forecasts, whether across formal quantitative methods or individual judgmental forecasts, has been shown to yield improved forecasts in terms of mean average percentage error (MAPE) given quite innocuous conditions, such as positive validity of judges. This paper examines both the approaches to aggregating forecasts and the context and process of generating group judgements. It attemps to combine contributions from a variety of separate literatures which are relevant to the problem of group judgmental forecasting. Care needs to be taken with some of the empirical work in the fields of group processes and group judgments as experimental groups are usually synthetic and frequently unfamiliar with the basic task. Familiarity with the task, and the context in which it takes place appear to be important determinants of performance.

IMPROVING JUDGMENT ESTIMATES OF THE MOMENTS OF PERT-TYPE DISTRIBUTIONS USED IN FORECASTING

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Program Evaluation and Review Technique (PERT) is widely used in project management, and certain forecasting models use as inputs subjective estimates of the moments of PERT-type distributions (Boehm's COnstructive COst MOdel, for example). PERT has been criticized with respect to its underlying theory (the use of a narrowly-defined beta distribution) and the bias of its estimates. This paper proposes the use of distribution-independent percentile estimates as inputs to revised PERT equations in place of the standard judgment estimates and the PERT equations now used. The results of computer simulations which reinforce this proposal are presented.

SOME PSYCHOLOGICAL EFFECTS ON JUDGMENTAL FORECASTING

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This paper discusses the results from a number of experimental investigations which were designed to measure the effects of a number of psychological variables on the process of judgmental forecasting; in particular the effects on the validity of the judgmental forecasts produced are monitored. The data from the forecasting tasks studied show a number of effects on forecasting that can be predicted from previous studies and psychological theories. The perceived desirability, controllability, personal relevance and imminence of the forecast events are all factors which influence the subjective likelihood of the events being forecast. Also consistent individual differences in forecasting performance are observed. Some implications of these findings for the practical utilisation of judgmental forecasts are considered.

COUNTRY AND POLITICAL RISKS II

Chair: **Stuart Bretschneider**
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EXPERT JUDGMENTS OF POLITICAL RISKINESS: AN ALTERNATIVE APPROACH

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A recent study (Mumpower, Livingston and Lee, Journal of Forecasting, 1987) used factor analysis and regression analysis to predict the political risk ratings given by the members of the Association of Political Risk Analysts to 49 countries. This paper uses the regression tree technique on the same data set. This approach improves the explanation of the variance of the risk ratings. It also sheds new light on the importance of each prediction variable.

NOISY SYSTEMS AND BIG FORECASTS: A PRACTICAL EXAMPLE

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ECGD's business is to provide UK exporters with a range of guarantees which insure them against both buyer risk (Company X says I'm not paying) and political risk (Government Y says I'm not paying). The annual insured business now totals approximately $25 B. The paper will centre around the practical approaches, difficulties and solutions which we have adopted in our forecasting strategy: expert opinion, time series methods, regression approaches, outlier analysis, seasonality, software uses and problems.

BIAS IN STATE GOVERNMENT REVENUE FORECASTING

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Recent work by Bretschneider and Gorr (1987) has established a basic theory as to why certain state governments are more accurate at forecasting revenues from year to year. Supported empirically, the theory identifies organizational, political, and policy influences beyond the normal forecasting model selection decision that influence forecast accuracy. This paper constructs and test a similar theory to explain bias in revenue forecasts. The theory considers bias as potentially asymmetric and investigates determinants of both positive and negative forecasting bias.

MARKETING

Chair: Stephen **P. Schnaars**
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THE ROLE AND APPLICATIONS OF FORECASTING IN MARKETING

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Decision areas where forecasting is applied to marketing are: * ascertaining specific sales potential of goods and services in various markets; * providing data inputs into sales planning and budgeting; * monitoring benchmarks or standards for evaluation of sales performance, and * answering "what if" questions (what will happen to sales of Brand A if the advertising budget is increased by ten per cent?). The purpose of this paper is to emphasize the role of forecasting in marketing, to describe a few popular forecasting techniques which can be used by small firms, to discuss the major criteria which are considered when applying forecasting to marketing, and to emphasize some implications which may concern the entrepreneur.

PRODUCTMARKET FORECASTING IN A CHANGING WORLD with the personal computer and artificial intelligence

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In our times, productmarkets are changing continuously and basicly up and down in consequence of many factors, causing big losses for unprepared companies. Big companies have their specialists for this forecasting problem. However, a lot of smaller companies would be interested, too, on the future of their products, but specialists are in several cases too expensive for them. The big variety of productmarket forecasting tools, each of them beeing praised by its advocates, embarrasses managers who usually did not study this topic in details. Two new tools, the Personal Computer and the Artificial Intelligence allow us to fit the different, well known productmarket forecasting methods to the circumstances given for a special product in a special point of time The lecture shows the newest results of the efforts to offer PREGNO, a simple and handy dialog program with Artificial Intelligence for the Personal Computer to solve the problem economically for the smaller companies, too.

MARKETING PLANNING TECHNIQUES FOR NEW INDUSTRIAL PRODUCTS: MARKET POTENTIALS AND SALES PROJECTIONS

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This paper describes objectives, conceptual design and operational structure of a computer model (developed on a spreadsheet), especially useful for marketing planning (market potentials and sales projections) of new industrial products (with reference to durable goods). In particular, the model allows a systematic and in-depth appraisal of all the major factors that have an impact on market share and sales: degree of market saturation (coverage and penetration of the theoretical market potential), components of market share and sales (new purchases, repeated purchases,. replacements and brand loyalty both in repeated purchases and in replacements). The most important advantage in the use of this model - provided it is linked to a coherent information system - is the possibility of designing customized and differentiated strategies, in function of market situations and available resources, and making them clear and explicit in order to allow better communication, implementation and control.

MEGATRENDS AND MEGA-MISTAKES: THE HISTORICAL ACCURACY OF GROWTH MARKET FORECASTS

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Looking over the long-term it is difficult to predict which technological products will spawn huge growth markets and which will go nowhere. This paper looks at many forecasts published in the business press and finds that most were dead wrong. They failed because they were enamored of technological wonder and did not consider the balance between price and performance. These forecasts were unduly influenced by the "spirit of the times" in which they were made. Most turned out to be grossly optimistic. The findings strongly suggest that although technological forecasts often assume a rapidly changing world, actual changes occur far more slowly.

TELECOMMUNICATIONS DEMAND FORECASTING

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HYBRIDIZATION OF TELECOMMUNICATION DEMAND FORECASTING MODELS WITH BEHAVIORAL CHOICE ALGORITHMS

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In recent years the once sedate telecom market has become dynamic, turbulent and intensely competitive. Market driven price strategies and optional rate schemes necessitate very disaggregate demand forecasts (eg: class-of-service, time-of-day, day-of-week). Consumers, conscious of the availability of deep discounts in multiple tier rate structures, migrate with changing rate structures optimizing their utility. Traditional demand models using macro-economic variables such as CPI, HHI etc. and historical demand information, generate aggregate forecasts, not accounting for consumer dynamism, and its implications. Hence the need for incorporation of predictive behavioural forecast models into traditional demand constructs. This paper discusses one such hybrid forecasting model.

THE IMPACT OF FACSIMILE ON INTERNATIONAL TELEPHONE AND TELEX TRAFFIC

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During the past few years, facsimile has increased very rapidly. Its impact on telephone and telex is of much concern. This paper describes how the impact of facsimile on international telephone and telex is assessed in Hong Kong. It presents models for forecasting of international telephone and telex traffic under the impact of facsimile, and discusses how forecasts are produced from these models.

TRAFFIC FORECASTING - A STATE-SPACE FORMULATION

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Telecommunications network planning requires greater performances in traffic forecasting methods. In TLP we have been developing new prediction traffic models, namely state-space models and Kalman filter algorithms for traffic forecasting. Our paper deals with the following discrete linear system: $\underline{x}_{k+1} = \varphi_k \underline{x}_k + \Delta_k \underline{u}_k + \underline{w}_k$, $\underline{z}_k = H_k \underline{x}_k + \underline{v}_k$ where $\underline{x}_k$ is a state vector with x_k (traffic) and $\dot{x}_k$ (growth rate), φ_k, H_k and Δ_k are the transition, observation and input matrices, $\underline{z}_k$ is the measurement vector, $\underline{u}_k$ is a deterministic input vector, $\underline{w}_k$ and $\underline{v}_k$ are the noise vectors. We analyse the way we overcame some usual difficulties related to the estimation of the noise covariance matrices, using a multidimensional search method. We also study the application of the model to a telephone traffic time series with seasonal behaviour.

A DIS-AGGREGATED APPROACH TO BUSINESS CONNECTIONS FORECASTING

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Over the past decade there has been a marked regional variation in the growth rates for business telephone connections in the UK. Difficulties in forecasting business connections at a local level have lead to use of a dis-aggregated approach. Using a combination of cluster and discriminant analysis, British Telecom has isolated a set of key "growth determining" variables. This paper discusses reasons why the aggregated techniques fail, and how the dis-aggregated approach has been applied.

A MATHEMATICAL MODEL FOR PREDICTING SOFTWARE RELIABILITY

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This paper describes a mathematical model that has been developed to predict the likely performance of a large software in telecommunication system in terms of the process inputs, learning experience and applications parameters. Also discussed are the preliminary results of the use of the prediction model in real life settings.

TRANSPORT FORECASTING

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AN APPROACH TO THE LOAD FACTOR EVOLUTION IN THE MULTISECTOR FLIGHT

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This paper deals with the determination of the load factor evolution, in various legs of the multisectorial flights, applying the ARIMA model to the time series obtained in the particular case of an IB.971 flight, attempting to calculate the value of the unknown data, generally to be obliged to cancel flight by technical, meteorological or other reasons, with the help of different methods, maintaining the capacity of the plane and its distribution over the year constant.

THE USE OF SIMULTANEOUS-EQUATION APPROACH IN FORECASTING THE DEMAND OF AIR TRANSPORTATION

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In an international highly competitive context, and in the perspective of the extension of Airline Deregulation to many countries, the demand of air transportation is becoming more difficult and more complex to predict and forecast. Given the complexity of the structure of the demand regarding this context, it may not be realistic to use only single-equation regression models in modeling the demand. The OLS technique may lead to biased estimates and forecasts in a single-equation model containing both demand and supply variables. The estimates of the coefficients will be inconsistent in this type of models. So, it may be preferable, in modeling the demand (for passengers and or freight) for prediction, to use the multi-equation regression approach. This could handle the case of simultaneous-equation models. In the first part of this paper, an attempt is made to briefly cover the complexity of the demand, especially in a highly competitive context. The inadequateness in the use of single-equation models is also briefly analysed. The aim of the second part is to build an econometric model based on multiple equation approach and simultaneous-equation models. In the last part, the theoretical aspects are explained in terms of many applications of simultaneous-equation models upon Air France passenger traffic (quarterly and annual data for Northern American and European networks). Many simulations and forecasts are made from the estimated models. Concerning the various applications, Air France Company has been kind enough to contribute in providing us with the several statistical series necessary to this study, as well as several pieces of information on the structure of the demand of air passenger transport on some of its networks. We wish to thank Air France for this help and contribution.

IN QUEST OF FUTURE TRAVEL DEMAND IN THE NETHERLANDS

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The uncertainties concerning future developments in travel demand patterns are anxiously great. Activity behaviour, car-ownership, car usage and public transport patronage are the result of numerous interrelated tendencies working in opposite directions. What will be the outcome on balance? The answer to this question is highly relevant for planners and policy makers in the transportation sector. The paper starts with an outline of present research needs in The Netherlands and the ability of research methods to fulfil them. On an aggregate level a systematic approach is presented that balances out various kinds of uncertainties and inaccuracies in our knowledge of present and future transportation behaviour. A mathematical model is described along with its implementation on a microcomputer that is being used in preparing the medium term Dutch National Transportation Plans. In the approach the aspect of appropriately managing forecasts is at least as important as model building and implementation. In the assessment of transportation forecasting models it is preferable to focus upon this aspect along with model potentials such as flexibility, learning capacity and ease in handling.

SCENARIOS I

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CROSS IMPACT ANALYSIS AND SCENARIOS: A REASSESSMENT

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The arrival and spread of powerful micro-computers in recent years now makes it practicable to use cross impact analysis as a routine method in business forecasting and planning. Of course, there exist a number of serious theoretical objections to the cross impact approach to the construction of scenarios. This paper re-evaluates some of these objections in the light of experiments with various computational methods for implementing the approach.

ON THE METHODOLOGY OF SCENARIO DEVELOPMENT

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Scenarios, which are meant to show how future developments can be influenced, hardly ever give any indication as to why certain things are included and others are not. This paper groups the elements which together describe a scenario into a number of categories; each of these categories plays a particular role in the sequence of steps necessary in drawing conclusions about the future from those scenarios. From a methodological viewpoint, this means that first those elements are defined which need to be described in order to define the problem. The next step is then to give specific alternative values to those elements to convert them into concrete scenarios. A practical application, the use of scenarios for the long term energy need of the Netherlands, is used to exemplify the methodology.

SCENARIOS: CHANCE OF SCIENCE: PREDICTING PREFERENCES FOR THE FUTURE

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There are numerous methods for generating scenarios; some involve brainstorming techniques and others involve the systematic manipulation of data projections. Since 1980 we have been using the Myers-Briggs Type Indicator instrument to develop a participating approach to scenario development in groups ranging from 15 to 75. Using the MB instrument to create 4 to 6 participation groups, a consistent four-fold taxonomy of scenarios can be established as one approach to organization foresight that is based upon different cognitive preferences. The four scenario types are generally described as: pragmatic, humanistic, strategic and charismatic.

SCENARIOS II

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SCENARIO APPROACH - A HOLISTIC VIEW OF FUTURES STUDIES IN STRATEGIC MANAGEMENT

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Scenario is an alternative view of the future and its essential features are to be a holistic, hypothetical and possible description of the future. Management Scenario approach (MSA) includes developing at least two alternative scenarios, describing what and where the company can be in these alternatives and formulating strategies based on this information. MSA can be seen as part of the strategic information system. The process developing scenarios produces information for strategic planning, decision-making and management. In this paper I try to combine these aspects of leadership to form a holistic view of the company coping with the future by using MSA. These results are based on two mail surveys in European companies in 1981-85 and on depth interviews in 10 European companies in 1987.

FORECASTING BY MORPHOLOGICAL PATTERN GENERATION

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In the present paper the problem of automated generation of the object properties patterns is under discussion. Especially appropriate for the aim appears to be the morphological analysis method. The morphological model could be used as a powerful tool for the exploratory forecasting, bearing an exhaustive set of the possible variants of the object realizations. The application in the case has been realized for the class of objects from the electrical apparatus sphere. For the morphological matrix rows some of the general technical parameters were chosen, as well as, their values - for the properties. An empirical algorithm for the real and meaningful value-combinations was elaborated. The formal conditions under which the output was not allowed were determined on the basis of a morphological tree-type network. The description of the logical ones was done by using a binary matrix, associated to the network. The possible patterns general set consisted of /9x9x4x5x4/=6480, but the meaningfulful among them appeared to be soms 451, for the 3 net-families, determined by the help of the cluster-analysis. The appropriate computer program is one of the 9 modules of the package, installed as a main tool of the strategical planning and innovations management system in the industrial organization.

ALTERNATIVE SCENARIO APPROACH TO FORECASTING AND PLANNING; PHARMACY AS A CASE STUDY

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Three aspects will be considered in this lecture: 1) In the volatile eighties the interaction between trends is often more important than the continuation of the trendline. This results in fewer structured problems using digital forecasting/planning methodology and more constructured problems needing holistic methodology, incorporating alternative futures, uncertainty, value judgements. Shift from long range to strategic planning. 2) The uses, appropriateness of various scenario approaches will be discussed. 3) Illustrating the alternative future scenario process using pharmacy as a case study. Pharmacy is becoming an alternative solution type problem as it is changing from a primarily curative to a preventive focus, from a specialised function towards becoming part of a holistic health concept.

THE MAIN PROBLEMS OF METHOLODOGY AND SYSTEM-CONNECTIONS OF PLANNING AND FORECASTING

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The short, medium and long term prognoses and plans should be dealt with in vertical and horizontal relations. The plans lasting for different periods of time (terms) must be consistent on the one hand their own system and have to satisfy the quantitative and qualitative requirements. On the other hand, the requirement of consistency must be realized in the system-connections of the prognoses and plans. The above requirements must also be secured by economic and methodological relations.

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DETERMINING AND USING ONLY DECISION-RELEVANT FUTURES

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In deciding among policy alternatives, one wishes to compare their future consequences. But for decisions with long-term effects, the number of possible futures is overwhelming. Rather than attempting to forecast them exhaustively, better decisions often can be found more efficiently by focusing on decision-relevant futures. This paper discusses a powerful technique, based on a fortiori analysis, for determining and using decision-relevant futures - futures that change the ranking of alternatives. The technique's application is shown in a 1971 study of future California transportation systems, and, with hindsight, some lessons-learned are identified.

GAUGING THE SENSITIVITY OF FAR-FUTURE FORECASTS TO TECHNOLOGY BREAKTHROUGH

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This paper discusses a methodology for gauging the potential effects of technology breakthroughs. It was applied to a 40 year projection by the US Air Force and is akin to a mathematical sensitivity analysis. The key is to understand technologies in terms of the capabilities they provide and quantitative measures of those capabilities. The effect of significant capability increases on the 40 year projection can then be gauged. The increases with the greatest effect point to areas in which the projection is most sensitive to technology breakthrough. In the Air Force case, the results were used to develop technological priorities.

UNCONVENTIONAL APPROACHES TO FORECASTING THE FAR FUTURE II

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A MOLECULE-CENTERED APPROACH TO FAR-FUTURE FORECASTING

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Our problem related to potential changes in U.S. Army doctrine in 30-years. We used a Delphi technique to identify important aspects of the future (the forces acting on the molecule) that could lead to changes in Army doctrine (the molecule). We discovered that participant's concerns were strongly tied to their assumptions about Army doctrine. This led to a shift in focus from general trends to the major assumptions (atoms) underlying Army doctrine, and thus to the particular forces that would affect them. Historical analysis confirmed that a strong correlate for change in doctrine was a change in its assumptions.

UNLEARNING AND BACKCASTING: RETHINKING SOME OF THE QUESTIONS WE ASK ABOUT THE FUTURE

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Predictive forecasting continues to dominate futures studies in the socio-economic and resource policy fields, despite a prevalent recognition of its terrible record and limited utility. In many cases, the search for the most likely future is not only misguided (since we are usually wrong) but also counter-productive because the most likely future may not be the most desirable. What are needed are not techniques that converge on likelihood but techniques that test the feasibility and impacts of alternative futures. This paper addresses the philosophical, political/institutional and methodological implications of such a shift in approach.

IMAGINARY MATTER

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This is a paper on time, man and his ideas for the future. Based upon cybernetic theory, a conceptual model of man's psychological attributes for grasping time and the future can be constructed. The paper is based on a Ph.D. thesis presented in 1988. With examples from litterature and from the author's own experiences in energy forecasting for industry, a Delphi study and scenario writing for international projects. The paper ends with a philosophical discussion on matters to be imagined and man's ability and limitations to deal with the future.

UNCERTAINTY AND ECONOMIC POLICY

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UNCERTAINTY AND INDEPENDENCE OF INSTRUMENTS

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In control problems, it is frequently assumed that instruments are independent but this assumption is not justified. In a deterministic model, it could be easily checked with the calculus of the rank of a matrix of multipliers. But this test is not a proper one because, as the determinant of a matrix is never numerically equal to zero, it would lead to the conclusion that with a state space of dimension n, n instruments are always independent. So we use a stochastic model to introduce the uncertainty about the impact of instruments. A test of independence is presented and an example with a small french model is given.

FORECASTING OF INDIVIDUAL ITEM RELIABILITY

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The method, allowing estimation of quality and individual forecasting of reliability for each item from general totality, with availability of corresponding information, has been developed and realized. Forecasting is based on considering probability connection between the value of the item predicted parameter by time t_p of the analysis and item initial state. In the course of analysis, the predicted parameter is studied as a function in a set of values of item informative parameters. The initial state is estimated by K values of informative parameters measured at the "initial" time t_o or within a short time interval. The method is discussed as to its application and operation environment. As well the problem statement, forecasting theory and computer realization are investigated. To discover an initial set of parameters, carrying data on item reliability, a special approach is worked out. Besides, the paper touches upon some results of the method practical use.

MACROECONOMIC POLICY PERFORMANCE: A COMPARISON OF RULES

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The purpose of this study is to compare the effects of alternative types of monetary and fiscal policies such as the constant growth rate rule and optimal control on a small (16 equation) quarterly models of the U.S. economy. The specification and estimation of this model will be given in this study, and the model's dynamic properties will be explored. Optimal control experiments will be presented for the model and will include "certainty equivalence" solutions, taking account of additive uncertainty, as well as a set of more general "parametric uncertainty" solutions. Several types of suboptimal control will be evaluated vis-à-vis optimal solutions. This will require the theoretical development of a uniform set of techniques to evaluate such suboptimal scenarios. These suboptimal scenariosinclude the application of "steady-state" feedback rules, arbitrary feedback rules, and several methods of evaluating historical policies. A set of computer algorithms for the analysis and optimal control of dynamic macroeconometric models has been provided by Professor David Kendrick from the University of Texas.

MODELING, FORECASTING, AND IMPROVING YUGOSLAV ECONOMIC PERFORMANCE

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How would the Yugoslav economy perform if present policies where continued unchanged into the future? What policy changes would improve performance? These questions motivate the paper, which presents a newly developed econometric model involving 39 estimated equations and 28 identities. The paper discusses the model's highlights, maps its structural relationships, and reviews its solution procedure. To answer Question 1 it establishes a baseline forecast for the years 1988 to 1995. To answer Question 2 it generates forecasts under remedial policy initiatives and compares them with the baseline. The preferred initiative is then noted, and its likelihood of implementation is considered.

TRIGG AND LEACH

Chair: **Ed. McKenzie**
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THE VALUE OF TRACKING SIGNALS IN INVENTORY FORECASTING APPLICATIONS

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A tracking signal is a measure used to monitor the performance of a forecasting model. It is used to alert management to a possible deviation of the actual data from the model assumptions. For an inventory system with many items, management needs a tool such as this to assist them in identifying those items for which the standard forecasting techniques do not seem to be functioning properly. This study employs simulation to investigate the ability of the tracking signal to identify pattern changes, its sensitivity to random fluctuations, and its robustness to underlying assumptions.

TRACKING EXPONENTIALLY SMOOTHED FORECASTS: AN ALTERNATIVE TO THE METHODS OF TRIGG AND LEACH

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Methods for dealing with poor forecasts are an integral part of most forecasting systems. In inventory systems where exponential smoothing is used, the ratio-type tracking signals introduced by Trigg and Leach have been widely used, but their proper application is still a subject for research and controversy. In this paper, the use of a control chart concept is advocated as a replacement for the use of the ratio-type tracking signal. Both adaptive and non-adaptive systems are discussed. The use of the control chart concepts are illustrated with an example.

A FURTHER MODIFIED APPROACH TO TRIGG AND LEACH'S ADAPTIVE RESPONSE RATE MODEL

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Trigg and Leach's adaptive response rate model is an efficient forecasting model. A modified approach to Trigg and Leach's model was presented by S.B. Lahiri in 1979. This paper examines and revises this approach. The revision includes the selection of the smoothing constants and selection of forecasting models which fit the changes of trend in time series. Three examples are given in the paper. The results show that the author's method do improve the S.B. Lahiri's modified approach.

A CASE STUDY DESCRIBING THE DEVELOPMENT AND IMPLEMENTATION OF A MEDIUM TERM FORECASTING SYSTEM FOR A LARGE DISTRIBUTION COMPANY

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A large distribution company with depots throughout the UK distributes goods on behalf of a wide range of clients engaged in the manufacture and retail sale of many different consumer products. In order to plan and arrange the appropriate levels of resources (i.e. vehicles, labour and space) it is necessary for the company to have reasonably accurate medium term forecasts of the weekly throughput of each depot. This paper describes the development and implementation of a forecasting system for the company which takes account of the major characteristics of each of the clients and the overall effect of changes in the client portfolio. The analysis involves the development of several novel adaptations of the traditional exponential smoothing approach to time series forecasting in order to reduce the required number of seasonal parameter values and to reflect the sensitivity with respect to certain dominant clients.

HOLT-WINTERS

Chair: **Arnold L. Sweet**
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HOLT-WINTERS FORECASTING: RECENT RESEARCH RESULTS

Chris Chatfield and **Mohammad Yar**
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The Holt-Winters forecasting procedure is a simple, widely used extrapolation procedure, based on exponential smoothing which can cope with trend and seasonality. This lecture describes recent research of both a theoretical and empirical nature. Topics covered include the choice of starting values for trend and seasonal indices, the choice of smoothings parameters, the construction of prediction intervals and the use of a damped trend term. Experience with the AUTOCAST and FORECASTMASTER software packages will be described. The distinction between an automatic and a non-automatic approach will be emphasized.

USING WINTERS' MODEL AND A DUMMY VARIABLE, INTERACTION REGRESSION MODEL TO DEFINE IMPROVED ARIMA MODELS FOR FORECASTING INCREASING SEASONAL VARIATION

Bruce L. Bowerman and **Anne B. Koehler**
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Modified ARIMA models are defined for forecasting time series exhibiting increasing seasonal variation. Some of these models are motivated by Winters' multiplicative exponential smoothing model, and others are defined by using a dummy variable, interaction regression model. Comparing traditional natural logarithm models with the modified models for six time series, we demonstrate that the modified models can yield mildly improved point forecasts and substantially shorter prediction interval forecasts.

PARAMETER SPACE OF THE HOLT-WINTERS' MODEL

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School of Business Administration, Dalhousie University, Halifax, Nova Scotia, Canada B3H 1Z5

In the additive Holt-Winters' seasonal exponential smoothing model, it is theoretically possible for smoothing parameters in the usual (0,1) interval to produce 'non-invertible' models. Results from 406 monthly series reveal that this is a real concern. In the multiplicative model, reasonable estimation procedures produce smoothing constants outside the additive invertible region. When this occurs, the impact on forecasts of values in the distant past is much larger than for recent values. Furthermore, forecasts from the usual model are inferior to those of similar models, that restrict the parameters to a subset of the additive invertible region.

DAMPED TREND EXPONENTIAL SMOOTHING

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Everette S. Gardner, Jr.
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Most timeseries methods assume that any predicted trend will continue unchanged, whatever the forecast lead-time. Recent empirical studies, however, suggest that forecast accuracy can be improved by either damping or even ignoring altogether trends whose persistence is doubtful. A forecasting model is presented which is based upon the standard Holt-Winters models but in which the trend is damped. The model has been tested on the 1001 time-series of Makridakis et al. and shows considerable improvement on the usual versions based on linear trend, especially at longer lead times. The model's performance also compares well with the more sophisticated methods considered in the Makridakis study. Both seasonal and non-seasonal forms are considered and a simple procedure for automatic model selection is assessed.

MAXIMUM LIKELIHOOD FOR GENERALIZED EXPONENTIAL SMOOTHING

L. Broze and **Guy Mélard**
Brussels University, Dulbea CP 140, 50, av. Roosevelt, 1050 Brussels, Belgium

This paper is the continuation of previous work where several forecasting methods based on exponential smoothing were considered. Generalized exponential smoothing (GES), the forecast function is a linear combination of fitting functions such as powers and exponential functions of time, sines and cosines. By using the equivalence of GES with autoregressive integrated moving average models, due to McKenzie, it is shown that the parameters can be efficiently estimated by using a fast Kalman filter algorithm. Among the advantages of the approach, initialization of the first smoothed values is not needed

ENVIRONMENTAL TRENDS AND DISCONTINUITIES

Chair: **Wim A. Hafkamp**
Institute for Environmental Studies, Free University of Amsterdam, 1007 MC Amsterdam, The Netherlands

FOREST DEVELOPMENT AND ECOSYSTEM DISTURBANCE IN ACADIA NATIONAL PARK, MAIN, USA

Chi-Ho **Sham**
Department of Geography, Boston University, 675 Commonwealth Avenue, Boston, Massachusetts 02215, USA

Dendroecology, the use of tree-ring analysis to investigate ecological and environmental changes in forest, has become popular among researchers in recent years. In this paper, the effects of two ecosystem disturbances, namely fire and drought, on forest development are analyzed using tree-ring widths of white pine measured at breast height as an indicator of ecosystem response. The impacts of these disturbances on tree growth are quantifiable based on the intervention analysis procedure developed by Box and Jenkins (1970).

ENVIRONMENTAL FORECASTING AT A NATIONAL SCALE AS A TOOL FOR POLICY MAKING IN THE NETHERLANDS

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Laboratory for Waste and Emission Research, National Institute for Public Health and Environmental Protection, P.O. Box 1, 3720 BA Bilthoven, The Netherlands

The Dutch government is preparing a strategic environmental plan covering strategic decisions to be made over a period of 8 to 10 years to come. Long term scenarios for environmental problems will be used as a basis for these strategic decisions. RIVM was invited by the Ministry of Housing, Physical-Planning and Environmental Affairs to prepare the desired long term environmental scenarios in close cooperation with several other Dutch institutes. General socio-economic developments, possible changes in specific economic sectors, developments in environmental quality and expected effects on public health and ecosystems are addressed for a period of at least 20 years to come. Specific models were developed and used to forecast each of the elements mentioned. Methods and results will be presented and necessary improvements of methods will be indicated.

COMPUTER-AIDED ENVIRONMENTAL PLANNING: CAEP. An interdisciplinary approach

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Jürgen Pietsch
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Analysing the development of medially encroaching methods and instruments for environmental planning, provision and forecasting, we do not see any adequate exploitation of the facilities of computer assistance. Without the possibilities of processing, archiving and retrieving the information in data bases an environmental planner is not able to make valid decisions. Very important are the facilities of data condensation by use of graphics, computer-assisted modelling and simulation and last but not least tools called 'expert systems', which mean a rule-based heuristic approach to special parts of planning problems. To utilize all these tools for environmental analysis, planning and forecasting the authors are working together interdisciplinary in developing an integrated computer-aided decision support system, running on workstations and PCs.

Chair: **William M. Stigliani**
International Institute for Applied Systems Analysis, A-2361 Laxenburg, Austria

NOT-IMPOSSIBLE FUTURE TRENDS IN EUROPEAN HYDROLOGY

F.M. Brouwer
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Temperature and precipitation are important factors for natural as well as managed vegetation. Water availability, e.g. is a major limiting factor for crop growing and forest production. A shift of climate is expected to occur on a global scale due to increased atmospheric concentration of carbon dioxide and other "greenhouse gases". Some "not-impossible" future trends in European climate and hydrology will be discussed, and a qualitative assessment will be presented regarding land degradation processes.

POSSIBLE SHIFTS IN EUROPE'S NATURAL VEGETATION ZONES DUE TO CLIMATIC CHANGES

R.S. de Groot
Nature Conservation Department, Agricultural University, Ritzema Bosweg 32A, Wageningen, The Netherlands

The broad-scale distribution of terrestrial ecosystem complexes is determined in large part by climate, and can be altered by climatic change. Climatic changes will probably have significant consequences for the species composition, structure and the distribution of natural vegetation zones. The possible effects of a change in temperature and precipitation on the location of six major vegetation types will be described. Clearly, a possible shift in vegetation zones will pose a major threat to natural ecosystems in protected areas all over Europe.

SOME QUALITATIVE PERSPECTIVES ON THE ATMOSPHERIC ENVIRONMENTS OF FUTURE EUROPE

Bo L.B. Wiman
Environmental Studies Programme, Gerdagatan 13, University of Lund, S-223 62 Lund, Sweden

Future patterns of anthropogenic emissions of the atmosphere in Europe can be calculated, in principle, from technical factors converting various scenarios of future industrial production, transportation structure, energy paths, etc. into emission levels. However, even very short-lived atmospheric constituants can have long-lasting secondary effects on the composition and mechanisms of the atmosphere, affecting its ecological role. Hence, future emission levels carry no simple relation to either composition or functioning of future European atmospheres. This forecasting problem will be qualitatively exemplified. Policies and attitudes involved in handling the uncertainties will be discussed.

CONDITIONAL FORECASTS OF ECONOMIC ACTIVITY, ENERGY CONSUMPTION AND POLLUTANTS IN EUROPEAN COUNTRIES

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Adequate environmental policy requires insight into the emissions levels of pollutants in the future and how they will be influenced by abatement policy, changes in energy consumption and economic development in the coming decades. In order to describe the relationships between these variables a model has been developed to calculate emission levels of air pollutants in European countries. The model is particularly suited to develop a set of scenarios that show the impact of alternative packages of policy measures on the emissions of air pollutants per branch of industry. It also allows to calculate the impact on the emission levels of changes in the annual rate of growth per sector of industry or changes in the fuel mix and efficiency improvement of energy consumption. The model is applied in the Dutch National Programme on Acidification that studies the impact of acidifying emissions on environmental quality. Therefore, in a separate model the dispersion of the pollutants via the atmosphere are calculated to establish the resulting deposition levels. The paper describes the structure of the model that provides conditional forecasts of economic growth, energy consumption and emission levels. The paper also shows how the model could be integrated into a research programme that studies the international aspects of acidification in a game theoretical framework, to establish optimal abatement options for European countries.

MACROECONOMIC IMPACTS OF POLLUTION CONTROL IN THE EUROPEAN COMMUNITY

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Institute for Environmental Studies, Free University of Amsterdam, 1007 MC Amsterdam, The Netherlands

The OECD model INTERLINK (International Linkage) was used to assess the macroeconomic impacts of air pollution control for the European Community. INTERLINK was adapted to include the effects of the expenditures on end costs of pollution control; a set of environmental variables was created and existing blocks of equations were modified. The analysis was carried out for a draft EC-Directive on large combustion plants. This Directive aims at reducing sulphur- and nitrogenoxides emissions from the large power and industrial plants. To comply with the Directive the EC is expected to invest some 15 billion ECU in air pollution abatement up to 1993. The annual costs will amount to 3.4 billion ECU in 1995. The results are that, during the investment period, the macroeconomic effects are small but positive, for most EC-countries.

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AGRICULTURAL FORECASTING

Chair: **Kees Burger**
ESI, Free University of Amsterdam, P.O. Box 7161, 1007 MC Amsterdam, The Netherlands

FORECASTING AGRICULTURAL SECTOR DEVELOPMENTS: METHODOLOGICAL APPROACHES AND EXPERIENCES

S. **Bauer**
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The purpose of the paper is to analyse and compare different theoretical and methodological approaches used in agricultural sector and policy analysis and for forecasting of the agricultural sector development. Experiences from applied forecasting and policy analysis work will be presented. This includes: short term forecasting of agricultural market and income development (based on trends and the various instability factors) and the influence of agricultural policy on the income distribution in agriculture; medium and long term forecasting by using a dynamic agricultural sector model, which is based on the dynamic interdependencies between production, factor input and income (methodological characteristic: coupling of mathematical programming and econometric models); and experiences from a regional linear programming model for Germany (impact of various policies on regional land use, concentration of agricultural production and income).

FORECAST-BASED POLICY ANALYSIS: THE CASE OF U.S. LIVESTOCK

Guy Henry, **David A. Bessler, Don E. Farris** and **Wesley F. Peterson**
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This paper considers policy analysis by using conditional forecasting. Two restricted and one unrestricted multiple time series specifications are compared. Results suggest that a Bayesian Vector Autoregressive (VAR) representation, restricted by priors from an expert, demonstrates superior forecasting ability. The most common procedure to evaluate policy changes has been to manipulate policy variables that are predetermined. However, it seems more realistic to use endogenous variables. For the policy variables, future time paths are generated and both unconditional and conditional forecasts are computed. In case of U.S. livestock, an eleven series Bayesian VAR was used to generate unconditional forecasts. From the 1985 Farm Bill five policy scenarios were analyzed. Results show that this method of policy evaluation can perform as well or even better than traditional approaches.

AGRICULTURAL FORECASTING - A "NEW" APPROACH

Andrew **P. Fearne**
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Since its inception in 1962 the Common Agricultural Policy (CAP) has assumed an increasingly dominant role in the agricultural sector of the European Community (EC). The fact that the production and marketing of agricultural produce in the EC is so heavily controlled by policy mechanisms - mechanisms which appear increasingly subject to change - means that the planner faces the particular problem of forecasting the outcome of political negotiations. Conventional forecasting methods offer little guidance: the commonly used time-series methods often require long runs of data and only perform effectively where a series shows some degree of stability or stationarity; conventional econometric methods explain past data adequately - once the policy mechanisms and levels for policy variables have been decided - but in effect they transform the forecasting problem into one of forecasting political decisions, a task for which there is no established methodology. This paper describes a two-stage approach to agricultural forecasting which involves the combination of a qualitative method to forecast policy decisions and a quantitative method to forecast the implications for the market. A Delphi forecast of EC dairy policy combined with an ARIMA model of monthly milk supplies provides an example of how this approach might be applied.

PREDICTION OF CATCHES, STOCKS AND FISHING MORTALITY RATES FROM CATCH AT AGE DATA

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Helgi Tomasson
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Observed catch numbers at each age are connected with stocks and fishing mortality rates by given non-linear relationships. Time series models of fishing mortality rates incorporate plausible restrictions on their variations with age. Stocks and fishing mortality rates are cast as state variables and estimated from the observed catches by linear approximations of the Kalman filter. Unknown parameters are obtained by the likelihood function of the catch prediction errors. The models are extended to include effort data. The models provide predictions of observed- and state space variables. As most fishing is subject to regulations conditional predictions are also relevant.

WEATHER FORECASTING

Chair: **Allan H. Murphy**
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RELATIONS BETWEEN RAINFALL AND SOLAR RADIATION: A STUDY OF TWO BRAZILIAN TIME SERIES

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We are interested to relate time series of rainfall with other natural phenomena, to analyse the behaviour of rainfall in many areas of Brazil. Earlier studies have shown relations between this series and those of sunspot and mean sea level. In this study, we will try to relate time series of rainfall and solar radiations at Cananeia, in the southeastern coast of Brazil: Latitude 25°00'09"S Longitude 47°55'06"W. Procedures of causality, multivariate analysis and transfer function modelling will be used for our purpose.

EXTREME DRY WEATHER INTERVALS OF THE GROWING SEASON IN BACKA, YUGOSLAVIA

M. Beric, E. Zelenhasic and **B. Srdjevic**
University of Novi Sad, Yugoslavia

A method of describing and analysing the stochastic proces of droughts, which are defined here as the upper extremes of intervals of no rainfall, is recommended. All important components of extreme dry intervals such as their duration, time of occurrence, their total number in a given time interval (0,t), the longest drought duration in a given time interval (0,t) and its time T(t) of occurrence are taken into consideration. Application of the method is performed on the records of 9 meteorological stations in Backa, Yugoslavia and a good agreement is found between the theoretical and empirical distribution functions for all analysed components of the process of extreme dry weather intervals. On the basis of the performed computations, a set of maps showing by contours extreme dry weather intervals, having return periods from 2,5,.... up to 100 years, related to the growing season, for the region of Backa in Yugoslavia is obtained. If the period of exploitation of an irrigation system is 60 years, than it could be expected to appear twenty dry weather intervals having 3 year return period. The duration of dry weather intervals is given on the set of maps. Obtained results give a prognosis of an average state of droughts during long time intervals (60, 100, 200.. years).

IS WEATHER A PROBLEM FOR SHORT RUN ECONOMIC FORECASTS?

Robert Kunst and **Andreas Wörgötter**
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We are concerned with the relation between fluctuations of weather and economic activity and its consequences for short run economic forecasts. The following points are of special interest for this topic: 1) Does weather influence economic activity? We are mainly interested whether a statistical relationship between fluctuations of key weather indicators and key economic indicators can be identified. As a first step the seasonal variance of economic indicators is estimated. If weather does influence economic activity, the seasonal variance should be highest in the first quarter of the year. The second step is devoted to a quantitative estimate of the proportion of seasonal variance, that can be attributed to weather fluctuations. The empirical analysis will be carried out with data from European OECD-countries. 2) Are short run economic forecasts correctly adjusted for recently observed weather-dependent economic fluctuations? It is a well known phenomenon, that short run economic forecasts can become less precise after their first revision, that is after for instance first estimates of the first quarter gross national product become available. In a first step we want to investigate the first revisions of the OECD-forecasts for European economies. If the assumed relation between weather and economic fluctuations is not correctly entering the forecasters model, we would assume that first quarter realisations of gross national product are misinterpreted as business cycle signals and will therefore lead to incorrect revisions for the forecasts of the current year. The motivation for this paper is to investigate, whether the use of short run weather indicators can improve the quality of short run economic forecasts.

PREDICTION OF TEMPERATURES: AN APPLICATION OF THE BOX-JENKINS METHODOLOGY

Antonio Tolsá M.
Department of Economics, Edificio de Bibliotecas, University of Navarre, Pamplona, Spain

This paper describes an application of the Box-Jenkins procedures to the construction of models and the prediction of four series of daily temperatures coming from four meteorological observatories in Navarra and adjacent zones during the period 1948-1957. An "ad hoc" procedure for deseasonalisation of data is presented and an AR(1) model is fitted to seasonality adjusted data. The models obtained are applied to short range prediction of daily temperatures. A comparative study of the main results for both four series is done and also a resumé of the main results and conclusions.

NEW PRODUCT FORECASTING

Chair: **Peter Kennedy**
Simon Fraser University, Burnaby, B.C., Canada V5A 1S6

USE AND MISUSE OF PRE-MARKET NEW PRODUCT FORECASTING MODELS - SOME CASE EXAMPLES

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Commercialized Pre-market new product forecasting model has been available for marketers since 1968. The usage of these Pre-market new product forecasting models (e.g. ASSESSOR, BASES, ESP, LTM/Litmus, SENSOR) is increasing very rapidly. During the past 20 years, many thousands of new consumer products have applied one or more of these forecasting models to provide go/no go marketing decisions prior to launching. Being the developer and marketer of the most popular forecasting model (BASES), I have experienced many variations of marketer's excellent use and misuse of the forecasting models. In this paper, I intend to present case examples of some proper uses and some misuse of the new product forecasting models and results.

ON USING INTUITION IN ESTIMATING NEW PRODUCT GROWTH

Peter **Kennedy**
Simon Fraser University, Burnaby, B.C., Canada V5A 1S6

estimation of, and thus prediction from, adoption/diffusion models of new product growth is unreliable because of unavoidably-small sample sizes. Market researchers have addressed this problem by making use of extraneous information, referred to as managerial intuition. This paper notes that this intuition has been incorporated in an inappropriate fashion in the literature, suggests that the mixed estimation technique is the proper way of utilizing this information, and extends the mixed estimation technique to handle nonlinearities such as that inherent in a popular innovation/diffusion model.

ELECTRIC UTILITIES AND DEMAND

Chair: **D.N. Tiemersma**
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DIVERGENT EXPECTATIONS AND IRREVERSIBLE INVESTMENT: A SECOND BEST MODEL

Pascal Gautier and **Jean-Paul Nicolai**
Service des Etudes Economiques Générales, Electricité de France, 2, rue Louis Murat, 75008 Paris, France

The standard pricing rules a public utility must obey in a static context (Ramsey-Boiteux) are not always relevant in a dynamic framework. This paper presents a two-period model in which a welfare maximizing monopoly is facing a consumer whose believes may differ from the utility's ones. The customer can take advantage of the monopoly service only through an irreversible investment. Reducing the discrepancy between the agents expectations rests on two main tools: the first period price and an investment subsidy. Optimal pricing and subsidizing principles are derived in this framework and compared to usual second best rules.

ELECTRIC UTILITY STRATEGIC FORECASTING IN A COMPETITIVE ENVIRONMENT

Steven D. Braithwait
Electric Power Research Institute, 3412 Hillview Avenue, P.O. Box 10412, Palo Alto, CA 94303, USA

The increasingly competitive environment facing electric utilities in the U.S. today has strong implications for both the methods used to forecast future demand levels and the relationship between the forecaster, resource planners and market researchers. This paper discusses a number of issues and challenges facing the forecasting activity at electric utilities, including increasing demands on the forecast as utilities move toward integrated resource planning, questions of appropriate technique (end use versus econometric), and methods to be used in conjunction with strategic planning. An argument is made for better coordination and interaction between the forecasting, market and load research, DSM program planning, and resource planning activities.

CONSUMPTION FORECASTING AT ELECTRICITÉ DE FRANCE; A NEW MULTI-ENERGY MODEL FOR RESIDENTIAL CONSUMPTION: MARS

R. Grassi, C. Chapuis and **I. Tournassoud** (presented by **M. Heraud**)
Electricité de France, Direction Générale, 2, rue Louis-Murat, 75384 Paris Cedex 08, France

The long term forecasting models used at EDF are based on analytical methods. An approach per electricity market and per use makes it possible to predict evolution of the load curve. The specific uses are now considerably slowing down. Competitive uses will be the basis for future growth of electricity consumption in the residential sector. It was therefore found necessary to create a new model, in order to take better account of the factors which determine demand. This model is based on a highly detailed multi-energy analytical approach, thus providing an instrument for both analysis and dialogue.

IMPROVING THE PRACTICAL RELEVANCE OF SELECTION UTILITY FORECASTS

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This paper critiques the selection utility forecasting formulae originally introduced by Cronbach and Gleser, and refined more recently by Schmidt, Hunter, and their colleagues. Five improvements to the commonly implemented selection utility formula are identified, with correcting algorithms outlined and operationalized. The five refinements address: 1) the impacts of ongoing personnel flows, 2) the probability of offer acceptance, 3) the reality of a two stage selection process, 4) the need to state forecasts in financially sensitive indices such as net present value, return on investment, and 5) the impact of inflation. A sample case illustrates the application of the improved selection utility forecasts to a large energy company.

REGIONAL ELECTRICITY CONSUMPTION PROSPECTS: 5 YEARS OF EXPERIENCE FOR THE P.E.R.C.E. MODEL

R. Grassi and **JF.Lhuissier**
Electricité de France, Direction Générale, 2, rue Louis-Murat, 75384 Paris Cedex 08, France

The planning of distribution and transmission networks and the need to have more specific regional elements in the context of increased decentralization has led EDF to improve its regional electricity consumption forecasts. Thanks to an analytical model of the regional distribution of national electricity consumption forecasts - the PERCE model - it is possible to take into account the specific features of the regional economy and the local commercial actions while ensuring cohérence between the 22 regions and the national level. PERCE provides an analysis context which facilitates the dialogue with regional authorities. In addition, in view of the detailed analysis level used, it is possible to deduce power forecasts that are particularly useful for investment choices.

ENERGY FORECASTING

Chair: **Joe Brocato**
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(Title and Abstract not available at time of publication)

QUANTIFICATION OF THE FACTORS AFFECTING THE SPECIFIC ENERGY CONSUMPTION IN FREIGHT TRANSPORT

Bahru **Meles,**
Asmara University, P.O. Box 1220, Ethiopia

Proceeding from problems (forecasting etc.) being of importance in practice, various kinds of relations between indices influencing the specific energy consumption in a freight transport organization are studied. A mathematical model is used to quantify these relationships, which is developed based not on probability theory but on a conception which is based on three basic assumptions emerging from experiences made which in turn serve to deduce conclusions and definitions to be used as a basis of developing the mathematical instrument for studying relations between any system of indices. The conception is based on the assumption that the performance of working teams in the economic unit under study depend on targets and conditions prevalent there, and in turn, their behavior is to be seen as the cause of the respective realization of indices.

WHAT DOES THE FUTURE HOLD FOR OPEC: AN ANALYSIS OF THE OIL MARKET IN THE 1990'S

Monle **Lee**
Division of Business & Economics, Indiana University at South Bend, 1700 Mishawaka Ave, South Bend, IN 46615, USA
Farhad Behzadi
Yale International Co., 54295 Fir Rd., Mishawaka, IN 46565, USA

While OPEC has lost most of its powers in the past few years, it is extremely dangerous for the western countries to forget its impact on the oil market. The oil glut and the dramatic drop in the price of oil in recent years, has once again made the western countries abandon their energy-saving policies. Coupled with the expected decline in the production of the North Sea oil in the 1990's, this would point to a resurgence of OPEC in the near future. Therefore, in order to avoid a crisis similar to that of the 1970's, the western countries should devise prudent energy policies for the 1990's.

SHORT TERM ENERGY FORECAST; ANALYSIS OF THE FORECASTING RECORD OF THE CEC

Nikitas **Deimezis**
Commission of European Communities, DGXVII, Energy, Terv 3/26, rue de la Loi, 200, B 1049 Brussels, Belgium

Since December 1984 the CEC has published, two or three times a year, a complete short term energy forecast covering fields such as energy prices, demand, production and net imports. Obviously, this was a difficult period for energy forecasting, as some major modifications of the energy scene occurred during this time, particularly the sharp fall in oil prices in 1986. This paper is a first systematic effort to analyze our forecasting record over the years 1984 to 1987, and to compare these forecasts with the actual outcome. The two main questions are: a) Did we anticipate the fall in oil prices in time? b) How successful have we been in forecasting the effects of rapidly changing oil prices?

ENERGY FORECASTING

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COST & USE OF ENERGY

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ACCOUNTING IMPLICATIONS OF OIL AND GAS BUSINESS FAILURE

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Full cost (FC) and successful efforts (SE) accounting practices are both still used in the oil and gas exploration businesses. The different treatment given by the two methods to unsuccessful and successful drilling efforts suggests that the use of FC or SE accounting methods may impact the likelihood of firms failing. In addition, previous studies have identified financial ratios that discriminate between manufacturing companies that will fail and those that will survive. This study develops similar information for oil and gas companies. Finally, the important roles of cash-flow and oil price levels on solvency in the oil patch are quantified.

ADAPTIVE K-STEP PREDICTIONS OF THE HEAT CONSUMPTION IN A DISTRICT HEATING SYSTEM

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This paper presents a model for the hourly heat consumption in a district heating system. The model partitions the heat production into 1) a component describing a systematic diurnal variation, 2) components describing the dependence on outdoor temperature and wind speed, 3) a component taking into account the changes in accumulated energy in the distribution system and 4) normal and diurnal autoregressors describing the correlation in time. Different adaptive k-step prediction methods are studied, and it is shown how they can be used together with the composite model for short term predictions of the heat consumption in the district heating system.

COST OPTIMIZATION OF THE FUTURE DUTCH ENERGY SYSTEM UNDER ENVIRONMENTAL CONSTRAINTS

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The Energy Study Centre (ESC) of the Dutch Energy Research Foundation (ECN) recently has completed an extensive study on the possibilities of new energy technologies up till the year 2020. Results of the study will be presented on the conference. Complete reports will be issued during 1988. The possibilities of new technologies for the Netherlands -market shares in various sectors- has been investigated by means of the dynamic linear programming computer code MARKAL which allocates markets during an economical minimalisation of the costs of the complete energysystem, simultaneously for the whole period till 2020. Various constraints and boundary conditions have been applied to the energysystem: availabilities and costs of energy carriers, several levels of environmental constraints, different developments in energy demand and also various discounting rates. Boundary conditions and constraints have been derived from three world-wide scenarios which form consistent backgrounds for the economic, social and technological development of the Dutch society. The results of the study vary from detailed descriptions of the market penetration of specific technologies till general conclusions concerning the cost of the total energy system. The integrated approach of environmental constraints, technological development and availability of energy carriers which has been applied in this study has lead to creative configurations of the scenarios dependent energy systems. The Dutch energy sytem appears to be rather stable, with only minor influences from changes in boundary conditions and constraints. This can be attributed to the availability of domestic natural gas which allows for a smooth transition into a more coal based energy system. Environmental constraints do not lead to substitution of gas for coal. Instead emissions are mainly reduced by application of abatement techniques as well as shifts in the use of energy conversion technologies. Integrated reduction of the emission of sulpher dioxide and nitrogen oxides by both means appears to be much cheaper than the use of abatement techniques alone.

NEW DEVELOPMENTS IN DEMOGRAPHIC FORECASTING

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LINKING BIRTH EXPECTATIONS TO FERTILITY ASSUMPTIONS IN NATIONAL POPULATION FORECASTING

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Long-term population forecasts are mainly determined by assumptions on the future level of fertility. Multivariate models are not likely to be of very much use for deriving long-term fertility forecasts as there are no reliable long-term forecasts of the explanatory variables. Useful information may be obtained from fertility surveys in which young women are asked how many children they expect to have. However, the results cannot be used directly for population forecasting as women tend to overestimate their own future family size. Hence some adjustment needs to be made. For this purpose the relational Gompertz model can be helpful.

PROBLEMS OF POPULATION MOVEMENT FORECAST

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There is a strong theoretical basis for describing population movement by Markov processes. Results of application of Markov processes for forecasting population movement also prove their high potentiality. Multi-status model, based on Markov processes, have been applied for a long time already. It is exactly this model in which researchers started to change intensity of transitions between groups taking into account conditions of residence there: demand for manpower, wages, housing and services security, etc. Such a complication of model has led to the appearance of factor-Markov model.

STOCHASTIC POPULATION FORECASTS

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A stochastic version of the demographic cohort-component method of forecasting future population is presented. Under this model the sizes of future age/sex groups are non-linear functions of random future vital rates. An approximation to their joint distribution can be obtained using linear approximations. A stochastic formulation points to the need of new empirical work on both the autocorrelations and the crosscorrelations of the vital rates. Problems of forecasting declining mortality and fluctuating fertility are contrasted. A volatility measure for fertility is presented.

RECENT DEVELOPMENTS IN MODELLING AND FORECASTING LIVING ARRANGEMENTS

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Traditionally forecasters of the number, size, and composition of households/families have used an elementary methodology known as the headship rate method. More elaborate forecasting methods are now available, however. They range from the relatively sophisticated but still static extensions of the headship rate method to dynamic methods that emphasize the events underlying the formation and dissolution of households/families. Based on a thorough review of the most significant of these methods, this paper concludes that better preparation of household/family forecasts requires development of a truly dynamic tool that (1) focuses on the evolution of demographic groups consisting of a mother and the children living with her and (2) relies on the methods and models of multistate mathematical demography.

THE DECLINE OF THE AMERICAN EMPIRE

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The evolution of Nobel prize awards has been studied as a learning/growing process with a logistic description for the international competition between the different nations. The American niche appears to be 65% exhausted by 1986 implying a diminishing expected rate of laureats in the future. Europeans have been continuously loosing ground while the third world countries are on the rise. Projections to the year 2000 and beyond are given. Correlations with age support the Darwinian nature of the competition for Nobel prizes. Awards to women show peaks coincidental with outbursts of feminism.

REGIONAL FORECASTING I

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REGIONAL DISAGGREGATION IN TRADE MODELLING

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With the help of two standard two commodities-two suppliers-two regions of destination models, this paper presents a theoretical analysis of the impact of geographical specialisation of trade flows on export performance. The analysis demonstrates that usual estimates of elasticities in applied trade modelling are biased if no attention is paid to the impact of geographic disaggregation and could consequently lead to wrong expectations or policies. Expressions for the biases are derived so that they can be calculated in applied trade modelling.

FORECASTING EMPLOYMENT IN SMALL METROPOLITAN AREAS USING A SIMPLE BVAR APPROACH

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This paper presents a simple Bayesian Vector Autoregression (BVAR) approach to forecasting employment in small metropolitan areas. The theoretical framework is consistent with the traditional export orientation of regional models. Exploratory regressions are conducted and show that the model fits the data well. The model is re-estimated with Bayesian priors, and the forecasting capabilities are improved. Consequently, this approach is a viable alternative to other more traditional forecasting techniques since the model provides accurate forecasts, have flexible data requirements, is relatively inexpensive to maintain and can be used on a personal computer.

FORECASTING SMALL REGION EMPLOYMENT LEVELS USING REGIONAL COMPOSITE INDEX

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The relatively severe data constraints at the small region level pose serious problems for forecasters, forcing them to seek input, driver, or causal variables from outside the region. Various national aggregates and composite indexes have been shown to be useful driver variables in time series models designed to forecast small region employment levels. Recently composite indicators have been developed for subnational units such as states and metropolitan areas. The purpose of this paper is to investigate the usefulness of two subnational composite indicators to forecast employment levels in a small metropolitan region.

ANALYZING THE SENSITIVITY OF THE TIME SERIES/SHIFT-SHARE TECHNIQUE OF FORECASTING THE LOCAL ECONOMY

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Shift-share analysis has been used for over two decades to analyze local economies and provide rather simple forecasts. Recently, it has been demonstrated that shift-share techniques may be adapted for use with standard time-series forecasting techniques such as ARIMA and transfer function modelling to provide more accurate forecasts for small-region economies. This paper extends work done on the marriage of shift-share and time series procedures by applying the technique to a new forecast horizon, and by testing the sensitivity of the technique to 1) the level of industrial disaggregation and 2) the length of period used in calculation of the shift-share components. Analysis will be based on twenty five years of monthly employment data for an industrial metropolitan area in the northeastern United States.

REGIONAL FORECASTING II

Chair: **Jean H.P. Paelinck**
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THE APPLICATION OF FORECASTS IN REGIONAL PLANNING

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Dealing with spacial planning issues requires insight in the future situation. It is of prime importance for the regional planning to be able to evaluate the effect of specific interventions on future developments. Predictive models may be employed to generate such insights. This paper deals with models which are currently applied in regional planning in The Netherlands. The basic model is a multiregional model for population-forecasts. The output of this model can be used in different other models in the fields of housing, employment, amenities. At the end of the paper a description is given of regional forecasts for the period 1987 - 2015.

A MICRO-COMPUTER MODEL OF THE REGIONAL EFFECTS OF FOREIGN EXCHANGE RATES

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A 24-variable block simultaneous equation macroeconomic model is used to simulate the effects of fluctuating foreign exchange rates on domestic sectors. The specific case of Mexico is examined using the peso-dollar exchange rate, spot crude oil prices, and primary commodity prices. This model was developed on inexpensive microcomputers so that policy makers may predict the regional effects of changes in the international economy. It is especially useful for developing countries which depend on a few primary commodities for their export revenues.

THE XXI CENTURY LATIN AMERICAN CITIES CHARACTERISTICS

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This essay holds some hypotheses about the latin american cities characteristics for the coming twenty years. High demographic growth. Economic crisis. Re-democratization process in the latin american societies. The State will be unavailable to satisfy all demands, due to the economic crisis. Rebuilding the civil society with another orientation. The State and the economic policies will be unavailable to structure the society, according to what has been stated above. So it will be tended to make people rebuild a society of their own. In this way, the traditional and historical process where the state used to be who shaped society and the latin american cities will be reversed.

AN ECONOMETRIC FORECASTING MODEL FOR FRENCH REGIONS: M.D.R

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MDR (Macroeconomic-Dynamic-Regional) is a semi-annual regional simulation econometric model empirically applied on the french regions. It emphasizes an explicative approach of short run regional economic evolutions. Its theoretical framework brings up a comprehensive analysis of the relationships, between national economic fluctuations and regional economic [illegible], between industrial employment, production and productivity, between static and dynamic multiplier impacts into the servi[illegible] industry, and between those fluctuations and the regional labor markets.

[illegible] A TELEMATIC CITY

Lui[illegible] **A. de Garrido**
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[illegible] is the key resource that will give rise to the Telematic Revolution. In this revolution the city seems to be essential [illegible] a suitable framework where the electronic and telematic activities work and are carried out in a more efficient manner. Ta[illegible] into account the increase of sales and the fall in prices, we can forecast a massive and fast implantation of telematics. Th[illegible] advantages are evident, but understanding the historical lesson of the Industrial Revolution with its chaotic consequences i[illegible] and urban planning, we will be able to forecast the possible consequences. Only being able to sense this could [illegible] forecast solutions. By the time we detect the problems it will be too late! A reasonable solution lies in a global, regulated [illegible] integrated implantation. But, in which manner? Will we be able to solve them together with the ones inherited from Ind[illegible] Revolution? Can architecture and space planning help? Which changes will be produced in the city?

REGIONAL FORECASTING III

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MIXED TIME-SERIES, LEADING INDICATOR FORECAST MODELS FOR REGIONS

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In this research, we compare several time-series forecast models of employment growth for states and regions in the United States. The predominant statistical method used in regional forecasting has been that of large scale structural models, driven by exogenous macroeconomic variables. The principal alternative models (primarily ARIMA), have not performed as well as the structural models at the state level. The principal source of weakness in these pure time-series models is that they fail to capture the influence of important external forces in the determination of the economic aggregates at the regional level. Recently, a number of attempts has been made to develop "mixed models", such as transfer function models. In this research, we compare the predictive ability of these mixed models to that of univariate time-series and structural models. The time-series techniques we compare are: 1. ARIMA models, 2. AR leading index models, 3. Vector AR, leading indicator models. Special attention is paid to the second type of model. Within this group, three variants of the model are compared. First, the AR leading index model will be estimated using OLS on selected regional leading indicator variables and national variables, such as money supply. Two shrinkage forecasting techniques will then be employed with this model. The first technique "shrinks" the forecast of changes in output for individual states toward the mean forecast for each state based upon a predictive loss function which penalizes forecasts which are further away from the mean forecast. The second shrinkage technique constrains some (or all) of the coefficients on the leading indicator variables to be the same for all states and regions in the sample. The vector AR model will forecast a mix of national leading indicator variables, local leading indicator variables, and the local employment variables. The system will be estimated with prior distributions put on the variance of estimated parameters of local variables on national variables to reflect the minimal feedback of local factors on the aggregates.

CITIES IN THE 21st CENTURY: PREDICTIONS AND PERSPECTIVES

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Can we anticipate any major discontinuities in urban form and functions in the 21st century? Or is the past the best prologue to the urban future as city-regions reassert their strategic significance in the emerging global society? In this presentation we draw upon the reactions to Cities in the 21st Century (Sage, 1982) to elaborate a complex urban futures management model. The presentation also considers whether the emerging high tech/high touch/high tension economy and society associated with the so-called "Information Age" will bring about major changes in the enduring urban functions of cities in Western society.

THE DEVELOPMENT OF URBAN TRANSPORT SCENARIOS FOR THE CITY OF RIO DE JANEIRO/BRASIL

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The study consists of the generation of alternative urban transport scenarios for the metropolitan area of Rio de Janeiro. A group ofabout 25 experts, with varying professional and knowledge backgrounds, have been selected amongst urban planners, consultants, public and private transport operators, academics and decision makers. A survey, based on the DELPHI methodology, was carried out for determining the most important variables to be considered and also the relationships between them. The resulting structural model was run according to a number of different combinations of input (policies) to produce alternative scenarios for the year 2000.

REGIONAL FORECASTING IN SPAIN

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(Abstract not available at time of publication)

SIMULATION OF TRAJECTORIES

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(Abstract not available at time of publication)

REGIONAL FORECASTING IV

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FORECASTING REGIONAL TOURIST ACTIVITY

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Starting from a historical model in four phases, based on the empirical analysis of the evolution of touristic regions, the paper proposes a mathematical model of spatial tourism behaviour. Such a model, specified as a generalised Lotka-Volterra system, allows to forecast touristic volume and locations. The application to a Suisse touristic region, the vallais, proves the applicability of the model and illustrates its prospective usefulness.

AN ECONOMETRIC FORECASTING MODEL FOR FRENCH REGIONS: M.D.R.

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MDR (Macroeconomic-Dynamic-Regional) is a semi-annual regional simulation econometric model empirically applied on the french regions. It emphasizes an explicative approach of short run regional economic evolutions. Its theoretical framework brings up a comprehensive analysis of the relationships between national economic fluctuations and regional economic fluctuations, between industrial employment, production and productivity, between static an dynamic multipliers impacts into the service industry, and between those fluctuations and the regional labor markets.(Abstract not available at time of publication)

URBAN MODELLING AND FORECASTING

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(Abstract not available at time of publication)

PROJECTING REGIONAL TRENDS WITH THE HELP OF LOCATION ELASTICITIES

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Economic development in a country can be analysed by looking at the development of separate regions located in the country. The principles of interdependency and of assymetry always can be observed. Continuiously activity levels are changing and a process of adaption is going on. The output levels in a system of regions never reaches an equilibrium. The output values are influenced by economic policy measures, which can be focussed on a specific region one, more general, on sectors which are represented in a number of regions. The effects of policy measures are hard to predict. In this paper regional development will be analysed defining a number of relevant regional economic variables. One of these variables is the location elasticity. Using both equilibrium and dynamic disequilibrium models the stability of these variables will be estimated. A number of regional output data of several countries will be used. If stable trends in regional development are found, they can be used as indicators for expected regional development.

TRENDS IN REGIONAL INCOMES

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The centre-periphery antithesis has been the object of much debate in the last few decades. The objective of the present paper is to test the validity of the divergence hypothesis for the European Community of Twelve. To that end we will first present a short theoretical analysis of the mechanism involved. Two tests will be carried out: - For the period of the industrial revolution up to the second world war we will analyse mainly national data, complemented with regional data for selected countries; - For the past war period we will analyse a complete data set for regions of the EC. On the basis of these results we will make a preliminary forecast for the rest of the century.

FORECASTING POSTAL SERVICES

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A NOTE ON THE USEFULNESS OF PANEL DATA WHEN FORECASTING WITH SHORT TIME SERIES

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There are many situations in which one is faced with the problem of forecasting a variable with only few observations in the time dimension. Consider for example the case of a firm which wants to predict the sales of a new product. Usual forecasting methods cannot give efficient predictions in this case. If disaggregated data (by geographical areas, by stores...) about sales are available, even over a very short time period, these panel data allow to get a more efficient forecast of total and/or disaggregated sales. Now, imagine that the firm has set a global sales forecast and that it wants to disaggregate it. Again, panel data (sales disaggregated by geographical areas, by stores...) lead to disaggregated forecasts which are much more reliable than those obtained by predicting each component separately, because of the small time dimension of the available sample. In this paper, we show in the first part that using panel data econometric methods is preferable, in this situation, to usual time series methods in the sense that it allows to achieve more efficient forecasts. In the second part we develop the way to obtain easily disaggregated predictions. Last, we illustrate these two aspects by presenting a forecasting model of collected savings over 21 regional areas by the French Postal Network.

A FORECASTING MODEL FOR FINANCIAL SERVICES

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The review is aimed at providing a model for the Post Office financial services. The purpose of this model is to supply forecasts (collection of savings and interest due on customer accounts) for planners who can then use such information in drawing up their management strategies. The model illustrates the wealth and structure of the Post Office's customer portfolio. It is quarterly and covers the period 1978/1 - 1987/4. At present it comprises some forty equations, half of which are econometric. Its forecasts are widely distributed throughout the General Directorate and are an aid for highest level decision making. The model can, in fact, also be used for simulation purposes, in which case the difference is measured, on a variental account as against a central account, resulting from one or several economic or regulatory factors (e.g. variation in wage rates or in the upper limits of saving accounts).

SCHOOLS & HOUSING

Chair: **Arnold H.Q.M. Merkies**
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AN ALTERNATIVE APPROACH TO THE FORECASTING OF BUILDING COSTS DURING THE EARLY DESIGN STAGES

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Research has been carried out in the UK regarding the provision of initial building cost advice to clients. It identified that clients are often dissatisfied with the quality of this service. As many of the UK quantity surveying practices have offices in other countries, it could be assumed that this is not unique to this country. This paper will review the need for accurate estimates of initial building cost and the current techniques employed. The method of computer cost model, which uses an individual own cost data, will be explained. The use of sensitivity analysis to improve probability will be described. The paper will explain how a computer based cost modelling system is a more accurate forecasting technique, giving rise to greater confidence in the results and improving the quality of service to clients.

A FORECASTING MODEL TO EVALUATE HOUSING POLICY IN THE NETHERLANDS

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In the course of the seventies, the Dutch government introduced a number of measures which were meant to influence the housing market, and which related to financing, subsidizing and price fixing for dwellings. These measures were rather drastic and obviously had a great influence on the housing market. They effect investments, maintenance, prices, exploitation results, quality of the stock and consequently the situation in the households. This article describes the calculation model which was developed by order of the Ministry of Housing to estimate the effects of the different measures within a context of macro-economic and demographic changes.

THE PERFORMANCE OF BUILDINGS

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It is evident from problems occurring in the property market that both owners and occupiers of buildings need a more meaningful method of evaluating the performance of a building. This is needed in order to improve their decision making process and to identify their overall financial commitments. The research on which this paper will be based has just been completed. The paper will identify the needs of different client types and comment on the usefulness of existing evaluation techniques, such as income/value, life cycle costing and value engineering. The paper will explain how and why communication procedures need to be improved and the techniques need to be developed in order to produce forecasts of a buildings performance over time.

FORECASTING THE EFFECTS OF SIZE REQUIREMENTS ON SCHOOLING

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Consequences of the effects of the instalment of size requirements for secondary schools are described on supply and demand of schooling. Supply contains composition, geographical dispersion and costs of the school system as well as the effects on the size and the complexity of schools; demand refers to the reallocation of pupils over districts, type of school, denomination and travelling costs.

FORECASTING IN HEALTH

Chair: **Panos Kontzalis**
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JOINT FORECASTS OF WHITE AND NONWHITE LIFE EXPECTANCIES: TESTS FOR CONVERGENCE

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The nonwhite/white mortality crossover controversy is investigated by analyzing temporal variation in nonwhite/white mortality differentials to understand them structurally and dynamically. Some aspects of the controversy are reviewed by showing graphically mortality between the U.S. nonwhite and white populations. Box-Jenkins joint forecasts of nonwhite and white life expectancies at birth to the year 2010 are made, demonstrating patterns that relate them. Results show gradual movement toward convergence. Concerns are raised about the notion of genetic frailty in the two populations and its policy implications.

FORECASTING STROKE RISK USING REAL TIME CAROTID ULTRASOUND IMAGING AND SPECTRUM ANALYSIS

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The cost of mortality and morbidity of stroke patients in the world is staggering. The medical profession agrees that strokes can frequently be prevented if the patient at risk is identified in time and appropriate therapy instituted. First, on the basis of the Chi-square test, based on data from 393 patients, the authors suggest 16 risk factors that are important to recommend a carotid ultrasound imaging test for a patient at risk. A logit model estimated using the above data indicate that to forecast the stroke risk patient, one needs to consider the following factors: age, carotid artery stenosis (50%), the family's history of atherosclerosis, smoking habit, abnormal cholesterol, and coffee intake.

ADAPTIVE FORECASTING AND CONTROL OF PSYCHOTHERAPEUTIC PROCESSES

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A general feedback model of psychotherapeutic processes is presented which can be applied on-line by means of a recursive estimation scheme. Adaptive control is accomplished through continuously updated infinite horizon solutions. In this way, strategic allocation of therapeutic efforts and its long-term effects can be determined in the course of an individual psychotherapy. A case study is presented which shows that the pattern of control by therapeutic manipulations may vary substantially across consecutive sessions.

FORECASTING THE MARKET POTENTIAL OF AN ETHICAL MEDICINE IN CASE NO DATA ARE AVAILABLE

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Market size, prescription habits, promotional activities and/or expenses, market shares, regional and nationwide sales etc. could be easily identified through Pharmaceutical audits and based on these data one can extrapolate figures into the future and calculate the potential market of a new introduction. But what about countries which have no access in any kind of Audits? What kind of data does one need, how can one obtain these data and can elaborate these data to forecast the potential sales of a new drug? What is the role of Market Research in this process? And further more how accurate are the figures? We will try to give answers to these hot questions, through our experience in Pharmaceutical Business, and propose an empirical model which could be useful in forecasting the potential sales of a new introduction without having access in Pharmaceutical Audits.

IDENTIFICATION OF AN INHOMOGENEOUS POISSON PROCESS WHOSE PARAMETER CONTAINS AN INOBSERVABLE AND NON STATIONARY ERROR; application to the analysis of a daily series of deaths in a large hospital

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The parameter of the law of an inhomogeneous process may contain an inobservable error. The error may be a non-stationary process which cannot be directly identified. If the process is an ARMA process depending on time, the non-stationary ARMA process is equivalent to the centred count process by the mean of the count. This last model has time dependent ARMA errors. The centred count is the error of a non linear model estimated by GLS or by ML under the hypothesis of normality. This hypothesis is not valid als such. Nevertheless, this 'pseudo' specification is justified regarding the method of generalised quasi pseudo ML which warrants the asymptotic normality of the estimators under non restrictive hypotheses. The procedure is applied to the identification and the estimation of parameters of a non-stationary process of daily deaths which appear in a large hospital.

MILITARY EXPENDITURES

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FORECASTING IN A HIGH TECHNOLOGY ENVIRONMENT; AN INTRODUCTION TO GUIDED WEAPON LIFE CYCLE COSTING PROBLEMS

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The future cannot be predicted with certainty and this is made more difficult in the fast moving fields of high technology often spearheaded by the demands of modern defence weapons. As the perceived threat changes, so the costs of acquisition and ownership of appropriate defence systems become increasingly more prohibitive. With only finite funds available to support all such competing system demands, there is greater pressure towards international collaboration, fewer systems and extended operating life spans. All these factors place greater emphasis on the need for more accurate forecasts of expenditure requirements and patterns for executive decision making purposes. This paper sets out to examine the inherent problems and identify some possible solutions by reference to an investigation of life cycle costs of a future ground-launched anti-tank guided weapon system.

FORECASTING PERSONNEL REQUIREMENTS FOR THE U.S. ARMY

James L. Kays, Ruth A. Maurer and **Carol Anderson**
United States Military Academy, West Point, New York 10996, USA

Forecasts of personnel inventory are important tools which enable the Total Army Personnel Agency (TAPA) to balance inventory with requirements and to foresee potential inventory problems. Personnel forecasts are based on continuation rates (C-rates), the percentage of each personnel type remaining in the Army from one year to the next. The TAPA-sponsored study recommends the best technique(s) for forecasting C-rates, suggests means for monitoring/tracking forecasts, and offers future research directions which might relate personnel policy to forecasting models. Results of the Makridakis competition are used as a starting point for the work.

FORECASTING PROBLEMS IN MILITARY MANPOWER APPLICATIONS

Susan J. Pinciaro
Navy Personnel Research and Development Center, San Diego, CA 92152-6800, USA

This paper will describe several forecasting problems faced by military manpower planners and approaches which have been and/or are currently being used by the US Department of the Navy to deal with these problems. Current research by the Navy to determine the effectiveness of these approaches and to develop alternative improved methodologies for handling these forecasting issues will be outlined.

A MACROECONOMETRIC APPROACH TO ECONOMIC WARFARE

Murray Wolfson and **Andrew Gill**
Department of Economics, California State University, Fullerton, California 92634, USA

Military war and economic war are interdependent. The threat of military war becomes economic war. A nation wages economic warfare whether or not hostilities are in progress by requiring deterrence arms expenditure by its opponent. We explore two approaches to economic warfare as it impinges on the international macroeconomic system. (1) Deterministic optimization. We construct a general equilibrium model of each country's choice of consumption, investment and defense as embodied in the social welfare function of the authorities subject to limited production possibilities. (2) Overdetermined structural models. Though less general, this approach faces the observed disequilibria and is more amenable to measurement. We posit an international macroeconomic system consisting of two antagonistic nations and a third "rest of the world". We display their normal deterministic international macro-equilibrium in traditional Keynesian terms. Our paper will outline our models and methods and offer preliminary econometric results applied to the Anglo-German Naval Arms Race prior to World War I as a pilot investigation.

FORECASTING AT MULTIPLE LEVELS OF AGGREGATION

Susan J. Pinciaro
Navy Personnel Research and Development Center, San Diego, CA 92152-6800, USA

In this presentation, current approaches to forecasting at multiple levels of aggregation will be described in the context of major, operational Navy forecasting systems. Current Navy efforts to investigate the questions outlined above will be described, and ideas will be sollicited and welcomed on these issues.

FORECASTING MODELS FOR USE IN THE UNITED STATES AIR-FORCE'S ENLISTED FORCE MANAGEMENT SYSTEM (EFMS)

Chair: **Warren E. Walker**
The RAND Corporation, 1700 Main Street, Santa Monica, CA 90406, USA

AN OVERVIEW OF THE AIR FORCE'S ENLISTED FORCE MANAGEMENT SYSTEM (EFMS)

Warren E. Walker
The RAND Corporation, 1700 Main Street, Santa Monica, CA 90406, USA

The enlisted component of the United States Air Force consists of approximately 500,000 airmen. Management of these resources means providing enough of the right kinds of airmen in the right grades and occupations in the right places at the right times to carry out the Air Force's missions. Management involves making decisions about force structure, promotion policies, and the procurement, assignment, training, compensation, separation, and retirement of personnel. This paper presents an overview of a decision support system that is being jointly developed by the RAND Corporation and the Air Force that will help the Air Force carry out their activities.

FORECASTING AIRMAN RETENTION BEHAVIOR IN THE MIDDLE TERM

Grace M. Carter
The RAND Corporation, 1700 Main Street, Santa Monica, CA 90406, USA
Michael P. Murray
Department of Economics, Bates College, Lewiston, Maine 04240, USA

We describe loss equations, based on ordinary least squares regression, that were developed for the Enlisted Force Management System to forecast enlisted losses during a period from one to seven years from the time of the forecast. These models show how airmen would respond to changes in economic conditions, military pay raises, and bonuses. For each occupation in the Air Force, they provide forecasts based on historical behavior of airmen in similar occupations. They also provide forecasts of the behavior of subgroups of airmen defined by qualifications or demographics. The models are used to manage personnel programs such as training and bonuses.

A MODEL FOR MAKING SHORT-TERM PREDICTIONS OF AIR FORCE ENLISTED INVENTORIES

Daniel Relles
The RAND Corporation, 1700 Main Street, Santa Monica, CA 90406, USA
Marygail Brauner
The RAND Corporation, 1700 Main Street, Santa Monica, CA 90406, USA

This talk describes the EFMS's Short-Term Aggregate Inventory Projection Model (IPM) and the time series models that underlie its loss and reenlistment predictions. The models specify, for each of a mutually exclusive set of about 1,000 cohorts, how many losses and reenlistments occur in each month. All models attempt to move cohorts one month ahead, but the functional forms of the models vary. Use of the IPM requires chaining these models forward 12 months. In addition to discussing the loss and reenlistment models and the IPM, the talk describes the implementation process and draws some general lessons applicable to other large-scale modeling efforts.

FORECASTING AND SOCIETY I

Chair: **Thomas Baumgartner**
Institute for Environment and Systems Analysis, Schiedhaldenstrasse 6, CH-8700 Kusnacht, Switzerland
Atle Middtun
Norwegian School of Management, Postboks 4636 Sofienberg, N-506 Oslo 5, Norway

RATIONALITY AND DECISION MAKING

Atle Middtun
Norwegian School of Management, Postboks 4636 Sofienberg, N-506 Oslo 5, Norway
Thomas Baumgartner
Institute for Environment and Systems Analysis, Schiedhaldenstrasse 6, CH-8700 Kusnacht, Switzerland

In contemporary society, forecasting of developments in societal sectors that are subject to political debate may itself become politically controversial. This may lead to politicalization of forecasting activities, especially in cases where forecasts are used for justifying controversial views of desirable futures. The scientific nature of modelling and forecasting exercises may become imparied in such situations. Modelling and forecasting failures have in the past been answered with model complexification, reflecting the technical orientation of the dominant modelling and forecasting professions. This response overlooks the fact that models and forecasts of a system today in most cases part of a socio-technical system. Groups use models to express their view of the system. And the social system is capable to react to the futures proposed in forecasts. This self-reaction requires new forecasting methods and implies changing roles for modellers and forecasters.

THE ORGANISATION OF FORECASTING

Robert Fildes
Manchester Business School, Booth Street West, Manchester M15 6PB, UK

Quantitative forecasting techniques are not much used in business. Instead, organisations rely on the judgement of managers working close to the product market. Increasingly, however, developments in the production planning area require more accurate forecasting. This presentation gives detailed evidence on how companies produce their market forecasts, and the perceptions of managers as to the inadequacies in the procedures. It concludes with a discussion of the reasons why organisations mismanage their forecasting activity, and how it might be improved.

FINANCIAL FORECASTING

Bernard Gauci
Department of Economics, Box 9732, Hollins College, VA 24020, USA

Forecasting of interest rates and other financial variables involves three types of models or representations of reality. The first two are the forecaster's own model and the objective (or true) model of the economy. This paper casts doubt on whether a true, objective model actually exists, and - if it does - whether it is identifiable, and what the precise function of each of the two models is. The forecaster normally assumes that his model and the objective model are one and the same. The paper will investigate the implications of the alternative strategy of assuming that the two are distinct. In addition, it calls for the recognition of a third type of mode, that of the market participants, in whose hands lies the actual determination of the financial variables. Financial theory has the hidden assumption that the three models are identical. This paper will look into the economic-theoretic and the sociological implications of a recognition of the separation of the three models.

THE REFLEXIVITY PROBLEM IN COUNTRY RISK ANALYSIS

Anton P. Müller
Institut für Staats- und Versicherungswissenschaft, Universität Erlangen-Nurnberg, Kochstrasse 4, D-8520 Erlangen, Federal Republic of Germany

Country risk analysis helps to make business decisions on international credits and foreign direct investments. If management acts in line with the risk analysis the structure and performance of the assessed country will be affected accordingly, thus creating a reflexive process in which perception changes reality. Mainstream country risk analysis has not yet addressed this problem thus creating the boom and bust in international lending. The paper will adress this problem within the context of the international debt crisis.

FORECASTING AND SOCIETY II

Chair: **Thomas Baumgartner**
Institute for Environment and Systems Analysis, Schiedhaldenstrasse 6, CH-8700 Kusnacht, Switzerland
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Norwegian School of Management, Postboks 4636 Sofienberg, N-506 Oslo 5, Norway

ENERGY-FORECASTING, LARGE SCALE PROJECTS AND THIRD WORLD DEVELOPMENT: The role of forecasts in legitimating large scale development projects at the nation and international levels - The case of Colombia

Turid Sato Danforth
2134 Leroy Place N., W. Washington D.C. 20008, USA

The paper discusses the role of forecasts in planning and decision-making on the basis of planning experience from the World Bank, and studies of project development in third world countries. The focus is on the dual role of forecasts as professional estimates of future development, and as an important basis for legitimation of decisions within third world nations and within the World Bank. Examples are taken from large scale World Bank financed energy-projects in Colombia

WORLD POPULATION FORECASTING (TENTATIVE TITLE)

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(Abstract not available at time of publication)

POPULATION FORECASTING IN INDUSTRIALIZED COUNTRIES: METHODOLOGY AND ACCURACY

Nico Keilman
Netherlands Interuniversity Demographic Institute (NIDI), P.O. Box 11650, 2502 AR The Hague, The Netherlands

(Abstract not available at time of publication)

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COUNTRY AND POLITICAL RISKS I

Chair: **Jean-Claude Cosset**
Faculty of Business Administration, Laval University, Quebec-City, Canada G1K 7P4

POLITICAL RISK ASSESSMENT: A LONG VIEW

Arvind K. Jain
Faculty of Management, McGill University, Montreal, Canada

Political risk assessment by international corporations emphasizes an evaluation of the stability of the host-country. "Strong leaders" are preferred to "weak" leaders. This research in the area of agency problem leads the author to argue that in the long run it is "strong" population, not a strong leader that makes for a better host. This paper develops this argument and shows how political risk assessment methods must be changed.

EUROMONEY AND INSTITUTIONAL INVESTOR COUNTRY RISK INDICES AND PREDICTIONS OF DEBT SERVICING PROBLEMS IN DEVELOPING COUNTRIES

Abolhassan Jalilvand
Faculty of Commerce and Administration, Concordia University, Montreal, Canada

This paper examines the performance of the well-respected Euromeny and Institutional Investor Country risk indices in predicting the recent debt servicing problems of developing countries. In particular, the indices' credit ratings for individual borrowing countries are used to form one to three years ahead predictions of debt reschedulings which occurred during the 1982-83 period of international debt crisis. Combined, our findings, based on a non-parametric statistical approach, are not generally supportive of the indices' predictive ability. While the spread based Euromoney index appears to have some predictive success in discriminating between rescheduling and nonrescheduling countries, its performance is unstable and deteriorates rapidly as the forecast horizon is shortened. The performance of the Institutional Investor credit ratings is even poorer. This index of bankers' overall judgment on borrowers' creditworthiness has consistently failed to predict accurately the rescheduling countries over all forecast horizons. Both indices are also subject to considerable misclassification errors in their predictions of rescheduling countries. The results also suggest that conventional macroeconomic indicators of country risk generally produce more reliable forecasts of debt servicing problems than those of the Euromoney and the Institutional Investor indices.

POLITICAL RISKS IN FINANCIAL MARKETS: AN INDIRECT FORECAST

Rolf Mirus and **Bernard Yeung**
University of Alberta, USA

(Abstract not available at time of publication)

(TITLE AND ABSTRACT NOT AVAILABLE AT TIME OF PUBLICATION)

Bernard Marois
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COUNTRY AND POLITICAL RISKS I

Chair: **Jean-Claude Cosset**
Faculty of Business Administration, Laval University, Quebec-City, Canada G1K 7P4

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Arvind K. Jain
Faculty of Management, McGill University, Montreal, Canada

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POLITICAL RISKS IN FINANCIAL MARKETS: AN INDIRECT FORECAST

Rolf Mirus and **Bernard Yeung**
University of Alberta, USA

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Bernard Marois
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THE USE OF GAMING, SIMULATION, AND MULTISCENARIO ANALYSIS FOR GEOSTRATEGIC POLITICAL-MILITARY PLANNING

Chair: **Paul K. Davis**
The RAND Corporation, 1700 Main Street, P.O. Box 2138, Santa Monica, CA 90406-2138, USA

THE RAND STRATEGY ASSESSMENT SYSTEM: A GAME-STRUCTURED KNOWLEDGE-BASED SIMULATION FOR POLICY ANALYSIS

Paul K. Davis
The RAND Corporation, 1700 Main Street, P.O. Box 2138, Santa Monica, CA 90406-2138, USA

This paper describes a large, sophisticated, and operational knowledge-based simulation for policy analysis called the RAND Strategy Assessment System (RSAS). The RSAS permits human gaming, the play of a human team against computerized political-military models, and closed simulations in which models play against models. The RSAS can therefore be used for exploring diverse strategies and scenarios (as part of the divergent thinking stage of research) and for more analytically structured and deductive forms of system analysis. Some of the models employed are highly interactive military simulations. Others are decision models designed to focus on the same issues and considerations observed in human decisionmakers. These decision models based on artificial intelligence concepts are designed to be very understandable and flexible. The process of building or adapting such models has proven to be extremely useful in illuminating dilemmas and issues that might be faced by strategic decisionmakers. The models can also be used as scenario generators, and regularly force analysts to confront troublesome issues that are ordinarily given short shrift. As a whole, the models are proving to be an important mechanism for exploring alternative futures and alternative possible crisis situations. The paper will discuss the nature of the modeling approach, its basis in the cognitive sciences, and its value to policy analysts.

GAMING THE FUTURE

Kleber S. Masterson, Jr.
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One of the most pernicious inhibitors to our ability to predict future trends is our dependence on paradigms, In almost every field, humans interpret reality in terms of models, or paradigms. While this is a useful and powerful indeed essential mental tool, it is usually accompanied by a reluctance to accept data which do not conform to the paradigms we believe and by a reluctance to drop paradigms which have become outmodel and to develop or accept new ones. New concepts in gaming are providing powerful mechanisms for explicitly addressing this problem. Examples are given for both military and industrial successes in using gaming as a method to better visualize the future.

USING GAME-STRUCTURED MULTISCENARIO ANALYSIS TO IDENTIFY CHALLENGES AND ASSESS ALTERNATIVES FOR GLOBAL POLITICAL-MILITARY STRATEGY

Paul K. Davis
The RAND Corporation, 1700 Main Street, P.O. Box 2138, Santa Monica, CA 90406-2138, USA

The RAND Strategy Assessment Center has introduced a new approach to military balance assessments and related strategic planning that emphasizes the use of multiscenario analytic war gaming to explore a wide range of possible contingencies and assumptions rather than relying upon "best-estimate" or "worst-case" analyses. The approach combines many of the best features of human war gaming and analytic modeling. This paper will discuss the approach from a generalized point of view, emphasizing the paradigmatic differences between strategic planning employing this approach rather than more traditional approaches There is a reason to believe that many of the lessons learned and techniques employed should be useful in a variety of problem domains -especially domains in which there are antagonistic parties or in which the economic and governmental environment is, in a sense, an "antagonist" to those attempting to do strategic planning.

TREND METHODOLOGY

Chair: **Jan G. de Gooijer**
Department of Economic Statistics, University of Amsterdam, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

CYCLE REGRESSION ANALYSIS: SIMULTANEOUS DECOMPOSITION OF TIME-SERIES DATA

LeRoy F. Simmons
Department of Information Systems and Decision Sciences, Loyola College, 4501 North Charles Street, Baltimore, Maryland 21210, USA

This paper makes two contributions to the state-of-the-art of time-series analysis. It provides new definitions for the four components of a time series and it demonstrates through the presentation of several illustrative examples how the model estimated by Cycle Regression Analysis results in simultaneous decomposition of the time series into these four components. Cycle Regression Analysis is a family of forecasting algorithms that employs nonlinear regression techniques to fit a sinusoidal model.

ON THE IDENTIFICATION OF THE SYSTEMATIC AND NON-SYSTEMATIC COMPONENT IN TIME SERIES' PATHS

Barend Abeln
DATABEL, Prinsengracht 508, 1017 KH Amsterdam, The Netherlands
Jan G. de Gooijer
Department of Economic Statistics, University of Amsterdam, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

After partitioning a time series into sequences of an optional but constant number of terms, every difference between consecutive terms can be broken up into two components: one which is systematic for the selected sequential length and one which is not. An entirely new approach to the separation of these components for any chosen length of sequence - irrespective of the degree of instability of the series - will be proposed. Interim company figures will be used to illustrate its effectiveness.

MULTIVARIATE AND STRUCTURAL TIME SERIES MODELS

Chair: **Per-Olov Edlund**
Stockholm School of Economics, Box 6501, S-113 83 Stockholm, Sweden

DYNAMIC FACTOR ANALYSIS

Wim Immink
Netherlands Organization for Applied Scientific Research - TNO, P.O. Box 342, 7300 AH Apeldoorn, The Netherlands

Dynamic Factor Analysis (time-dependent structure analysis) studies the relationship between observed time-dependent variables (measurements) and underlying latent time-dependent factors. A Dynamic Factor Model and its properties are presented together with a procedure which identifies the linear relations between time-dependent observations and the latent factors; moreover this procedure estimates the unique variances and identifies the latent factors as ARMA time series. Once the factor model is fitted, the Kalman filter is used to obtain factor estimates. As an example, we discuss the identification of time-dependent latent causes of the evolution of pollutants in water. Finally an illustrative example in economics is presented.

FROM A VAR MODEL TO A STRUCTURAL MODEL, WITH AN APPLICATION TO THE WAGE PRICE SPIRAL

Alain Monfort and **Roger Rabemananjara**
Institut National de la statistique et des etudes economiques, 18, boulevard Adolphe-Pinard, 75675 Paris 14, France

In this paper a VAR model is considered as a general framework in which a structural model can be tested. We carefully described the hypotheses defining a structural model; this leads us to discuss various notions such as: predeterminedness, non-causality, exogeneity, contemporaneous identification, overall identification, weak and strong structuralness. Then we propose a test procedure, based on the asymptotic least squares method, which allows to successively test each aspect of a structural model. This procedure is applied to the wage price spiral.

FORECAST OF MATERIAL CONSUMPTION AND INCENTIVE STRATEGY FOR ORDER

Yanwei Jing, Yu Sun and **Siying Zhang**
Department of Automatic Control, Northeast University of Technology, Shenyang, Liaoning, P.R. China

In this paper, the material inventory management problem is discussed. Generally, there exist three variables in the problems. They are inventory, consumption and receipts. By using the Kalman filter theory, the consumption of the material is forecast, and then an incentive strategy is presented to draw up the contract for material order. The model presented in this paper possesses the advantage that the consumer has the pre-knowledge about the material consumption, and the supplier has to supply the material goods according to the contract. Both the Kalman filtering theory and the Stackelberg game theory are tried to apply to the inventory management problems and proper success has been obtained in this paper.

A LM TEST PROCEDURE APPLIED TO THE IDENTIFICATION OF STOCHASTIC CYCLES IN TIME SERIES

R.C. Souza and **K.L.P. Vasconcelos**
Grupo de Sistemas, DEE, PUEC/RJ, Rua M. de Sao Vicente, 225, Gávea, Rio de Janeiro, RJ, Brazil

The idea of modelling a time series through its unobserved components is not new; in fact it forms the basis of the "Structural Modelling", recently proposed by Harvey, (1983). A particular formulation within this class, nown as "trend + cycle" model, was successfully used by Harvey & Souza, (1986) to model rainfall data. Differently from the traditional deterministic harmonic formulations, the cycle is now modelled by a damped sine wave which results in a stochastic component with an ARMA{(2,1) reduced form. In this paper we consider an extension of this particular class so as to include a second possible stochastic cycle component in the series. The extended model is then formulated in the frequency domain and a Lagrage Multiplier procedure is developed to test sequentially the presence of none, one or two stochastic cycles in the series being analised. The proposed procedure is applied to two real time series; the first corresponding to the annual rainfall in Fortaleza, North-East Brazil and the second to the well known sun spots data.

FORECASTING AND SOCIETY III

Chair: **Thomas Baumgartner**
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Atle Middtun
Norwegian School of Management, Postboks 4636 Sofienberg, N-506 Oslo 5, Norway

AIDS: PROJECTIONS AND POLICIES IN NEW YORK STATE

Fred **Wenstøp**
Norwegian School of Management, N-1341 Bekkestua, Norway

The system dynamics model for the future development of AIDS incidences in New York was made in cooperation with the New York State Health Department. The model shows how the rate of incidence will increase during the next 4 years followed by a temporary downturn, and then a resurge which may last as long as 15-20 years. The model is very sensitive to certain parameter values, as e.g. the current prevalence of HIV. The paper discusses the model, its projections, and the conflicting political issues which were involved.

THE ROLE OF ENERGY-ECONOMY INTERACTION MODELS IN DECISION-MAKING PROCESS: A COMPARISON BETWEEN FRANCE AND JAPAN

Régis Kalaydjian
Centre International de Recherche sur l'Environnement et le Développement, Ecole des Hautes Etudes en Sciences Sociales, 10, rue Monsieur le Prince, F-75006 Paris, France

The structure and use of energy-economy interaction models can be connected with energy decision making process. Two examples help to specify this correlation: a French model and a Japanese one, used at the beginning of the 80s. For both cases we compare: - the structural peculiarities of each model, which can explain their specific uses; - the outlines of French and Japanese energy policy backgrounds within which the models were used. The conclusion emphasizes that each model reflects rather than leads the energy decision making process in both countries.

EPISTEMOLOGICAL AND NORMATIVE ISSUES IN KNOWLEDGE-BASED HEALTH SYSTEMS ANALYSIS; Towards a methodology for health forecasting and planning specially adapted to the Third World context

Bernd **R. Hornung**
Institute of Medical Informatics, Philipps-University Marburg, Bunsenstr. 3, D-3550 Marburg, Federal Republic of Germany

For the forecasting of the behavior of social systems involving non-quantifiable, e.g. normative aspects, like health care systems, a qualitative approach has been developed using the DEDUC-program, a shell for qualitative modelling. Its epistemological basis is cognitive systems analysis, which permits to take into account recent developments in cybernetics (autoposies) and in informatics (knowledge-based systems). The paper discusses fundamental problems and potentials of such an approach and its particular adequacy for health planning and forecasting under the conditions of Third World countries.

FORECASTING THE SOCIAL IMPLICATIONS OF STRUCTURAL CHANGES IN SCIENCE

Ota **Sulc**
Institute for Philosophy and Sociology, Czechoslovak Academy of Sciences, Praha 1, Jilská 1, Czechoslovakia

The first prerequisite for the integration of world science into the process of the intensification of the economy of small, industrially developed countries, is the selection of world scientific forecasts according to basic problem situations of science policy making: 1. connected with the generation of societally relevant knowledge, 2. connected with the creation of societal goals for science, 3. linking supply side with demand side for science. The second prerequisite is the arrangement of scientific forecasts into the so called Science Forecasting Field, which represents a relatively stable methodological form and structure for identifying links between three structural elements and forecasts of their development: 1. state of the art in the scientific fields (disciplines and specialities), 2. scientific and scientific-technological themes for basic research, 3. scientific problematics synthesizing elements of basic research results and serving as models of the development of science.

FORECASTING AND SOCIETY IV

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FORECASTING AND THE REALISATION OF MAJOR TECHNOLOGY PROGRAMMES. METHODOLOGICAL REFLECTIONS ON TWO LONG-TERM FORECASTS OF THE FRENCH ENERGY TRANSITION

Jean-Charles Hourcade
CIRED, 10 rue Monsieur le Prince, F-75006 Paris, France

The paper discusses the epistemological conditions under which models are used. The research is focussed on the links between technological choice, the economy and societal development and the ways they can be represented in forecasting models. This argument is illustrated with a comparative analysis of two recent forecasts of the French long-term energy future that will reveal the opposite ways of proceeding with the analysis and the different conclusions reached. The two different approaches are compared with respect to the linkages between energy consumption and economic activity, the reverse effects of energy production on macro-economic equilibrium, and between energy and industrial processes.

ENERGY FORECASTING. THE EPISTEMOLOGICAL CONTEXT

Michael Kraus
International Energy Agency, 2 rue André Pascal, F-75775 Paris, France

Long-term energy forecasting has traditionally been a major concern of applied systems analysis. In interdisciplinary research approaches, economists, engineers, natural and social scientists have developed complex models to predict the future behaviour of systems. Influenced by the technical nature of systems analysis, uncertainties in a model and its predictions have primarily been understood as a function of the quality of the model design. Deviations observed between forecasts and actual developments have thus been considered a property of the model. This paper contributes to this discussion looking at the structural features of any forecast. The paper is complemented by an investigation of the factors that explain the errors in the energy prognoses for the FRG from 1950 to 1980.

REFLEXIVITY IN SOCIAL AND ECONOMIC PREDICTION AND ITS CONSEQUENCE FOR PREDICTIVE ACCURACY

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(Abstract not available at time of publication)

ASYMMETRIC DYNAMIC PROCESSES

William F. Hahn
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An Asymmetric Dynamic Process, ADP, is a new type of stochastic process for use in modeling and forecasting. An ADP is generated in a two step procedure. Initially, the direction of change is determined. Conditional upon this direction the absolute magnitude of the change is then determined. This paper discusses the estimation of a class of ADP's where both the direction and the magnitude of change are determined by a single, normally distributed variable. The parameters of the ADP are used in probit analysis to forecast the direction and the magnitude of the process.

FORECASTING PRESIDENTIAL POPULARITY

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Pami Dua
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Economists and political scientists have long recognized the important influence that inflation and unemployment exercise on presidential popularity. We have constructed a nonlinear model in which lagged inflation and unemployment variables pay key roles in successfully explaining the popularity of presidential performance with respect to the economy as measured by the University of Michigan Survey Research Center. This work is completed. We are now applying our nonlinear model to forecast presidential popularity as measured by Gallup Poll data generated by answers to the question "Do you approach or disapprove of the way Mr. ..... is handling the job of President?"

ENGINEERS AND THE FORECAST OF ACCIDENTS AND CATASTROPHIES: ASPECTS OF THE SAFETY PHILOSOPHY IN NUCLEAR POWER TECHNOLOGY, PART 1 (TENTATIVE TITLE)

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(Abstract not available at time of publication)

FORECASTING BY LATTICE & OTHER STATISTICAL ALGORITHMS

André Klein
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TIME SERIES MODELLING AND FORECASTING WITH ADAPTIVE LATTICE FILTERS

Anna Badach
Department of Economics. University of Gdansk, Armii Czerwonej 101, Pl 81-824 Sopot oland

The development of new techniques for modelling and forecasting of time series has been enhanced by increasing performance capabilities of computers. Parametric modelling of the observation is a part of data analysis before decisionmaking, connected with the requirement of information compression during time series features extraction. The paper deals with some adaptive (order- and timerecursive) methods and algorithms for parameter estimation of AR-models and predictors with lattice structure and their applications. The autocorrelation formulation of linear prediction problem leads to the order-recursive Levinson-Durbin algorithm and the partial correlation formulation allows to develop the order and time-recursive Burg algorithm.

SIMULATING ' 'ORECA

Alain Berlinet
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In the practice of forecasting by means of statistical methods the generation of artificial series takes an important place. For a large class of models this generation requires the building of sequences of independent identically distributed random variables with given (or estimated) laws. Many algorithms are known for such a purpose with their qualities and defects. This paper describes an algorithm based on random geometry which generates samples of any probability law from a sequence of uniform pseudo-random numbers. Its advantages are the following: * an a priori goodnesss of fit is imposed; * the sample is ordered; * only the knowledge of the probability density function is required; * no inversion of the cumulative distribution function is needed; * it works in any dimension.

SUBJECTIVE PROBABILI Y AND XPECTED Y W 'HOUT DDITIVI'

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An act maps states of nature to outcomes; deterministic outcomes as well as random outcomes are included. Two acts f and g are comonotonic, by definition, if it never happens that $f(s) > f(t)$ and $g(t) > g(s)$ for some states of nature s and t. An axiom of comonotonic independence is introduced here. It weakens the von Neuman-Morgenstern axiom of independence as follows: If $f > g$ and if f, g and h are comonotonic then $\alpha f + (1 - \alpha)h > \alpha g + (1 - \alpha)h$. If a nondegenerate, continuous and monotonic (state independent) weak order over acts satisfies comonotonic independence then it induces a unique non-(necessarily-) additive probability and von Newmann-Morgenstern utility. Furthermore, expected utility with respect to the nonadditive probability, as defined here, represents the weak order over acts.

FORECASTING METHODS BY LATTICE ALGORITHMS

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In this paper we present a forecasting package based upon Lattice theory. VAR methods have been used by Litterman as an interesting modeling and forecasting alternative to Box-Tiao powerful methods. Lattice theory provides powerful adaptive forecasting method that can be used in on line applications. The software developed by us includes: a canonical simulator for multivariate time series models; univariate and multivariate forecasts using lattices; forgetting factors to accommodate changes in volatility and parameter instability.

LOGISTIC REGRESSION CONFIDENCE INTERVALS OF PREDICTED PROBABILITIES: A TUD OF MODEL CONCORDANCE

Edward J. Lusk, L. Braitman, D. Schultz and **P. Hildebrand**
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The authors examine the difficulties in identifying specific model departures from the maximum likelihood model and the consequent effect on the model probabilities.

THE PAST AND FUTURE OF FORECASTING

Spyros Makridakis
European Institute Busines: dministration, Bou

RESEARCH NEEDS 'ORE

J. Scott Armstrong
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ıe demand for research on forecasting is strong. This conclusion is based on the high number of citations to papers published out research on forecasting and upon the subscriptions for journals devoted to forecasting. The supply of research papers is ;o strong following a rapid growth in the 1960s and 1970s. This research has produced important findings. However, compari- n of this supply with the needs expressed in two surveys of academics and practitioners showed that numerous gaps exist. ıe research that is being produced does not match up well against the research desired. Suggestions are made as to wha search is needed and how the research should be conducte

SEVEN DEADLY SINS OF FORE AS'

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At no time in recent history has uncertainty at the economic, industry, and individual-business level en greater, and the need for good forecasting more apparent. Forecasters have been developing sophisticated methodologies, ata bases, and computer programs to support their function. Yet, at least in the United States, many companies are eliminatin downgrading, or dispersing their economists and forecasters. This talk will discuss, and suggest how to avoid, a number of 'sins' frequently committed by forecasters which, in the view of the speaker, have gravely diminished their credibility to ma

PITFALLS OF ECONOM FORE

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Frans A. van Vught
ubli Administrat Jniv ity Rapen eiden herlan

In this study pitfalls of economic forecasting arise in two forms: (1) as fallacies, i.e. as violations of one or more logical principles; (2) as methodological errors, i.e. as violations of the principles associated with the hypothetical-deductive approach and/or ignoring important dissimilarities between physical sciences and social sciences. The following pitfalls are studied: the post hoc ergo proper hoc fallacy, the fallacy of basing predictions on a circulus vitiosus, the pitfall of measurement without theory, the pitfall of integrating theories, the pitfall of corroboration, the pitfall of intuition, the pitfall of scientific determinism, the pitfall of subjectivism c.q. irrationalism, the pitfall of conventionalism c.q. psychologism. Pitfalls of economic forecasting are discussed within an econometric framework, taking a dynamic simultaneous equation model (DSEM) as a starting-point. The specification of the DSEM will be used to outline important dissimilarities between physical sciences and social sciences. By way of conclusion we discuss the main reasons why economic forecasts are in general less reliable than forecasts based on physical theories.

IMPROVING FORECASTING ACCURACY

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TIME-VARIATION IN ECONOMIC RELATIONSHIPS: A FORECASTING PROBLEM

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It is a well-known fact that many fixed coefficient specifications of macroeconomic relationships exhibit episodic breakdowns. Forecasting must, therefore, accept that structural changes in the data do take place. A major test for all forecasting methods then becomes how well their response is in a changing environment. For forecasting univariate time series, the Multi State Kalman Filter approach developed by Harrison and Stevens (1971, 1976) and cast in a discounting framework by Ameen and Harrison (1985) has proved to be a successful device. In many economic applications, however, valuable information is contained in other observable variables, so that a multivariate approach can be preferable to a univariate one. In this paper we therefore extend the Multi State Kalman Filter method to include exogenous regressors and use it to investigate the changing relation between real interest rates and inflation.

MODELLING THE FORECAST REVISION PROCESS: A PATH ANALYSIS

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This paper extends the authors' previous work on the subjective revision of sales forecasts generated by a quantitative (extrapolative) model. Specifically, a path model of the forecast revision process is specified and tested, utilising forecast information obtained from an industrial company and relating to 868 products. The main variable of interest is the improvement/degradation in the forecast resulting from subjective revision by management, the focus being on the direct and indirect effects of different influences impinging upon the effectiveness of revision. Based on theoretical expectations, a six-variable path model is constructed, involving (a) the volatility of past demand, (b) the past performance of the extrapolative model, (c) the past revision patterns, (d) the forecast produced for the model for the current (i.e. decision-making) period, (e) the revision applied to this forecast, and (f) the improvement in forecast accuracy obtained as a result of revision. Following estimation of the path coefficients, a non-significant path is removed and the model re-estimated in its reduced form. All estimated linkages are consistent with a-priori expectations, thus lending support to model's suitability as a representation of the forecast revision process; the results are discussed in the context of previous evidence on subjective revision and directions for future research are identified.

FORECASTING IN AFRICA: PROBLEMS AND DIFFICULTIES. A NEW APPROACH

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Homogeneity and sufficiency of data are needed in regression modelling, and stability of the dynamics of economic indicators assumed to be maintained in the future is necessary for using such models in forecasting. These basic conditions are scarcely satisfied in most part of Africa because of the existing objective problems. The author suggests a methodology of Covariance modelling for forecasting. The different approaches for calculating forecasting errors and confidence intervals, suggested by the author (a problem which the author has no concrete solution to) will be discussed.

INDUSTRIAL COMPETITIVENESS

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PREDICTING MARKET SHARES AND COMPETITIVE BEHAVIOUR USING SAMPLES OF DIFFERENT MARKETS

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The paper deals with short-term forecasting of market shares using market share models. The predictive power of market share models is a subject that has received considerable attention in marketing literature. However, hardly any attention has been paid to the question of how the values of the marketing instruments of competitors can be predicted. In this paper the sensitivity of predicted market shares to different assumptions with respect to competitive behavior is investigated.

COMPETITIVENESS MEASUREMENT AND CASH FLOWS

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The correlation between accrual and cash flow ratios has been studied scarcely. In larger scale this was done by Ketz & Combola. The authors did not study, however, whether the correlation would have been higher with leads or lags between different types of flow concepts. In the present paper the author has applied cash flow information in competitiveness measurement and analysis. The leading character of cash flow information between Finnish and Swedish total manufacturing is related to unit labour cost information collected from OECD statistics. The competitiveness indicator of the Finnish paper industry in relation to the Swedish one lagged by two years correlated very strongly with the changes of corresponding market shares.

FORECASTING COMPETITORS' ACTION: A MULTIDISCIPLINARY PROBLEM - FOCUSED REVIEW

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The task of forecasting competitors' actions is often an important part of the development of strategy. The paper offers a systematic evaluation, resulting in the identification of some promising direction for research in competitor analysis: (1) Development of experts and duplication using expert systems, (2) Modelling subproblems (e.g. Buyer Models) and (3) Factor analytic studies.

FORECASTING SALES AND PRODUCTION OF SYNTHETIC ORGANIC CHEMICALS USING A MICROCOMPUTER

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Models were created for short-term forecasting of sales volume and production for eight organic chemicals using a microcomputer. BASIC computer programs FORECAST, STEPWISE and EPISTAT were used in a four-phase, forecasting process that included data collection, exponential smoothing, regression analysis and model evaluation. Correlation coefficients for all models ranged from 0.964 to 0.690. Eighty-eight percent of all models had correlation coefficients greater than 0.80 and 50% were greater than 0.90. Actual data for all chemicals in this study were within 99% confidence limits for all models, demonstrating that accurate, short-term forecasts can be made with the proposed models.

STRATEGIC PLANNING I

Chair: **Lajos Besenyei**
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EFFECTIVELY MANAGING MICROECONOMETRIC MODELING FOR CORPORATE STRATEGIC PLANNING: A PERSPECTIVE

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This paper provides a perspective on some important but often ignored philosophical and methodological considerations in econometric model development and management that are necessary to effectively position microeconometric modeling as the analytical tool that best supports the management of corporate performance objectives. Issues such as structural integration, variable selection, information content of regression error terms, and consistency are discussed. Experience shows that microeconometric modeling can produce an effective forecasting system if it is properly conceived, properly applied, and properly managed. But, more importantly, it has the potential of laying the structural foundation for a market information system that acts as a repository of business intelligence for effective corporate strategic planning.

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

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

STRATEGIC PLANNING USING PORTFOLIO ANALYSIS AND MULTIVARIATE FORECASTS

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In this contribution we present a normative model for strategic planning using portfolio analysis. Most portfolio models use an implicit forecasting of the returns that is very naive. It assumes independence among the items of the portfolio and a poor estimation of the risk matrix. These assumptions may be reasonable for the stock market but hardly realistic in BUS models. We include a VAR method of forecasting returns and an efficient estimate of the risk matrix. Dynamic factor analysis through forecasting innovations can be used to take account of synergic effects when a simplified version of the full model is used.

STRATEGIC PLANNING II

Chair **Nicolas V. Danila**
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STRATEGIC MANAGEMENT AND FORECASTING IN THE NETHERLANDS: A SURVEY

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Many corporations nowadays are familiar with the concept strategic management. In strategic management processes the manager can be supported by forecasting methods and techniques. Our research interest concerns mainly the latter. In this paper we'll show in how far Dutch corporations make use of the possibilities forecasting offers. More specific our research aims at: Which forecasting methods and techniques do large corporations use on behalf of their strategic decision processes. To obtain answers on these and other more detailed questions we approached the top 100 of Dutch corporations of the weekly "Financieel Economisch Magazine" (1987). As far as we know such research has not been done systematically in "The Netherlands since that of Keuning, Eppink and De Jong (1976). The paper has the following structure. First we dwell on the subject strategic management process. Then we choose the forecasting methods and techniques which can be used theoretically in strategic management processes, guided by some defined criteria. Finally we show which methods and techniques are actually used, with what purpose, by the examined corporations.

ON THE CRITICAL SUCCESS FACTORS CONCEPT IN STRATEGIC CONTROL SYSTEMS

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In this paper the problem of applying the critical success factors (CSF's) concept to strategic control in business is considered. It is shown how CSF's can be used to establish criteria for estimation of the strategic behaviour of business organizations. By means of CSF's it is possible to forecast at a certain confidence level the future state of the firm. Appropriate forecasting methods for building up CSF's trajectories are also discussed. The approach was applied to the specific economic conditions in Bulgaria and the results confirmed the effectiveness of the method in management practice.

ALADIN: A TOOL FOR STRATEGIC PLANNING

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ALADIN method was first used for the management of R & D projects and programs in general and for the evaluation and selection in particular. The multi-dimensional model works on checklists, matrices, multicriteria, consensus and graphic aspects. The first part of the paper will present that method. A broad industrial utilization of that approach leads us to propose it also for the formulation and the implementation of strategic planning. The integration of strategic planning with other control systems such as budgets, information and reward systems is facilitated by the use of ALADIN method. The second part of the paper will present the contribution of that tool to strategic planning.

STOCKS, EARNINGS & EFFICIENCY

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FORECASTING SEASONAL EARNINGS PER SHARE

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The purpose of this paper is to compare the accuracy of four forecasting models for monthly earnings per share data, a seasonal time series. The four models are Holt-Winters exponential smoothing model (HW), Box-Jenkins ARIMA Modeling (BJ), linear regression of data deseasonalized by the Census II-X11 method (X11), and linear regression of data deseasonalized by the X11-ARIMA method (X11ARIMA). Study of earnings per share data is important because (1) these data exhibit all the systematic components of a time series, (2) earnings per share forecasts are important for purposes of financial decision making and strategic planning, and (3) previous studies of earnings per share data did not compare these four forecasting models. SAS forecasting procedures are used.

EXPECTED RETURNS, EARNINGS TIME-SERIES AND EARNINGS RESPONSE COEFFICIENTS

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The purpose of this study is to compare alternative estimates of the coefficient (the earnings response coefficient (ERC) that relates accounting earnings to stock prices. Academic researchers have used unexpected returns and levels regression methods to estimate this coefficient. The financial media and Wall Street, however, appears to focus on the price to earnings ratio. Despite the economic equivalence of the various forms of the ERC empirical estimates differ considerably. The expected security returns implied by estimates of ERCs from levels regressions and PE models are plausible while the returns from unexpected returns models are too high to be realistic.

COMPLEX DYNAMICS ON STOCK EXCHANGE MARKET

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Alain Lesage
IRES, Catholic University of Louvain, Belgium
Michèle Sanglier
Institute de Physique-Chimie Solvay, Free University Brussels, Belgium

A dynamic model of price formation on the stock exchange market is derived from the concepts underlying dissipative structures. It is shown that the global efficiency of the market is very much dependent on the existence of a minimum proportion of high-risk takers. Introduction of telecommunication which accelerates information flows is viewed in this perspective. Moreover, we show how an external prediction about the future evolution of prices may be self-realizing.

FURTHER EVIDENCE AGAINST THE EFFICIENCY OF FUTURES MARKETS

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Part 1 of the paper emphasises that profitable forecasts of futures prices are possible even when there is little autocorrelation among price changes. Part 2 provides trading results for 1982-5 using published trading rules that seek to exploit price trends and are known to have performed well up to 1981 (S.J. Taylor, Modelling Financial Time Series, chapter 8, John Wiley and Sons, 1986). Results are given for commodity and currency futures net of trading costs. Risk is considered.

TECHNOLOGICAL FORECASTING I

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MODEL SELECTION IN TECHNOLOGICAL FORECASTING

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There is a considerable variety of ways in which the stochastic element can be incorporated into a logistic or Gompertz scheme for forecasting technological growth. After reviewing these alternatives, we indicate now a choice may be made between them using appropriate diagnostic tools. The performance of these diagnostics is evaluated using both simulated and actual series.

ANOTHER LOOK AT TECHNOLOGICAL SUBSTITUTION MODELS

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Conventional models of the technological substitution process like that of Fisher-Pry are based on deterministic differential equations. In contrast this paper considers approaches designed to explicitly model the stochastic nature of substitution. A range of models will be described, a comparison of the modelling and forecasting performances will be presented and discussed.

FORECASTING TECHNOLOGICAL SUBSTITUTIONS WITH SHORT TIME SERIES

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It has been shown in the literature that the data of technology substitutions exhibit a strong correlation across different time periods, i.e., a strong serial correlation. Significant improvement in predicting such substitutions has been achieved by incorporating serial correlation and power transformation parameters into four growth curve models. The modified models, or data-based transformed (DBT) models, however, break down when the number of time points is small. This paper proposes a generalized growth curve model for forecasting technology substitutions with short time series. The model combines the concepts of power transformations and repeated measurements with a common serial covariance structure. Concurrent time series for several cases provide the repeated measurement requirement of the model. Improvement in forecasting accuracy by using this model is demonstrated with two sets of telephone data.

ESTIMATING TECHNOLOGICAL PROGRESS: THE QUANTITY ELASTICITY OF SUBSTITUTION

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One can easily draw the conclusion from the existing body of literature that the only important elasticity of substitution in production decisions is the price elasticity of substitution. In this paper I have attempted to capture technological progress directly by determining the quantity elasticity of substitution at the firm level. It is generally agreed that a large part of technological progress is attributed to the extent that capital is being substituted for labor in this high tech environment that we find ourselves in. It is this very statistic that is determined from this study along with many other interesting statistics. Sixteen tables are presented with information for all the companies studied presented in each table. No statistics nor companies have been omitted from the tables as this permits an easier interpretation and comparative analysis. Even insignificant statistics have been reported to maintain continuity and easy comparisons. The table of means shows some very comparable and interesting statistics. Although it is recognized that time series data does not lend itself very easily to meaningful means, the means were determined from percentage data in this study and accordingly can be given considerable credence.

FORECASTING INDUSTRIAL MARKETS AND TOURISM

Chair: **Steve Witt**
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STRUCTURING A NEW STRATEGY FOR INDUSTRIAL BENEFITS

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The changing structure of foreign country imports or industrial benefits has received increased attention over the past five years, by managers of advanced technology companies. In particular, technology offsets are being used by newly industrialized countries to forge a bold new trade strategy in order to become major players in this costly competitive game. The consequence of these compensatory arrangements has placed increased emphasis on developing strong linkages through licences, coproduction, turnkeys and marketing knowhow. The principal focus of this paper is to examine technology offsets, a form of industrial benefits, in light of the dynamics of negotiating contracts from the international manager's perspective. In addition, an agenda for future technology offset undertakings is examined in which influencing variables are separated in order to best understand the renewed competitive behavior of the principal actors. The author has researched twenty-five high-tech companies which provide excellent case studies to support the theme of the paper.

LONG TERM PROSPECTS FOR FRENCH PRODUCTION SYSTEM

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The scheduling of large-scale investments in energy production and transmission is a delicate exercise, a risky wager concerning the long-term development of requirements and, therefore, economic performance. As such, it is vital for French electricity and gas companies to have a representation that is as close as possible to the latter, particularly as regards to large energy consuming industries. For this reason, EDF and GDF asked the Bureau d'Information et de Prévision Economique to set up a permanent structure for long-term forecasting of the French production system, associating macroeconomic, sectoral experts and company economists with a coherent inter-sectoral model for the production of quantified scenarios. After a quick presentation of the DIVA inter-sectoral model, we shall describe the conditions of its use in 1987 as well as the main characteristics of the scenarios envisaged for the year 2010 for the French economy.

FORECASTING AND GOVERNMENT INDUSTRIAL POLICIES

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Accurate forecasting is at the heart of the industrial development policies of any government seeking to ensure that its country's future industrial structure will be comprised of new, dynamic industries. It must be able to pinpoint industries with potential for high growth - it has to be able to "pick winners". Many governments have tried to do this, some using sophisticated methods, some relying on little more than hunches. This paper will examine the methods employed by several developed countries in Europe, North America and Asia, describe their conclusions and assess their degree of success.

FORECASTING TOURISM DEMAND: A COMPARISON OF THE ACCURACY OF SEVERAL QUANTITATIVE METHODS

Stephen F. Witt and **Christine A. Martin**
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Forecasting accuracy is examined in the context of international tourism demand. Seven quantitative forecasting methods are used to generate out of sample forecasts for tourist flows across twenty-four origin-destination pairs, and two forecasting horizons. Two alternative accuracy measures are used to evaluate forecasting performance. Statistically significant differences in forecasting accuracy are identified using the ANOVA and Scheffé tests. Several of the simple forecasting methods produce more accurate forecasts than econometric forecasts. As expected, one-year-ahead forecasts are more accurate than two-years-ahead forecasts. Aggregation of data series appears to reduce forecasting accuracy slightly.

TECHNOLOGICAL FORECASTING II

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METHOD FOR TECHNOLOGICAL FORECASTING BASED ON ENERGY AND INFORMATION

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A method for technological forecasting based on energy and information is proposed. Determination of objective laws as regards to evolution of a given technical and economical system S is based on investigation of 'work' performed, that is, the consumed 'energy' in the process of its evolution. Both work and energy are described by means of information in its semantical aspect. The evolution of the system S is investigated as a manageable movement from one state to another with a new quality of S in the multidimensional morphological space.

PROBLEMS OF FORECASTING TECHNOLOGICAL BENEFITS FROM REVOLUTIONARY SCIENCE: THE CASE OF SUPERCONDUCTIVITY

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No area of scientific research seems more promising than superconductivity. Recent developments in superconductivity research, particularly the ability to achieve superconductivity effects at ever higher temperatures, has ushered visions of a rich array of new technologies flowing from this revolutionary science. While technological forecasters have made some progress in understanding the flow of technology from science, even revolutionary science, forecasts made at the zenith of the revolution are particularly fraught with problems. However, it is not possible to retreat from such forecasts as judgments about business and government investments in superconductivity research are decidedly linked to assessments to likely technological payoffs. After outlining some of the problems in assessing technological payoffs from revolutionary science, this paper focuses particularly on superconductivity and its implicit lessons for technological forecasting.

TECHNOLOGICAL FORECASTING IN DEVELOPING COUNTRIES

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The special role technological forecasting plays in all planning activities, at different socio-economic levels, is analysed especially in relation to the problems of technological development strategy determination at different socio-economic levels. Attention is paid to the specific features and role technological forecasting plays in developing countries having in mind the most common and widespread one-sided technological transfer present in these countries today. The main tasks of technological forecasting, and the most suitable methodology adapted to fulfill these tasks are the main issues analysed in this paper.

THE ROLE OF STANDARDIZATION ACTIVITIES IN DIFFUSING NEW TECHNOLOGIES IN A COMPETITVE MARKETING ENVIRONMENT

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Inspite of optimistic forecasts at the time of introduction, sales of many new technological products fail to grow. Often, rapid growth in sales of new technologies depends on the sponsors success in diffusing common standards industrywide, particularly when user interconnections or complementary products are critical elements of the technology. Good examples are videotex or personal computers. However, once standardization is achieved, competitors, drawn to the large base of established users, can "pirate" markets from the innovator. This paper explores the role of standardization in building technology growth forecasts. It also identifies options open to companies to foster standardization and growth of new technologies while attempting to retain market share.

ASSESSMENT OF MARKET IMPACT OF SOCIALLY SENSITIVE TECHNOLOGY

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New nuclear technology made it possible to propose small heating only reactors with very much improved safety characteristics. In order to establish the necessary forecasting scenarios of a possible market impact with due consideration of a very much politically influenced decision process to commission such systems, use of system dynamic analysis was made. By modelling the decision process proper, taking into account the established procedures and delays, a forecast of the quantitative [illegible] market was obtained. Analysis of the simulated decision process allowed to gain an understanding of bottlenecks and critical timings of the market evolution to be expected.

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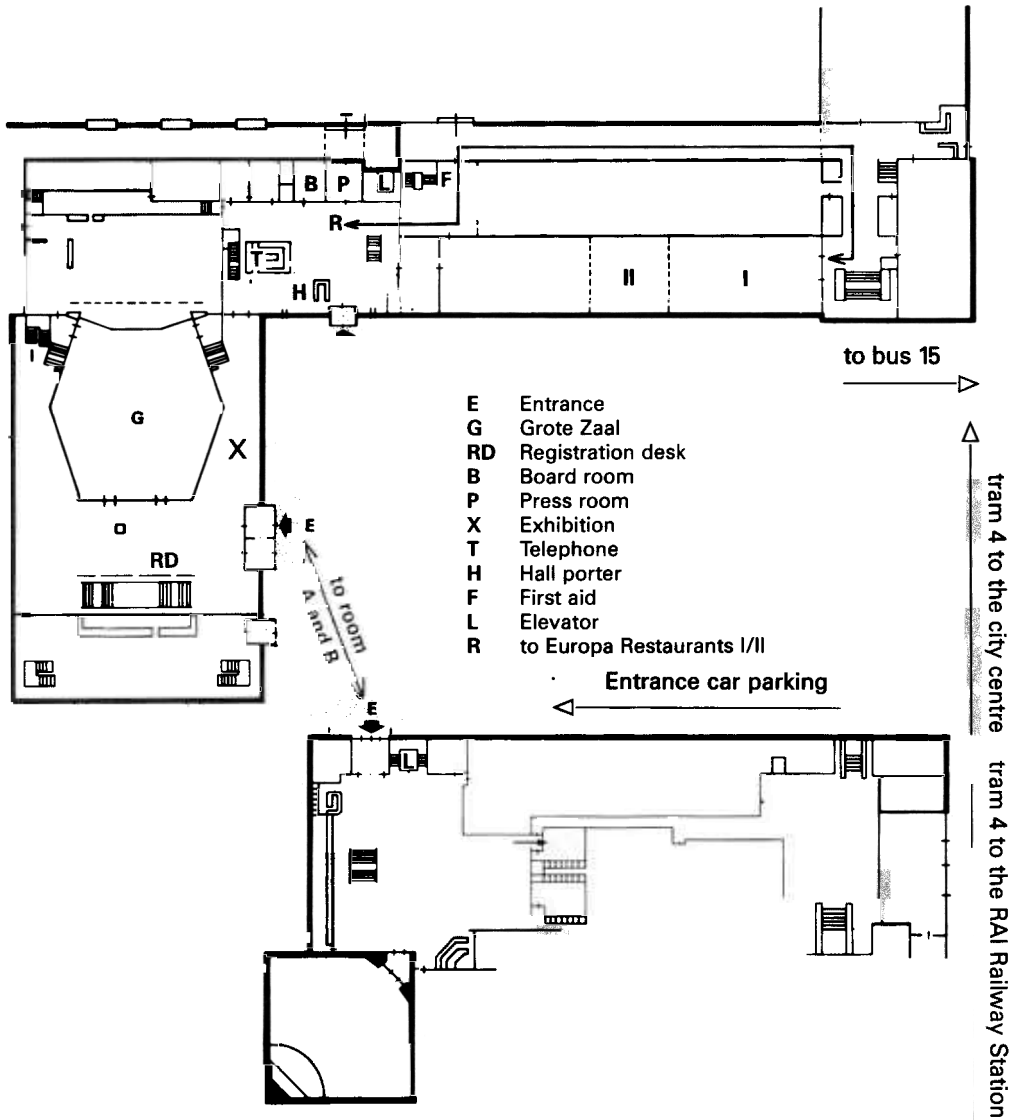

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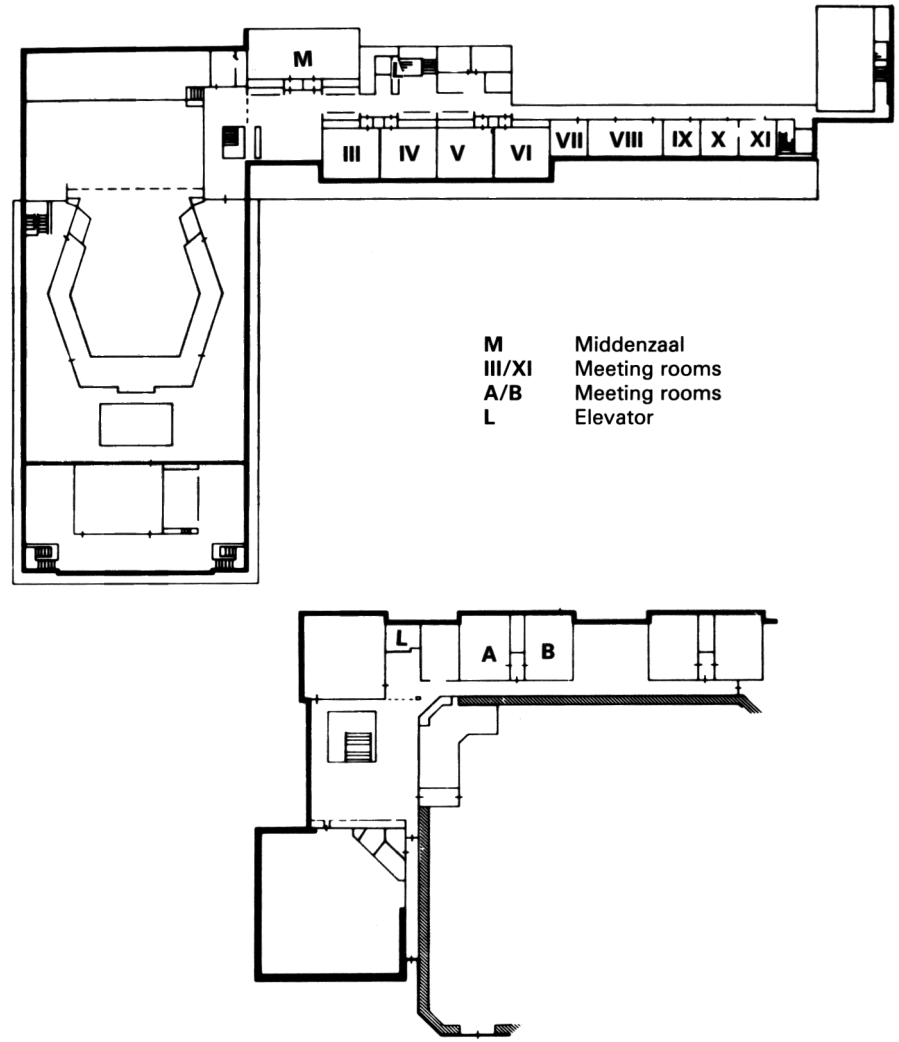
R to Europa Restaurants I/II

First floor



M Middenzaal
III/XI Meeting rooms
A/B Meeting rooms
L Elevator

THE NINTH INTERNATIONAL SYMPOSIUM ON FORECASTING

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