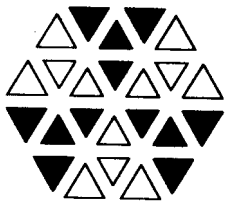
ISF 84
LONDON PROGRAMME

FOURTH INTERNATIONAL SYMPOSIUM ON FORECASTING

FOURTH INTERNATIONAL SYMPOSIUM ON FORECASTING
8–11 JULY 1984



SPONSORSHIP

This Symposium is unique in that a number of organisations have given generous sponsorship. This has been used to support participation from speakers who would otherwise have been unable to attend, and it has also had the effect of considerably broadening the Symposium's scope. The principle sponsoring organisations are:

the Economic and Social Research Council, London,
Shell International Petroleum Company Ltd.,
Her Majesty's Treasury

with additional support from:

the Bank of England
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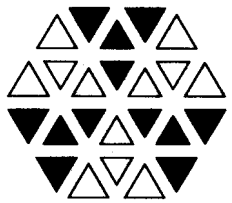
The Conference Committee wish to thank them all for their help.

ISF 84 is sponsored by the INTERNATIONAL INSTITUTE OF FORECASTERS & THE MANCHESTER BUSINESS SCHOOL



OBJECTIVES

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

BENEFITS

IIF provides information on:

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

IIF currently has two major vehicles for providing information:

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

DIRECTORS

Robert Carbone, Laval and McGill Universities, Québec, **CANADA**

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

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FOUNDING PARTNERS

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

ISF 85

The Fifth **International Symposium on Forecasting** will be held
in **Montreal, Canada** on **June 9 – 12, 1985**
at the **Queen Elizabeth Conference Centre**

sponsored by the **International Institute of Forecasters**
in collaboration with the **Faculty of Management, McGill University**

Send abstracts of not more than 100 words to:
IIF c/o Dr. Estela Bee Dagum, Faculty of Management, McGill University, Montreal, Canada H3A 1G5
Telephone 514-392-4251 Telex 05-268-510

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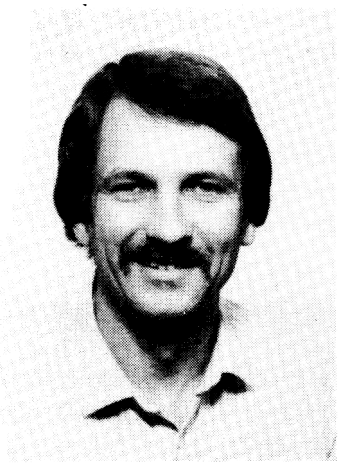
Conference Administrator

Robert Fildes
General Chairperson



Dick Baillie
Econometric Forecasting

Alan Budd
Macroeconomic Forecasting

Andrew Harvey
Time Series Methods

Larry Phillips
Judgement

Brian Twiss
Social and Technological Forecasting

Phil Holroyd
Social and Technological Forecasting

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London

THE FOURTH INTERNATIONAL SYMPOSIUM ON FORECASTING

LONDON, ENGLAND
July 8—11, 1984

GENERAL CHAIRPERSON and Financial and Business Applications
Robert Fildes
Manchester Business School
Booth Street West
Manchester M15 6PB
Tel: 061-273 8228

CONFERENCE COMMITTEE

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University of Birmingham
Birmingham B15 2TT
Tel: 021-472 1301

Macroeconomic Forecasting
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London Business School
London NW1 4SA
Tel: 01-262 5050

Time Series Methods
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Department of Statistics
London School of Economics
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Tel: 01-405 7686

Judgement
Larry Phillips
Director, Decision Analysis Unit
London School of Economics
London WC2A 2AE
Tel: 01-405 7686

Social and Technological Forecasting
Brian Twiss/Phil Holroyd
c/o Strangford
56 Ben Rhydding Road
Ilkley
West Yorkshire LS29 8RN

Welcome to London and the Fourth International Symposium on Forecasting. For those of you who are newcomers here, it follows on from the earlier successful Symposia in Quebec City, Istanbul and Philadelphia. Many of you are 'repeat buyers' and have decided to come on the straightforward grounds that earlier Conferences have demonstrated their usefulness, either for improving forecasting practice in the organisation or stimulating new research ideas.

Newcomers no doubt have similar expectations but with some misgivings. We hope you won't be disappointed. This first major European venture of the International Institute of Forecasters has been organised slightly differently than earlier Symposia but with the same aim – to improve the quality of forecasting practice through the interchange of ideas and experiences between forecasters working in government, business and academia.

The Symposium is organised into six major streams, and the individual stream organisers have been primarily resonsible for putting together their stream of papers. I would like to thank them for their efforts. On the following pages we have summarised the sessions in each stream to provide a more straightforward guide for conference attendees with specific interests.

*The **Manchester Business School** and many of its staff have helped me substantially in giving the professional service that these Symposia need. MBS has also actively supported the **Journal of Forecasting** since its founding. Without that help neither this Symposium nor the UK activities of the Journal could have been successfully carried out.*

On behalf of the Organizing Committee we wish you an enjoyable Symposium. If you've any complaints our pictures are on the left of page for the purposes of identification!

Robert Fildes
General Chairperson, ISF84
Manchester Business School

Conference Venue
London Business School

Sponsored by
The International Institute of Forecasters
in collaboration with the **Manchester Business School,**
University of Manchester, England Tel: 061-273 8228 Telex: 668354

All
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ADMINISTRATIVE DETAILS

REGISTRATION

All delegates should check in at our registration desks The locations and times are as follows:

SUNDAY 8TH JULY from 2 p.m - 6 p.m

White House Hotel	*for registration of White House, Regent Crest and Grafton residents only.*
Sherlock Holmes Hotel	*for registration of Sherlock Holmes Hotel residents only.*
London Business School	*for all residents of the London Business School and delegates not booked into the above hotels.*

MONDAY 9TH JULY from 8 a.m. - 4 p.m. at London Business School only.

Late registrations can be made at the Conference Office room SG02.

CONFERENCE OFFICE

A permanently staffed conference office is situated in room SG02 at the London Business School to help you with any enquiries or further information about the conference. The Conference Office will be open from 8.30am-6pm each day.

BADGES

Please ensure that you wear your ISF 84 Badge as this serves as a pass for all programme sessions, lunches and social events.

CHECK-OUT REGULATIONS

All delegates are responsible for paying their own hotel accommodation expenses; hotel deposits retained by us will be credited directly to the appropriate hotel accounts.

PUBLIC TELEPHONES

Telephones are located on the ground floor of the London Business

MESSAGE CENTRE

A message centre is available in the reception area of London Business School together with a bulletin board for personal messages.

COPYING SERVICE

Copying services can be obtained at the London Business School at a cost of 5 pence per sheet (7 cents). Please bring all papers for photocopying to the Conference Office.

ADMINISTRATIVE DETAILS

INTERNATIONAL INSTITUTE OF FORECASTERS

Information concerning membership of IIF and subscriptions to the Journal of Forecasting will be included in our Registrant information packs. We will also be pleased to help with any enquiries you may have on the Fifth International Symposium on Forecasting (ISF 85) to be held in Montreal. And for those who really like to plan ahead, ICF86 is in Paris.

PROGRAMME BOOK

Further copies of the above are available from the Conference Office at $10 per copy and, after the Conference, from Robert Fildes at the Manchester Business School, Booth Street West, Manchester M15 6PB. Please send a cheque for $15 to cover postage and packing.

EXHIBITION OF BOOKS AND JOURNALS

There will be an exhibition of books and journals related to forecasting in the London Business School Bookstore, situated in the Plowden Building overlooking Park Rd.

SOCIAL PROGRAMME

RECEPTION

Sunday July 8th from 6.30 - 10 p.m. at the Nine Kings Suite, Royal Lancaster Hotel, Lancaster Terrace, London W2. Admission by badge only and on presentation of invitation from registrants and guests (in registrant's packs). It is possible to register at the door.

Professor Sir James Ball of London Business School and one of Britain's major contributors to the development of macroeconomic forecasting will give a brief talk.

Primarily though this will be an informal occasion where speakers, session chairpersons and conference guests can meet before the conference gets too hectic. A light buffet supper and complimentary cocktails will be provided. We look forward to meeting you all.

TOURS

TOUR A: Castle & Gardens Tour visiting Sissinghurst and Leeds Castles
Monday 8th July (return by 6pm.)

TOUR B: visting Oxford, Bladon and Blenheim Palace
Tuesday 9th July (return by 7pm.)

Departure points and times for both tours are as follows:

9 a.m. from London Business School Reception

9.10 a.m. from White House Hotel Reception

9.20 a.m. from Regent Crest Hotel Reception

9.30 a.m. from Sherlock Holmes Hotel Reception

Tour tickets will be handed to all registrants who have booked and paid in advance by the tour courier. Spare places are available but please book first at the Registration Desks or Conference Office.

EATING AND DRINKING AT THE CONFERENCE

The Conference is very full. Our intention was to hold a small conference here in Europe and look to North America for the mega conferences that fit the bill so well there. We have been overwhelmed by the demand here; many people have been turned away, and some practically strong-armed us to get accepted. This inevitably means there is pressure on the resources that London Business School is contracted to provide. We have aimed to provide a variety of places where coffee may be drunk and lunch may be taken. If you find a queue at one spot, try another! But again, our apologies if you find yourself with an irritating wait.

COFFEE BREAKS

Coffee, tea and fruit juice will be available mid-morning and mid-afternoon in the London Business School Dining Room, the Fairbairn Room and LT6.

LUNCH

Lunch is provided to the value of £8-00 for all full registrants, on presentation of your lunch ticket, at the following venues:

London Business School Dining Room and Boaters Bistro (in London Business School)

Mumtaz Indian Restaraunt, 410 Park Road, London NW1 (see your map), a 2 minute walk away. The Mumtaz offers excellent food in a charming atmosphere.

Volunteer Pub, Baker Street, London WI (see your map). You meal ticket will go a long way here and it may take your mind off the afternoon sessions!

Moriarti's Italian restaurant in the Sherlock Holmes Hotel on Baker St. This is a very pleasant restaurant and should prove very useful for those registrants with guests staying at the Sherlock Holmes.

As time is limited for some registrants and due to full capacity at the conference please shop around to avoid queueing.

PLEASE REMEMBER TO BRING YOUR LUNCH TICKET AND WEAR YOUR BADGE

THE FIFTH
INTERNATIONAL SYMPOSIUM ON FORECASTING

MONTREAL, CANADA
June 9 – 12, 1985

Organized by
THE INTERNATIONAL INSTITUTE OF FORECASTERS
in collaboration with the
FACULTY OF MANAGEMENT, McGILL UNIVERSITY

GENERAL PROGRAM

PLENARY SESSIONS featuring keynote addresses by:

ROBERT L. BASMANN, Texas A & M; ROBERT FILDES, Manchester Business School; RUDOLF E. KALMAN, Swiss Federal Institute of Technology; SPYROS MAKRIDAKIS, INSEAD and McGill University; JANET NORWOOD, Commissioner of the U.S. Bureau of Labor Statistics; GEORGE TIAO, University of Chicago; MARTIN WILK, Chief Statistician of Canada.

Over 100 INVITED/CONTRIBUTED SESSIONS organized by the leading experts on topics such as:

Forecasting Methods • Sales • New Products • Production • Strategic Planning • Energy • Natural Resources • Judgmental Methods • Economics • Statistical Methods • Inventory Control • Software Evaluation • Finance • Exchange Rate • Crime • Demography • Sport • Technology • Weather • Use and Misuse of Forecasting.

CALL FOR PAPERS

Abstracts (not to exceed 100 words) should be submitted before FEBRUARY 1, 1985, to IIF, c/o Dr. Estela Bee Dagum, Faculty of Management, McGill University, Montreal, Canada H3A 1G5.

TRAINING IN FORECASTING – A 3-DAY WORKSHOP

COVERING . . .

THE BOX-JENKINS METHOD
EXPONENTIAL SMOOTHING AND ADAPTIVE METHODS
ECONOMETRIC METHODS
NEW PRODUCT FORECASTING
ORGANIZATIONAL ASPECTS, DATA MANAGEMENT AND FORECAST REPORTING FUNCTIONS

WHO SHOULD ATTEND?

MANAGERS who have to supply or evaluate business forecasts
PRODUCT MANAGER/DEMAND FORECASTERS upon whose forecasts organizational plans and objectives are set
PRODUCTION MANAGERS upon whose forecasting accuracy inventory control depends
MARKET or FINANCIAL ANALYSTS seeking more accurate forecasts
ECONOMISTS faced with the task of predicting future trends.

WHY ATTEND?

You will . . .

receive INSTRUCTION from the WORLD'S LEADING EXPERTS
have the opportunity to exchange with an INTERNATIONAL PEER GROUP
receive ample HANDS-ON COMPUTER EXPERIENCE

EXHIBITS AND MICRO COMPUTER SOFTWARE FAIR

Exhibits Feature • Computer Software, Hardware and Time Sharing • Forecasting Services • Data Management Systems • Books and Journals • Data Banks • Consulting Services • Forecasting Packages.

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Bell Canada

Morty Yalovsky
McGill University

For further information contact:
Robert Carbone, IIF, Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, Canada H3A 1G5.

CONFERENCE PROGRAMME

CONFERENCE PROGRAMME MONDAY

MONDAY MORNING AT 9.00 a.m.

ROOM	SESSION	CHAIR		ROOM
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LT2	Advanced Time Series Applications	Robert Carbone	2	LT2
LT3	Evaluation of Economic Forecasts and Models	Ken Holden	3	LT3
LT4	Industrial Forecasting	David Mayes	4	LT4
LT5	Econometric Methodology I	R. Tremayne	5	LT5
LT6	Keynote Speakers in Technological Forecasting @ 9.10	Brian Twiss	6	LT6
GO7	New Product Forecasting I	C. Easingwood	7	FBR
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GO7	Structural Change in the Economy	Jeffrey Fisher	16	FBR
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FAIRBAIRN ROOM

MONDAY
10.30-5.00

FORECASTING SOFTWARE FOR PERSONAL COMPUTERS
A HANDS-ON WORKSHOP

Organisers: ***McGee, Victor E.***, *Amos Tuck School of Business Administration, Dartmouth College, Hanover, New Hampshire 03755, USA*
Beaumont, Chris, and Miller, Gordon, *London Business School, Regent's Park London NW1 4SA, England*

This workshop will be available all day Monday and has three objectives:

(1) to get live exposure to microcomputer forecasting software
(2) to disseminate information about the software packages that exist, and
(3) to catalog the current status of forecasting software for micros.

A one page flyer describing the arrangements has been sent to all registrants and is available from the organisers and the Conference Office.

Software is often classifed as (A) in the process of being developed, (B) up and running but unproven, or (C) running, documented and proven. For this ISF84 workshop the organisers have concentrated on category C. Information is also being sought on software in the other two categories.

Sign-up Procedure: *A number of software companies and software developers have agreed to provide their software for demonstration purposes. In many instances the developers will be on-hand to advise and seek opinions. Several micros will be available on a sign-up basis, and the procedure to be followed is similar to signing up for a tennis court. The queueing discipline and order of priority will depend on the demand, but the overriding objective of the organisers is to create an informal atmosphere, conducive to learning from each other.*

Disclaimer: *All participants will be asked to sign a disclaimer to relieve the IIF (International Institute of Forecasters) of any responsibility for software that is to be demonstrated in this workshop.*

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P102	Business Applications of Sales Forecasting Systems	Tim Davidson	9

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P102	Forecasting Errors & Confidence Intervals II	G. Calzolari	35

ROOM LT1

MONDAY
9.00-10.30

TREND CURVES I

TIME SERIES

Chair: **Sharpe, John,** Bradford Management Centre, Emm Lane, University of Bradford, Bradford, BD9 4JL, England

"FORECASTING USING ADAPTIVE GROWTH CURVES"
Meade, Nigel., Imperial College of Science and Technology, Department of Management Science, Exhibition Road, London SW7 2BX, England

The popularity of growth curves such as the logistic and Gompertz in forecasting market development is well established. Most applications have concentrated on fitting data rather than forecasting. This paper describes the use of an extension of the Kalman filter applied to growth curves to facilitate forecasting specifically. Unlike the usual least squares fitting procedures, the flexible nature of the Kalman filter estimation procedure enables the growth curve to adapt to changes in determinants of market development. This approach will be demonstrated on some previously published data sets and on some very volatile series, sales of popular records.

"TREND CURVES: THE SPECIFICATION PROBLEM"
Mar-Molinero, Cecilio., University of Southampton, Dept Accounting & Management Science, Southampton, SO9 5NH, England

This paper examines the problem of trend curve selection. It is argued that a general model such as the generalised logistic family with a non-zero lower bound and serially correlated residuals should be estimated from the data. It is shown that the serial correlation scheme can be interpreted to be an adjustment mechanism. Such a general model is in most cases impossible to estimate. The reasons for estimation failure are given and its consequences explored. It is concluded that forecasts produced by means of trend curves are often arbitrary and give a false sense of confidence. The series of 'Tractors in Spain' is used as an example.

"TECHNOLOGICAL FORECASTING: GROWTH CURVES AND DISCOUNTED LEAST SQUARES"
Ord, Keith., and Young Peg., Division of Management Science, The Pennsylvania State University, University Park, PA 16802, USA

The method of discounted least squares enables the most recent observations to be given more weight in parameter estimation. The forecasting of growth curves is examined using both discounted least squares and conventional estimation procedures. Several examples, drawn from the current literature, are examined by each method and the strengths and weaknesses of the discounted least squares approach discussed.

"MODELLING GROWTH"
Khabie- Zeitoune, E., North East London Polytechnic, Mathematics Dept, Romford Rd, London E15 4LZ, England

The exact likelihood of series arising from continuous time differential equations models sampled at irregular intervals is computed explicitly and can be maximised. It further provides a neat rationalisation of classical growth models such as the logistic, Gompertz, Richards and Von Bertalanffy curves within a unified framework. Its algorithmic performance compares favourably with that of nonlinear regression techniques, which in any case have failed to take into account correlation between observations in a manner in which the dynamic of a growing system is highlighted. Real data sets from econometrics and biology are analysed.

ADVANCED TIME SERIES APPLICATIONS

TIME SERIES

Chair: **Carbone, Robert,** Faculty of Management, McGill University, 1001 Sherbrooke St West, Montreal, Quebec, Canada H3A 1G5

"A TIME SERIES MODEL FOR US GASOLINE CONSUMPTION AND THE ASSESSMENT OF ITS STABILITY 1969-1983"
Fullam T.J., and Aczel, Amir D., School of Business & Public Admin, University of Alaska, 1108 F Street, Juneau, AK 99801, USA

An ARIMA time series model for consumption of motor gasoline in the United States is developed. The model is then used for forecasting series values several time-periods ahead. The forecasts are utilized in the construction of a Box-Tiao test statistic at different time origins. The tests demonstrate that the structure of the U.S. consumption of motor gasoline series changed in late 1973 during the Arab oil embargo, and then again in 1978 - this time drastically - most likely due to long-term effects of the 1973 shock, due to conservation efforts, and to increasing prices of gasoline.

"AN ADAPTIVE METHOD FOR FORECASTING GRAIN CONSUMPTION IN ISRAEL"
Fisher, Jeffrey, Research Department, Bank of Israel, PO Box 780, Jerusalem 91007, Israel

An adaptive system for forecasting ongoing consumption of various types of imported grain was developed for the Israeli Ministry of Industry and Commerce. The system allows for monthly forecasts up to one year ahead and incorporates the system of monthly forecast corrections. The forecasts serve policy making in the area of grain purchases and of timing of grain cargo arrivals. The paper presents a description of the principles underlying the building of such an adaptive system whose methodology is based on time series analysis. Also presented is an analysis of the special nature of the system which involves breaking down forecast errors into three types: a) those stemming from the chosen system itself; b) errors stemming from changes in trend; c) random errors. The analysis of errors is based on Theil's method; 660 monthly forecasts were compared ex post with actual data. The system's forecasts were also compared with forecasts made by experts working for the Ministry of Industry and Commerce.

"A MULTIVARIATE ARIMA MODEL OF THE BENZENE AND GASOLINE MARKETS"
Horrell, James F., College of Business Administration, University of Oklahoma, 307 West Brooks, Adams Hall, Norman, Oklahoma 73019
Jenkins, Gwilym and McLeod, Gordon, Gwilym Jenkins and Partners Ltd, Parkfield, Greaves Rd, Lancaster LA1 4TZ, England

Of particular interest to the Petrochemical Industry is the difficult problem of forecasting aromatic prices. Among the aromatics, benzene has the largest volume in terms of chemical applications and also is a good gasoline ingredient.

The natural priority of the gasoline market gives rise to a causality structure between it and the benzene market. Measuring these markets is a multidimensional problem and consequently, a multivariate transfer function ARIMA model has been built between a vector of gasoline market series (spot and wholesale prices, consumption and inventories) and a similar vector of benzene market series. The development of models for the internal structure of the market and the causality structure between markets will be presented and discussed.

"AN APPLICATION OF THE KALMAN FILTER TO A STRUCTURAL DYNAMIC MODEL OF THE U.S. DISHWASHER MARKET"
Babb, Christopher T., Raytheon Co, 141 Spring St, Lexington, MA 02173

The discrete Kalman filter is applied to a structural state space model of the U.S. dishwasher market to adaptively estimate seasonal factors and underlying rates of factory shipments and retail sales. The underlying retail rate is determined by using retail sales seasonal factors plus a lag function of housing permits. The underlying shipments rate follows a random walk. Forecasts of actual factory shipments are a prediction time-step dependent weighting of the underlying shipments value and the underlying retail rate multiplied by an appropriate seasonal factor. Logarithmic transformations are used to handle bounding restrictions on seasonal factors.

MONDAY
9.00-10.45

EVALUATION OF ECONOMIC FORECASTS AND MODELS

MACROECONOMIC FORECASTING

Chair: Holden, K., University of Liverpool, PO Box 147, Liverpool, L69 3BX, England

"EVALUATIONS OF FORECASTS AND MODELS"
McNees, S.K., Federal Reserve Bank of Boston, Boston, Massachusetts 02106, USA

We are often guilty of blurring the elementary but fundamental distinction between conditional and "unconditional" forecasts. This sin has impeded the constructive evaluation of forecasts and models. There is not necessarily a close relation between the usefulness of a forecast (or a model) to a household or a business and its value to macroeconomic policymakers. It would be entirely possible, for example, for forecasts to be helpful even when they are derived from seriously flawed conditional models that would provide misleading macropolicy conclusions. Similarly, one can imagine a conditional model that would pass many of the standard tests for stability yet could not generate helpful insights to private decisionmakers.

Forecast and model evaluation is subjective but it need not be capricious. The paper offers a few suggestions on what might be done to make evaluations more informative.

"A COMPARISON OF FORECASTS FROM THE LIVERPOOL AND NATIONAL INSTITUTE MODELS"
Matthews, K.P.G., Economics Div, Monetary Policy Group, Bank of England, Threadneedle St, London, EC2R 8AH, England

In this paper, the Liverpool Macroeconomic model will be used to describe the practical techniques of forecasting with Rational Expectations models containing forward expectations. In the context of an annual model making annual forecasts, the accommodation of information that includes current endogenous variables such as interest rates and exchange rates will be examined. The forecasting performance of the Liverpool model will be examined, and the published ex ante predictions which includes judgemental forecasts will be compared with pure model forecasts. Finally, the paper will discuss the development of the model in the light of errors in forecasting.

"MACROECONOMIC FORECASTING IN AUSTRIA"
Thury, G., Austrian Institute of Economic Research, A-1103 Vienna, PO Box 91, Austria

In the present paper, we attempt a critical evaluation of the accuracy of macroeconomic forecasting in Austria. For this purpose, we calculate conventional magnitude measures of forecasting accuracy as well as probabilities of correctly predicting directional changes for the predictions made by the two Austrian forecasting institutions (WIFO and IHS) and by the OECD. The period analyzed covers the years 1974 to 1983. Prior to that date, the forecasting performance was quite satisfactory. But it is relatively easy to make accurate predictions during a period of constant economic growth. Beginning with 1975 however, the economic climate started to change drastically in Austria too. Therefore, it seemed interesting to investigate how forecasters came to grip with this new economic situation.

"THE ACCURACY OF ECONOMIC FORECASTS AND MODELS"
Ash, J.C.K., Dept of Economics, University of Reading, Reading, England
Smyth, D.J., Dept of Economics, Wayne State University, Detroit, Michigan 48202, USA

This paper evaluates forecasts of the international economy made by the Organisation for Economic Co-operation and Development (OECD). Twice a year the OECD publishes an assessment of current economic activity in its seven major member countries - Canada, France, Germany, Italy, Japan, the U.K., and the U.S.A. - together with forecasts, half-year by half-year, for the ensuing eighteen months. Our evaluation of these forecasts covers the period 1968-82, and includes one-, two- and three- step ahead predictions of the components of aggregate demand, output, prices and the balance of payments. Using this large data set, comprising over 8000 pairs of predictions and outcomes, we calculate measures of overall accuracy and report the results of various diagnostic checks on forecasts performance.

ROOM LT4

MONDAY
9.00-10.30

INDUSTRIAL FORECASTING

APPLIED ECONOMETRICS

Chair: Mayes, D., NEDO, Millbank Tower, Millbank, London SW1P 4QX, England

"FACTORY AUTOMATION IN THE UNITED KINGDOM"
Woodward, V.H., 252 Goswell Road, London, EC1V 7EB, England

Factory automation is already well developed in certain areas of UK industry. However, new microprocessor based electronics will give a substantial impetus to automation over the next decade, with major implications not only for established areas of automation but also to hitherto unexploited areas.

The paper attempts to quantify the present position and to forecast future developments, specifying the impact on demand and employment in both electronic and non-electronic sectors.

"THE DISAGGREGATED INFORMATION SYSTEM"
Bedell, R.D., Dept of Trade and Industry, Rm 1921, Millbank Tower, Millbank, London SW1 4QU, England
Coote, N.T., CSO, Gt George St, London SW1P 3AQ, England

The purpose of this paper is to discuss the recent experience gained by professional staff at the Department of Trade and Industry (DTI) in the operation of an input-output model of the UK economy in recent years. The Disaggregated Information System (DIS) was developed in order to examine the industrial implications of a given, macro-economic medium term view of developments in the UK economy. The system uses a detailed input output accounting framework to assess the likely demand for individual industry's products on the basis of the assumed level of overall final expenditure and hence, after allowing for imports, it can access likely levels of domestic output for each sector. The exercise is conductd at a highly disaggregated level of industrial detail - the current model identified some ninety individual sectors. This approach is significantly different to the practice adopted on most other large scale macro-economic models of the UK economy. Experience so far has shown that the outcome can be markedly differing projections of industrial output. The reasons for these differences have been explored by conducting a series of simulations with the DIS model and comparing the results with those obtained using an existing conventional UK macro-economic model. The paper reports the findings of this work and goes onto discuss further improvements that can be made to DIS when the model is redesigned in the coming months to bring it into line with new industrial classification and price base used in the compilation of UK industrial and economic statistics since last Autumn.

"INDUSTRIAL FORECASTING AND STRUCTURAL CHANGE"
Hesselman, Linda, and Fairclough, Irwin, PO Box 114, 21 St. Andrews St, Cambridge, CB2 3RW, England

A major problem with econometric forecasting is how to use qualitative information about structural change to improve forecasting performance. This paper examines the ways in which structural change can be modelled in a large input-output system used for industrial forecasting. The types of structural changes considered include product and process innovation; changes in product characteristics (eg size of firms, competitive structure of supply); changes in resource endowment; and changes in population structure and tastes. The paper will discuss how these changes can be incorporated in a forecasting system using econometric, institutional and qualitative information. The effects of such changes will be considered in the context of some long term forecasts of UK industrial structure.

"CONSTRUCTION FORECASTS"
Mayes, David, NEDO, Millbank Tower, Millbank, London, SW1P 4QX, England

This paper is a contribution to the debate on the merits of judgemental forecasting. It makes an appraisal of the performance of the Joint Forecasting Committee of the Building and Civil Engineering Economic Development Committees in providing forecasts up to two years ahead of several categories of construction output in the UK and considers suggestions that have been made about the optimal incorporation of econometric models in this forecasting process.

"THE COMBINATION OF EXPERTS' SECTORAL KNOWLEDGE AND MACRO-SECTOR-ECONOMETRIC APPROACHES"
Malsot, Jean., BIPE, Paris, 122 Ave Charles de Gaulle, 92522 Nevilly-sur-Seine, cedex, France

This paper examines how the experience accumulated by experts in sectoral medium term forecasting for the French economy have been combined by BIPE in PGD (Previsions Glissantes Detailles) with the two INSEE models DMS and PROPAGE. Forecasts are made each year over a five year time horizon for the domestic market and foreign trade in over 200 categories of goods and services. The most recent forecast extends to 1988.

ECONOMETRIC METHODOLOGY I

APPLIED ECONOMETRICS

Chair: Tremayne, A.R., Department of Economic Studies, University of york, York, England

"ERROR CORRECTION SYSTEMS"
Davidson, J., London School of Economics, Houghton St, London WC2A 2AE, England,

This paper investigates systems of stochastic difference equations which are parameterised as error correction equations, embodying a system of explicit target relationships. Conditions for stability and trend neutrality are investigated, where the latter term implies that the target relations are independent of the growth rate in growth steady state, where exogenous inputs are smooth functions of time. A necessary stability condition is obtained which entails a simple rank condition on a parameter matrix, and a test statistic is derived. Integral correction models are also considered and the results illustrated by simple examples.

"ARE TIME SERIES FORECASTS SELF-FALSIFYING?: A STUDY OF EXPECTATIONS FORMATION"
Wickens, M.R., Department of Economics (University of Southampton), Southampton, England

This paper is concerned with the formation of expectations in strucutral systems. A number of different ways of forming expectations are considered: univariate time series methods, recursive least squares and bayesian learning procedures. It is shown that for a simple cob-web model univariate time series forecasts are generally self-falsifying but if used iteratively may in certain cases become self-fulfilling. Recursive least squares and Bayesian methods are alternative learning procedures which have the advantage of using more structural information. The main issue is whether they produce self-fulfilling forecasts and hence can be used to form rational expectations.

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APPLIED ECONOMETRICS

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KEYNOTE SPEAKERS ON TECHNOLOGICAL FORECASTING

SOCIAL & TECHNOLOGICAL

Chair: Twiss, B., Strangford, 56 Ben Rhydding Road, Ilkley, West Yorkshire, LS29 8RN, England

"ANTICIPATING SCIENTIFIC PROGRESS"
Bright, James R., Presidential Professor, Colorado School of Mines, PO Box 736, Golden, Colorado 80402, USA.

Scientific findings, and even thoughtful suspicions of scientific possibilities, are so important that they deserve early consideration by industry and government, who must translate them into economic reality. However, a comprehensive rationale for capturing such science insights has not been presented, although many individual examples can be shown.

The goal of this paper is to propose and describe a number of methods by which society might gain earlier awareness of scientific developments and their societal implications.

This paper distinctly disavows the idea of forecasting the actual scientific findings (with one or two limited exceptions), but is directed at ways in which we might enhance and/or speed our awareness of the kind of capability and knowledge that current scientific work may produce and when it might appear. Proposals include (1) analysis of descriptions in R & D funding proposals, (2) analysis of the historical evolution of science in given fields as a guide to parallel evolution in other fields, (3) scientific opinion, (4) scientific recognition of opportunities for interactions, (5) descriptions of scientific progress, obstacles and time schedules for achievement, (6) trend extrapolations of such progress, and (7) the examination of scientific paradigms.

"THE USE OF FORECASTING IN SETTING SCIENTIFIC PRIORITIES"
Petrella, R., FAST, Commission of the European Communities, Rue de la Loi 200, B-1049 Brussels, Belgium

The title clearly delimitates the problem-are considered in the paper ie. forecasting as a tool for setting "policy" priorities for science and technology. Within this context, the paper will deal with six main issues:

First: nature and role of forecasting

- Forecasting has primarily a strategic/teleonomatic function.

- Forecasting cannot foresee the future in a probabilitic matter. What it can and should do is to highlight the nature and the characteristics of the "area of choices".

- Forecasting in science is less reliable and more aleatory than in technology, though science and technology are increasingly intertwined.

- Forecasting cannot be without assessment, especially in technology.

- Assessment cannot be limited to purely scientific and technical dimensions. It incorporates, intrinsically and extrinsically, economic, social and cultural dimensions.

In fact, in order to be credible vis-a-vis the users (those who take decisions on the priorities) forecasting has to show the short and long term policy implications and consequences.

- Thus, forecasting is not a "neutral" exercise, even if forecasters do not use normative or intuitive methods but use extrapolatory techniques.

Second: the importance of the relations between forecasters and users.

- Forecasting in practice is a rich and diversified experience, depending on the nature and type of the real end user.

- Problems arise because very often there is not a single user but a multiple one (as in the FAST case), as the rationale, the mandate, operating modes, the type of researches (expertise) and the techniques of a forecasting exercise are user dependent.

Third: The influence of the "macro context".

Energy forecasting exercise in the early 60's and it's use(s) will be functionally different from an energy forecasting in the late 70's and another at the beginning of the 90's.

Fourth: the relationships between the fragility of the "scientific" bases of forecasting and the strength of the "ideological" bases in forecasting.

This point is evidenced by the fact that in general different couples of forecasters/users produce a systematically different set of forecasts (for example in the field of the assessment of the relationships between technological change and employment).

Fifth: despite all limitations, forecasting is actually used in setting priorities (examples will be given).

Sixth: the ways by which forecasting is used for setting priorities in science and technology are not always apparent and linear.

ROOM G07
SLOAN ROOM

MONDAY
9.00-10.30

NEW PRODUCT FORECASTING I

BUSINESS APPLICATIONS

Chair: Easingwood, Chris,: Manchester Business School, Booth Street West, Manchester, M15 6PB, England

"USING EMPIRICALLY DERIVED DIFFUSION RATES IN FORECASTING NEW PRODUCTS"
Geurts, Michael., Professor of Marketing, Brigham Young University, Provo, Utah, USA
Lawrence, K., AT&T Long Lines, Bedminster, New Jersey, USA

This paper focuses on a specific diffusion forecasting model that is an extention of the model developed by Bass. The model used is an autocatalytic model that includes the capacity to incorporate both the impact of competitive substitute products and the impact of derived demand products. Additionally the paper modifies and uses the methodology developed by Peterson and Mahajahn to develop interactive non-influenced and influenced adoption rate.

The paper looks at product sales from over seventy different companies to see how diffusion rates change as a function of 1) promotion expenditures, 2) number of competitors already in the market, 3) prices, 4) manufacturing capacity, 5) strength of competitors, 6) government purchasing, and 7) economic conditions.

This paper presents an analysis based on actual sales for all of the companies selling semi-conductors. Diffusion rate variables are determined.

Most previous research in developing empirically derived diffusion rates has ignored the impact of the seven named variables listed above.

"SYSTEMATIC FORECASTING OF THE APPLICATIONS FOR NEW TECHNOLOGY"
Ong, C.H., and Pearson, A.W., Manchester Business School, Booth St West, Manchester, M15 6PB, England
Down, B., Ferranti Electronics Ltd, Fields New Rd, Chadderton, Oldham, England

Scientific and technical developments open up opportunities for organisations in areas where the increased capability can be effectively matched with market needs. The relevance tree type of analysis can be used as a first sieve to identify different areas of potential application. These can be analysed in more detail, taking into account the likely competitive advantage or technical merit of the development and the perceived value of this from a potential user point of view. Additional information is usually generated which indicates required levels and directions of further research, development and design work.

Such analysis emphasises the importance of relating improved technical performance to user need and the value of exploiting any such combinations as rapidly as possible by targeting at identifiable market segments. It also emphasises the importance of recognising the likelihood of changes in both technical potential of alternative technologies and of changing user needs in future time periods.

An approach which has been found to be useful in practice is described and illustrated by a case study in a currently active project area.

ROOM P101

MONDAY
9.00-10.30

STATISTICAL ASPECTS OF MODEL BUILDING

TIME SERIES

Chair: **De Gooijer, Jan G.**; V. Amsterdam, Jodenbreestraat 23, 1011 NH, Amsterdam - C, Netherlands.

"INVERTIBLE REGION OF THE HOLT-WINTER MODEL"
Archibald, B., Dalhousie Univ., School of Business Administration., 6152 Coburg Rd, Halifax, Nova Scotia, Canada B3H 1Z5

The ARIMA equation of an additive version of the Holt-Winters seasonal exponential smoothing model is used to determine the invertible region of the smoothing constants. A second procedure to test for invertibility without determining the ARIMA form is described, and is used to investigate the multiplicative model. As in the additive case, there are smoothing constants well within the usual (0,1) interval that are not acceptable. A small perturbation, in the distant past, to the series being forecast results in large changes to the smoothed values (and forecasts).

"COMPUTING THE VARIANCE OF THE FORECAST ERROR FOR THE MULTIPLICATIVE (HOLT-WINTERS) SEASONAL MODEL"
Sweet, A.L., School of Industrial Engineering, Purdue University, Grissom Hall, West Lafayette, Indiana 47907, USA

By using a linear approximation to the equations for the multiplicative (Holt-Winters) seasonal forecasting model, followed by a transformation of variables, it is shown that the equations for the additive seasonal model are obtained. Attention is then focused on finding the regions where the variance of the forecast error becomes infinite as a function of the three smoothing constants. It is shown that these regions are identical for both the additive and multiplicative seasonal models. The linear approximation is then used to derive a method of computation for the variance of the forecast error. This result leads to the conclusion that the variance of the forecast error is nonstationary and periodic. Computations are compared with estimates of the variance obtained from simulated series.

"A SIMULTANEOUS COMPARISON BETWEEN SOME UNIVARIATE TIME SERIES FORECASTING METHODS"
Hietikko, Harri, University of Tampere, P.O. Box 607, SF-33101, Tampere 10, Finland

We compare four different forecasting methods: the Box-Jenkins method, the Holt-Winters procedure, the method of stepwise autoregression and the frequency domain method. We have studied models which are relevant in practice, for example ARIMA(0,1,1). From each model 50 realizations are generated and the forecasts X_{ij}, i=1,2,...,50, j=1,2,...,4 are calculated corresponding to each realization and forecasting method. The mean and the root mean square of the forecast errors are compared. A generalization of the analysis of repeated measurements is applied to the simulation study and the hypothesis concerning to the differences between these four forecasting methods is tested.

"WINTERS' FORECASTING MODEL USING POISSON SMOOTHING PROCESS: SMALL SAMPLE RESULTS WITH COMPARISON TO WINTERS' EXPONENTIAL, BOX-JENKINS, AND REGRESSION MODELS"
Nathan, J., University of Scranton, Scranton, PA 18510, USA

Winters' exponential forecasting model explicitly accounts for level, trend, and seasonality in a discrete time-series. A Winters' model using the recently introduced Poisson smoothing process is presented in this paper. Small sample time-series (with short-histories) are used to compare the Winters' model forecasts with the more sophisticated (and statistically robust) Box-Jenkins and regression forecasts. Series with short-histories are chosen because practitioners frequently wish to make forecasts after only a few cycles.

The experience of forecasting in a small sample environment shows that the new Winters' forecasting model using Poisson smoothing process can perform as well as exponentially weighted Winters' model, Box-Jenkins, and regression models.

"THE ESTIMATION OF THE VARIANCES OF SAMPLE AUTOCORRELATIONS"
Pukkila, T.M., University of Tampere, Department of Mathematical Sciences, Tampere 10, Finland

The estimated autocorrelations have an important role practically in any applied time-series analysis. In the interpretation of the estimated autocorrelation function the corresponding standard errors are needed. For example the so-called Bartlett's asymptotic formula for the standard errors is available. These standard error estimates, however, depend on the process in question. Furthermore, the standard errors are often available only for certain lags. In the paper it is shown, both analytically and using simulations that using the Bartlett's approximation it is possible to develop a frequency domain formula to estimate the variance of an estimated autocorrelation for any lag.

ROOM P101

MONDAY
9.00-10.30

BUSINESS APPLICATIONS OF SALES FORECASTING SYSTEMS

BUSINESS FORECASTING

Chair: Davidson, Timothy A., Temple, Barker & Sloan Inc., 33 Hayden Ave., Lexington, Mass 02173, USA

Session Overview:

Just as a forecasting researcher needs to be reminded of the values of pragmatism, so does the designer of sales demand forecasting systems. Today's business managers rarely call for the use of ARIMA models or other elegant modeling approaches when it comes to monthly forecasts for their MRP or DRP systems. Rather, the system specifications include objectives like smoother production schedules, reduced inventory carrying costs, and fewer out-of-stocks through lower forecast errors. Management wants systems for forecasting that will do the "dirty work" of data handling (tabulation, reporting and dis-aggregation). They expect to invest intellectual input periodically in the choice of models used, but they call for simplicity and flexibility. The ability to easily override any quantitative forecast is of paramount importance. In a practical sense, management wants systems they can control and understand. This session covers the characteristics of sales forecasting systems found to be most desirable by today's business community. Software products available for both forecast modeling and for "production" forecasting systems will be identified and evaluated with respect to their "pragmatic" characteristics. A case study application of a forecasting system by a manufacturer of consumer packaged goods will be used to stimulate discussion. The use of syndicated and customized market research data to verify, to sharpen and, in some cases, to replace mathematically-based forecasts will be discussed.

"CRITERIA FOR THE SELECTION OF FORECASTING SOFTWARE"
Mahmoud, Essam, West Virginia University, Morgantown, WV 26506-6025, U.S.A.

The selection of forecasting packages is becoming more difficult for management because of the increasing number of packages available. Many of these packages are designed for large computer systems which have the size of memory necessary. There has, however, been a revolutionary increase in the use of desk top computers over the last several years. In order to reduce uncertainty and make an optimal purchase decision, managers need comprehensive information regarding the characteristics (functions, language, memory required, materials and manual support, cost, etc.,) of different packages.

In this study a procedure for selecting forecasting software is developed based on an emperical investigation of the managerial decision making process involved in evaluating and selecting forecasting software. The study also identifies a list of realistic and clearly defined criteria, to be used by managers in selecting the optimum package or packages for their needs.

"MARKET RESEARCH ALTERNATIVES TO FORECASTING"
Jackling, Peter, Managing Director, Demotab Ltd., 99-101 Regent St, London SW1R 7HB, England

Discussant

Levernier, Jacqueline, Forecasting Manager, Kitchens of Sara Lee, 500 Wankegan Rd, Deerfield, IL 60015, USA

ROOM LT1

MONDAY
11.00-12.30

KEYNOTE SPEAKERS ON JUDGEMENT IN FORECASTING

JUDGEMENT

Chair: **Phillips, Larry,** London School of Economics, London WC2 2AE, England

"ON THE QUALITY OF HUMAN JUDGEMENT: BAD NEWS OR BAD PRESS"
Beach, Lee Roy, Dept of Psychology, University of Washington, Seattle, Washington 98195, USA

Much has been heard of late about research demonstrating the pervasive fallibility of human judgement. However, most of us find our own judgement, with the occasional jarring exception, to be sufficient for its required uses. Why then is our experience so at odds with the research results? The answer lies in (1) the advocacy nature of the research itself, with its narrow criterion of what constitutes 'rational' judgement, and (2) the faddish nature of the scientific enterprise. Both are discussed, and alternatives to the prevailing view are advanced.

"SOCIAL JUDGEMENT THEORY AND THE PSYCHOLOGY OF PREDICTION"
Brehmer, Berndt, University of Uppsala, Box 227, S-751 04 Uppsala, Sweden

Social Judgement Theory emphasizes that human judgement must be studied under conditions where people have relevant experience. Results from studies where people have such experience, either from learning or instruction, show that although they do not follow statistical rules, they nevertheless make predictions from uncertain information with some accuracy, a result that contrasts with the picture of man as a "cognitive cripple" which stems from the heuristics and biases approach which study judgement under conditions that require the subjects to rely on statistical principles. Thus, when people have relevant experience, they do not need to know statistics to make intuitive predictions.

ROOM LT2

MONDAY
11.00-1.00

DEMOGRAPHIC FORECASTING

SOCIAL & TECHNOLOGICAL

Chair: Long, John., Population Projection Branch, US Bureau of the Census, Washington D.C., USA

"FAMILY FORMATION AND HOUSING NEEDS IN SRI LANKA : 1981-2001"
Gafoor, A.L.M. Abdul, Marga Institute, PO Box 601, Colombo, Sri Lanka.

A country's housing need arises from the necessity to replace old housing, upgrade existing sub-standard housing, reduce crowding and accommodate new families. The latter often accounts for more than half the future need. Future housing need is generally estimated by taking the projected population and dividing it by an expected household size and then subtracting from it the existing housing stock. In the present paper we look at the phenomena of family formation and family dissolution and estimate the number of housing units needed to accommodate newly formed families, the number of housing units released from use by dissolved families and hence the net requirement of new housing units. The only assumption made is that the rates of survival and marriage observed during the initial period would be stable over the projection horizon. The sensitivity of changes in these rates is examined. It turns out that, for Sri Lanka, while increasingly more new families will be formed in the last two decades of this century, more will also be dissolved resulting in an increasingly lesser number of new housing units becoming necessary.

"EMPLOYING A SATURATING STOCHASTIC DIFFERENTIAL EQUATION FOR FORECASTING THE RELATIVE GROWTH OF BRAZILIAN URBAN POPULATION"
Giorgi, Rudolfo, Rua Siqueira Campos 143, B1 "E", S1 "1524", Rio de Janeiro, Brazil 22031, South America

During the last years the growth of the brazilian urban population in detriment of rural one shows clearly a quite important migration flux to the major cities. The main cause of this exodus is the low productivity of the agricultural production.

For forecasting the relative growth of the urban population a saturating stochastic differential equation supported on the Naroll & Bertalanffy's deterministic model of the migratory flux is advanced. The solution of this equation shows for example that in year 2000 30 millions more than in 1970 will live in the major cities (more than 500,000 inhabitants). Certainly this will mean the excess of supply of labor force, the increasing of the "poverty belts" and the frustration or the marginality.

"FORECASTING FERTILITY IN DEVELOPED COUNTRIES BY THE USE OF ARIMA MODELS - AN EXPLORATORY ANALYSIS"
Murphy, M., London School of Economics, Houghton Street, London WC2A 2AE, England.

A series of ARIMA models are fitted to a number of annual fertility series for a selection of developed countries over the period 1922-1980. The object is to compare the empirical forecasting performance of series including live births, crude birth rate and total fertility rate for making forecasts of births for a variety of forecast horizons. It is concluded that the births series provides the best overall forecasting performance. The implications of these findings for current official population projection methods and demographic theories of post-war fertility swings are discussed.

"THE LOGISTIC CURVE AS A MEANS OF FORECASTING HUMAN POPULATIONS"
Raeside, R., Dept of Maths, Napier College, Colinton Rd, Edinburgh, EH10 5DT, Scotland.

Historically, the logistic curve, with the work of Pearl and Reed, was looked on with favour, but, after significant discrepancies of predictions with the future observed population, it fell into disrepute. This paper reconsiders the use of logistic curves in the light of the contemporary demographic situation. Examples are given for the developed countries, notably the U.S.A., Great Britain, Sweden and France. A discussion of how the logistic curve can be related to the vital rates is given. Finally, a forecasting algorithm based on the logistic equation combined with Box-Jenkins type modelling is presented.

"POPULATION FORECASTING - A SYSTEMS VIEW"
Keilman, Nico, Netherlands Interuniversity Demographic Institute
Cruijsen, Harri, Netherlands Central Bureau of Statistics

This paper describes the process of producing a population forecast, seen from a systems perspective. Such a process involves seven stages: systems identification, systems description, model construction, choice of parameter values and model calculations, sensitivity analysis, implementation and monitoring. The general procedure is illustrated by the 1980-based official population forecasts of the Netherlands, compiled by the Netherlands' Central Bureau of Statistics in 1981. Finally, some speculations are given as to the future of population forecasting in the Netherlands.

"INTEGRATING MULTIPLE FORECAST TRADITIONS IN POPULATION PROJECTIONS METHODOLOGY"
Long, John F., Population Projections Branch, Washington DC 20233, USA

Population projections methodologies follow many disparate traditions: demographic accounting, judgemental, time series, capacity utilization explanatory and several ad-hoc methods. Using the case of the U.S. Census Bureau's national and subnational projections, we discuss strategies for integrating these traditions into a coherent methodology combining the best parts of each tradition. Specific methods include implementation of time series methods for short term forecasting, multiregional population projections methods, and demographic-economic modelling.

ROOM LT3

MONDAY
11.00-12.30

ENERGY FORECASTING I

SOCIAL & TECHNOLOGICAL

Chair: Scanlan, Tony, ALEC Ltd, 37 Woodville Gardens, Ealing, London W5, England

"A SCENARIO METHOD FOR FORECASTING"
Sviden, Ove, Dept of Management & Economics, Institute of Technology, University of Linkoping, Linkoping, Sweden

The paper presents a method for scenario design used for energy forecasting at Volvo and for a research project within "the Future of the Automobile Program".

The scenario consists of a small number of 'scenes' for selected years, say 1980, 1990, 2010, and 2040 to illustrate the present situation, some short term trends, to idendify market growths in the middle term perspective and a visionar scene giving a long term perspective.

The scenario synthesis process can be described as applied systems engineering. A scenario "Gas in Scandinavia" is included as an example.

"THE LONG TERM FORECASTING OF OIL TANKER SUPPLY AND DEMAND"
Jenkins, G.I., World Energy and Shipping Trends Limited (WEST), 1 Hamilton Drive, Sunningdale, Berks SL5 9PP, England

An oil tanker has a life of about twenty years. Thus long term forecasting in this context may be defined as the period approximately five to twenty years ahead. In the near long term future, the forecasting of tanker supply may be made following a precise analysis of the current world fleet, taking into account new buildings, scrappings, and by analysing the operating environment for tankers in the near future.

The demand for tankers may be forecast by taking into account the level of world economic activity, energy supplies, the world oil trade and hence the oil tanker demand. The forecasting procedure is simple to outline but requires much careful analysis to obtain a credible forecast.

The evolution of the methodology is described and examples are discussed where even though there has been large uncertainty associated with some of the elements, reliable forecasts were obtained.

"ENERGY FORECASTING AND THE ECONOMY - TOP DOWN OR BOTTOM UP?"
Scanlan, Tony, Director "ALEC" Ltd, and Secretary British Institute of Energy Economics, 37 Woodville Gardens, Ealing, London W5, England

The paper reappraises the energy disruptions to the world economy over the past decade and considers how much this was due to over reliance on macro or micro economic approaches to world trade.

Specific reference is made to the shipping industry and its relation to oil and energy. The other theme implicit in the analysis is the role of government and the significance of changes in economic rent in energy economics.

"NEW ZEALAND ELECTRICITY FORECASTING"
Barr, Hugh, Applied Mathematics Division, Department of Scientific and Industrial Research, Box 1335, Wellington, New Zealand

Over the last 33 years, New Zealand's electricity demand has passed through three distinct phases.

(i) an exponential growth phase of domestic and commercial electrification
(ii) a linear growth phase, complicated by increments in major electricity consuming industries
(iii) an uncertain growth trend in the last 8 years, characterised by stagnant domestic demand

Ten year electricity forecasts for much of this interval are also available. The paper will discuss the response of the forecsts to the actual data, and the considerable difficulties that appear to have been encountered. It will also discuss simple and more disaggregated models for the future, and the forecasting difficulties these face.

ROOM LT4

MONDAY
11.00-12.30

FINANCIAL MODEL BUILDING

MACROECONOMIC FORECASTING/FINANCIAL APPLICATIONS

Chair: Mills, Terence C., School of Economic Studies, University of Leeds, Leeds, England

"MEASURING THE INCOME RESPONSE TO MONETARY POLICY IN CANADA"
Siklos, Pierre., and Raj, Baldev., School of Business and Economics, Wilfrid Laurier University, Waterloo, Ontario, Canada, N2L 3C5

The renewed interest in the Quantity Theory in recent years can be attributed mainly to the seminal theoretical works of Milton Friedman. His work has contributed to the belief, which is shared by many economists, that active monetary policy affects GNP with a short lag. This belief has found support in the large body of empirical literature that has grown out of Leonell Andersen's and Jerry Jordan's pioneering work on the St. Louis model which shows that monetary policy lags are about 4 quarters in the U.S. A recent more comprehensive study by Raj and Siklos (1983), utilizing the multivariate spectral analysis, appears to support the notion of short lags.

This paper re-examines empirically the issue of the money-income policy response and supplements some limited empirical evidence by Hay (1967) and Harry Johnson and John Winder (1964) on this issue and takes into consideration the openness of the Canadian economy, which was not done in earlier studies. The dynamics of the money-income relation are studied both in the frequency domain as well as in the time domain through a two-sided distributed lag relationship between and among the variables considered.

The evidence reveals that the underlying relationship between money and income growth is far from simple.

"FORECASTING EXCHANGE RATES USING A MONETARY MODEL"
Richardson, David H., Dept of Economics, St Lawrence University, Caton, New York 13617, USA
Wu, Mickey, T.C., Coe College, Cedar Rapids, Iowa, USA

The paper develops short-run econometric models which are appropriate for forecasting exchange rates. The models are essentially monetary models in that the exchange rate is defined as the relative price of national currencies and disturbances affect the exchange rate through adjustments in the asset markets.

Two different models are considered. The first deals with perfectly flexible exchange rates and the second takes into account the possibility of managed floating.

The models are estimated using data from France, Japan, United Kingdom and West Germany. The accuracy of forecast is judged by comparison with forward exchange rates and forecasts from simple autoregressive models.

"FINANCIAL FLOWS IN THE LBS MODEL OF THE UK - A SMALL OPEN ECONOMY WITH THREE ASSET PRICES"
Keating, Giles, Centre for Economic Forecasting, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, England

For each sector - persons, companies, pension funds and overseas - the main model determines income and expenditure, leaving a balance for net purchase of financial assets (or acquisition of liabilities). This balance is distributed among many assets and liabilities, including bank deposits, gilts, equities and foreign currency. Choice is by a mean-variance model, estimated using an iterative method to ensure satisfaction of cross-equation restrictions implied by portfolio theory. For gilts, equities and foreign currency, prices move to equate supply with demand. This ensures that expected capital gains plus interest or dividends are equal for all assets, apart from a risk premium that varies with the distribution of asset holdings across sectors.

"FORECASTING A PRICE VECTOR FOR DEALERS IN COMPETITIVE EXCHANGE RATE MARKETS"
Cordier, Jean., Institute de Gestion Internationale Agro-Alimentaire, Group E.S.S.E.C., Avenue de la Grande Ecole, PO Box 105, Cergy-Pontoise, France
Indjehagopian, Jean-Pierre, Department of Statistics, Groupe E.S.S.E.C., Avenue de la Grande Ecole, PO Box 105, Cergy-Pontoise, France

The objective of this paper is to forecast a price vector for dealers in competitive exchange rate markets (US$., against DM., JY., £., FF.).

The production of forecasts is based upon the identification and estimation of lead-lag relationships and causalities within the market, using multivariate time series analysis VARMA. Some links between the forecasts quality and the information system will be emphasized.

As a conclusion, the predictive performance of the method will be established using traditional statistics, but also compared with a public forecast, the futures market quotations. This brings the problem of market efficiency and potential profitable trading.

ROOM LT5

MONDAY
11.00-12.30

COST FORECASTING I

BUSINESS/APPLIED ECONOMETRICS

Chair: Adcock, Chris, C., C Squared Co Ltd., 79/83 Great Portland Street, London W1N 5RA, England

"FORECASTING CANADIAN NUCLEAR POWER STATION CONSTRUCTION COSTS"
Keng, C.W. Kenneth, Economics and Forecasts Division, Ontario Hydro, 700 University Avenue, Toronto, Ontario M5G 1X6, Canada

This paper attempts to use an econometric method to forecast the construction costs escalation of a standard Canadian nuclear generating station (NGS). A brief review of the history of Canadian nuclear electric power is provided. The major components of the construction costs of a Canadian NGS are studied and summarized. A data base is built and indexes are prepared. Based on these indexes, an econometric forecasting model is constructed using an apparently new econometric methodology of forecasting modelling. Forecasts for a period of forty years are generated and applications of alternative scenario forecasts and range forecasts to uncertainty assessment are demonstrated. The indices, the model, and the forecasts and their applications, to the best of the author's knowledge, are the very first ever done for Canadian NGS constructions.

"THE EXPERIENCE CURVE FROM THE ECONOMIST'S PERSPECTIVE"
Howell, S., Manchester Business School, Booth St West, Manchester M15 6PB, England

This paper undertakes a critique of Experience Curves from several angles. It considers the extent to which they can be regarded as an extension of Learning Curves and concludes that the benefits from learning-by-doing at plant-level are exhausted relatively early. It goes on to consider the evidence that there is a common slope to Experience Curves, their usefulness for forecasting prices and possible reasons for a spurious correlation between accumulated output and average cost. It concludes by demonstrating the differences in strategic implications between the various possible economic factors which may underlie the Experience Curve.

"THE ACCURACY OF MILITARY COST AND SCHEDULE FORECASTS"
Biery, Frederick P., TASC, 1700 North Moore St, Ste 1220, Arlington, VA 22209, USA

This paper reviews why forecasting errors occur in military projects and the accuracy of these estimates. It compares the accuracy of military cost estimates with commercial and non-defense government project cost estimates and finds military estimates are often more accurate. Military cost and schedule errors have also been reduced when compared to the errors made in earlier decades. Some likely reasons for this improvement are also advanced.

ROOM LT6

MONDAY
11.00-12.30

KEYNOTE SPEAKERS IN TIME SERIES

TIME SERIES

Chair: **Harvey, Andrew,** Dept of Statistics, London School of Economics, Houghton Street, London, WC2A 2AE, England

"SOME RECENT DEVELOPMENTS IN BAYESIAN FORECASTING"
Harrison, P.J., Department of Statistics, University of Warwick, Coventry, CV4 7AL, England

A number of developments in Bayesian Forecasting will be presented including those of multiple discounting, variance learning, stochastic transfer functions and non Normal/non linear modelling. Discussion will take place within the context of an application concerned with the relationship between Consumer Awareness and Television Advertising.

"FORECASTING WHEN PATTERNS CHANGE BEYOND THE HISTORICAL DATA"
Carbone, Robert, Faculty of Management, McGill University, Samuel Bronfman Building, 1001 Sherbrooke Street West, Montreal, P.Q., Canada, H3A 1GS

Future data patterns consistent with the ones observed in the past are a basic assumption of all statistical forecasting methods currently available. In the field of business and economics, however, pattern changes are common and frequent. An alternative approach to forecasting is then required.

This presentation will highlight a new method jointly developed with Spyros Makridakis which is designed to deal with possible pattern changes beyond the historical data. The approach is based on the development of two adaptive models: a short and a long term. These models are reconciled to produce final forecasts, by setting certain parameters as a function of the number, extent, and duration of the changes in patterns that have occurred in the past. The proposed method is applied to the 111 series used in the M-Competition. Post-sample forecasting accuracy comparisons show the superiority of the proposed approach over the best performing methods in the M-Competition.

SLOAN ROOM G07

MONDAY
11.00-12.30

STRUCTURAL CHANGE IN THE ECONOMY

MACROECONOMIC FORECASTING/APPLIED ECONOMETRICS

Chair: **Fisher, Jeffrey**, Economics Department, Bank of Israel, PO Box 780, Jerusalem, Israel

"SOURCES OF STRUCTURAL CHANGE IN THE POSTWAR UNITED STATES"

Feldman, Stanley, J., Interindustry Service, Data Resources, Inc., Lexington, Massachusetts, USA
McClain, David, School of Management, Boston University, 704, Commonwealth Avenue, Boston, MA02215, USA

This paper documents and analyzes the sources of structural change in the United States during the last twenty years. It uses an input-output framework to represent both aggregate economic influences, as well as the impact of changing production relations, on the structure of production in 400 sectors in the U.S. economy. Output changes over time in these sectors are decomposed into the portion attributable to a changing level and mix of final demands, and the portion due to changing input-output coefficients. The paper concludes with some preliminary evidence on the future course of structural change in the United States, and with a discussion of the implications of the findings for the industrial policy debate in the United States.

"A SIMPLE COMPUTER SIMULATION TO FORECAST THE INDUSTRIAL TREND UNDER CONSTRAINT OF OIL SUPPLY: A CASE OF JAPAN"

Nishino, Kichiji, System Science Inst, Waseda University, Tokyo 160, Japan

Some results of a computer simulation on the possible future trends of the Japanese industrial structure are described. This simulation model is based on a linear programming calculation under certain constraints of energy consumption, using the abbreviated industrial input-output table for 1979. The objective function of this linear programming model, which the author refers to as a welfare function, is selected to be maximized by the output variable vector of domestic industries under some possible constraints.

"ANALYSIS OF STRUCTURAL INSTABILITY IN THE SYSTEM OF NEWSPRINT DEMAND IN THE U.S."

Baudin, Anders, and Westlund, Anders., Department of Statistics, University of Umea, S-901 87 Umea, Sweden

The structural instability of the newsprint demand system in the US is studied by test statistics such as CUSUM(R) and CUSUMSQ(R) based on recursive residuals, and by CUSUMSQ(OLS) and MOSUMSQ(OLS;G) based on ordinary least-squares residuals. MOSUMSQ(OLS;G) is recommended, partly due to its good expected power properties. It is argued that predictions of the newsprint demand system should consider structural instabilities, those observed historically, as well as those which are expected in the future. Short term ex post predictions are then calculated, for the structural stability case as well as for various parameter variability assumptions.

ROOM P101

MONDAY
11.00-12.30

FORECASTING AND DECISION SUPPORT BY EXPLOITING GIVEN INFORMATION

SOCIAL AND TECHNOLOGICAL

Chair: **Müller, Rolf A.**, Daimler-Benz AG., Forschungsgruppe Berlin, Daimlerstrasse 123, 1000 Berlin, 48, West Germany.

Session Overview

The control of systems requires information, especially forecasts concerning future behaviour of the system in question. But information, like energy, can not be created out of nothing, but must be gained by exploiting or transforming already existing information. So we need a tool helping us to represent and transform available (or given) information correctly into required information. Models claim to be such a tool. But how can we find true models of complex systems?

This question will be answered for an important class of systems: ensembles (populations, collectives) of objects, considered as time systems. The proposed model consists of a reconstruction of that part of language we already use and need to express given or required information about the reality in question. These models need no additional information beyond the effectively given information, eg. no hypotheses concerning regression functions. They lead to stochastic processes of Markov type, where the state equation and the equations for the "observations" flow out of the reconstruction of the language mentioned before. We then may apply Filtering Techniques to exploit or transform the given information.

Applications of the method to the energy system, population and housing in cities, simulation of traffic flow and to the future demand for cars will be presented at the Conference.

"IS THERE ANY NEED FOR LONG-TERM FORECASTING METHODS?"
Müller, Rolf A., Daimler-Benz AG., Forschungsgruppe Berlin, Daimlerstrasse 123, 1000 Berlin 48, West Germany

More often than not, forecasting seems to be misunderstood as an exercise of extending trajectories or - in the multivariate case - inverting near-singular matrices.

Since any forecasting task may be interpreted as a way of transforming information within complex systems, there is no need for any special forecasting method.

Schmid's PRTI approach (Procedure for the Representation and Transformation of Information on Complex Systems), which essentially is an application of linear filter theory to general data structures, provides sufficient means for the solution of a wide range of problems related to information processing within complex systems in general and forecasting in particular.

"PROCEDURE FOR THE REPRESENTATION AND TRANSFORMATION OF INFORMATION ON COMPLEX SYSTEMS (PRTI)
Schmid, B., ORL-Institute, Swiss Federal Inst of Tech, ETH-Honggerberg, CH-8093, Zurich, Switzerland

Forecasting or answering questions about a (complex) system should consist of nothing but the transformation of effectively given information, making optimal use of all information at hand about the system, and not using additional hypotheses.

We describe a method to represent information, on systems consisting of many sorts of objects and their changes, as a stochastic process (Markovian, linear state equation). Filtering techniques are then applied to exploit the given information.

Reliable results, especially for complex systems, have been gained in many fields, where usually methods requiring additional information (such as hypotheses on regression functions or the like), are applied.

"LONG-TERM INQUIRY OF THE SWISS ENERGY SYSTEM USING THE PRTI APPROACH"
Zaengerle, R., ORL-Institut, Swiss Federal Inst of Tech, ETH-Honggenberg, Zurich, Switzerland, CH-8093

The PRTI approach, a tool in long-term quantitative planning or forecasting, consists of two essential steps:
the reconstruction of language describing the system and the coding of data or the quantitatives aspects of the information.

These two steps of the PRTI approach are shown by the application to the Swiss Energy System.

Further, results are presented describing energy-production scenarios. These results are not a consequence of a special forecasting method, but transformations of input-data, ie. consisting of our knowledge and assumptions about future and scenarios, coded as confidence intervals. So, if one accords with the input-data, one has to accept these results.

"FORECASTING WITH A HOUSING MODEL USING THE PRTI-APPROACH AS A DECISION BASE FOR URBAN PLANNING"

Gabathuler, Christian., ORL-Institut, Swiss Federal Institute of Technology, ETH-Honggerberg, Zurich, Switzerland CH-8043

Urban planning has to be action orientated. Better decisions are likely if their full consequences can be assessed. But there is no possibility in planning of knowing all the consequences of a decision. But there is knowledge about some of the consequences, given certain conditions. A method that can accommodate incomplete information is needed to give a consistent picture. The PRTI-approach fulfills these conditions.

On this basis has been developed a reference model that examines the interrelationship between people, households and housing. The use of and results from the model will be explained with reference to Zurich, a city suffering population decline.

"CAN CRUDE INFORMATION PERMIT A CONSISTENT VIEW OF THE IMPACT ON LAND USE CAUSED BY CHANGES IN THE TRANSPORTATION SYSTEM? A PLANNER'S VIEW"

Signer, R., ORL-Institut, Swiss Federal Inst of Tech, ETH-Honggerberg, Zurich, Switzerland, CH-8093

1. When home and workplaces change in number and location, the pattern and mode of commuting will change. These changes depend on the different characteristics of the transportation system and the travel time budget of the commuters.

2. When characteristics of the transportation system are changed, certain relationships improve, others deteriorate, resulting in modified commuting patterns and modes; even home or workplaces may display regional movement.

3. Crude information from different sources, with which planners usually have to deal, are used to obtain a consistent view of the probable changes by means of the PRTI approach. A hypothetical region serves as an example.

"A COMPLEX INFORMATION SYSTEM OF LONG TERM PASSENGER CAR OWNERSHIP"

Minx, Eckard P.W., Müller, Rolf A., and Reske, Joachim, Daimler-Benz AG, Forschungsgruppe Berlin, Daimlerstrasse 123, 1000 Berlin 48, West Germany

Results are presented of a disaggregated stochastic forecasting model of passenger car ownership of private households in the Federal Republic of Germany up to the year 2010.

It is the first application of B. Schmid's PRTI approach to passenger car forecasting. The method has the following properties:

- forecasts are not understood as extended trajectories but as spaces of possible future developments.

- input data as well as results are given as intervals (mean vector and covariance matrix) taking inaccuracies into account.

- intervals can be reduced by using (inaccurate) partial information from the context of the variables.

ROOM LT1

MONDAY
2.00-3.30

PANEL ON LONG WAVES

SOCIAL & TECHNOLOGICAL

Chair: **Hobbs, Geoff:** ICI PLC, Millbank, London SW1P 3JF, England

Session Overview

The discussant will address the questions:

if we accept that Long Waves exist, where are we now?
are we in recession or depression?
when will we "hit bottom"?
What recovery signs should we be looking for?

Participants will also discuss the forecasting methodology underlying their arguments.

Participants:

Van Duijn, Jacob, J., Robeco/O, Heer Bokelweg 233, 3032 Rotterdam, The Netherlands
Sternman, John D., Sloan School of Management, 50 Memorial Drive, Boston, Massachusetts 02139, USA
Loveridge, Dennis J., Pilkington's New Ventures, Pilkington's, Prescot Rd, St. Helens, Merseyside, WA10 3TT, England

ROOM LT2

MONDAY
2.00-3.30

QUALITY OF JUDGEMENTAL FORECASTS

JUDGEMENT

Chair: Brehmer, B., Institute of Psychology, University of Uppsala, PO Box 227, S-751 04 Uppsala, Sweden

"HUMAN JUDGEMENT IN FORECASTING: SELECTION AND UTILISATION OF DATA"
Sniezek, Janet A., Department of Psychology, Muller 107, Ithaca College, Ithaca, N.Y. 14850, USA

Judges' selection and utilization of statistical information in a single-cue probability learning prediction task were studied. This task demanded that judges make predictions of a scaled criterion from a scaled cue which was probabilistically related to the criterion. In various conditions, the judges were either given or permitted to choose statistical information about past events with the given cue value. Middle 50% criterion range, the criterion mean, or the criterion for a random case. Results showed that judges choose and use optional information with a frequency above chance; however, their behaviour is markedly inconsistent. Theoretical implications are examined.

"BUDGETARY FORECASTING: A COMPARISON OF STATISTICAL AND JUDGEMENTAL FORECASTS"
Kocis Jr, Daniel J., Information Systems Division, Newsweek, 444 Madison Avenue, New York 10022, USA

This research explored the relationship among nine bivariate models of budgetary forecasting which included statistical and judgemental estimates. The usual framework of statistical vs judgemental was found to be inappropriate as a factor analysis on correlations among forecasts revealed a single homogeneous group. Results indicate that all estimates exhibited little forecast variance when considering MAPE or MAD although R^2 varied considerably. This is known as paramorphic representation, a situation of algebraically different models exhibiting similar residual variance. The choice of model selection should then be assessed upon nontangible differences while obeying the law of parsimony and choicing the simplest models.

"THE FORECASTING PROCESS: INFERENCES FROM EVALUATIONS"
Stekler, H.O., Industrial College of the Armed Forces, National Defense University, Fort Lesley J. McNair, Washington D.C. 20319, USA

There have been many studies which have evaluated forecasts and some recent research on the judgemental forecasting process. Since most forecasters do not record the procedures which are utilized, or the reasons why the variables were adjusted as they were, it is necessary to infer this information from the forecasts themselves. This paper will attempt to determine why the errors occurred or how forecasters might have generated their predictions. The paper examines four issues (1) why underestimates occur, (2) the excluded information in the extrapolative procedures, (3) the revision process of multi-period predictions, and (4) the prediction process in the neighborhood of cylical turning points.

ROOM LT3

MONDAY
2.10-3.45

STRATEGIC INFORMATION MANAGEMENT AND FORECASTING

Chair: Williams, W.H., AT&T, 100 Southgate Parkway, PO Box 1955, Morristown, NJ 07960, USA

"PERCEIVED CORPORATE STRATEGIES"
Binkowski, E.S., Research & Development, Strategic Comaps Inc, 70 Greenwich Avenue, New York, NY 10011, USA

The perception of corporate strategies is often based on a small number of factors which are sometimes at odds with each other and with actual corporate performance. Examples are drawn from Fortune magazine's recent surveys of corporate reputations. Suggestions for improvement and integration are given.

"CONVERTING FORECAST DATA TO FORECAST INTELLIGENCE"
Jeske, John, W., AT&T Communications, 295 North Maple Avenue, Basking Ridge, NJ 07920, USA

Forecasters tend to fall into one of two schools; theoretical or pragmatic. The result has been that the bulk of the research for forecasting has dealt with the mathematical statistics of time series. However, while everyone realizes something can be learned from the "real world" little significant research has been accomplished in this area. The purpose of this paper is to present some analytical direction for the integration of the theoretical with the practical. The first issue is the need to interrelate the method and environment in which the basic data are generated. Another issue that will be addressed is how the use of a forecast impacts on the theoretical objectives. The final area which will be discussed is the time dimension of the feedback loop involved with the forecast. While no well-defined solutions will be presented, it is believed that even if only intuitive consideration can be given to the listed issues; then the value of a forecast to the forecast user can be significantly increased.

"MANAGING ECONOMIC ACCOUNTS FOR FORECASTING PURPOSES: SOME INSIGHTS FROM CANADIAN TELECOMMUNICATIONS"
Olley, Robert, E., Dept. of Economics, University of Saskatchewan, Saskatoon, Canada
Kiss, Ferenc, Bell Canada, 25 Eddy Street, 5th Floor, Hull, Canada J8Y 6N4.

This paper is based on our experience in generating a system of economic accounts in the Canadian telecommunications industry. These accounts are intended first to measure, then to permit analysis and forecasting of economic phenomena for managerial and policy decisions. The numerous economic variables are described. The central focus is on the management of economic accounts. Construction, maintenance and development of the data are discussed. An analysis of interdepartmental co-operation, co-ordination and information flows is presented. An assessment is offered of the possible methods of generalizing intra-firm measurement techniques for use in an entire industry. Throughout the paper, data management requirements arising from forecasting applications are given a central place.

"INTEGRATED STATISTICAL BUDGET FORECASTING"
Williams, W.H., AT&T Information Systems, Morristown, New Jersey 07960, USA

Forecasting budget items on a line-by-line basis is both difficult and risky. The line items are highly interrelated in complex functional ways. As a result separate line forecasting runs the risk of distorting the historic, but usually consistent, relationships among these line items.

In this paper we describe a multivariate procedure which utilizes adaptive nonlinear, robust, principal components to preserve interrelationships and which can be tracked and forecast through time.

ROOM LT4

MONDAY
2.00-3.45

EXPECTATIONS AND SURVEY DATA

APPLIED ECONOMETRICS/JUDGEMENT

Chair: **Klein, Philip**, Dept of Economics, Pennsylvania State University, University Park, PA 16802, USA

"FORECASTING THE PRODUCTION VOLUME OF THE FINNISH METAL INDUSTRY USING BUSINESS SURVEY VARIABLES"
Terasvirta, Timo, The Research Institute of the Finnish Economy (ETLA), Lonnrotiwsarn 4B, 00120 Helsinki 12, Finland

Results of business surveys are often used to construct cyclical early warning systems which take the form of weighted combinations of smoothed and seasonally adjusted time series. The purpose of this research is different: models yielding quantitative short-term forecasts of the volume of Finnish industrial production are specified and estimated using aggregated anticipations of the firms as predictors. Different branches of industries and the total volume are considered separately and the results are compared. Not all questions in the questionnaire of the quarterly survey possess predictive value, and different questions seem to be relevant for different industries. The paper discusses both the model building techniques and the results.

"USE OF REGRESSION METHODS TO IMPROVE THE QUALITY OF SAMPLE PREDICTIONS WHEN RESPONDENTS ARE NOT EQUALLY KNOWLEDGEABLE"
Eichhorn, Benjamin, H., & Temkin, Sanford, Rider College, PO Box 6400, Lawerenceville, New Jersey 08648, USA

This paper extends previous work which shows that information about adequacy of each respondent's prediction model can be used to improve the overall sample prediction. The models presented in this paper explore the cases when the respondent's adequacy assessment and the value of his forecast are correlated. We also look for proper cut-off points to eliminate low quality contributions to the overall forecast. Methods of regression analysis are used to obtain solutions for these models.

"COMBINING ECONOMETRIC AND JUDGMENTAL FORECASTS FOR 250 INDUSTRIES"
Narasimham, Gorti, V.L., U.S. Department of Commerce, Bureau of Industrial Economics, Washington DC 20230, USA

Each year, the U.S. Industrial Outlook makes one-year and five-year forecasts for about 250 industries, an ambitious task which poses unique problems:

How can the forecasts be made consistent with a macro forecast and with each other?

How can judgemental forecasts of industry performance be combined with econometric forecasts?

Is the resulting set of forecasts better than the results of an econometric model used by itself?

This paper attempts to describe the analytical basis for generating industry forecasts for the U.S. Industrial Outlook, an annual publication by the U.S. Department of Commerce, The Council of Economic Advisers (CEA) in the Executive Office of the President makes an overall macroeconomic forecasts of the U.S. economy in the beginning of each year. There are also available a number of macroeconomic forecasts made by private groups using macroeconomic models. However, business economists and forecasters are all too conscious of the need to translate these fairly broad results of macroeconomic models to the level of specific industries or even product lines. The macroeconomic scenario providing projections of the Gross National Product, by major categories of final demand can be subjected to an input-output analysis to obtain provisional estimates of industry outputs implied by the overall outlook. These industry forecasts can be developed at two-and-four-digit levels of standard industrial classification (SIC) detail.

The macro and industry-specific projections are provided to the industry specialists in the U.S. Department of Commerce who are responsible for the preparation of individual sector forecasts. The analysts apply the information they have developed while monitoring their assigned industries throughout the year and adjust the forecasts to reflect specific developments which their judgement indicates will affect the outcome.

"GRAPHOSCOPY - A NEW SURVEYING METHOD FOR BUSINESS CYCLE FORECASTING"
Apeloig, Shalom., IFO-Institut fur Wirtschafts forschung, Poschingenstrasse 5, Postfach 86 04 60, 8000 Munich 868604 86, Germany

Graphoscopy is a new method for direct and metrically scaled measurement of people's expectations of economic developments over time. The innovation consists in graphing the past movement of an economic variable - in this case the index of net production, seasonally adjusted and smoothed, for a number of manufacturing branches - and to ask the survey participants to extend these graphs freehand according to their expectations of the future cyclical course during the given forecasting period.

The given reference series allows the participant to view the projection of future developments in close context with the past and present situation. This way the survey method avoids the need to provide information on base data and allows the participant to render a complex and detailed description of anticipated developments, including such details as the timing of turning points as well as shape, duration, and intensity of the expected upswings or downswings.

In contrast to the survey methods used up to now, the participant's complex pattern of anticipation is not reduced to one single signal ('better', 'unchanged', 'worse' in the business survey or annual average rates of change in the investment survey and "Prognosis 100") but is provided in the form of a differentiated, in the respondent's mind primarily qualitative judgement.

Graphoscopic survey methods are not restricted to business cycle analysis and metrically scaled anticipations. Rather, with their help any dynamic anticipation trend for which an ex post reference series exists can be better understood. Last but not least, it should also be perfectly suited as input into numerous Delphi inquiries.

"AN EVALUATION OF QUARTERLY NATIONAL INSTITUTE FORECASTS"

Holden, K., and Peel, D.A., Department of Economic and Business Studies, University of Liverpool, Liverpool

This paper examines the quarterly forecasts of inflation and the change in real gross domestic product and its components for horizons of one to four quarters ahead. The forecasts are tested to see if they satisfy three implications of the rational expectations hypothesis: unbiasedness, efficiency and consistency. Explicit consideration is given to the information set available when the forecasts are made. In general, the data do not support the rational expectations hypothesis and our results provide little encouragement for the view that aggregate expectations will meet the ex post requirements of rationality.

ROOM LT5

MONDAY
2.00-3.00

PANEL ON
POPULATION FORECASTING

SOCIAL & TECHNOLOGICAL

Chair: **Willekens, Dr. Frans**: Deputy Director, Netherlands, Interuniversity Demographic Institute, Prinses Beatrixlaan 428, 2273 XZ Voorburg, Netherlands.

Forecasting the size and composition of populations and subpopulations and of the demographic processes behind changes in population structure raises issues of methodology, reliability and utilization. Recent innovations and envisaged future developments in forecasting methodology, techniques for hypotheses formulation and user involvement, reliability measurement and monitoring are reviewed in a background paper, which serves to guide the discussion. Since a number of innovations originated in fields other than demography, a multidisciplinary perspective is adopted. Special attention will be devoted to controversial views on how to forecast subpopulations that are relevant to the user and how to increase forecasting performance.

Presenter: **Willekens, Frans**: Deputy Director, Netherlands, Interuniversity Demographic Institute, Voorburg, Netherlands.

Panelists: **Long, John**: Chief, Population Projection Branch, US Bureau of the Census, Washington DC, USA

Field, J.: Government Actuaries Dept, 22 Kingsway, London, WC2, England.

Ahlburg, D.A.: Industrial Relations Center, University of Minnesota, Minneapolis, USA.

ROOM LT6

MONDAY
2.10-3.30

KEYNOTE SPEAKER
IN
APPLIED ECONOMETRICS

APPLIED ECONOMETRICS

Chair: Baillie, **Richard T.**, Dept of Economics, University of Birmingham, Birmingham B15 2TT, England

"EVALUATING LINEAR ECONOMETRIC SYSTEMS"
Hendry, David F., Nuffield College, Oxford, England

The information required to evaluate econometric models is analysed to highlight tests which are useful for appraising the (often implicit) assumptions sustaining estimation, inference, forecasting and policy. Existing approaches emphasise dynamic simulation tracking performance, the historical forecasting record and the economic plausibility of estimated systems. However, these criteria are inadequate and potentially misleading for judging models qua models since they do not correspond to the information sets relevant to testing models. Four alternatives are proposed: forecast encompassing (linking forecasting pooling and non-nested tests in an encompassing approach); n-step ex ante forecasting confidence bands: long-run model properties; and inter-equation feedbacks.

Discussants

Baillie **Richard T.**, Dept of Economics, University of Birmingham, Birmingham B15 2TT, England
McNees, **Stephen K.**, Federal Reserve Bank of Boston, Boston, Massuchusetts, 02106, USA
Melliss, **Chris**, Senior Economic Adviser, HM Treasury, Parliament St,. London, England

ROOM G07

(SLOAN ROOM)

MONDAY
2.00 - 3.30

FORECAST ERRORS AND CONFIDENCE INTERVALS I

TIME SERIES

Chair: Smith, J., University of Warwick, Coventry CV4 7AL, England.

"ON THE USE OF BOOTSTRAPPED CONFIDENCE INTERVALS FOR FORECASTS OF SHORT TIME SERIES"
Findley, D.F., Statistical Research Div., U.S. Bureau of the Census, Washington D.C. 20233, USA

Freedman and Peters (1984) recently applied a resampling procedure (the "bootstrap") to obtain estimates of mean square error for the forecasts from an autoregression with exogeneous terms. In this talk, we start with a theoretical analysis of their suggested procedure for the case of (not necessarily stationary) autoregressive models without exogenous terms. The theoretical mean square forecast error from an estimated model is the sum of two components, the mean square forecast error of the optimal predictor and the mean square difference between the optimal forecast and the estimated model's forecast. Our analysis shows that the bootstrap estimate of mean square forecast error is the sum of the usual (naive) large-sample estimate of the first component and a possibly useful small-sample estimate of the second. We present some results from a Monte Carlo study of the bootstrap estimate of the second component.

"FORECAST BY ECONOMETRIC MODELS WITH EXOGENOUS VARIABLES STOCHASTIC IN THE FORECAST PERIOD"
Bianchi, Carlo., and Corsi, Paolo., Centro Scientifico IBM, Via S. Maria 67, 56100 Pisa, Italy

Forecasts produced by econometric models are subject to many sources of uncertainty: error terms, coefficient estimates, exogenous-variables forecasts and possible misspecification of the model. There is a large literature dealing with the first two components; fully analytic methods have been developed for linear models, simulation techniques are applied in nonlinear case.

The last two sources of uncertainty have not yet been extensively investigated; in fact, forecasts are generally given, conditional on exogenous variables and model structure. As for exogenous contribution, analytic and simulation techniques proposed in the literature are based on a-priori knowledge of the variance-covariance among exogenous variables.

In this paper, empirical results are presented for some nonlinear econometric models with the exogenous variables variance-covariance matrix built by different hypotheses.

"EVALUATING FORECAST UNCERTAINTY IN ECONOMETRIC MODELS: THE EFFECT OF ALTERNATIVE ESTIMATORS OF MAXIMUM LIKELIHOOD COVARIANCE MATRIX"
Calzolari, Giorgio., and Panattoni, Lorenzo., Centro Scientifico IBM, via S. Maria 67, 56100 Pisa, Italy

Most of the methods proposed in the literature for evaluating forecast uncertainty in econometric models need an estimate of the structural coefficients covariance matrix among input data. When estimation is performed with full information maximum likelihood, alternative estimators of such a covariance matrix (Hessian, outer product, generalized least squares type matrix, etc) although asymptotically equivalent, often produce large differences in practical applications.

Experimental results will be given for some econometric models well known in the literature, both with historical data and with data generated by Monte Carlo.

ROOM P101

MONDAY
2.00-3.30

TREND CURVES II

TIME SERIES

Chair: Meade, Nigel; Dept of Management Science, Imperial College, Exhibition Rd, London, England

"LOGISTIC CURVE: PARAMETER ESTIMATION AND APPLICATION TO POPULATION FORECASTING"
Tashchian, Armen., and Roobina, Ø., College of Business, The Florida State University, Tallahassee, Florida 32306, USA

The Logistic curve [$y = \gamma/1 + \exp(\alpha + \beta x)$], is widely used in describing the growth of populations that will eventually reach an upper limit : Y is the population size at time x. The purpose of this paper is to present an efficient algorithm to estimate the parameters of Logistic curve, and to compare the goodness-of-fit of the Logistic curve to other popular methods of forecasting. Comparisons and predictions will be made using population data of some U.S. and European cities.

"THE DISPLACED LOGISTIC AS A TREND CURVE"
Oliver, F.R., Dept of Mathematics, University of Exeter, Exeter, EX4 4RJ, Devon, England

The exponential is widely used as a curve representing growth or decay from or to a zero (or unknown) asymptote, for forecasting and other purposes. It is usually and simply estimated by logarithmic least squares, although ordinary least squares can also be used. The function can be generalised by means of a vertical displacement. This non-zero asymptote may be estimated simultaneously by OLS, and a method for doing so is described. Some large-sample properties of the parameter estimators are derived. A number of Monte Carlo studies explore to what extent they are applicable to small numbers of observations.

"THE IMPACT OF FORECASTING PERFORMANCE OF DIFFERENT APPOACHES TO THE ESTIMATION OF CERTAIN TREND CURVES"
Price, D.H.R., and Sharp, J.A., University of Bradford Management Centre, Bradford, England

A somewhat unexpected result of a previous study of forecasting methods by the authors was the sensitivity of the Logistic Curve to changes in the frequency of re-estimation and the actual estimation method.

This paper reports on a study designed to examine this question in more depth for both the Logistic and the Gompertz curve. As in previous work the forecasts used are those for peak electricity demand in the UK, since these make possible the derivation of financial measures of forecast performance via a financial simulation model of the UK Central Electricity Generating Board. Amongst the factors that will be investigated are:

a) impact of the model formulation used, viz. open or closed loop type

b) frequency of re-estimation of the model

c) the effect of using less noisy, temperature corrected data compared with the raw data

"A MODIFIED GOMPERTZ LIFE-CYCLE CURVE"
Nash, D.H., Department of Mathematical Sciences, Drexel University, Philadelphia, Pennsylvania 19104, USA
Holdowsky, M., Chase Econometrics, 150 Monument Road, Bala Cynwyd, PA 19004, U.S.A.

Many products and services follow life cycles approximated by skewed bell-shaped curves, which grow to a peak and then decay. A useful family of such curves can be obtained by modifying a Gompertz curve. In particular, let $0 < \alpha, \beta, c < 1$ and $K > 0$. Then $G(t) = \alpha^{\beta^t}$ defines a Gompertz curve, and $g(t) = K c^t G(t)$ yields the modification. Varying c permits the fraction of the area under g(t) to the left of the peak point to assume any value between 0 and 0.5. The form of g(t) allows parameter estimation by certain non-linear regression programs. Some applications and other properties of g(t) are described, including algorithms for estimating the function.

ROOM P102

MONDAY
2.00-3.30

STATE SPACE & ARIMA MODELS

TIME SERIES

Chair: Mehra, R.; Scientific Systems Inc: 54 Rindge Ave Ext., Cambridge, MA 02140, USA

"MODELLING AND FORECASTING TIME SERIES USING STATE SPACE METHODS"
Narayan, Jack Y., Department of Mathematics, State University of New York at Oswego, Oswego, New York 13126, USA
Aksu, Celal, Department of Accounting, School of Management, Syracuse University, Syracuse, New York 13210, USA

An exposition of the state space methodology for modelling and forecasting time series is presented. The State Space forecasting approach to forecasting is very general and includes the traditional regression and ARIMA time series models as special cases. Applications are given to illustrate how the method can be used to do univariate time series analysis, transfer function analysis, and multiple time series analysis. The equivalence to and advantages over the ARIMA methods are discussed.

"APPLICATIONS OF STATE SPACE FORECASTING MODELS USING UNCONVENTIONAL SOURCES OF DATA TO STEER THE FORECASTS"
Waage, Frenck., A.T.T. Technologies, Org 07 321120 (13th Floor), Gateway II, Newark, New Jersey 07102, USA

Conventional forecasting techniques, projective and driving-force based, leave out much information which is often essential. We show how such information can be included.

This paper specifically discusses a state space model which uses conventional driving forces as one source of information, advance orders as a second source and sales representatives' opinions about the future as a third source. These sources are weighted by their precision.

The conventional driving force drives the forecast along a trajectory which is flight adjusted by the advance peek of the future which salesmen's opinions and advance orders afford.

"THE ASSESSMENT OF CHANGING RELATIONSHIPS"
Johnston, F.R., and Harrison, P.J., School of Industrial and Business Studies, University of Warwick, Coventry CV4 7AL, England

Model builders are often interested in quantitative measures of relationships between variables. This paper describes a simple recursive method for estimating the regression coefficients based on the Normal Discount Bayesian Models. The method is easy to program and involves no matrix inversion. With no discounting it is exactly equivalent to multiple linear regression. With a degree of discounting, which can be set by individual variable (and variance), the method can be used in the more realistic situations when the parameters evolve through time.

"STATISTICAL METHODS FOR FORECASTING"
Ledolter, Johannes, Dept of Statistics, University of Iowa, Iowa City, Iowa 52242, USA
Abraham, Bovas, University of Waterloo, Waterloo, Ontario, Canada N22 3G1

The simplifying operators in ARIMA models determine the form of the corresponding forecast functions. For example, regular differences imply polynomial trends and seasonal differences certain periodic functions. The same functions also arise in the context of many other forecast procedures, such as regressions on time, exponential smoothing and Kalman filtering. In this paper we describe how the various methods update the coefficients in these forecast functions and discuss their similarities and differences. In addition, we compare the forecasts from seasonal ARIMA models and the forecasts from Winters' additive and multiplicative smoothing methods.

ROOM LT1

MONDAY
4.00-5.30

MODEL SELECTION I

TIME SERIES

Chair: Edmundson, R.H.; School of Accountancy, University of New South Wales, PO Box 1, Kensington, New South Wales, Australia

"AUTOMATIC SELECTION OF FORECASTING METHODS FOR NON-STATIONARY SERIES"
Ord, Keith., and Texter, Pamela., Division of Management Science, The Pennsylvania State University, University Park, PA 16802, USA

When a relatively large number of small-scale series must be forecast, the time saved by selecting a model automatically may well outweigh the costs of somewhat increased forecast error.

Previous approaches to the selection of a forecasting procedure have either assumed that the process is stationary (e.g. The AIC) or else selected from a menu of possible methods (e.g. Makridakis' work in the M-competition). This study attempts to develop a series of tests which may be used to select a method when the process is non-stationary.

"DIAGNOSTIC CHECKING OF NON-STANDARD TIME SERIES MODELS"
Smith, J.Q., Department of Statistics, University of Warwick, Coventry, CV7 4AL, England

Diagnostic checks have become a standard tool for helping to assess the adequacy of a forecasting system since Box and Jenkins' (1970) ARIMA modelling technique became popular. However most of the research has developed checks for normal or second order stationary models. This paper gives various diagnostic checks that can be performed simply on non-normal non-standard models like the class of Multiprocess Models (Harrison and Stevens, 1976) where residuals are definitely not normal. The performance to date of these models can then be objectively scrutinised on line. Examples, including a generalised cusum technique, are given to illustrate the effectiveness of the techniques on specific series.

"SOME REFLECTIONS ON FORECASTING COMPETITIONS"
Chatfield, C., University of Bath, Claverton Down, Bath, Avon, BA2 7AY, England

Is the M-competition a "landmark for years to come" or "ludicrous"? The talk will briefly discuss criteria for making comparisons, the problem of replicability, and the problem of testing hypotheses. A number of practical examples (including the notorious Chatfield and Prothero data) will be given to indicate that the more crucial question is often, not which forecasting method to choose, but whether to adopt an automatic or subjective approach. In some situations, forecasts must be made without human intervention, but in other situations sensible forecasters will plot their data, look for outliers, seasonality and so on, and make subjective adjustments to standard procedures where appropriate. Recommendations on a choice of method will also be made.

"THE SELECTION AND USE OF LINEAR AND BILINEAR TIME SERIES MODELS"
Tremayne, A.R., and Poskitt D.S. Dept. of Economic and Related Studies,
University of York, York YO1 5DD, England.

The paper is concerned with both theory and practice in time series analysis. There is a brief discussion of nonlinear models in general and bilinear models in particular which throws some light on why the latter may prove useful to the practitioner. Applications of linear models to a transformed version of a well known scientific data series and bilinear models to the original data are provided. These empirical exercises provoke discussion concerning criteria which can be used to select a preferred model or models and various alternative specifications are compared by means of their forecasting performance.

ROOM LT2

MONDAY
4.00-5.30

IMPROVING JUDGEMENT I

JUDGEMENT

Chair: Hogarth, R.M., Center for Decision Research, University of Chicago, 1101 East 58th St, Chicago, Illinois 60637, USA

"THE POTENTIAL BENEFITS OF CONFLICT FOR JUDGEMENT UNDER CONDITIONS OF UNCERTAINTY"
Cosier, Richard A., Department Chairperson, Administrative and Behavioural Studies, Graduate School of Business, Indiana University, Bloomington, IN 47401, USA

Managerial decision making frequently involves a four step process: the need for a decision becomes known; staff experts research the issues; a staff report is presented to the key decision maker; and the decision maker arrives at a decision. Because the staff report usually reflects bounded rationality, the final decision is choice (judgment) under uncertainty.

In a seminal article, Mason (1969) suggested that the method of presenting advice to the decision maker may have a great impact on decision quality. Specifically, he recommended that decisions would be improved if advice were presented in a dialectical format. Research by Cosier and his colleagues, however, suggests that a devil's advocate approach may be preferable to the dialectic as an aid for predicting future "states of nature". This paper will summarize the cases for the dialectic and devil's advocate methods for assisting managerial decision making. Conclusions will suggest a contingency approach may be in order. The dialectic may be useful under conditions of extreme uncertainty when little or no historical data are available or useful. The devil's advocate method may be helpful when there is some environmental information that can be used to bear upon the decision.

"INTERPRETATION, SUMMARIZATION AND PRESENTATION OF DELPHI DATA
Eschenbach, Ted G., School of Engineering, University of Alaska, 3221 Providence Ave, Anchorage, Alaska 99508, USA

Geistauts, George A., Alaska Pacific University, 4101 University Drive, Anchorage, Alaska 99508, USA

The design of Delphi questions and the summarization of results must consider (1) which statistical measure best summarises each type of question and response pattern, (2) whether feedback should be individual and/or collective panel positions, (3) whether reference values should be provided as point data or trend data or not at all, and (4) whether cross-impact relationships should be explicitly explored or implicitly derived. Results from a three-round, 91 panelist, 800 item Delphi study of Alaska's economic future are used to analyze and demonstrate the implications of different alternatives. The development and presentation of consistent, alternative scenarios is also described.

"SALES FORECASTING AT TIME AND LIFE"
Ashton, Alison Hubbard Faculty of Business, The University of Alberta, Edmonton, Alberta T66 261, Canada

Davis, Mary N, Life Magazine, Time & Life Building, Rockefeller Centre, New York, NY 10020, USA

This paper describes a study of forecasting, by Time and Life executives, of annual page sales. It involved two phases: (1) An experiment compared executives' forecasts for Time, based on archival data, with actual outcomes. "Lens model" analyses included the lens model equation, man vs. model, composite forecasts and an analysis of the relationship between consensus and accuracy. (2) Archival forecasts by Time executives were compared with forecasts from a regression model. These results are synthesized from technical/academic and practical points-of-view.

ROOM LT3

MONDAY
4.00-5.30

FINANCIAL MARKETS

FINANCIAL APPLICATIONS

Chair: Taylor, Stephen J. Dept of Operational Research, University of Lancaster, Lancaster, LA1 4YX, England

"FORECASTING THE VARIANCE OF FINANCIAL RETURNS"
Taylor, Stephen J., Dept of Operational Research, School of Management & Organisational Studies, University of Lancaster, Gillow House, Bailrigg, Lancaster, LA1 4YX

Daily changes in the logarithms of financial prices, called returns, have fluctuating variances. These variances can be forecast using past returns. Variances cannot be observed so empirical results are based on forecasts of absolute returns. If these are accurate so also are certain variance forecasts.

The accuracy of several forecasts is explored for currency futures and other financial assets. Two-thirds of the returns are used to optimise forecasting parameters, then forecasts are compared on the remaining data. The best forecasts can be used to estimate the values of options.

"THE FORECASTING PERFORMANCE OF STOCK OPTIONS PRICES IN A THIN MARKET"
Gemmill, Gordon, The City University Business School, Frobisher Crescent, Barbican, London, England

Options prices are highly sensitive to changes in the volatility of underlying assets. It follows that the implicit volatility embedded in the price of a publicly traded option should be a good forecast of the eventual outcome. However, in a thin market quoted prices are subject to considerable noise. Assuming the Black and Scholes model to hold, this paper compares the forecasting performance of such implicit volatilities with historically estimated volatilities for the period 1978-83 using data from the London Traded Options Market.

"ON THE CONTENT AND STRUCTURE OF A LARGE SUBSPACE OF TECHNICAL PREDICTORS OF THE STOCK MARKET"
Hibshoosh, Aharon, Department of Marketing and Quantative Studies, San Jose State University, School of Business, San Jose, CA 95192, USA

Foster, J. Thomas., Wedbush, Noble and Cooke, Los Angeles, USA

Published studies assessing the predictive power of systems of technical indicators of the stock market have examined only a few, selective, isolated, technical indicators.

To improve the validity of such assessments we present the results of the first stage of inquiry into the content and structure of a large subspace of technical indicators of the stock market.

The paper defines a set of statistics for the descriptions of the majority of the indicators of a widely followed technical system by Granville. Using a non-parametric, multidimensional, scaling analysis, the paper draws first order interferences on the subspace spanned by this collection of technical predictors.

"EXCHANGE RATE RISK AND VOLATILITY: EVIDENCE FROM BID-ASK SPREADS"
Glassman, Debra, Department of Economics, University of British Columbia, 1873 East Mall 997, Vancouver, British Columbia, V6T 1Y2, Canada

This paper develops and estimates a model of exchange rate bid-ask spreads in which the independent variables represent exchange rate volatility and the rate of transactions in foreign exchange markets. The model is tested on six and one half years of daily data for each of six currencies quoted versus the US dollar. The currencies are the British pound, Canadian dollar, German mark, French franc, Japanese yen, and Swiss franc. The sample period is July 1, 1977 to December 31, 1983.

The model in this paper differs from and extends previous studies in a number of ways. First, the volume of currency futures trading is used as a proxy for the rate of transactions in interbank foreign exchange markets. Second, in recognition of the non-normality of exchange rate distributions, more than one higher order moment of the exchange rate distribution is included to represent exchange rate volatility. Finally, foreign exchange traders are assumed to predict current exchange rate volatility on the basis of the recent past.

The model performs fairly well for all currencies except the Canadian dollar, which varied far less than the other currencies. The results support the idea that more than just the standard deviation of the exchange rate is required to adequately represent exchange rate volatility. This finding can be applied to the measurement of risk premia in foreign exchange markets.

INDUSTRIAL APPLICATIONS OF ECONOMETRICS: I
AUTOMOBILE DEMAND

APPLIED ECONOMETRICS

Chair: Dahl, Carol A., Dept of Economics, Louisiana State University, Baton Rouge, Louisiana, USA

"AN AUTOMOBILE SEGMENT MODEL INCORPORATING A PARTIAL ADJUSTMENT PROCESS"
Shillingford, J.D., General Motors Corp., 767 5th Avenue, New York, NY 10153, USA.

To capture the changing relationships among the various auto segments, an auto segment model has been developed utilizing a stock adjustment framework. The model incorporates a number of critical sector specific variables, is robust and has elasticities of appropriate magnitude. The modelling results support the general applicability of the partial adjustment process in auto demand modelling. At the same time, the work indicates that this theoretical framework is not appropriate for use with all auto segments. The role of interest rates and the importance of discontinuities such as strikes and credit constraints were also addressed. The model is currently used in corporate unit volume forecasting.

"AN EVALUATION OF UNIVARIATE AND BOX JENKINS MODELS OF THE AUTOMOBILES INDUSTRY"
Zober, Martin., School of Business, University of Iowa, Ames, Iowa 50011, USA.

Forecasting procedures in the auto industry have concentrated primarily on demand models. These models are related to the demand for consumer durables in general. In all models, income appears to be an important variable. The latest models disaggregate autos by sub-compact, compact, medium, large and luxury cars. The data used in either annual or quarterly data.

The present research builds an econometric model with supply and demand components. The data is monthly data rather than quarterly or annual, and the forecast is ex post.

A number of studies have been made comparing Box Jenkins with regression or econometric procedures. The only case in which econometric forecasts do better than Box Jenkins is that in which they are combined with Box Jenkins. In all other cases, the Box Jenkins alone performs better. This paper used the univariate Box Jenkins procedure to extrapolate the independent variables in the econometric model. The forecast is compared with an univariate and transfer function model of Box Jenkins.

Since the data used in the past models have been quarterly or yearly, they were not adequate to forecast in the short run. In this paper, simulation has been executed with the econometric model by varying the assumptions of the exogenous variables. The econometric model is based on ideas drawn from studies made of demand for automobiles.

The following measures of effectiveness have been used: mean absolute deviation, Theil's "U" statistic, Theil's decomposition of the mean square error of the residuals, and the autocorrelation of the residuals.

This suggests the following hypotheses which are tested:

1. Based on the measures listed above, the econometric model will outperform the univariate Box Jenkins procedure in the twelve month ex post forecast;

2. The univariate Box Jenkins will, using the measures listed above, outperform the econometric model for the three month and six month ex post forecast;

3. The transfer function model will perform better than either the univariate Box Jenkins in the three month, six month, and twelve month ex post forecast.

"EXTERNAL CONSTRAINTS IN THE CAR INDUSTRY - A BAYESIAN MODEL"
Peguin-Feissolle, Anne., CEFI, CNRS ERA 984, Faculte des Sciences Economiques, Chateau La Farge, Route des Milles, 13290 Les Milles, France

The paper tried to develop a method which would clarify any structural rigidity or pressures for change in a production system. A model is developed which describes the industrial performances of the car industry, taking into account intermediary consumption strategies of firms in the industry. Bayesian econometrics are then used to identify industry rigidities. Two countries are studied: France and Germany. First, for each country, the model is estimated using Bayesian methods. In the second stage, the German results are taken as prior information: Bayesian methods then allow this prior information to be updated by the French sample. The posterior information which is then obtained can be used to evaluate whether the French sample is compatible with the German prior information. Distances between the posterior results are computed to evaluate structural rigidities in the industry.

"THREE ALTERNATIVE APPROACHES TO AUTOMOBILE DEMAND:SOME EMPIRICAL RESULTS"
Kalantzopoulos, Orsalia, General Motors Corporation, 767 Fifth Ave, New York, NY 10153, USA

Modelling automobile demand has proven to be a very complex task. Research concerning the demand for consumer durables in general and cars in particular has frequently been encumbered by a variety of problems that affect both the developments of demand theory and the construction of demand models. These problems, which are primarily due to the lack of availability of relevant data, make it extremely difficult to construct and test rigorous demand models. Consequently considerable disagreement concerning the proper specification of automobile demand models persists. This paper will evaluate three different approaches to model building, drawing conclusions on how best to overcome the many data related problems.

ROOM LT5

MONDAY
4.00-5.30

TECHNOLOGICAL FORECASTING AND THE PROMOTION OF TECHNOLOGICAL CHANGE

SOCIAL & TECHNOLOGICAL

Chair: Twiss, B., Strangford, 56 Ben Rhydding Rd, Ilkley, W Yorks LS29 8RN, England

"FORECASTING THE PROGRESS OF ROBOTICS THROUGH AN ANALYSIS OF PATENT AWARDS"
Maurer, R., Colorado School of Mines, PO Box 736, Golden, Colorado 80402, USA.
Brossia, C.E.,

Economic activity, by its nature, commits current resources to the future. Forecasting the future is an integral part of the business decision process. Solow estimated that technological progress has accounted for more than half of the historical growth in national output. The science of technology forecasting is not well established, due in part to the lack of quantifiable time-series indicators of technology status. This paper examines the suitability of statistical data extracted from US Patent publications as an indicator of technology. Robotics technology was selected for use as an illustrating case study. A forecast of robotics substitution for human operative labor is made indicating 0.7% substitution by 1990 and 19% substitution by the year 2000.

"THE NOTION OF TECHNOLOGICAL LIMITS AS AN AID TO TECHNOLOGICAL FORECASTING"
Van Wyk, Rias J., University of Stellenbosch, Stellenbosch, South Africa.

One approach to technological forecasting involves trend extrapolation. The trends extrapolated are usually performance or structural paramaters of artifacts. Forecasters are able to extrapolate better if they can visualize limits beyond which these trends cannot proceed. If the capabilities of artifacts fall short of their ultimate constraints much scope exists for technological development. If these capabilities are approaching their limits less potential exists. This paper outlines a chart of technological limits for use by forecasters. This chart is structured in such a way that it ties in with a standard classification of technologies and a standard set of technological trends. It shows which limits are well documented and which require further research.

"BIRTH, LIFE, DEATH & REBIRTH: LONG WAVES AND TECHNOLOGY"
Dodd, Digby, Dodd & Associates, Sparrows Barton, Easton, Nr Corsham, SN13 9QD, England
Latin, R.V., Standard Telecom Ltd, London Rd, Harlow, Essex CM17 9NA, England

This paper will examine the relationship between Longwaves as a manifestation of socio-technological change. It is hypothesized that the Longwave belongs to a set of quasi macro-laws which characterise a given society. At the basic core of these macro-laws is the learning rate of people and the rate that knowledge is updated and diffuses through society. An individual learns by going through four phases of Divergence, Assimilation, Convergence and Application. These will be related to the five phases that a product passes through from cognition, pioneering, gestation, diversification to standardization. It is possible to view the Longwave as an envelope of socio-technological change curves. Finally, products appear to follow individual S shaped growth curves; perhaps society follows linked S shaped curves one for growth and one for death, followed by rebirth as it moves from an old to a new paradigm? The paper will identify the new paradigm allowing rapid diffusion of appropriate technologies and postulate on the next paradigm.

"INDUCING THE NEXT LONG WAVE"
Priban, Ian, British Consortium for Innovation, Cavell House, Charing Cross Rd, London WC2, England

The rationale and evidence for the likely induction and catalysis of a spontaneously rising long-wave will be presented in terms of the following features:

1. The results of a systems analysis of historical events and patterns.
2. The role of perceptions, concepts and technology - tools, systems and infra structure - and individual aims and actions relative to the characteristics of the context.
3. A reference frame for synthesising a clear, integrated vision of a fundamentally new course ahead.
4. A detailed view of precedent turning points, their forces and patterns.
5. Empirical studies and observations of peoples perceptions of changing governability in 1970's and 1980's and the recognition of the need for radical innovation.
6. The leadership prerequisites - vision, intelligence and action - necessary to stimulate irreversibly a new long wave, and the alternatives.

ROOM LT6

MONDAY
4.10-5.30

THE ESRC MACROECONOMIC MODELLING BUREAU

MACROECONOMIC FORECASTING

Chair: **Wickens, Michael**, Dept of Economics, University of Southampton, Southampton, England

"THE ESRC MACROECONOMIC MODELLING BUREAU"
Wallis, Kenneth F., Dept of Economics, University of Warwick, Coventry, England

The Economic and Social Research Council established the Macroeconomic Modelling Bureau at the University of Warwick in September 1983. This talk reviews the background to that decision and describes the Bureau's programme of work.

The main purpose of the Bureau is to improve the accessibility of UK macroeconomic models, to promote general understanding of their properties, and to facilitate comparison between models. Initially attention has concentrated on the models of the ESRC-supported teams:

Cambridge Growth Project
City University Business School
Liverpool University
London Business School
National Institute of Social and Economic Research

Each model has been mounted at the Warwick Computer Centre, together with its historical and forecast databases. The Bureau's user service gives academic researchers access to these models from computer terminals in their home institutions. The Bureau's comparative research programme incorporates standardized comparisons of overall model properties and forecasts, and reviews of specific features.

Discussants

Henry, S.J.B., National Institute of Economic & Social Research, 2 Dean Trench St, Smith Square, London, England

Zarnowitz, Victor, University of Chicago, NBER and the Graduate School of Business, 1101 East 58th St, Chicago, Il 60637, USA

ROOM G07
(SLOAN ROOM)

MONDAY
4.00-5.30

ECONOMIC/DEMOGRAPHIC FORECASTING III

SOCIAL & TECHNOLOGICAL

Chair: Ahlburg, D.A., Industrial Relations Centre, University of Minnesota, Minneapolis, MN 53455, USA

"CHANGING DEMOGRAPHIC PATTERNS AND THE HOUSING MARKET"
Ermisch, J., Policy Studies Institute, 112, Castle Lane, London, England.

Households occupy dwelling units, and it is through households that the various dimensions of housing demand are expressed. Thus the first part of this paper considers the factors influencing the number of households formed out of the population. In particular, an economic theory of household formation is outlined, and the results of an econometric application of the theory are examined. With this as a background, a measure of the change in the number of households purely attributable to age/sex distribution changes is derived. The second part of the paper uses this measure in an econometric analysis of the effect of changes in the age/sex distribution of the population on house prices and public and private sector investment in housing. That is, the resource implications of demographically-induced household growth are examined. This part also attempts to measure some feedback effects of the housing market on household formation, giving some tentative results. The third part of the paper investigates the effect of demographic changes on the composition of housing demand, rather than just aggregate demand. A number of dimensions of housing demand are explored: dwelling size and type, housing tenure, quality attributes and household expenditure on housing and residential location. More detailed measures of the effect of the age/sex distribution of the population on the size, type and tenure dimensions of housing demand are constructed. In general it can be said that British housing markets are subject to considerable demographic pressure during the 1980s, but during the 1990s the demographic impetus to household growth and aggregate housing investment gradually fades away. During the next twenty years, demographic changes are increasingly shifting the pattern of housing demand in favour of owner-occupation, larger and higher quality dwellings and less central locations.

"SMALL-AREA POPULATION FORECASTING"
Voss, Paul.R., Applied Population Laboratory, Dept. of Rural Sociology, 311 Agricultural Hall, University of Wisconsin-Madison, Madison, WI 53706, USA

Kale, Balkrishna, D., Demographic Services Center, WI Dept. of Administration, 101 S. Webster St. P.O. Box 7864, Madison, WI 53707, USA

The demand for small-area (i.e. sub-county) population forecasts is increasing at precisely the time that resources to generate such forecasts at the local level are diminishing. As a consequence, pressure is often put on state demographic agencies to produce state-wide small-area forecasts for general purpose planning or for specific public works projects. Such agencies, however, are handicapped in the face of such a task by an underdeveloped tradition, literature and body of generally accepted methodology. This paper reports the results of an investigation of small-area population forecasting techniques. Test findings of several methodologies (singly and in combination) used to produce 1970-based projections of 1980 population are presented and disucussed.

"THE U.S. DIVORCE RATE, 1955-1990"
Ahlburg, Dennis A., Industrial Relations Center, University of Minnesota, Minneapolis, MN 53455, USA .

The paper discusses the economic consequences of divorce for women and children involved in divorce. Factors which lead to an increase in the divorce rate are investigated and a model is built to explain variations in the U.S. divorce rate for the period 1955-1979.

The factors found to have a significant impact on the divorce rate are relative income, female labour force participation rate, the number of children under five years of age per woman, and the tightness of the labour market.

The model is used to forecast the divorce rate out to 1990. The divorce rate is forecast to decline slightly over the 1980's, although it will remain above the level of most of the 1970's. The decline in the divorce rate will probably not be sufficient to cause a decline in the number of women and children affected by divorce. Such a finding emphasizes the importance of a full investigation of the current system of child support, alimony and the role of the A.F.D.C. program as a program of support for those affected by divorce.

"FORECASTING THE FEMALE LABOUR FORCE IN BRITAIN"
Joshi, Heather, London School of Hygiene and Tropical Medicine, 31 Bedford Square, London, England

An econometric study of employment by single year of age during the period 1950-74 has generated models which forecasts the female labour force over the last quarter of the century. These forecasts use official projections of the population of women, their past and projected fertility behaviour and cohort-specific constant terms to generate employee rates at constant demand for any age group specified between 20 and 59. The paper also discusses whether the long run economic trend is suitably characteristized by the difference between cohorts observed in the period 1950-74 and whether and by how much constant demand participation rates need to be adjusted to reflect the business cycle.

ROOM P101

MONDAY
4.00-5.30

ASPECTS OF ESTIMATION

TIME SERIES

Chair: Bunn, D.; London Business School, Regents Park, London, NW1 4SA, England.

"NONLINEAR ESTIMATION BY ONLINE COMPUTATION OF BAYESIAN STATISTICS"
Jacobs, O.L.R., University of Oxford, Engineering Laboratory, Parks Road, Oxford OX1 3PJ, England

The paper shows how Bayes' rule can be directly applied to estimation through noisy nonlinear measurements in real systems when an on-line computer is available to implement numerical computation of conditional probability distribution and their statistics. Such computers are now routinely available with adequate power for one-dimensional distributions in many applications and for two-dimensional distributions in slow applications.

A novel linearisation is presented which summarises the operations of nonlinear measurement followed by Bayes' computation of conditional statistics. This opens the way to practical alogrithms for recursive estimation, which are described.

The work was motivated by case-studies and is justified by examples from simulations and experimental studies. Analysis to guarantee nice properties of the algorithms is not yet available.

"FORECASTING FOR STATE-SPACE AND ARMA MODELS USING THE EM ALGORITHM"
Shumway, R.H., Division of Statistics, University of California, Davis, CA 95616, USA

The development of a sound methodology for time series forecasting depends on (1) selecting an appropriate model and (2) estimating the parameters of the model by some efficient method such as maximum likelihood. For ARMA and state-space models, application of the EM algorithm leads to simple recursive derivative-free schemes for maximizing the likelihood, with the forecast functions generated within the estimation phase. In this paper the EM procedure will be compared to other recursive schemes in the literature and some examples involving forecasting quarterly earnings per share of various U.S. Stocks will be presented. The simplicty of the approach will be illustrated by presenting software which can be run on a minimally configured microcomputer.

"AFECD - ADAPTIVE FORECASTING AND ESTIMATING BY CHANGE-DETECTION"
MacNeill, Ian B., Department of Statistical and Actuarial Sciences, The University of Western Ontario, London, Canada

To accommodate possible parameter changes at times which are not specified in advance, we propose an adaptive procedure for estimating parameters and for forecasting. The mechanism for activating the adaptive procedure is a successively up-dated change-detection statistic. The statistic has small expected value when no change is present and has large value when change takes place - the larger the change, the larger the statistic. The statistic defines discounting factors which determine how much of the past will be used both for estimating parameters and for forecasting.

The change-detection statistic is designed to effect major changes to parameter estimates and to forecasts in a discrete fashion only, as opposed to certain other adaptive procedures that react continuously to perceived fluctuations in data, and so indicate change even when parameters remain fixed.

ROOM P102

MONDAY
4.00-5.30

FORECASTING ERRORS AND CONFIDENCE INTERVALS II

TIME SERIES

Chair: Calzolari, Giorgio; Centro Scientifico, IBM, Via S. Maria 67, Pisa 56100, Italy

"PRELIMINARY DATA ERRORS AND THEIR IMPACT ON THE FORECAST ERROR OF SIMULTANEOUS EQUATIONS"
Trivallato, Ugo., Department of Statistics, Universita di Padova, Via S. Francesco 33, Padova, Italy 35121

The paper is concerned with the contribution of errors in preliminary data (before the final revisions become available) to the forecast error of dynamic linear structural econometric models.

A decomposition of the forecast error, and of the forecast error variance, is performed, which allows the identification of three sources of error: the random disturbance term, errors in estimated coefficients, errors in the preliminary data.

The suggested decomposition is applied to a small macroeconomic model of the Italian economy, by using the analytic simulation technique.

"CONFIDENCE INTERVALS OF FORECASTS WHEN THE EXPLANATORY VARIABLES ARE STOCHASTIC"
Fingerman, Joel., Department of Management & Quantitative Methods, Roosevelt University, 430 S. Michigan Avenue, Chicago, Illinois 60605, USA

ch every forecast a forecast confidence interval associated with that forecast should be determined. owever, in practice, forecasts are usually not stated in terms of forecast intervals or multivariate regions. In particular, forecast confidence intervals are usually not provided when the explanatory variables are, in themselves, forecasted, and thus stochastic. This paper presents methods by which to account for the stochastic nature of forecast-period explanatory variables when establishing confidence intervals. Examples from single equation models, structural equation models, time series models and simulation models to illustrate how confidence intervals of forecast for such models are determined.

"STATISTICAL PROPERTIES OF FORECAST ERRORS"
Sankaran, S., Faculty of Administration, University of Regina, Regina, Saskatchewan, Canada S4S 0A2

This paper focuses on the statistical properties of forecast errors. It extends the results of an earlier study on the randomness of errors of published Canadian forecasts. Special attention is given to the skewness and kurtosis measures, and to the correlations between forecasts of different variables by the same forecaster, and between forecasts of the same variable by different forecasters.

CONFERENCE PROGRAMME TUESDAY

TUESDAY MORNING AT 9.00 a.m.

ROOM	SESSION	CHAIR	
LT1	Cost forecasting II	G. David Hughes	36
LT2	Panel on Corporate Planning Models	John Precious	37
LT3	Energy Forecasting II	Derek Bunn	38
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LT5	Exchange Rates I	Laurence Copeland	40
LT6	Panel in Computer Support in Forecasting @ 9.10	Spyros Makridakis	41
FBR	Probability Assessment and Choice	Larry Phillips	42
G07	Pooling and Unobserved Components @ 9.10	Timo Terasverta	43
P101	Linking Forecasting to Decision Making	J. S. Armstrong	44
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TUESDAY MORNING AT 11.00 a.m.

LT1	An Industrial Organization Investigation of the Forecasting Industry	Mervin Daub	47
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LT3	Business Policy Forecasting	John Morecroft	49
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LT5	Exchange Rates II	Paul Ormerod	51
LT6	Panel on Time Series Methods in Forecasting @11.10	Andrew Harvey	52
FBR	Keynote Session on Modelling the Supply Side	Alan Budd	53
G07	New Product Forecasting II	M.D. Geurts	54
P101	Forecasting Applications in the Firm	J.A. O'Brien	55
P102	Industrial Applications of Econometric Forecasting II: Transportation Forecasting	Ken Button	56

TUESDAY AFTERNOON AT 2.00 p.m.

LT1	Forecasting for Operations	Dale Flowers	57
LT2	Changing Social and Political Attitudes	C.R. MacNulty	58
LT3	Commodity Forecasting	D.G. Bean	59
LT4	Developing Practicing Forecasters	Hans Levenbach	60
LT5	Political Forecasting I	N.M. Fraser	61
LT6	Keynote Speaker in Applied Econometrics @ 2.10	David.J. Smyth	62
FBR	Energy Forecasting III	Leo Drollas	63
G07	Macroeconomic Models & Policy Making	Sean Holly	64
P101	Travel & Tourism Forecasting	R.R. BarOn	65
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TUESDAY AFTERNOON AT 4.00 p.m.

LT1	Time Series Analysis on Micro or Mainframe @ 4.10	Peter Young	68
LT2	Improving Judgement II	George Wright	69
LT3	Exchange Rate Forecasting III	Don Alexander	70
LT4	Practical Problems in Social Forecasting	J.S. Halliday	71
LT5	Keynote Session on Business Cycles	A. Britton	72
LT6	Comparative Forecasting Accuracy and the Value of Exogenous Variables @4.10	Doug Wood	73
FBR	Information Technology	John Tydeman	74
G07	Forecasting Corporate Financial Flows	Paul Griffin	75
P101	Seasonality and Seasonal Adjustment I	R.H. Shumway	76
P102	Econometric Methodology II	R.C. Sousa	77
SG14	Developing and Testing Macroeconomic Models	Colin Ash	78

ROOM LT1

TUESDAY
9.00-10.30

COST FORECASTING II

BUSINESS APPLICATIONS/APPLIED ECONOMETRICS

Chair: **Hughes, G. David.**,School of Business Administration, University of North Carolina, Chapel Hill, NC 27514, USA.

"FORECASTING EXPERIENCE CURVES WITH LOTUS 1-2-3"
Hughes, G. David., School of Business Administration, Carroll Hall 012A, University of North Carolina, Chapel Hill, NC 27514, USA
Josephy, N.H., Harvard Business School

Estimation and forecasting experience curves is facilitated with a template that uses the Lotus 1-2-3 microcomputer integrated package.

Alternative ways of estimating experience curves, including regression, are exhibited with immediate graphic representation. Refinements include provision for inflation, disaggregation of activities to reflect utilization by other products, capacity limitations, and economies of scale. Experience curve applications in marketing are illustrated using sensitivity analysis, confidence intervals, and best/worst scenarios. Links are made between demand, as reflected in the product life cycle, and costs, as predicted by experience curves.

"FORECASTING WEAPON SYSTEM PRODUCTION COSTS IN THE DEPARTMENT OF DEFENSE"
Bohn, M.T., and Glass-Royal, D., Analytical Sciences Corporation, 1700 North Moore Street, Suite 1220, Arlington, VA 22209, USA

Forecasting procurement costs for weapon systems is exceedingly complex. Accurate forecasting of final procurement cost requires a thorough understanding of how changes in the production rate effect both long run and short run costs. The authors have examined a learning curve, production rate formulation that takes into account both long run and short run production cost curves to forecast recurring unit costs for weapon system procurement. Also included is a brief discussion of the unique nature of the Defense "market".

"MODEL SPECIFICATION ISSUES WHEN USING ACCOUNTING DATA"
Stolleman, Neal C., GTE Service Corporation, One Stamford Forum, Stamford, CT 06904, USA

In recent years, there has been a proliferation of econometric studies concerned with analyzing the characteristics of the production structure of firms. Several of these studies have been related to the telecommunications industry. A common feature of these studies is the utilization of static duality theory between production and cost functions. This duality allows one to mirror all of the economically relevant aspects of the production function in terms of the cost function, and in addition, the derivative property of the latter allows one to determine the optimal demands for factors of production. Econometric estimation of the price elasticities of demand for these factors is then possible. Usually factors of production are defined in terms of the traditional land, labour and capital categories, and certain sub-categories. This paper postulates that additional separability restrictions on the functional form should be imposed in order to reflect the reality of the institutionalized resource utilization process within firms. Furthermore, the use of accounting data to mirror underlying economic relationships is shown to bias estimates of the price elasticity of demand for the services of factors of production. Some of the implications of this bias are discussed, as well as possible effects on the residual. Recommendations for circumventing the bias effect include an alternative model specification or a different method of constructing quantity indices from accounting data. These recommendations follow naturally from the analysis.

ROOM LT2

TUESDAY
9.00-10.30

PANEL ON
CORPORATE PLANNING MODELS & FORECASTING

FINANCIAL APPLICATIONS

Chair: **Precious, John:** Tioxide Group PLC, 10 Stratton St, London W1A 4XP, England

Session Overview

The session on corporate planning models and forecasting will look at the practical problems encountered using forecasting techniques in computerised planning models. The key-note paper will be based on the results of a survey conducted specifically for the symposium. This survey covers the types of forecasting techniques currently in use and ranks them in order of reliability and popularity. Companies not using mathematical techniques give some interesting reasons for their abstinence. The speakers have accumulated a vast amount of experience of modelling in industry and are by no stretch of the imagination dedicated forecasters. This session is unlikely to appeal to pure academics nor to those who believe that sophisticated forecasting techniques are widely used in industry. It may hopefully give some clues as to how planning models can be used most effectively.

Presenter: **Sherwood, Dennis:** Deloitte, Haskins & Sells, Richmond House, 1 Rumford Place, Liverpool, England.
Author of: Financial Modelling; A Practical Guide, Gee, 1984.

Discussants: **Burnham, Peter:** Coopers and Lybrand Associates, Fleetway House, 55 Farringdon Street, London EC4., England.

Sutcliffe, Roy: EPS Consultants Ltd., Boundry House, Boston Road, London W.7., England.

ROOM LT3

TUESDAY
9.00-10.30

ENERGY FORECASTING II

SOCIAL & TECHNOLOGICAL

Chair: **Bunn, D.**, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, England

"ENERGY MODELLING - THE STATE OF THE ART"
Dahl, Carol, A., Dept of Economics, Louisana State University, Baton Rouge, Louisiana 2107, USA

The importance of energy to industrial economies coupled with the instability of their markets in the last decade have caused a lot of time and resources to be devoted to large scale energy models. This paper considers the state of the art of these models by first reviewing examples of large scale energy modelling approaches. Models are both national and international and include the following non-mutually exclusive methodologies: energy balances, econometric, linear and nonlinear programming, input-output, simulation, and optimization.

Last the purpose and limitations of the models and their effectiveness at meeting various forecasting and policy objectives are considered.

"ELECTRICITY FORECASTING"
Kwiecinski, Paul, G., Utility Forecasters Forum, 2145 King La Crosse, WI 54601

Electric forecasting has undergone a tremendous change since the oil embargo of the mid-seventies. As the editor of the Utility Forecasters Forum, and as a practicing forecaster, I've found that utilities in the United States use a number of different techniques to model and forecast electric loads.

My presentation discusses three basic topics of electric load forecasting:

1. The range of forecasting techniques being used by forecasters. Forecasters are using a number of techniques depending on available data, resources, time, and purpose;

2. The necessity of forecasting in a time of excess capacity and slow growth. Some utilities are even questioning the need for forecasters under these conditions; and,

3. The uncertainty in electric load forecasts. What will shape future electric consumption in the U.S.?

This is not an analytical treatment of methods used, but rather it is geared to the practitioner - someone with limited time and resources who nevertheless is expected to come up with a useful and defendable forecast.

"STRATEGIC ENERGY SYSTEMS FOR ANALYSING MACROECONOMIC EFFECTS"
Kohler, D., Rand Corporation, 1700 Main Street, Santa Monica, California, 90406, USA

This paper describes an interactive macro model for the U.S. economy that was developed to support strategic energy policy games conducted for the U.S. Department of Energy, by The Rand Corporation.

Hybrid in structure, this model combines elements of standard macro models and general equilibrium models. It is unique in its high degree of flexibility, which allows continuous operator interaction to simulate a wide variety of policy options.

ROOM LT4

TUESDAY
9.00-10.30

KEYNOTE SESSION
ON
SOCIAL FORECASTING

SOCIAL & TECHNOLOGICAL

Chair: **Loveridge, Denis,** Pilkington's New Ventures, Pilkington Bros, Prescot Road, St. Helens, Merseyside, WA10 3TT, England

"SOCIAL-TECHNOLOGICAL FORECASTING: PITFALLS IN AN ESSENTIAL AREA"
Lesourne, J., Conservatoire National des Arts et Metiers, 292, rue Saint Martin, Paris, Cedex 0375141, France

Two reasons justify the introduction of social-technological forecasting in prospective analysis: discontinuities often originate in technical discoveries or sociological events while, in the long term, the usual division between fields of knowledge loses its validity. However, three pitfalls have to be avoided: an insufficient knowledge of the scientific disciplines involved, a poor description of the system considered, an absence of effort to obtain data. The second pitfall will be illustrated by two examples: the analysis of the prospects of the demand for environment, the construction of unemployment scenarios for a Western European country.

"THE BIOCYBERNETIC APPROACH AS A BASIS FOR PLANNING OUR ENVIRONMENT"
Vester, Frederic, Studiengruppe fur Biologie und Umwelt, Nusthaustrasse, 8000 Munchen 2, West Germany

Since appropriate planning instruments to deal with computer systems were lacking, we developed a macroscopic instrumentarium called Sensivity Model which enables the planner to understand the socio-economic-ecological environment eg. of a region as a biocybernetic system and thus can compare it with ecosystems and their fundamental cybernetic laws.

By a new kind of simulation, interpretation and evaluation device this approach helps us in more appropriate planning, but also to obtain the badly needed political and material support for decisions to improve the future ability of a system to survive and to evolve. Thus a practical neutral instrument was created applicable to any geographic region as well as to any economic complex.

"THE EFFECTS OF DEVELOPMENT ASSISTANCE ON DEVELOPING COUNTRIES: A WORLD MODELLING APPROACH"
Gigengack, R., World Model Project, Faculty of Economics, State University of Groningen, PO Box 800, 9700 Av. Groningen, The Netherlands.

In this paper some long-term effects of development assistance are examined using the world model SARUM. Seven scenarios, differing in their assumptions about the size of the assistance given and the distribution of the given assistance over alternative development activities are constructed and simulated. The results of these exercises are compared, especially with regard to the patterns of (relative) gross output and the external balance of four major "developing regions".

:XCHANGE RATES I

MACROECONOMIC FORECASTING/FINANCIAL FORECASTIN(
APPLIED ECONOMETRICS

:hair: Copeland, , Dept Management ences IMIST PO Box 88, Manchester M60 England

'BIAS AND EFFICIENCY OF UK FOREIGN EXCHANGE RATE FORECASTING SERVI
Beenstock, Michael., Brasse, Valerie., and Chan, Kam-fai., niversit Bus ity
The Barbican Centre, London, England

A sample of exchange rate forecasts produced by U.K. based services are analysed in terms of statistical bias and efficiency. On the whole, the forecasts are very poor and forward exchange rates are better indicators of exchange rate developments than the forecasts themselves. Attempts to generate composite forecasts based on individual forecasts and exchange rate data implied that the forecasts contain little or no marginal information above that already embodied in published exchange rate data. Because we use overlapping forecast data appropriate statistical methodologies need to be applied.

FORWARD EXCHANGE RATE AS A PREDICTOR OF FUTURE SPOT RATES: MODELLING RISK AND EXPECTATIONS"
Murfin, A., and Ormerod, P., Henley Centre for Forecasting, 2 Tudor Street, London EC4, England

This paper summarises two approaches to exchange rate forecasting, both based on the response of exchange rates to 'surprises' or 'news'. In the first section a (bivariate) time series model of the spot and forward rate is discussed; it produces one month ahead spot rate forecasts for sixteen currencies which beat the forward rate in 70% of cases. In the second section, a more detailed economic model of the $:£ spot exchange rate is proposed. It involves systems estimation of money supply, interest rate, consumer price index, current account and exchange rate equations on a monthly basis for 1973-82.

:XPECTATIONS AND FORECASTS OF FUTURE EXCHANGE RATES"
McMahon, P.C., and Baillie R.T., Department of Economics University of Birmingham, Birmingham B15 England

Alternative definitions of market efficiency correspond to expectations and predictions formed from different information sets. A summary is given of previous work examining the evidence and interpretation of the bias in the forward rate and some new results based on different information sets are presented. The implications for models of exchange rate determination and generation of forecasts are also considered.

ROOM LT6

TUESDAY
9.10 - 10.40

TIME SERIES/GENERAL FORECASTING

PANEL ON COMPUTER SOFTWARE SUPPORT IN FORECASTING

Chair: Makridakis, Spyros, Editor, Journal of Forecasting, McGil University, Montreal, Canada.

Session Overview

This panel discussion will examine the most recent developments in computer software support in forecasting. A survey paper (by Professor Jarrett) primarily concerned with micro software will be presented offering an overview of available packages.

Following this, panellists who panellists who represent differing viewpoints and who have been directly involved in the development of computer software will present their own views of those aspects of a software forecasting system that are of particular importance to them, as well as those developments that they see as most desirable.

	Affiliation
Panel: Jeffrey Jarrett	Dept. of Management Science University of Rhode Island, Kingston, RI 02881, USA
David DeLong	SAS Institute, Cary, North Carolina
Robert F. Ling	IDA, and Dept. of Mathematical Sciences, Clemson University, Clemson, South Carolina, USA
Timothy A. Davidson	Sibyl/Runner and Applied Decision Systems, Temple, Barker & Sloan Inc., 33 Hayden Ave., Lexington, Mass 02173, USA
Essam Mahmoud	University of West Virginia Morgantown, WV 26506-6025, USA

PROBABILITY ASSESSMENT AND CHOICE

JUDGEMENT

Chair: **Phillips, Larry**, Decision Analysis Unit, London School of Economics, Houghton St, London, England

"AMBIGUITY AND JUDGEMENT UNDER UNCERTAINTY"
Hogarth, Robin M., University of Chicago, Graduate School of Business, Center for Decision Research, 1101 East 58th Street, Chicago, Illinois 60637, USA

Whereas the consideration of ambiguity, or "second-order" probabilities, is normatively inappropriate within the personalistic theory of probability, such considerations do affect both choice and judgements under uncertainty. This paper presents a descriptive psychological model of how ambiguity affects the assessment of probability. It will demonstrate that the key factors affecting such assessments are the imaginability of alternative probabilities and the person's "attitude toward ambiguity in the circumstances." Experimental tests of the model will be presented with reference to inference tasks, choices between gambles, and the purchase and sale of insurance. Implications for judgemental forecasting will be stressed.

"AN INTERACTIVE ELICITATION OF SCENARIO PROBABILITIES"
Moskowitz, Herbert., and Malesh, S., School of Management and Krannert Grad School of Management, Purdue University, Krannert Building, West Lafayette, Indiana 47987, USA

An interactive approach for assessing scenario probabilities used in long range forecasting and decision analysis is developed. The proposed method converges toward a unique (or most probable) set of scenario probabilities, that is consistent with the probability calculus and minimizes the time and cognitive demands on the assessor. The method requires only limited information from the assessor, marginal event probabilities, first-order conditional event probabilities (most likely values and ranges), and relative probability rankings for sequentially selected scenario subsets which minimize entropy. It also allows for inconsistent responses. The theory, methodology, and implementation of this computerized approach is described.

"SUBJECTIVE PROBABILITY ASSESSMENT FOR RARE EVENTS: A LABORATORY EXPERIMENT"
Thomas, H., and Samson, D., Dept of Business Administration, University of Illinois, 1206 South Sixth Street, Champaign, Illinois 61820, USA

Technological advances over the past few decades have led industrial societies to the point where potentially catastrophic events are possible although unlikely in many situations. Events such as nuclear power plant meltdowns and LNG tanker accidents near populated areas are examples.

In order to set standards and make decisions regarding potentially catastrophic events, it is necessary to evaluate both their likelihood and severity. If both the likelihood and loss severity of an event are small then the outcome can often be ignored by decision makers. However, events having low probabilities should be carefully examined if possible severities are high. A number of researchers have recognized the importance of assessing the likelihood of catastrophic events. Although there has been much research conducted on the subjective assessment of probabilities there has been relatively little focus on the special difficulties associated with assessing probabilities for rare events.

This article reports on a pilot study where subjects made assessments of low probabilities using the following procedures:

(1) unaided point estimates;
(2) the "standard" five point fractile procedure due to Raiffa (1968);
(3) event trees.

The primary research question was whether decomposition of a low probability event into higher probability "sub-events" would lead to a better overall assessment.

"FORECASTING WITH THE ANALYTICAL HIERARCHY PROCESS: PRINCIPLES, PITFALLS, PERFORMANCE"
Bahmani, N., Khorrami, A., and Sherman, H., Montclair State College, Upper Montclair, New Jersey, N.J. 07043, USA

The purpose of this paper is to present a model based on the analytical hierarchy process (AHP) that is based upon pairwise comparisons using the subjective scale developed by Saaty for analyzing hierarchies in general. The AHP is one of several methods which can be used by decision makers to make decisions in a dynamic complex environment. This approach is illustrated in an application to the prediction of the consumer product selection in supermarkets.

SLOAN ROOM G07

TUESDAY
9.10-10.40

POOLING AND UNOBSERVED COMPONENTS

APPLIED ECONOMETRICS

Chair: Terasvirta, T., ETLA, Lonnrotinkatu 4B, 00120 Helsinki 12, Finland

"UNOBSERVED COMPONENTS AND THE DEMAND FOR MONEY IN FINLAND"
Juselius, K., Institute of Economics, University of Aarhus, Building 350, DK-8000 Aarhus C, Denmark

An empirical investigation of the demand for money in Finland is performed based on the additive unobserved components approach. It is shown that the seasonal pattern as well as the general dynamic structure are totally different for M1 and (M2-M1). The frequently adopted procedure to empirically analyze the broad concept of money M2 without decomposing it in to the more homogenous concepts, currency and deposits, seems to aggravate a proper specification of the dynamic structures of the seasonal as well as nonseasonal components. It is shown that an error correction mechanism type of model with proportional, derivative and integral effects seems to be a reasonable description of the demand for deposits whereas the demand for currency can be described by a much simpler equilibrium model with an AR error process.

"POOLED CROSS SECTION AND TIME SERIES ESTIMATION: A GENERAL APPROACH THROUGH SPECIFICATION ANALYSIS"
Hsin-Kwang, Kuo, R., Marketing-ITI, American Telephone and Telegraph Company, Bedminster, New Jersey, USA

Recently, considerable efforts were made by researchers to solve estimation problems in the context of pooled cross section and time series model. The approach adopted in the model specifications in these researches is largely through assumption. Thus, fixed effect model, random effect model, or random coefficient model is postulated, and solutions were then proposed for each of the models to obtain empirical results. In this paper, a general regression model under conditions of specification error is derived. Extensions to this model are then made to pooled cross section and time series case. It is shown that all the above models are special cases to this general model. Estimation problem to this general model is solved, and properties discussed.

"REDUCING UNCERTAINTY IN SHORT-TERM PROTECTIONS: LANGUAGE OF MONTHLY AND QUARTERLY MODELS"
Greene, M., and Corrado, C., Board of Governors of the Federal Reserve System, Washington DC 20551.USA

This paper shows how monthly data and forecasts can be used in a systematic way to improve the predictive accuracy of a quarterly macroeconometric model. A minimum variance pooling technique (nonrecursive Kalman filtering) is used to optimally incorporate monthly information into the quarterly prediction process. The technique is extended to handle such pragmatic complications as model nonlinearity, limited monthly information sets, and serially correlated forecast errors. Results obtained using Federal Reserve Board models indicate the potential for significant reduction in forecast error variance.

"FORECASTING CHURN FOR SPECIAL COMMUNICATIONS SERVICES"
Greis, Noel P., Bell Labs/C50, WB ID-207, Holmdel, N J 07733, USA

Demand for telecommunications is not completely described by growth, or changes in net demand. The stochastic process underlying growth which reflects the disconnects and subsequent connects of circuits which does not contribute to growth is called churn. Forecasting churn is essential for estimating labor costs and planning the rate of new service introduction or retirement of old technologies. The results of a churn estimation study are presented. Four methods for predicting churn were analyzed, including cross-sectional mean methods. Special attention was given to circuit groups which have very few circuits, or groups for which insufficient history is available.

"ECONOMETRIC MODELS OF DEMAND FOR MECHANICAL WOOD PRODUCTS"
Baudin, A., Statistical Institute, University of Umea, S-901 87 Umea, Sweden
Lundberg, L., School of Forestry, Department of Forest Economy, S-901 87 Umea, Sweden

An econometric model for the demand of forest products, estimated on pooled time-series-cross-section data, is presented. The model is to be used for long term forecasting of sawnwood and panels demand for individual countries as well as for regions. The theoretical background is presented and discussed as well as a number of methodological problems. Different alternative model structures are estimated and compared with respect to their behaviour in time and across countries. The discussion, then, is concentrated on the uncertainty of long term forecasting on the basis of these models.

ROOM P101

TUESDAY
9.00-10.30

LINKING FORECASTING TO DECISION MAKING

GENERAL FORECASTING

Chair: **Armstrong, J. Scott,** Wharton School, University of Pennsylvania, Philadelphia PA19104, USA

"THE EFFECTS OF FORECASTING EVALUATION FRAMEWORKS ON MANAGERIAL DECISION-MAKING"

Toraskar, Kranti, Mgmt. & Org. Science Dept, Drexel University, 32nd & Chestnut Streets, Philadelphia, PA 19104

Monitoring of forecasting systems (Jenkins, 1982) and dealing with their imperfection (Makridakis, 1983) represent major challenges for the organizational, use-related research on forecasting. Such research will be preconditioned by the conceptual framework adopted for evaluating the performance of forecasting. This paper examines alternative forecasting evaluation frameworks and their effects on the user/manager's decision-making process. Major research factors are incorporated in an experimental design simulating a forecast-based managerial decision situation. An experiment using business students tests the feasibility of the process developed, and suggests significant differences. Concurrently, a field study is being conducted to enhance the empirical orientation of the experimental material. Initial field observations confirm that managers do seek/develop and use evaluative information about forecasting. Findings of the study will be corroborated through a final experiment using subjects with managerial work experience. The paper will present early results of the entire investigation.

"PUTTING EDUCATIONAL FORECASTS INTO PROPER PERSPECTIVE: A PRACTICAL GUIDE FOR DECISION MAKERS"

Dede, C.J., and Kierstead, F.J., University of Houston-Clear Lake, 2700 Bay Area Boulevard, Houston, TX 77058, USA

For years educators and forecasters have had problems understanding each other pursuant to the use of educational forecasts. Often many of the decisions and plans developed from these forecasts have contributed to the macroproblems faced today in education. This paper will suggest some practical strategies for not only putting present educational forecasts in proper perspective, but also to improve the communications between policysetters and forecasters in the future.

ROOM P102

TUESDAY
9.00-10.30

MODEL SELECTION II

TIME SERIES

Chair: Tremayne, A.R., Dept of Economic Studies, University of York, York YO1 5DD, England

"DISCRIMINATING METRICS FOR A PRIORI SELECTION OF TIME SERIES"
Edmundson, R.H., Lawrence, M.J., and O'Connor M.J., University of New South Wales, PO Box 1, Kensington, New South Wales, Australia 2033.

This paper reports on the pilot study conducted to determine the feasibility of developing metrics to permit a priori selection of forecasting techniques. The metrics developed are objectively derivable from the values of the time series.

The study indicates that further research is warranted. In the course of the study two discriminant functions were developed. The first of these makes a selection between a graphical, judgemental method and deseasonalised single exponential smoothing, and the second between Box-Jenkins and deseasonalised single exponential smoothing.

The paper describes the metrics employed, the analysis methodology, and interprets the discriminant functions.

THE NATURE OF ECONOMIC DATA: FORECASTING AND MODELLING BY MEANS OF TIME SERIES ANALYSIS"
Fisher, Jeffrey., Research Department, Bank of Israel, PO Box 780, Jerusalem 91007, Israel
Levich, Efim,Praedicta, Inc., Jerusalem, Israel

The present theory of forecasting economic variables by means of time series analysis is based on the assumption that the nature of economic measurement is similar to that of measurement in the physical sciences. However, complex system theory points to this assumption as being inaccurate. The paper attempts to build a theory of economic measurement, based on a different methodology. This alternative approach enables us to look at the accuracy of economic data from a different angle. In addition, the approach sets down clear limits to choice of time series models suitable for forecasting economic variables at the macro-level.

"A NOTE ON MODEL SELECTION CRITERIA FOR STATE DEPENDENT MODELS"
Cartwright, Phillip A., University of Georgia, Athens, Georgia 30602, USA

This note considers alternative model selection criteria for state dependent models. Empirical evidence is offered to support the contention that when interest is in forecasting, use of the the model selection criterion of minimum mean squared error of the predictions generated by the fitting algorithm will not necessarily lead to selection of the best forecasting model.

"SELECTING A FORECASTING METHOD FOR INVENTORY CONTROL: WHAT SHOULD BE THE CRITERIA?"
Lefrancois, P., Department des Sciences Economiques et Administratives, Universite du Quebec, Chicoutimi, Quebec G7H 2B1, Canada

The purpose of this paper is to present some results related to the application of several forecasting methods in an inventory control context. In particular, it is shown that an accuracy measure based on the level of stockouts given a reorder policy ranks the methods differently than do currently used measures based on forecast errors.

ROOM SG14

TUESDAY
9.00-10.30

NON-LINEARITY AND NON-NORMALITY

TIME SERIES

Chair: Chatfield, Chris, Dept of Mathematics, University of Bath, Bath, England

"APPLICATION OF STATE DEPENDENT MODELS TO IDENTIFY THE FORM OF THE NON-LINEARITY IN MULTIVARIATE SYSTEM"
Hill, Gareth., Unilever Research, Port Sunlight Lab, Quarry Road East, Bebington, Wirral, Merseyside, L63 3JW, England

This paper describes the application of state dependent models, developed by Priestly et al, for univariate time-series, to multivariate systems. An extensive program of simulation is described in which the applicability to short, noisy, non-stationary series, as found in most commercial series, is tested. The application of these models to macroeconomic series is also discussed.

"OPTIMAL ERROR PREDICTORS: A COMPARISON WITH SOME STATISTICAL TECHNIQUES ON TWO CLASSICAL TIME SERIES"
Milanese, M., Genesio, R., Tempo, R., and Vicino, A., Dipartimento di Automatica e Informatica, Corso Duca degli Abruzzi, 24, 10129 Torino, Italy

This paper deals with a new approach to time series forecasting based on recent results of the general theory of optimal algorithms. This method can be useful when no reliable statistical hypothesis can be made or when a limited number of measurements is available.

Two real classical time series are analyzed: the Wolfer Sunspot Numbers and the Annual Canadian Lynx Data. Linear and non-linear statistical models and non-linear techniques based on group method of data handling are used for comparison. The reported results of the optimal algorithm predictor compare very favourably with those obtained by using other techniques, especially with regard to multistep ahead forecasts.

"ARIMA MODELLING WITH NON-NORMAL ERRORS - A COMPARISON OF OLS AND MAD ESTIMATORS"
Oveson, Richard M., and McDonald, J., Managerial Economics, Brigham Young University, Provo, Utah 84602, USA

Experience has shown that econometric forecasts may be improved if model parameters are estimated using minimum absolute deviations instead of least squares techniques. MAD estimators improve forecasting results when random errors are not normally distributed, especially if the underlying distribution has "fat" tails. This paper extrapolates these results to time series analysis and examines the forecasting properties of ARIMA models with random components generated by normal exponential, Pareto and LaPlace (double exponential) distributions. The parameters of these ARIMA models are estimated using both least squares and MAD estimating techniques and the relative forecasting accuracy of the two estimating techniques are compared using Monte Carlo experiments. ARIMA processes of different order are generated using each distribution, the resulting series are truncated, parameters are estimated using both MAD and least squares criteria and the last five values of each series are forecast using the estimated model parameters. Forecast results are then compared across order, distribution and estimating criteria.

"PRELIMINARY TRANSFORMATIONS IN TIME SERIES MODELLING"
Dickey, D.A., North Carolina State University, Raleigh, N.C. 27514, USA
Brocklebank, J.C., SAS Institute Inc, Cary, N.C. 27511, USA

The theory of estimation and forecasting of stationary time series is fairly well developed at this time. The SAS procedures such as ARIMA and STATESPACE allow you to easily fit models to stationary data and forecast from these models. Procedures such as FORECAST and AUTOREG allow for specific types of nonstationarity but these must be specified in advance by the user. Thus the user must either assume a specific type of nonstationarity (for example, a trend) or reduce the data to stationarity through some type of preliminary transformation.

This paper reviews the Box-Cox transformation as introduced in Box and Cox (1964) and used in the well-known book by Box and Jenkins (1976). Examples using the SAS System demonstrate methods that indicate when contemporaneous transformations are beneficial.

For problems of the unit root nonstationary type, this paper reviews detection mthods ranging from visual inspection techniques as explained in Box and Jenkins, to the relatively recent hypothesis tests developed by Dickey and Fuller (1979). This methodology is also explained by example using SAS code.

ROOM LT1

TUESDAY
11.00-12.30

AN INDUSTRIAL ORGANIZATION INVESTIGATION OF THE FORECASTING INDUSTRY

GENERAL FORECASTING

Chair: Daub, M., School of Business, Queen's University, Kingston, Canada K7L 3N6

Session Overview

The role which expectations play in economic affairs has become a critical question in modern macroeconomic theory. Despite the "rational expectations" revolution it can yet be argued that the process by which economic expectations are actually formed is little understood, if at all. While there are several possible explanations for this current state of affairs, one of the more important is that no empirical study of the forecasting industry has ever been carried out. As a result, a classical large-scale industrial-organization-oriented study of the forecasting "industry" has been undertaken, in this instance in the Canadian context.

A number of questions are addressed. For example, what is the nature of the demand for forecasts. In particular, why and how are such forecasts actually used in making pricing, output and other major firm decisions; where are they obtained; to what extent is forecasting controlled; and other such concerns. Alternatively, as regards supply considerations, what are the production and cost characteristics associated with the production of expectations; what market structures exist in the industry; are there different shortrun vs. long run considerations involved; and so on. The Cavesian paradigm of structure, conduct and performance is observed. Included is a history of aggregate forecasting in Canada.

The session will take the form of a presentation of some results by the study's author. Then a panel session will ensue. Representatives from the forecasting industry in three countries, namely the United States, Canada and the United Kingdom will comment on how the issues raised relate to their own forecasting industry's situation.

Participants:

Daub, Professor M., School of Business, Queen's University, Kingston, Canada

and

McCracken, Mike, President, Informetrica, Ottawa, Canada
Caton, Chris, Vice-President, Data Resources, Lexington (Mass) USA
Jones, Hywel, Director, The Henley Forecasting Centre, London, UK

ROOM LT2

TUESDAY
11.00-12.30

PERSONNEL FORECASTING

JUDGEMENT/GENERAL FORECASTING

Chair: Robertson, I., UMIST, Sackville Street West, Manchester M60 1QD, England

"PERSONNEL SELECTION AS FORECASTING"
Herriot, Peter, Birkbeck College, University of London, Malet Street, London, WC1E 7HX, England

The theory and recommended practice of selection assessment is outlined, and contrasted with the dynamic nature of recent models used in manpower planning. Specifically, selection procedures are seen to be static in their view both of the individual and of the job. Inferences to supposed personal qualities which predict behaviour across situations and remain constant over time were criticised as deriving more from the implicit personality theory of the selector than from anything to do with the applicant. Examples are given from the speaker's research into graduate recruitment procedures in the UK. Finally, an alternative dynamic model of recruitment and selection as a process of social exchange is proposed. According to this model, the expectations of individuals for themselves and of organisations for these individuals changeover time, partly as a function of their interdependence.

"IMPROVING PERSONNEL RECRUITMENT AND SELECTION ROI'S USING BOTTOM LINE FORECASTING METHODS"
Etherington, Lois, Faculty of Business Administration, Simon Fraser University, Burnaby BC, V5A, S6, Canada

This paper extends to the design phase the post hoc application of utility formulae for calculating the dollar benefits that accrue to effective personnel recruitment and selection programs. It emphasizes interactive trade-offs from: 1) spending to increase the applicant pool and 2) spending to improve the accuracy of selection from the applicant pool.

The paper is in four sections. Section one reviews the utility formulae and their measurement assumptions. Section two forecasts dollar benefits likely for strategies open to most firms for improving recruitment returns, using two specific organizations as examples. Section three extends the forecasting to include the dollar benefits due to improved accuracy of selection decisions, using specific organizations as examples. Section four examines possibilities presented by interactive selection forecasting systems linked to human resource information system data bases.

"TRAINABILITY TESTING, SELF ASSESSMENT AND ABILITY TO LEARN"
Downs, Sylvia, Occupational Research Unit, Applied Psychology Department, UWIST, Cardiff

The literature indicates that realistic previewing of a job is a valuable aid to self selection. Work previously reported (Downs S., Farr R.M. and Colbeck L.) showed that trainability tests were helpful both to job applicants and organisations in making decisions about job offers and acceptances. More recent work has developed the use of trainability tests for helicopter observers together with self assessments before and after the test. Results show a relationship between realistic assessment and ability to learn the job.

"REPERTORY GRIDS AS A FORECASTING DEVICE"
Smith, M., Dept of Management Sciences, UMIST, PO Box 88, Manchester M60 1QD, England

Kelly, in his theory of Personal Constructs, postulated that all men behave like scientists, exploring the world about them and, on the basis of these explorations, they construct mental maps. When called upon to make a decision, we consult these mental maps in order to select an appropriate action. It follows that if we can obtain a copy of an individual's map we are in a better position to predict their behaviour. This is particularly true when the maps show where the individual is now and also where he would 'like' to be in the future since there is considerable evidence that life is a process of implementing one's self image.

Repertory grids are a very flexible technique for collecting data and producing a copy of these mental maps. The paper will briefly describe the five main stages of the classic case and it will outline some possible applications in fields of advertizing and corporate policy decisions, including personnel selection.

BUSINESS POLICY FORECASTING

GENERAL FORECASTING

Chair: **Morecroft, J.D.W.**, Sloan School of Management, M.I.T., Cambridge, Massachusetts, USA

Session Overview

The session will feature three presentations of model-based studies of business policy - derived strictly from applications projects together with a critique of such an approach. The first three presentations will focus on the process of developing and using models rather than their detailed formulation. How was the project organized? How were the results presented to executives? What policy insights did the project produce, and how important was the model itself in generating these insights? What special techniques (such as advanced graphics and user-friendly interfaces) were used to improve communication of the model to managerial audiences? The session should be of broad interest. The speakers are all doing innovative work in improving the communication of model-based business policy analysis. They have all been involved in high-visibility projects that have had a substantial impact on managerial thinking. The fourth speaker will take a quite distinct approach to the same subject arguing that a subjective, value laden approach is the most appropriate.

"FORESIGHT IN BUSINESS PLANNING"
Cleary, J.P., AT&T Information Systems, Room 4817, 1776 On the Green, Morriston, NJ 07960, USA
Morecroft, J.D.W., Sloan School of Management, M.I.T, Cambridge, Massachusetts, USA

Business planning is the art of converting strategic concepts into achievable action plans. But to do this requires foresight, the ability to anticipate how multiple business programs will mesh and interact over time. This paper describes how one company has used behavioural simulation modeling to add foresight to its conventional business planning methods. The company was planning a major market migration to convert its customer base from old to new-generation equipment. This paper first describes the analysis of the market migration strategy with the company's conventional planning methods. It then contrasts the conventional analysis with a model-based analysis using a system dynamics simulation model. Particular attention is paid to surprises and new insights revealed by the model, which extended managerial foresight of market behaviour. The paper addresses how the model's insights were communicated to executives and describes the reception and impact of the model-based analysis.

"BRIDGING THE 'INTERPRETATION GAP' IN BUSINESS POLICY ANALYSIS"
Probert, David, E., Long Range and Strategic Studies Unit, British Telecom, 88 Hills Road, Cambridge, England

Computer models for strategic analysis have been used within our unit for over 5 years. In our experience a large proportion of resources in modelling has to be put into bridging the "interpretation gap" between the computer model and client. This paper discusses how we have implemented a range of strategic models through using interactive computer graphics, combined with workshops/seminars for the discussion of key policy issues. Finally, we discuss our thoughts for the future in which we see "intelligent front-ends" as providing us with new ways to bridge the gap between "mental" and computer models.

"USING SYSTEM DYNAMICS MODELING TO IMPLEMENT ORGANIZATIONAL CHANGE IN A PROFESSIONAL SERVICE FIRM"
Mott, Geoffrey P., Palo Alto, California, USA

At some point in its history an organization will almost invariably confront the need to change its assumptions about how to grow and develop. Either its environment will have changed to the point where old structures are no longer relevant, or a basic incompatibility will emerge between the organization's goals and the way it is set up to achieve those goals. This class of problem is particularly acute for Professional Service Firms confronted with the problem of controlling the behaviour and growth of an unpredictable, fluid asset base: people. In this article the author uses the methodology of System Dynamics to model the professional environment within a major CPA firm. The impact of qualitative variables is explicitly investigated and linked to the economic performance of "the system". The results of the modelling exercise are discussed and the author's experience in communicating these results is described. The author illustrates the important role placed by the System Dynamics framework and methodology in helping decision-makers enhance their understanding of the interaction between the "hard" and "soft" variables.

"PROBABILITY, POSSIBILITY AND ECOLOGY"
Loveridge, D.J., Pilkingtons New Ventures, Pilkingtons, St Helens WA10 3TT, England

In recent years there has been a renewed interest in alternative ways of planning. The heady days of extrapolative planning has been demoted to its appropriate status and much of its numeracy is now seen for what it was, spurious prediction rather than informed forecasting. A new mood is in the air, searching for new ways to develop a companies future business. Short-term survival and long-term vitality need to cohere, while the uncertainty that surrounds such coherence needs to be made explicit, and embraced as full of opportunity, not regarded as a debilitating nuisance. There are concepts that throw some light on these requirements in the combination of subjective probability; possibility and ecology as the unifying theme. This paper explores how these conceptual themes may work together, providing assistance to the development of alternatives for a companies future. What is discussed does not in any way represent a 'method', since the development of a companies future is a value laden, political process, in which the themes discussed can only play a part.

ROOM LT4

TUESDAY
11.00-12.30

LEARNING FROM THE PAST

SOCIAL & TECHNOLOGICAL/GENERAL FORECASTING

Chair: Bright, J., Presidential Professor, Colorado School of Mines, POB 736, Golden, Colorado 80402, USA

"RESEARCH ON RESEARCH IN FORECASTING"
Armstrong, Scott, J., Wharton School, University of Pennsylvania, Philadelphia, PA 19104, USA

Research on forecasting has grown dramatically since 1960, especially for judgmental forecasting. This paper assesses the research in an attempt to identify what has changed since 1960. This leads to conclusions on the best approaches to forecasting. Some research supports what was known, while other studies have produced surprising results.

"WHAT THE HELL IS REALLY GOING ON ANYWAY?"
MacNulty, K., 'Kantele', Pier 16, Marina, Brighton, Sussex, England

Few thoughtful people argue that we in western society are not in a serious and deteriorating situation. Many are abandoning the rational point of view on which our society is founded, and are turning to what appears to be something quite different: mutual support groups, eastern religion or even fantasy. These non-rational alternative points of view are attracting an increasing number of people. A new paradigm is emerging.

This paper examines material from Greek mythology, the ancient Jewish tradition, and similar sources in an effort to shed light on such questions as:

- What is the nature of man that he seems to require a non-rational component in his environment?

- What is the nature of the "irrational" element that attracts him?

- What is it that our industrial paradigm appears to lack which non-rational alternatives seem to offer?

- Did the age of reason throw the baby out with the bath water?

and to address the more general question:

- What the hell is really going on, anyway?

"PROPHETS AND PREDICTORS: 1783-1984"
Clarke, I.F., Dellwood, Frog Lane, Milton under Wychwood, Oxon, OX7 6JZ, England

Forecasting is to modern technological societies what the alphabet was to the earliest civilisations of Eurasia. It is the appropriate response to the onward movement of the technologies. Forecasting practices began in the early 1800s with crude census devices for anticipating urban growth patterns; they became more refined in method with advances in statistical know-how and with the proliferation of many new professions in the last quarter of the nineteenth century; and they began to be a tool of governments during the First World War. Since then the development of forecasting has been a series of quantum leaps. The primary influences have been governmental planning between the wars, the demands of military operations during the last war, and the great changes - social, political, technological - of the postwar years that have all in their different ways posed profound questions about the shape of coming things.

EXCHANGE RATES II

MACROECONOMIC FORECASTING/APPLIED ECONOMETRICS

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

"STATIONARY AND NON-STATIONARY MODELS FOR THE ANALYSIS OF NEWS IN FOREIGN EXCHANGE MARKETS (WITH CONSEQUENCES FOR EXCHANGE RATE FORECASTING)

McDonald, R., Loughborough University, Loughborough, Leicestershire, England
Young, Robert, University of Nottingham, Nottingham, England

This paper compares alternative methods of inferring news in exchange rate series. Traditional univariate ARMA methods are compared with dynamic linear models fitted using the Kalman Filter. Theoretical relationships between models in these classes are discussed and implications for the interpretation of disturbances are suggested.

Applications include a long term analysis of monthly data involving principal exchange rates and interest rates, money supply and balance of payments variables; and an analysis of daily data on exchange rates and euro-currency interest rates.

Results emphasise the importance of a flexible approach to model duration. Consequences for exchange rate forecasting are derived.

"ARE MARKETS FOR FOREIGN EXCHANGE AND EUROCURRENCY MULTIMARKET EFFICIENT"

Calantone, Carl and Errunza, V.R., McGill University, Samuel Bronfman Building, 1001 Sherbrooke Street West, Montreal, P.Q., Canada, H3A 1G5

The purpose of this paper is to investigate the weak form efficiency hypothesis for foreign exchange and Eurocurrency markets using a series of multimarket tests.

In the past, this hypothesis has been tested on a market by market basis, utilizing only a single time series as the appropriate information set for a weak form efficiency test.

We follow the lead of Geweke and Feige (1979) who propose a more powerful test than the usual weak form tests, which include information in the past series of currencies other than the particular currency of interest. Simultaneous tests of such a series of hypotheses provide a statistically more powerful test in each market, as well as an overall test for all markets simultaneously. The above authors used a quarterly data series beginning in 1972. We first extend this research, by examining the shorter end of the maturity spectrum, using one month non-overlapping observations from the 1975 to 1977 floating rate period, yielding about 150 data points per series for the Canadian Dollar, U.S. Dollar, West Germany Mark, Swiss Franc, and U.K. Pound. Next, we extend the efficiency tests to open interest speculation in the eurocurrency market, assuming risk neutral investors. Interest rates, forward rates, and spot rates were carefully matched on a daily basis to evaluate the efficiency hypothesis for an integrated foreign exchange-eurocurrency market test. Positive results would indicate that there is no information in a past series of speculative profits in any of the five markets that could be used to identify one period ahead speculative profits in any particular market.

Finally, we discuss implications for forecasting in the foreign exchange and euromoney markets based on efficiency test results.

"EXCHANGE RATE FORECASTING: A TIME SERIES ANALYSIS"

Doukas, John, Faculty of Commerce and Administration, Concordia University, Montreal, Quebec H3G 1M8, Canada
Mahmoud, Essam, College of Business and Economics, West Virginia University, Morgantown, WV 26506-6025, USA

The hypothesis that forward exchange rates are unbiased predictors of the corresponding future spot exchange rates has been tested extensively and generally has been accepted. The forward rate, however, is not a very good predictor of the corresponding future spot rate. The relationship between the forward rate and the future spot rate is rather tenuous and in particular, the forward rate is not successful in predicting major changes in the spot rate.

This paper analyses and evaluates the application of selected time series forecasting techniques to predict future spot rates over the period 1976I - 1983III, roughly the last two full business cycles. The range of the selected techniques includes simple techniques such as a Random Walk model and Exponential Smoothing techniques to sophisticated ones such as Box-Jenkins. A comparison of each of these techniques will be presented as well as the forward exchange rate.

"TESTING PURCHASING POWER PARITY: IMPLICATIONS FOR EXCHANGE RATE FORECASTING"

Baillie, Richard, T., University of Birmingham, Birmingham B15 2TT, England
Lippens, Robert, E., General Motors Corporation, 767 Fifth Ave, New York, NY 10153, USA

The paper considers several different dynamic models that relate spot exchange rates to relative prices, relative money supplies and interest rate differentials in both unilateral and multilateral frameworks. Error correction type mechanisms and vector autoregressive models are considered and short and long run versions of PPP are tested. Vector autoregressive models are used in order to allow for interdependence between the different countries error terms.

Indications for policy and forecasting are discussed and a brief analysis of ex ante forecast errors is presented.

TUESDAY
11.10-12.40

PANEL ON TIME SERIES METHODS IN FORECASTING

TIME SERIES

Chair: **Harvey, Andrew**, London School of Economics, Houghton St, London WC2A 2AE, England

"CONTRIBUTIONS OF TIME SERIES ANALYSIS TECHNIQUES TO FORECASTING"
Newbold, Paul, Department of Economics, University of Illinois, Urbana-Champaign, 330 Commerce (West), 1206 South Sixth Street, Champaign, Illinois 61820, USA

This paper discusses the impact of modern time series model building methods on the practice of forecasting. The aim is to concentrate on the underlying principles of a well-conceived time series analysis, contrasting these with the derivation of forecasts through exponential smoothing and traditional economic model building. The analysis of a single series, and of related time series, is discussed in general terms, and an application involving a transfer function-noise model with three input series is outlined. Finally, conjectures are made as to what might be the most promising avenues for further research in time series analysis, as it relates to practical forecasting.

Discussants:

Ansley, Craig, University of Chicago, 1101 East 58th Street, Chicago, Illinois 60637, USA

Harvey, Andrew, London School of Economics, Houghton Street, London, WC2A 2AE, England

FAIRBAIRN ROOM
KEYNOTE SESSION

TUESDAY
11.00 - 12.30

ON

MODELLING THE SUPPLY SIDE

MACROECONOMIC FORECASTING

Chair: Budd, Alan, Centre for Economic Forecasting, London Business School, Regents Park, London NW1 4SA, England

"MAINSTREAM KEYNESIAN MODELLING AND SUPPLY SIDE THINKING"
Waelbroeck, Jean, University of Brussels, CENE 1P9, 50 Avenue Franklyn Roosevelt, Brussels 1050

Mainstream Keynesian models have at their core equations that account for changes in the components of aggregate demand. That demand influences prices and interest rates, which in turn influence its components. Supply enters the analysis in a piecemeal way, via proxies like the unemployment rate or capacity variables in price equations. Only the best models make a serious attempt to model income distribution, but here again the feedbacks are scattered and partial: profits influence investment demand in some models and not in others, the wage share may have an effect on the propensity to consume.

In the last decade, policy conern has focused increasingly on supply: the "oil shock", debates about Thatcher or Reagan effects on productivity, about catching the dreaded Dutch disease. This has had its counterpart in the concept of classical unemployment defined by disequilibrium macroeconomic theory. Is Europe, in particular, in a "classical" situation where jobs are in short supply because it is not profitable for firms to provide work for the unemployed, or in a Keynesian ituation where the culprit is deficient demand?

This sets out an "either or" situation which can be dealt with only by a new type of model, that switches from Keynesian to classical regimes and back. Construction of such models presents fearsome difficulties. The paper will argue that "either or" should be replaced by "and" This would still represent a significant change in the type of model that is desirable.

"FORECASTING THE U.K. ECONOMY INTO THE MEDIUM-TERM"
Beenstock, Michael, and Warburton, Peter, City University Business School, Frobisher Crescent, Barbican, London EC2Y 8HB, England.

It is generally recognised that "Keynesian" models of the economy are unsuitable for forecasting beyond the short-term and that the modelling of the 'supply side' is necessary. In this paper we argue that the dichotomy of models into short-term and medium-term models on this basis is false. We suggest an alternative basis for the dichotomy and conclude by describing a model of the U.K. economy that integrates medium and short-term forecasting.

ROOM G07
SLOAN ROOM

TUESDAY
11.00-12.30

NEW PRODUCT FORECASTING II

BUSINESS APPLICATIONS

Chair: Geurts, Michael, D., Brigham Young University, Provo, Utah, USA

"FORECASTING THE DIFFUSION OF MAJOR NEW PRODUCTS"
Easingwood, C.J., Manchester Business School, Booth St West, Manchester, M15 6PB, England

Diffusion models have been used for some time to describe the spread of major new products. Although usually providing good retrospective fit, their value for forecasting is more uncertain. Good results were reported by Bass (1969), but Heeler and Hustad's results (1980) were less reliable. This paper takes a new, flexible diffusion model from marketing (Easingwood, Mahajan and Muller, 1983) and shows how it can be used to define nine distinct diffusion classes. Each class has a typical diffusion shape and is associated with a particular combination of product, marketing and market characteristics. Forecasting the sales of a new product will then necessitate anticipating the likely combination of product, marketing and market characteristics and thus placing the new product in its appropriate class. This should provide a reasonably constrained sales forecast.

"NEW PRODUCT FORECASTING AND THE KNOWLEDGE WORKER"
Gerstenfeld, Arthur, Worcester Polytechnic Institute, Worcester, Mass. 01609, USA

In an earlier article published in the Journal of Business, entitled "Technological Forecasting" I tried to establish the relationship between corporate growth and the use of technological forecasting. In a more recent article in the same journal I agreed with some critics who pointed out that although the relationship was there, there were indeed many intervening variables. In this paper I try to establish the relationship between growth and the use of tools for productivity.

The paper focusses on "white collar" productivity, particularly how the information age replaces the factory worker with knowledge workers. The "tools" then become, personal computers, electronic mail, electronic filing, networking, optical character readers, artificial intelligence, micrographics, networks, etc.

The paper concludes with a discussion of the need for integration of technology and humanism. In spite of all the technology that will be used by the knowledge workers, the human contribution to productivity will remain paramount - but different. Issues such as motivation, participation, decision making (in spite of artificial intelligence systems) will still be the determining forces that will equate with success and growth.

"FORECASTING NEW PRODUCT CONSUMER DEMAND BASED ON CONSUMER ATTITUDINAL RESPONSES"
Lin, Lynn Y.S., Burke Marketing Services, 2600 Victory Parkway, Cincinnati, Ohio 45206, USA

During the past fourteen years consumer goods manufacturers have increasingly employed pre-test market forecasting models to assess new product sales potential. In this paper, we intend to describe, and to demonstrate the accuracy of, the BASES Model, which utilizes consumer attitudinal responses to successfully forecast demand potential. BASES is a new product pre-test market forecasting system introduced in 1977 in the US and in 1980 in Western Europe. Currently, it is the most frequently used model of its kind in the world, with experience in over 2000 new products and 147 in-market validation experiences.

This paper will contain a description of the test procedure, explain the experiment involved in developing the calibration model to translate attitudinal responses into purchase behaviour, and furnish overall validation results with some individual case examples.

ROOM P101

TUESDAY
11.00-12.30

FORECASTING APPLICATIONS IN THE FIRM

BUSINESS FORECASTING

Chair: O'Brien, J.A., Olsen Research Associates Inc, 6305 Ivy Lane, Greenbelt, Maryland 20770, U.S.A.

"A PLANNING MODEL FOR GENERATION OF OFFICE SPACE REQUIREMENTS"
Clancy, Patricia C., IBM, Department 29F/045, 11400 Burnet Road, Austin, Texas 78758, USA

The procedure most commonly used for planning office space requirements consists of multiplying the planned seated population by a density factor of square feet per person. This method, while providing a reasonable estimate site wide, fails to take into account variances in office requirements caused by job levels, special equipment (drafting tables, terminals and printers), mixed office standards, functional decentralization and site maturity. The following paper outlines a method by which the above information may be included for generating more accurate and detailed strategic space plans.

"FORECASTING AS A DECISION SUPPORT TOOL IN PROJECT MANAGEMENT"
Anbari, Frank T., Amtrak, Rm 632, 1617 J.F. Kennedy Blvd, Philadelphia, PA 19103, USA

Project Management is an increasingly popular approach for effecting change and accomplishing major undertakings. A successful decision support system for project management relies on forecasting techniques as the central theme for projecting completion time, cost and resource requirements.

Computer-based decision support systems are used in the dynamic environment of project management to forecast potential problem areas and to offer possible corrective action(s). Emphasis is placed on the range of the critical variable(s) in project decision and on the vital human-machine partnership to ensure the successful completion of the project.

"STATISTICAL TECHNIQUES IN SHORT RANGE FORECASTING OF GASOLINE VOLUMES AND PRICES"
Schaper, H.J., Union 76 Division, Eastern Region, Union Oil Company of California, 1650 East Golf Road, Schaumburg, Illinois 60196, USA

Historically, volume and price data has been reported monthly as required by standard accounting methods. These time periods include discontinuous data with different causal factors. Averaging mitigates the true correlations. A separate computer network is used to collect data daily and assemble it in uneven time periods of homogeneous data. Using expanded time series to variable lengths improves forecasting accuracy. The data is then restructured into usual time frames to meet accounting requirements and also supply the production model which utilizes calendar periods. This paper will trace the practical process of developing the new system including the operating facilities required.

"FLIGHT RATE FORECASTING THROUGH SIMULATION"
Ostensoe, P.A., Boeing Computer Support Services, Inc, Room G2B, Building 4200, Marshall Space Flight Centre, Huntsville, Alabama, USA

This paper describes the simulation modelling of space shuttle ground resource operations to forecast flight rate capabilities of the space transportation system.

The model approach is based on each shuttle treated as a customer, awaiting service by a variety of serial and parallel service stations. The simulation model lends itself towards easy parametric analysis of the flight rate projection based on varied resource levels, turnaround times and ground flow operations. The output of the simulation is a series of timelines which graphically depict seize/release times of key resources, allowing for clear identification of ground flow bottlenecks.

ROOM P102

TUESDAY
11.00-12.30

INDUSTRIAL APPLICATIONS OF ECONOMETRICS II
TRANSPORTATION FORECASTING

APPLIED ECONOMETRICS

Chair: Button, Ken., Dept. of Economics, University of Loughborough, Loughborough, Leicestershire, England

"FORECASTING WITHIN THE CIVIL AVIATION AUTHORITY"
Abrahams, S., Civil Aviation Authority, CAA House, 45-59 Kingsway, London, WC2B 6TE, England

The Authority produces forecasts for a wide variety of purposes from forecasting passengers numbers on individual routes in support of its function of granting route licences to forecasting aircraft numbers on a national scale as evidence at Public Enquiries.

The methods of forecasting are just as wide. The forecasting on an individual route basis requires a detailed knowledge of the particular circumstances likely to motivate the passengers using the route such as frequency of service, alternative travel opportunities, competing air services, the nature of the route and the type of passenger expected to use it. As such, no one forecasting technique is appropriate and a variety of forecasts are made, each giving a different aspect of future traffic. At the other extreme, when forecasting national traffic levels for up to twenty years ahead a macro approach is used. However, no great sophistication is built into the models used as in the case of forecasting with long lead times the input assumptions are more likely to produce errors in the forecasts than inaccuracies in the model.

A major factor in deciding upon the forecasting methodology will be the purpose for which the forecasts are required. Forecasts required primarily for the use of the Authority itself will be left to the experience and expertise of the Authorities forecasters whereas forecasts produced for Public Enquiries will be subject to the most detailed scrutiny in a highly exposed forum.

It is the experience of the Authority that here is little to choose between the results produced by the various techniques available to it provided they are used with intelligence. The uncertainty produced by the errors in input is leading the Authority to consider the use of scenario forecasting techniques but so far this approach is in its infancy.

"LIES, DAMNED LIES AND TRAFFIC FORECASTS"
Pearman, Alan., School of Economic Studies, University of Leeds, Leeds LS2 9JT, England.

The paper will be focused on the last of the three, and will consciously endeavour to avoid the first two. More specifically, it will concentrate on available procedures for medium- and long-range forecasting of variables critical to transport policy formulation. In addition to methods already commonly adopted in the transport sector, the paper will try to evaluate the potential of techniques developed and applied elsewhere. in assessing performance and promise, the angle of approach on each occasion will be to ask, how well, in practice, is this technique suited to providing the critical information a decison maker needs? Technical factors as such will not feature prominently.

"SOME REFLECTIONS ON FORECASTING COMMODITY FLOWS"
Pitfield, D.E., Dept of Transport Technology, Loughborough University, Loughborough, Leicestershire, England

It is increasingly recognized that forecasts of freight are required in some detail if decisions on infrastructure provision are to be well-informed. Nevertheless, despite this recognition, the wholesale transfer of modelling methodologies, albeit with some modification, from passenger transport research to freight has not borne fruit. This paper outlines some of the efforts made to model freight flows, discusseds their failings and suggests ways in which improvements may be obtained.

ROOM LT1

TUESDAY
2.00-3.30

FORECASTING FOR OPERATIONS

TIME SERIES/BUSINESS APPLICATIONS

Chair: **Flowers, Dale.**; Dept of Operations Research, Weatherhead School of Management, Case Western Reserve University, Cleveland, Ohio 44106, USA

Session Overview: This session is primarily directed at the conference theme of "Putting Forecasting into Practice". The first paper develops models for forecasting demand for related (dependent) products. . The second paper reports on the effect of product group forcing for a particular company. This practice is common in industry, although very little has been published about it. The final presentation proposes some practical solutions to common forecasting problems for operations. The proposals are based on a very extensive base of practical applications and relate to several problems identified by Mr. Muir in his ISF '83 talk. This session should be of a particular interest to practitioners responsible for forecasting for many items.

"DEPENDENT DEMAND"
Brown, Robert G., PO Box 239, Thetford Centre, Vermont 05075, USA

Let us stipulate that we can find an entirely adequate time series model either in terms of an autoregressive model, or a standard set of orthogonal fitting functions. The issue considered here is when demand for a stocked product is very likely to be related to the sales of some other product. Two questions arise for the systems designer and the user. (a) Under what circumstances is it better to forecast the relationship than the series itself, and (b) what is the practical form of the model of that relationship.

"THE IMPACT OF PRODUCT GROUP FORCING ON INDIVIDUAL ITEM FORECAST ACCURACY"
Flowers, Dale., and Reddy, C.S., Dept of Operations Research, Weatherhead School of Management, Case Western Reserve University, Cleveland, Ohio 44106, USA

The purpose of this project was to investigate the impact of product group "forcing" on individual item accuracy. Product group forcing starts with a forecast of demand in either dollars or units for the aggregate (sum) of the products in the group. Forecasts are also prepared for each item in the group independently of the group forecasts. Then the item forecasts are "forced" to sum to the aggregate forecast by scaling each up or down. A set of historical simulations were run for an actual data base provided by a company to determine if such forcing would have improved item forecast accuracy as compared to simply accepting the independent item forecasts.

"HOW TO IMPROVE YOUR FORECAST ACCURACY"
Muir, James., American Software, 443 East Paces Ferry Rd, Atlanta, GA 30305

Objective

There are literally thousands of combinations of variables which can be manipulated in the process of trying to achieve the most accurate forecast. Without some short-cut methods, choosing the best among these combinations is nearly impossible, particularly in companies that have many thousands of forecasts to make.

Scope

This talk will address which technique to choose, and how to determine the most important variables of that technique. Specific emphasis will be placed on choosing a seasonality strategy, and a strategy for dealing with unusual demand.

Conclusion

Each participant will leave with a far greater understanding of what factors are most important in influencing forecast accuracy and how to make these choices.

ROOM LT2

TUESDAY
2.00-3.30

CHANGING SOCIAL AND POLITICAL ATTITUDES

SOCIAL & TECHNOLOGICAL

Chair: MacNulty, C.R., Taylor Nelson Associates, 457 Kingston Road, Ewell, Epsom, Surrey, KT19 ODH, England

"SOCIAL CHANGE IN EUROPE"
MacNulty, C.R., Taylor Nelson Associates, 457 Kingston Road, Ewell, Epsom, Surrey, KT19 ODH, England

Social change has occurred throughout Europe at an unprecedented rate during the past 15-20 years. There are many ways of looking at social change - from a long term historical perspective; by examining social trends; by mapping the trends and observing the changing nature of the map; and by viewing society as a set of groups, each selected according to values, beliefs and attitudes, then by examining the nature and dynamics of these groups over time. The results of all these procedures have pointed to a growing turbulence within society, caused by the emergence and growth of people with values which are quite different from those which were accepted as the norm twenty years ago.

Presently, approximately 30% of the populations in all European countries espouse these new values which are characterised by a requirement for individual freedom and autonomy; a desire for self-development and personal growth; a trend away from materialism, and an increasing antipathy towards large scale technology. Since these people tend to be among the better educated groups in society, they are already having significant impacts upon business by causing changes in the marketplace, the workplace and by increasing pressure on business operations through single issue groups, resulting in delays, disruption and occasionally government regulation.

If this social change continues, it is likely to have profound effects on the nature of society, work and government within the next 10-15 years.

"FORECASTING UTILITY LEVELS OF ORDINARY PEOPLE"
Wearing, A., Professor of Psychology, Dept of Psychology, University of Melbourne, Parkville, Melbourne, Australia

Forecasting utility levels (where utility is sometimes understood as perceived quality of life, or psychological well-being) of ordinary people is both important (because these levels determine the behaviour of the socio-economic system eg. through voting behaviour), and difficult (because such forecasts require a model of the determinants and predictors of utility). The present study uses data collected in two waves (1981 and 1983) to identify (a) which and to what extent various variables (eg. demographic, economic, personality, social systemic etc) were related to utility in different domains of life, and the extent to which these were related to overall utility, (b) the predictive capability of these variables, and (c) the effects of exogenous events on the variables in the system and on the various utility measures. The information was collected from a representative sample of 942 persons in the state of Victoria, Australia, and used to create and evaluate a number of structural equation models. Policy implications of both the procedure and the results are discussed.

"ON THE ROLE OF WORK/NONWORK INVOLVEMENTS IN PREDICTING JOB AND NONJOB ATTITUDES"
Parasuraman, S., Dept of Management, Drexel University, Philadelphia, Pennsylvania, USA
Zammuto, Raymond F., NCHEMS, Boulder, Colorado, USA
Outcalt, Dennis, Dept of Psychology, Wayne State University, Detroit, Michigan, USA

Data gathered from 193 staff nurses employed in a medical center hospital are used to assess the spectrum of roles comprising the work and nonwork spheres of individuals' lives. Five role categories are identified as representing the life space of the subjects in this study: work/career role; family/primary social role; religious role; community/social role; and leisure/recreational role. The subjects' relative psychological investments in these five roles are used to predict selected job and nonjob attitudes. Results of multiple regression analysis show that individuals' involvements in the five role categories are differentially related to job involvement, job satisfaction, life satisfaction, and organizational and professional commitment.

"LIFE PERFORMANCE = MOTIVATION x ABILITY: A FUNCTIONAL MEASUREMENT ANALYSIS"
Singh, R., and Bhargava, S., Indian Institute of Management, Ahmabad, India

In four experiments, judges received information about motivation and ability of stimulus persons and forecasted their life performance. Factorial plot of the Motivation x Ability effect yielded the linear fan pattern. Because both the multiplying and differential-weight averaging rules predict a similar fan pattern, distinguishing tests developed in functional measurement were also made. Tests based on reliability of information could not detect the underlying rule. A new test based on the logic of two-state integration model, however, confirmed the multiplying rule but infirmed the alternative averaging rule. Results also showed that judges imputed values for missing information while predicting life performance, and that functional measurement allows determination of precise value for the missing information.

ROOM LT3

TUESDAY
2.00-3.30

COMMODITY FORECASTING

FINANCIAL APPLICATIONS

Chair: **Bean, D.G.**, Bean, Bower & Co 521/535 Royal Exchange, Manchester, M2 7EN, England

"FORECASTING COMMODITY FUTURES INVESTMENT PERFORMANCE"
Matthews, Peter, F., Statistical Services Ltd, 5903 Calla Drive, Mclean, Va 22101, USA

The commodity fund manager is less interested in a forecast for a specific commodity than in a forecast for the overall performance of his portfolio of commodities. If the manager is using fixed mathematical (objective) rules for making trading decisions, rules which can be tested on historical commodity price data, then it is possible to construct a forecast of expected performance for any time period of interest. The paper shows how a 95% lower confidence bound for expected future performance can be constructed and demonstrates its actual use in monitoring the performance of a commodity fund over the past three years.

"PRACTICAL FORECASTING FOR A COMMODITY TRADE HOUSE"
Robinson, Trevor, E.D. & F. Man (Sugar) Ltd, Sugar Quay, Lower Thame St, London, EC3R 6DU, England

A great deal of time is expended by academics on producing computer models which describe, and attempt to forecast, the commodity markets. The building of these models within a commodity trade house is often a waste of time. Traders or dealers take no interest in the workings of the model, only in its output i.e. is the market going up or down. The research director and his team are judged on the accuracy of their forecasts, not the sophistication of their forecasting techniques. It is no excuse to say that the model was wrong if the forecasts are wrong.

In many houses there is an amusing form of snobbery attached to the relationship between traders and analysts. The former are suspicious of anyone with more than two '0' levels, the latter amazed that everyone has not got that number of PhD's. The former are street-wise and proud of the fact that they are the people who bring in the money; the latter believe that they know better and could bring in much more money, if only given the chance - but at the same time believe that such wheeling and dealing is slightly beneath them.

The speaker's practical experience in meeting and solving these problems will be recounted (in a fairly light-hearted manner).

ROOM LT4

TUESDAY
2.00-3.30

DEVELOPING PRACTICING FORECASTERS

GENERAL FORECASTING

Chair: **Levenbach, H.**, Core Analytic, 310 South Street, Morristown, NJ 07960, USA

"MAKING MBA'S INTO FORECASTERS"
Ansley, Craig, F., Graduate School of Business, University of Chicago, 1101 East 58th St, Chicago, Illinois 60637

If there's one theme that runs through the entire MBA curriculum, it's that business is a sequence of decisions made under uncertainty, so that the more one knows about the future, the better off one will be. The student's reaction to this is to demand courses in forecasting. After "Applied Business Forecasting", the student expects to be able to embark on his career without having to worry about being second-guessed.

Of course we can't tell him what he wants to know. So what do we do? Here are some things to consider:

Technical Skills This is what we know most about, and it is easiest to communicate, that knowledge.
Knowledge of the Field of Application Often it is possible to use a theoretical model to suggest what might work. Microeconomic models of demand and marketing models for sales forecasting are perhaps the best examples. Here we are also fairly well equipped, but it's difficult to find good examples that work the way a textbook might say they should.
Practical Skills These are perhaps the hardest to communicate, but this is definitely an area where a good business school environment works. In a forecasting course, we find examples and give the students projects where the problem is ill-defined and the approach far from obvious. But it is the fallout from other courses with similar goals that does most. Our efforts are just part of the process.
What can we forecast? An important message to communicate, especially given students' expectations, is that we can't forecast everything. We must emphasize the importance of finding out whether forecasting is worth the effort, and if not, why not. The stock market is the perennial example.
What can be learned by experience? After 10 weeks of explaining that the future won't organize itself in the right way for mechanized prophecy, we have to give some hope. We can teach the right way to think about forecasting, but the best way is taught only by experience.

"CENTRALIZED TRAINING FOR THE CORPORATE FORECASTER"
Thomson, Ken, J., Ameritech, 225 W. Randolph St, Chicago, Illinois 60606, USA

The title of my paper implies an invitation. I will spend the rest of my time qualifying that invitation! Implementing a Forecaster Training Program is far from a casual undertaking. It should be approached with caution and be facilitated with careful analysis and preparation. Choosing to deploy such a program using in-house resources is highly risky and requires a considerable degree of organizational sophistication and maturity.

To bring to your attention many of the factors involved in implementing such a program. I will present a case study of how the Bell System Operating Telephone Companies in the United States approached the problem and developed a solution. First, I will, by way of necessary background present a brief history of the development of professional forecasting in the Bell system. This background is essential to understand what the Bell System Companies later did, and why and how they did it. Next, I will outline three key building blocks which led to the decision to train. I will then identify two fundamental decisions taken at the very beginning which went a long way towards setting up successful implementation of the training program. I will develop important staffing and management implications rising from the decision to train. I will then turn briefly to a description of the process used to develop the Forecaster Training Courses and in so doing, I will emphasize the importance of professional training inputs. A brief description of the curriculum products will afford an opportunity to consider a few management issues of importance.

"TEACHING THE SAS APPLIED TIME SERIES ANALYSIS AND FORECASTING COURSE OUTSIDE THE UNIVERSITY"
Brocklebank, John, C., SAS Institute Inc, Cary, North Carolina 27511, PO Box 8000, USA
Dickey, David, A., Department of Statistics, North Carolina State University, Raleigh, North Carolina,

With the advent of efficient and powerful computers, the task of performing lengthy calculations on large data bases is now economically feasible. At the same time, new advances in software development allow the implementation of more recent methodologies, but impose certain demands on the end user. This paper discusses some of the problems and solutions associated with teaching time series and forecasting techniques outside the university. Topics include, the motivating tools used to acquaint the student with the underlying concepts and the training necessary to apply some of the latest SAS/ETS techniques for analyzing and forecasting time series data.

ROOM LT5

TUESDAY
2.00-3.30

POLITICAL FORECASTING I

SOCIAL & TECHNOLOGICAL

Chair: Fraser, Niall, M., Faculty of Engineering, University of Waterloo, Waterloo, Ontario, Canada, N22 3G1

"AN EVALUATION OF POLITICAL RISK ASSESSMENT"
Simon, Jeffrey, D., Political Risk Assessment Co., 612 Montana Avenue, Santa Monica, California 90403, USA

With political risk assessment enjoying widespread corporate and academic interest, a multitude of approaches to the topic have emerged. Although differing in scope and methods, they all share one common element: an attempt to reduce the uncertainty in overseas political and social developments. This article examines the relative strengths and weaknesses of the various approaches, and addresses the issue of achieving a proper balance within a firm between risk forecasting on the one hand, and risk management on the other. A framework for identifying both risks and opportunities is presented, including ways to link macro and micro risk developments.

"POLITICAL AND SOCIAL FORECASTING USING CONFLICT ANALYSIS - THE US PRESIDENTIAL RACE"
Fraser, Niall, M., University of Waterloo, Waterloo, Ontario, Canada, N22 3G1

Political and social situations are usually too complex and poorly defined for most mathematical techniques of analysis. Yet political and social forecasting can be very important to individuals, companies and even nations. Conflict Analysis is a quantitative technique which is useful for the modelling and prediction of complex political and social problems. In this paper, the basic components of a conflict model are described. The method of analysing a conflict model and relating it to the real world situation is also explained. In order to demonstrate the procedure, the current (at the time of presentation) status of the US Presidential election campaign is used as an illustrative example.

"AN EMPIRICAL INVESTIGATION OF APPROACHES TO POLITICAL RISK FORECASTING"
Rice, Gillian, Dept of Marketing, College of Business and Economics, West Virginia University, Morgantown, WV26506-6025, USA
Thomas, Urs, Dept of Marketing, Concordia University, 1560 de Maisonneurre Blvd West, Montreal PQ H3G IM8, Canada

Coping with environmental problems overseas is particularly important from a Canadian point of view, given the significance of international business to the economy and the need for Canada to become more competitive and to gain a presence in more overseas markets (especially those in developing countries). This paper reports an investigation involving the examination of the practices of international firms in Canada with respect to forecasting political risk in overseas countries. The objectives of the research is to further develop the relationship between the political environment and the firm. Recommendations can then be made as to how firms should evaluate the political environment and integrate political information into the decision-making process. Data was obtained through a mail questionnaire survey. Variables measured include managerial perceptions of political risk, the structure of the firm, methods of international involvement, information processing procedures and forecasting methodologies.

ROOM LT6

TUESDAY
2.00-3.30

KEYNOTE SPEAKER
IN
APPLIED ECONOMETRICS

APPLIED ECONOMETRICS

Chair: **Smyth, David J.**, Dept of Economics, Wayne State University, Detroit, Michigan 48202, USA

"CONSTRUCTING AND USING RELIABLE MULTIVARIATE FORECASTS"
Sims, Christopher A., Dept of Economics, University of Minnesota, 271 19th Ave Sth, Minneapolis, Minnesota 55455, USA

It is proving possible to use an explicit statistical modelling technique to generate forecasts of multiple economic time series as reliable as those produced with the standard econometric models supplemented by judgemental adjustments. The methods are described and compared to standard econometric and vector ARIMA methods, and results obtained with the methods are summarized.

Discussants

Harvey, Andrew, London School of Economics, Houghton St, London, England
Wickens, Mike, Dept of Economics, University of Southampton, Southampton, England

FAIRBAIRN ROOM

TUESDAY
2.00-3.30

ENERGY FORECASTING III

SOCIAL & TECHNOLOGICAL

Chair: **Drollas, L.**, BP, Britannic House, Moor Lane, London, EC2Y 9BU, England

"A MODEL OF THE CRUDE OIL MARKET IN WHICH MARKET CONDUCT VARIES"
Ulph, A.M., and Geroski, P.A., Dept of Economics, University of Southampton, Southampton, England

Ulph, D.T., University of Bristol, Bristol, England

In this paper we present a model of the crude oil market in which the conduct of oil suppliers (in this case, their pricing policies) varies over time. The factors which cause pricing policy to change are changes in the financial position of oil suppliers, and changes in the willingness of suppliers to act co-operatively in setting prices. The latter is due to perceptions of producers about past co-operation of other producers. The model is fitted to data for 1966-1981, and the hypothesis of changing conduct is confirmed.

"A COMPARISON OF ENERGY USE IN MATURE ECONOMIES"
Greenman, J.V., ., Dept Mathematics, University of Essex, Colchester, Essex, England

Medium-sized Bergstrom-Wymer type dynamic models are used to analyse the role of energy in the aggregate production processes of the US, the UK, Italy, West Germany and Japan. The nonlinear equations of the models are estimated using full information maximum likelihood techniques, taking into account all constraints on the parameters. A major objective of the study is to examine whether the differences in energy use arise through differences in structure or solely through differences in relative prices. The models are also being used to simulate the response of the systems to a variety of supply and price shock scenarios.

"THE SEARCH FOR OIL IN THE US: AN ECONOMETRIC APPROACH"
Drollas, L ., BP, Britannic House, Moor Lane, London, EC2Y 9BU, England

A model of drilling activity in the US, over the years 1938-81 has been specified and estimated. The very act of searching for oil, the question of whether this search is successful or not, and how much oil is discovered (and produced) as a result, are all issues that are examined by way of an econometric model that is specified in continuous time and estimated in discrete-approximation form using annual data. The results suggest that the search for oil is driven by economic factors (expected gains versus costs) and that the success rate is also a function of economic variables; however, the actual amount of oil added to the pool of resources every year is heavily influenced by physical factors like the cumulative amount of drilling that has taken place up to that moment. While not being able to predict precisely the amount of oil likely to be found in the US in the future, the model can give us some idea of the lengths to which people are likely to go to look for it.

"FORECASTING THE INTRODUCTION OF A BACKSTOP TECHNOLOGY: THE COMMERCIAL LIQUID METAL FAST BREEDER REACTOR"
Strauss, Hans, and Willauer, Edward, Dept of Economics, Laurentian University, Ramsey Lake Road, Sudbury, Ontario, P3E 2C6, Canada

It is a popular belief that the uranium consuming conventional fuel cycle pressurized water reactor (PWR) should be replaced by the uranium conserving advanced fuel cycle liquid metal fast breeder reactor (LMFBR) as soon as it is technologically feasible because there is a fixed finite quantity of uranium available. However, the point in time when it is desirable to switch from the PWR to the LMFBR will depend not only on the set of technologically feasible fuel cycles but also on relative resource scarcity and price.

Using traditional economic theory of an exhaustible resource we develop a simulation model which is used to forecast the commercial introduction of the LMFBR under alternative conditions. When account is taken of relative scarcity and price we find that the LMFBR should not be introduced until close to the 22nd century. If the LMFBR uses relatively more resources or if uranium is relatively less scarce then we estimate, the introduction will be even further in the future.

SLOAN ROOM G07

TUESDAY
2.00-3.30

MACROECONOMIC MODELS AND POLICY MAKING

MACROECONOMIC FORECASTING

Chair: **Holly, Sean,** Centre for Economic Forecasting, London Business School, Regent's Park, London NW1 4SA, England

"THE USE OF JUDGEMENTAL FORECASTS IN ECONOMIC POLICY SELECTION: A FORMAL ANALYSIS"
Hughes Hallett, A.J., Erasmus University, Rotterdam and the University of Warwick, Coventry, England

Policy evaluation using econometric models is often criticised for being unreliable as a result of the potential specification and estimation errors, and for not recognising the limitations on the possible interventions. This paper examines how judgemental forecasts, being the policy makers favoured alternative (possibly in combination with econometric forecasts), may be incorporated into a formal decision analysis. The decisions are formulated as a (dynamic, nonlinear) stochastic optimal control problem, which is shown to decompose on to a simulation phase and an optimisation phase. Judgemental forecasts are treated as "pseudo-simulations" (based on an information set and given policy assumptions) which can be inserted as part of this simulation phase. The selection procedure then becomes a limited search to locate the optimal policy adjustments to the original assumptions, constrained to remain within a set of values defined as "acceptable" by the policy makers.

This process of iterative improvements makes an efficient policy way of generating recommendations incorporating judgement forecasts. It is illustrated here by analysing recent Dutch policies based on judgemental forecasts of the Central Planning Bureau. The recommendations identify the balance of payments and employment as key targets, and suggest expansion rather than the retrenchment which has been observed in practice.

"EXPLOITING LINEAR PARTIAL INFORMATION FOR OPTIMAL USE OF FORECASTS - WITH AN APPLICATION TO U.S. ECONOMIC POLICY"
Zweifel, Peter,., Institute for Empirical Research in Economics, University of Zurich, Kleinstrasse 15, CH-8008 Zurich, Switzerland

Traditional forecasting methods are based on the assumption that the distribution of estimated parameters and hence of the future values of the predicted variable is known. However, forecasts typically amount to linear partial information (LPI), eg. of the form "state 1 is more likely to prevail than state 2, and state 2 more likely than state 3, among five possible states". This paper shows how such LPI statements can be exploited to increase the decision value of a forecast. It also shows how additional (partial) information can be used to transform a priori LPI into a posteriori LPI. For an illustration, LPI analysis is used for the valuation of conflicting forecasts of the US economy.

"UNCERTAINTY, FORECASTING AND BUDGET CHANGES"
Britton, Andrew, National Institute of Economic & Social Research, 2 Dean Trench St, Smith Square, London SW1P 3HE, England

The National Institute of Economic and Social Research has been preparing quarterly national income forecasts continuously since 1959. This paper exploits the Institute's long time-series of forecasts and outturns to measure the uncertainty surrounding short-term macroeconomic forecasts. This is followed by a discussion of the way in which that uncertainty is influenced by the conduct of fiscal policy. Consideration is given to the difficulty of forecasting what fiscal policy changes there will be, and also in assessing what effects such policy changes will have on output and prices. The examination of the Institute's forecasting record is extended to include an evaluation of the adjustments made to those forecasts to take account of subsequent changes in fiscal policy.

ROOM P101

TUESDAY
2.00-3.30

TRAVEL & TOURISM FORECASTING

Chair: BarOn, R.R.V., Israel Ministry of Tourism, Jerusalem, Israel

"FORECASTING TOURISM AND TRAVEL SERIES OVER VARIOUS TIME SPANS UNDER SPECIFIED SCENARIOS"

BarOn, R.R.V., Israel Ministry of Tourism, Jerusalem, Israel

Tourism and Transport series reflect the movements of hundreds of millions of people - by origin, destination, means of transport, dates etc. Forecasting (for National and Regional Tourism Administrations, transport and tourism enterprises) should take into account many economic parameters relating to the marketing segments and also the effects of fashions, promotion and unusual events on demand, supply and competitiveness.

The specification of appropriate scenarios is illustrated, with automatic (ARIMA) and Judgement Aided Models (JAM) for periods of one to five years. Trends can be monitored each month relative to short-term forecasts by using seasonal analysis (eg. X-11 ARIMA). The use of disaggregate models for individual choice is also discussed.

"TOURISM FORECASTING: UNIVARIATE ANALYSIS TO FORECAST TOURISM DEMAND IN TURKEY"

Yucelt, U., and Isley P.W., Division of Business and Management, Norwich University, Northfield, Vt 05663, U.S.A.

Turkey with its reach history and excellent climate is an ideal visiting place for foreign travellers. Its history started with Hittites and continued with Lydians, Dorians, Persians, Greeks, Romans, Byzantines, Seljuks and Ottomans. Turkey is a peninsula country and offers all four climates to visitors for year long enjoyment. Despite the fact that Turkey has a great potential, it has a small market share in the world's tourism market.

Turkey has in recent years attempted to increase its share of the world market in tourism. We pose the question here of how successful this policy has been. If we could identify a change in the trend that would indicate success of the policy.

We propose to use a Box-Jenkins method. The Box-Jenkins is an univariate technique and successfully used to forecast the tourism demand in other studies. If we can identify a structural change in the stochastic process we would have evidence of policy success. Data will be obtained on a monthly basis from Statistical Year Book of Turkey between 1958-1983. It is hoped that the findings of our study will present evidence of effective policy decisions and strategic planning in the Turkish tourism industry.

ROOM P102

TUESDAY
2.00-3.30

TIME SERIES APPLICATIONS

TIME SERIES

Chair: Lusk, Edward J., Biostatistics, Cancer Center, University of Pennsylvania, Philadelphia, PA 19104, USA

"EVALUATION OF ADAPTIVE AND HEURISTIC MODEL FOR ONLINE FORECASTING OF FLOODS"
Kumar, Arun., Civil Engineering Department, Delhi College of Engineering, Kashmiri Gate, Delhi-110006, India

A flood forecasting model involves transfer function relationship between rainfall (input) and the flood discharges (output). Though the transfer function is nonlinear, its form is not identifiable due to many interrelated meteorological and hydrological factors and is approximated as a linear model. In this study, the comparative performance of a non-linear model with ARMAX model is attempted. The form of the non-linear model is identified through a heuristic procedure based on GMDH (group method of data handling) as suggested by Ivankhenko (1970). It is observed that during calibration stage, heuristic model fits better than the properly validated ARMAX model. However, when the model is applied on other flood events, the performance of linear ARMAX model is significantly better than the non-linear heuristic model. It is further shown that the performance of the linear model can be further improved by recursively updating the parameters based on forecast errors.

"A DYNAMIC-STOCHASTIC APPROACH FOR FORECASTING HOSPITAL ADMISSION AND DISCHARGE FUNCTIONS"
Hammer, Jerry A., College of Business Administration, Northern Arizona University, Flagstaff, Arizona 86001, USA
Phillips, H.E., School of Business Administration, Temple University, Philadelphia, PA 19122, USA

Among the major problems confronting hospitals today are admission and occupancy control. In this paper, time series (ARIMA) models are employed to approximate dynamic admission functions for five patient-care categories, as well as for the total sample. The estimated admission functions are then combined with length of stay distributions, whose parameters are empirically generated, to obtain dynamic discharge functions. The estimated admission and discharge forecasts are compared to observed patterns. The models clearly identify cyclical components and account for more than 30% of the observed variation. They are useful for both forecasting and simulation purposes.

"PREDICTION OF HIGH TIDES IN THE BALTIC SEA"
Spliid, Henrik, and Nielsen, Bjarne Kjaer, IMSOR, Technical University of Denmark, DK-2800 Lyngby, Denmark

Some possibilities for forecasting high tides in the southern part of the Baltic Sea are presented and compared. The aim of the study is to predict situations with very high water levels due to meteorological conditions such that measures to prevent serious flooding can be taken and proper warnings can be given to the public. A number of time series analysis methods are used including analyses in the time domain and in the frequency domain. In order to model the influence of wind speed and air pressure at different locations in the Baltic Sea impulse response functions are estimated and time series models with exogeneous variables are analysed. Finally a comparison between the alternative models, including the model used until now, is made. The results show that considerable improvements can be achieved by using an on-line ARMAX model instead of the conventional regression type model.

"FORECASTING METHODS FOR INCOMPLETE GOVERNMENT TIME SERIES: COST EFFECTIVENESS OF DATA COLLECTION"
Wright, D.J., Faculty of Administration, University of Ottawa, 135 Wilbrod St, Ottawa KIN 9BS, Canada

Many time series contain, in practice gaps where data points are missing, whereas methods available for forecasting require a complete series. The present paper tests the performance of three new forecasting methods for this situation, using data from government and other publications. The methods are sequential and therefore highly efficient computationally. Computational requirements and forecast accuracy are used as criteria in comparisons. The degradation of forecast accuracy as successive data points are removed is used to assess the cost effectiveness of regular data collection.

ROOM SG14

TUESDAY
2.00-3.30

FORECASTING APPLICATIONS IN ACCOUNTING

FINANCIAL APPLICATIONS

Chair: Lawson, Gerry, Manchester Business School, Booth St West, Manchester, M15 6PB, England

"FORECASTING AND CAPITAL GROWTH"
Oakford, Robert V., Stanford University, Stanford, CA94305, USA

This paper presents evidence that the long-term growth rate of a firm's equity capital depends primarily on the distribution of the yields of its investment opportunities but that poor forecasting can cause a firm's capital growth rate to be appreciably less than its potential value. The firm's long-term equity capital growth rate can be affected also by its debt policy, its cash reserve policy, and its dividend policy. Factors that can have appreciable transient effect on a firm's equity-capital growth rate include the initial financing of a new firm and random variation in the firms investment opportunity generation process. The evidence was gained by computer simulation of sequences of capital rationing decisions in hypothetical firms; however, the technique used in this research could be used for self study by an actual firm that had sufficient information about its investment opportunity generation process.

"LONG RANGE STRATEGIC BUDGETING USING COMBINED FORECASTS"
Foote, P.S., New York University, 417 Tisch Hall, New York, NY 10003, USA

Decentralized firms combine the forecasts of domestic, and often of international, managers in preparing budgets. Top managements prepare independent aggregate forecasts for the firm. Budgeting involves negotiations over narrowing differences between the top management forecasts and the sum of the forecasts of individual managers. All managers lack some data being used by other managers.

This paper examines the competing techniques for combining the forecasts. The choice of the combined forecasting technique affects performance evaluation and long range planning and control.

"PROBLEMS IN REPORTING FORECASTED CONTINGENT LOSSES"
Brackner, J.W., and Skousen, Clifford R., School of Accountancy and Bus., Utah State University, Logan, Utah 84322, USA

Reporting contingent losses in financial statements has been a major concern to the financial community and the accounting profession in many countries, including Australia, canada, the UK and the US. Specific standards promulgated for reporting in these countries require professionals who prepare financial statements (corporate officers, legal counsel, and licensed accountants) to form a subjective forecast about the probability of the occurrence of a future event(s). Our recently completed empirical study of over 1,200 of these professionals indicates the standards are unreliable and, based on our findings, an objective forecasting model was developed to replace the subjective one.

ROOM LT1

TUESDAY
4.10-5.30

TIME-SERIES ANALYSIS ON MAINFRAME AND MICROCOMPUTER

TIME SERIES

Chair: **Young, Peter**, University of Lancaster, Gillow House, Bailrigg, Lancaster, England

"TIME SERIES ANALYSIS ON MAINFRAME AND MICROCOMPUTER"
Young, Peter, and Wilson, G.T., University of Lancaster, Bailrigg,Lancaster, England

During the past few years, powerful methods of time-series analysis have been developed which have great potential for practical application and considerable importance in forecasting terms. Such methods will not be widely applied in practice, however, unless they are made available to the general user in the form of computer programs and program packages that are freely available and user-friendly. The aim of this session will be to discuss in detail typical examples of recently developed, advanced time-series and signal processing computer programs for both main-frame and microcomputers.

Granville Tunnicliffe Wilson (Lancaster) will describe the main-frame GENSTAT time-series package and introduce a number of practical examples which illustrate its use in the analysis and forecasting of time-series data. John Hampton and Peter Young (Lancaster) will describe both main-frame (interactive) and microcomputer versions of the CAPTAIN (Computer Aided Program for Time Series Analysis and Identification of Noisy Systems) programs for recursive time-series analysis and signal processing. Also a development of the microcomputer version (MICROCAPTAIN) for forecasting applications will be described by Peter Young and Peter Armitage (Civil Service College). In all cases, an attempt will be made to present the material in a tutorial and visually interesting form. The MICROCAPTAIN program for the APPLE II micro, for example, will be demonstrated during the session (requirements Apple II (64K) or IIe micro.. with at least one disc drive and a colour monitor - if possible incorporated in a projection system). The GENSTAT and main frame CAPTAIN programs will be illustrated by Peter Armitage using overhead projector/35 mm slides.

The program packages to be described during this session are primarily intended for the analysis of stochastic time-series data described by transfer function-type models: in the purely stochastic case the ARMA type of model; and, in the case where deterministic inputs (exogenous variables, leading indicators) are present, the transfer function model for the main process, plus ARMA representation of the noise residuals. Both single input and multivariable versions of these models will be considered and, in the CAPTAIN recursive analysis, the discussion will include the estimation and tracking of temporal variations in the model parameters which may arise because of nonstationarity or nonlinearity. Some attention will also be given to the problem of data pre-processing and a recursive smoothing approach to this problem will be demonstrated which has the advantage of requiring the user to specify only a single program parameter.

The session will finish with a discussion session which will allow the audience to ask questions about both the nature of the programs and the numerous practical examples described in the presentations.

ROOM LT2

TUESDAY
4.00-5.30

IMPROVING JUDGEMENT II

JUDGEMENT

Chair: **Wright, George,** Decision Analysis Group, Psychology Department, City of London Polytechnic, Old Castle St, London E1 7NT, England

"IMPROVING JUDGEMENTAL FORECASTING"
Ayton, Peter., and Wright, George, Decision Analysis Group, Psychology Department, City of London Polytechnic, Old Castle Street, London E1 7NT, England

What research findings can usefully be applied to improve the quality of probabilistic judgemental forecasting? A wide ranging review of the pertinent literature suggests that some results may not be generalisable beyond their task specific settings. Further, the effects of a number of variables relevant to real world forecasting situations remain unexplored. New data presented here indicates that subjects have difficulty in producing coherent future event likelihoods for differing but related time periods. Also the influence of perceived utility of events may contaminate likelihood judgements. A number of general methods for improving the coherence, calibration and resolution of judgemental forecasters' output are recommended.

"OPTIMAL SCORING RULES"
Foreman, Joshua, Dept of Economics, Wichita State University, Wichita KS 67208, Kansas, USA

The probabilistic forecaster issues, as his forecast, a probability density function over all possible future states of the world. The categorical forecaster predicts the realization of one particular state. Categorical forecasting is usually understood as being implicity probabilistic, and, in any case, may be viewed as degenerate probabilistic forecasting.

The function which maps the forecast p.d.f. and the realized state of the world into the user's payment to the forecaster is known as a scoring rule. Considerable debate has raged over the years over which scoring rule is "best". This paper establishes rigorously a conjecture of de Finetti's: the optimal scoring rule is a linear sharing rule, in which the forecaster receives a fixed payment (possibly negative) plus a non-trivial share, S, of the user's realized profits. The user will pay a subsidy equal to (1 - S) fraction of the forecaster's research expenditures, if any. This incentive structure will also induce truthful revelation of the forecaster's p.d.f. The microeconomic tools of principal/agent theory are employed to establish these results.

"THE CALIBRATION OF AGGREGATIONS OF SUBJECTIVE PROBABILITIES AND PROBABILITY DISTRIBUTIONS"
Ferrell, William R., Systems & Industrial Engineering Dept, University of Arizona, Tucson, Arizona 85721, USA

Mathematical or behavioural combination of individual subjective probabilities and probability distributions is frequently done to improve forecasting or decision analysis. Aggregation, however, can have a systematic effect on calibration, the extent to which the relative frequency of occurence of events equals their assessed numerical probability. Simulations and studies using models of calibration reveal possible mechanisms underlying these effects and may make it possible to predict them. The paper surveys the results of this work and attempts to provide a coherent account of how aggregation influences calibration.

"THE USE OF A COMPUTER AID IN STOCK MARKET FORECASTING"
Donnell, M.L., Par Technology Corporation, 7926 Jones Branch Drive, Suite 170, McLean, Virginia 22102, USA

Recent advances in computer science have led to the use of computers as problem solving aids. This project investigates judgements in forecasting and computer software support of security analysis in a stock market domain. Knowledge engineering of security selection in simulated general market conditions has led to the development of an "expert system" tool for increasing forecasting performance. Utilizing artificial intelligence techniques, this intelligent expert system aid uses stock market assessments and inference procedures to predict the probability of stock return data.

Focusing on the cognitive processes involved in using such a problem solving aid, this research attempts to develop a theory of the cognitive psychology of user interactions with intelligent interface systems, and, based on this theory, recommends optimum design principles. The central hypothesized principle is that the type of cognitive interaction between a user and an expert system aid is governed primarily by the degree of cognitive consistency between the system and the user's cognitive approach to the problem domain. Empirical studies that will identify important issues in computer software support for problem solving and forecasting are currently being conducted.

"APPROXIMATION MODELLING"
Leone, R.P., and Kumar, V., University of Texas, Austin, Texas 78712, USA
Decision-making models are being increasingly used for a large number of managerial applications. While corporate planning models cannot predict the future, they can help management assess risk and uncertainty. Similarly, management decision-making models are not able to predict the exact nature of an outcome but can help managers evaluate available alternatives in a relative sense. Many decision making models take intrinsically non-linear forms which are hard for managers to conceptualize. This paper proposes a linear approximation procedure which is tested with simulated data, as well as, with data from a leading US corporation involved with such models.

ROOM LT3

TUESDAY
4.00-5.30

EXCHANGE RATE FORECASTING III

MACROECONOMIC FORECASTING/FINANCIAL APPLICATIONS

Chair: Alexander, D., Treasury, City Bank, 399 Park Ave, New York, New York 10043, USA

"INTEREST RATE HEDGING: A MANAGERIAL RESPONSE TO ADVERSE INTEREST RATE FORECASTS"
Kawaller, I.G., New York Office, Chicago Mercantile Exchange, 67 Wall St, New York, NY 10005, USA
Eckinger, H., Chicago Mercantile Exchange, 27 Throgmorton St, London EC2, England

This paper deals with the process of interest rate hedging using short-term interest rate futures as a means of minimizing the risk associated with adverse interest rate forecasts.

As a first step, a brief discussion of interest rate futures will be provided. Second, the link between the interest rate forecast and its associated cost (or benefit) will be explained. Third, all the risks and opportunities associated with a static hedge will be explored, including concepts of initial margin, variation margin, basis risk, yield curve and cross hedge uncertainties. And finally, the paper will close with a discussion of dynamic hedging or hedge management techniques.

"CALCULATION OF EXCHANGE RATE NORMS WITH A DYNAMIC MODEL"
Armington, P., and Wolford, C., Armington Wolford & Associates, 3031 Macomb Street North West, Washington DC, 20008, USA

This paper uses an estimated dynamic model of ten currencies to calculate "equilibrium" rates or exchange rate "norms" for different historical periods. Against the backdrop of a comprehensive examination of the model's forecasting performance over the past decade, both in terms of accuracy and profitability, this paper identifies several periods of currency misalignment. Equilibrium norms are then calculated as the geometric mean of six year forecasts generated by model solutions initialized in the month of the peak or trough. Given the estimated periods of cycle contained in the model, this average of the six year forecast serves as a plausible estimate of the central tendencies of exchange rates during each period.

"CONCURRENT AND LAGGED RELATIONSHIPS AMONG FOREIGN EXCHANGE RATES"
Jones, Kenneth J., Florence Heller School, Brandeis University, Waltham, MA 02154, USA
O'Reilly, Daniel, F.X., Data Resources, Inc., Lexington, MA 02173, USA

Eighty foreign exchange rates taken at a weekly frequency and expressed in equivalent U.S. dollars per unit were factor analyzed at zero (concurrent) lag and at non-zero lags. Analysis in the frequency domain was used for the investigation of non-current lags. The spectral properties of gaps between exchange rates sharing common factors were also investigated. The results of this analysis are interpreted in terms of certain world trade loops.

"HOW TO HEDGE OPTIMALLY: HEDGING MODEL AND A SURVEY OF FORECASTING THE EXCHANGE RATE"
Lin, Winston T., School of Management, State University of New York, 218A Crosby Hall, Buffalo, New York 14214, USA

This paper addressed the issue of how to hedge optimally by developing a simple hedging model. The non-linear model is solved by the use of Multi-Purpose Optimization System (MPOS) computer package. A numerical example for a hypothetical multinational firm is presented. Since the model includes the future spot exchange rate as an important input, it calls for a brief survey of forecasting models of the exchange rate. The model also includes the measurement of the foreign subsidiaries' exposure as another principal input. This justifies the need for a discussion of three translation methods and an analysis of the merits of the Financial Accounting Standards Board No.8 and No.52 Statements.

"MODELLING THE DOLLAR'S EFFECTIVE EXCHANGE RATE, 1973-1983"
Edison, H.J., Board of Governors of the Federal Reserve System, Washington DC 20551, USA

A number of recent studies have found that structural exchange rate models are no more accurate than forward rates or random walks in forecasting out-of-sample exchange rates, even in ex-post forecasting. This paper discusses some of the deficiencies in the specification and estimation of structural exchange rate models. It presents an alternative model of exchange rate determination which attempts to encompass previous models. Using this alternative model, an attempt is made to explain the movement in the dollar over the past year (1983).

"EXCHANGE RATE MODELS - PROBLEMS IN FORECASTING"
Alexander, D., Treasury, City Bank, 399 Park Avenue, New York, NY 10043, USA

This study examines the recent performance of various structural and time series exchange rate models. The first part of the study surveys the predictive accuracy of various forms of the monetary/asset and time series exchange rate models. The second part of the study looks at different variables and how they influence the long run level of the exchange rate. The third part of the study will include these variables used in conjunction with cross sectional time series estimation as a means of improving forecast performance.

ROOM LT4

TUESDAY
4.00-5.30

PRACTICAL PROBLEMS IN SOCIAL FORECASTING

SOCIAL & TECHNOLOGICAL

Chair: **Halliday, J.S.**, Dept of Industrial Studies, University of Liverpool, PO Box 147, Liverpool L69 3BX, England

"PRACTICAL GUIDELINES FOR CONDUCTING AN INTER-ORGANIZATIONAL KSIM CROSS IMPACT ANALYSIS"
Halliday, J.S. and Mullett, J.C., University of Liverpool, Dept. of Industrial Studies, PO Box 147, Liverpool, L69 3BX, England

This paper describes the application of KSIM cross impact analysis to a 'real-world' problem which necessitated the participation of specialists from many different organizations and fields of expertise. Participants were often required to give considerable time and effort to the analysis and to comment on sensitive topics. The more usual 'round-the-table' format was therefore not possible. A new approach was developed consisting of individual consultations and group seminars leading to a 'rationalized' view. This approach will be described and practical guidelines offered to facilitate in the presentation of KSIM to participants, and, to aid in the evaluation of variables and their cross impacts.

"A STRATEGY-SCENARIO INVESTIGATION OF THE DUTCH CONSTRUCTION SECTOR"
Wissema, J.G., Vam der Woertstraat 50, 2597 pl Den Haag, Netherlands.

The objective of this study is to investigate which construction-strategies are to be recommended for future use in the Netherlands, a construction strategy being defined as the entire process of design, construction methodology and organization, together with corresponding ways of decision making, financing etc. Four such strategies have been identified. These were used against three possible societal developments, described in the form of socio-economic scenarios. At each of the 12 resulting situations, the costs in 1992 of a house will be estimated by means of an integral cost model. As the study is still in progress, this paper concentrates on the method of investigation, the strategies, the scenarios and the cost model.

"SIS AND EXPLO: INSTRUMENTS FOR SUPPORT OF POLITICAL DECISION MAKING"
Markus, Gerd, Ministry of Youth & Social Affairs, Bremen, West Germany

The paper describes software (and models) developed to support processes of political decision making on problems of adequate supply of "social infrastructure", ie. schools, hospitals, social services.

The software instruments constitute a framework for model-building of supply and demand of public services. Beyond its present use, its application in the fields of vocational training and labour market development will be tested.

The two central instruments are a dynamized accounting framework relating external and instrumental variables to a balance of supply and demand for any given period within a medium-term planning horizon, and a - mathematical - framework for investigating long-term social developments and their consequences for public policy decisions. (The first instrument also has been tested in an Optimal Control surrounding).

Problems of integrating the use of these instruments into the strategic decision-making process of a professional bureaucracy are reported.

"SENSITIVITY TESTS FOR KSIM CROSS IMPACT ANALYSIS"
Mullett, J.A.J., Mullett, J.C., and Halliday, J.S., University of Liverpool, Dept Industrial Studies, PO Box 147, Liverpool, L69 3BX, England

This paper describes several simple sensitivity tests devised as aids in the conducting of KSIM cross impact analysis. The variable tests aim to evaluate, in a quantitive manner, the relative importance of each of the variables in a model. The principle of these tests is to measure the effect of the exclusion of a variable or a group of variables upon the other variables. The tests measure the indirect as well as the direct effects of variable deletion. Another test measures the sensitivity of the KSIM model to modifications in the input value. The application of these tests will be illustrated using examples from a 'real-world' analysis undertaken by the authors.

ROOM LT5

TUESDAY
4.00-5.30

KEYNOTE SESSION ON BUSINESS CYCLES

MACROECONOMIC FORECASTING

Chair: **Britton, Andrew,** National Institute of Economic and Social Research, 2 Dean Trench St, Smith Square, London SW1P 3HE, England

"BUSINESS CYCLE ANALYSIS AND EXPECTATIONAL SURVEY DATA"
Zarnowitz, Victor, University of Chicago and National Bureau of Economic Research, Chicago, Illinois, USA

What is the role of foresight, and the significance of the lack of foresight under uncertainty, in the theory of business cycles? What relevant evidence on these questions can be extracted from the survey data on agents' expectations and experts' forecasts? To provide some answers, the recent work in this area is reviewed in the perspective of economic and doctrinal history. The address proceeds from (1) a discussion of the expectational aspects of modern business cycles theories and (2) a critique of the currently dominant approaches to (3) a summary of the evidence and (4) some illustrations and implications for further analysis. Of the conclusions drawn, perhaps the most general one is that expectations matter a great deal but are not all-important. They may be rational in the sense of effectively using the limited available knowledge and information, but they are also diversified and not always self-validating or stabilizing.

"HOW FAR CAN CHANGES IN GENERAL BUSINESS ACTIVITY BE FORECASTED?"
Oller, L.E., Ministry of Finance, Economics Dept, PO Box 295, SF-00171 Helsinki, Finland

An F test of Parzen's prediction variance horizon (PVH, Parzen, 1982) of an ARMA model yields the number of steps ahead that forecasts contain information (short memory). A special 10 year pattern in Finnish GDP is introduced as a "seasonal" in an ARMA-model. Forecasts three years ahead are statistically informative but exploiting the complete 10 year pattern raises doubts both about model memory and model validity. In an appendix, model short memory is generalized to the multivariate case.

ROOM LT6

TUESDAY
4.10-5.30

COMPARATIVE FORECASTING ACCURACY AND THE VALUE OF EXOGENOUS VARIABLES

GENERAL FORECASTING/APPLIED ECONOMETRICS

Chair: Wood, D., Manchester Business School, Booth St West, Manchester, England

"A COMPARISON OF THE ACCURACY OF ECONOMETRIC AND EXTRAPOLATION (TIME SERIES) FORECASTING METHODS"
Makridakis, Spyros, Faculty of Management, McGill University, Samuel Bronfman Building, 1001 Sherbrooke Street West, Montreal P.Q. Canada, H3A 1G5

Mahmoud, Essam., Dept of Marketing, College of Business & Economics, West Virginia University, Morgantown W.V. 26506 - 6025, USA

The purpose of this study is to compare the performance of econometric and extrapolation forecasting methods. The comparisons involve the forecasts made by a number of econometric services (Wharton Econometric Forecasting Associate, Inc., Data Resources Inc., Chase Econometrics) with those of automatic time series methods (Naive, Exponential Smoothing, AEP). In addition to the comparisons between econometric and time series methods, the accuracy and characteristics of the various approaches will be analyzed and their implications on policy and decision making discussed.

"A COMPARISON OF METHODOLOGIES FOR FORECASTING ELECTRIC POWER SALES"
Goodrich, Robert, L., and Mehra, Raman K., Scientific Systems Inc., 54 Rindge Av Ext, Cambridge, MA 02140, USA

Engle, Robert F., Quantative Economic Research Inc., 6095 Tamilynn St., San Diego, Ca 92122 USA

A number of advanced forecasting methodologies were investigated for their usefulness in predicting residential electricity sales for up to three years. The methods included ordinary least squares, serial correlation econometric, time varying parameters, adaptive variance (ARCH), univariate and multivariate state space, Winters, ARARMA, Harrison-Stevens, ridge vector autoregression, and naive models. The forecasting models were fitted to monthly historical data from 1962 to 1977 in ten geographically representative states, used to forecast sales for the period 1978-1980, and then evaluated against actual historical sales. Multivariate state space proved superior for shorter horizons, seasonal serial correlation or adaptive parameters for longer.

"A COMPARISON OF MULTIVARIATE FORECASTING PROCEDURES FOR ECONOMIC TIME SERIES"
Kling, John L., McIntire School of Commerce, University of Virginia, Monroe Hall, Charlottesville, Virginia 22903, USA

Bessler, David A., Texas A & M University, Dept of Agricultural Economics, College Station, Texas 77843, USA

In recent years several methods for identifying and estimating models for vector time series have been suggested. Most of the applications have examined either within sample results or out-of-sample results compared, perhaps, to univariate models. In this paper we compare the out-of-sample forecasting results for several versions of the class of vector models commonly referred to as vector autoregressions. Six competing methods for identification and estimation are applied to models for macroeconomic, agricultural, and oil market time series. Comparisons, using several metrics, are made at different forecast horizons and include the forecasts of univariate and combination methods.

"CROP YIELD FORECASTS AND THEIR VALUE"
Allen, P.G., and Morzuch, Bernard J., Dept of Agricultural and Resource Economics, University of Massachusetts, Amherst, Mass 01003, USA

Aggregate crop yield forecasts are used for various policy purposes. In the case examined here they are used by Ocean Spray, the cranberry growers co-operative, to make storage leasing decisions. Yield equations with weather and technology variables are estimated econometrically. Yield forecasts are updated through the year using both actual and forecasted weather data. Forecasts of temperatures generally improve yield predictions. The value of perfect weather forecasts is computed.

FAIRBAIRN ROOM

TUESDAY
4.00-5.30

INFORMATION TECHNOLOGY

SOCIAL & TECHNOLOGICAL

Chair: Tydeman, John, News International plc, PO Box 7, 200 Grays Inn Road, London, WC1X 8EZ, England

"EVALUATION OF AN ECONOMETRIC FORECASTING MODEL OF TELEVISION STATION VIABILITY"
Klein, Michael, Michael Klein Econometrics, 1305 N. Fifth Terrace, Blue Springs, MO 64015, USA

In response to pressures to reallocate the US UHF television spectrum, the Federal Communications Commission retained the RAND Corporation to forecast the number of UHF commercial television stations that are likely to come on the air through 1990. The econometric forecasting model RAND developed was thoroughly critiqued by six prominent communication economists who, with one exception, found the model to be the best quantititive tool practically possible for forecasting the number of UHF stations. This paper is a retrospective evaluation of the economists' judgement and the forecasting accuracy of the RAND model at the midpoint of its forecasting horizon (1982).

"FORECASTING THE INTERNATIONAL TELECOMMUNICATION TRAFFIC BY THE DATA SLIDING METHOD"
Kunisawa, K., Dept Information Sciences, Science University of Tokyo, Noda, Chiba 278, Japan
Horibe, Y., Shizuoka University, Dept of Information Sciences, Faculty of Engineering, Hamamatsu 432, Japan

In forecasting the future international telecommunication (telephone, telex, telegraph) traffic in each country, the data compiled by ITU (International Telecommunication Union) are the best available, but because the time series are short, extrapolations based on an individual data series are likely to be unreliable. It is often the case however that, with a wide-spread phenomena such as international communications, a global view point may provide a better long-range perspective in identifying future trends than a view based on each individual (country) separately. In this paper we present the 'data sliding method' to overcome this problem of inadequate data. This method 'slides' the traffic data per person for various countries along the time axis and "joins" them together to form a single logistic curve (either growing or declining), thus developing a longer data base and improving the possibility of reliable long-range forecasts. Computer results are shown, and a necessary and sufficient mathematical condition for the method to be applied is given. Reliability of the forecasts is also considered.

"FORECASTING FIBER OPTICS GROWTH: EMPIRICAL EVIDENCE"
Shelley, C.J., Suffolk University, 8 Ashburton Place, Boston, Massachusetts 02108, USA

Forecasts of enormous growth in the fiber optics (FO) industry have been made every year for the past five years; and just as often decisions based on those estimates have had to be revised when expectations were not met. Planning suffered as suppliers, customers and financial markets discovered the forecasts were overly optimistic.

This study was undertaken to examine the basis for this optimism, and the foundations for real industry growth. A questionnaire was administered to determine demand from the point of view of manufacturers and suppliers. In-depth interviews were held to discover factors important to growth. Results indicate continued growth, but differing significantly by market segment.

ROOM G07

(SLOAN ROOM)

TUESDAY
4.00-5.30

FORECASTING CORPORATE FINANCIAL FLOWS

FINANCIAL APPLICATIONS

Chair: Griffin, Paul, School of Administration, University of California, Davis, California 95616, USA

"THE EFFECT OF ECONOMIC CYCLES IN THE CONSTRUCTION OF TIME SERIES MODELS FOR INDUSTRY QUARTERLY EARNINGS"
Fries, Clarence E., University of Arkansas, Dept of Accounting, Business Admin Bldg, Fayetteville, Arkansas 72701, USA

Conflicting research evidence suggests that time-series models of quarterly earnings at the industry level may be period-specific. Consideration of a typical economic cycles in the identification and estimation of earnings models affords the opportunity to improve predictability. More importantly, evidence that cycle-specific models are better predictors would support an argument for transference of forecast responsibility from management to investor. Such an evidentially-supported argument could mitigate the SEC's indefatigable attempts to require publication of management forecasts. That is, investors could make their own assessment of economic behaviour in a forthcoming period. Preliminary empirical results indicate the feasibility of cyclical models.

"SOME TIME SERIES PROPERTIES OF CASH RECOVERY RATES"
Ismail, B., School of Management, Syracuse University, Syracuse, New York, NY 13210, USA

Given evidence of and rationale for relying on cash flows to assess firms performance, this paper examines the time-series behaviour of CRR (corporate cash recovery rates). Cross-sectional results obtained from runs test, autocorrelations, and partial adjustment models, revealed the following:

(1) CRRs appear to be nonrandomly distributed. (2) Changes in the series exhibit significant autocorrelations. (3) Overall, the series appear to be adequately described by a constant expectations process; some form of an autoregressive process. The results strongly indicate the existence of a systematic pattern in past series of CRR's; this should prove useful in identifying firm-specific CRR's forecast models.

"FORECASTING SALES OF FOOD MANUFACTURERS WITH LIMITED OBSERVATIONS"
Koshal, Rajindar K., Koshal, Manjulika, and Nandola, Kahandas, N., Ohio University, Copeland Hall, Athens, OH 45701, USA

The purpose of this paper is to develop a sales forecasting model which may be used by an individual food manufacturing firm when it has only a small number of observations. This paper develops a covariance model and coefficients are estimated by using sales data for 18 years, 1960-77 and for 12 food manufacturing corporations listed on the Compustat .Industrial tape. These twelve coporations were selected since a complete set of data for other corporations was not available. The forecasting model estimated provides good forecasts for the next two years. This suggests that this forecasting model is useful for planning purposes for at least two years ahead.

"PREDICTING REVERSION PARAMETERS"
Van Breda, M.F., E.L. Cox School of Business, Southern Methodist University, Dallas, Texas 75275, USA

Earlier work by the author, Van Breda, described an initial attempt to develop a dynamic model of corporate earnings behaviour based on the economic theory of declining marginal rates of profit. The reversion parameter in that model appeared to be systematically related to the accounting book life of the company. Further research reveals that the reversion parameter is related to a theoretically predictable growth parameter as well and to growth indicators such as advertising and research and development. These results suggest that it might yet be feasible to build economically meaningful models of corporate earnings behaviour.

ROOM P101

TUESDAY
4.00-5.30

SEASONALITY AND SEASONAL ADJUSTMENT

TIME SERIES

Chair: Shumway, R.H., Division of Statistics, University of California, Davis, California 95616, USA

"DETERMINING TURNING POINTS AND LEAD-LAG RELATIONS TO CHOOSE THE CORRECT STRUCTURE OF DECOMPOSITION OF TIME SERIES"

Huot, Guy, Statistics Canada, **Gait, Nazira**, University of Sao Paulo-Brazil, and Rua Joachim Antunes, 683 - Apartment 42, Sao Paolo cep 05415, Brazil

This paper analyses some aspects of seasonal adjustment in periods of sudden changes of the level of time series.

The recent economic recession in Canada has profoundly affected the evolution and the structure of time series: in just one year, it has nearly doubled the level of some series. Such a sudden large change prompts questions about the seasonal adjustment and the detection of the fundamental tendencies at the end of the series.

The series under consideration in this study are: claimants and beneficiaries of unemployment insurance.

We first present the problems regarding the choice of decomposition models, the determination of turning points and the lead-lag relationship between time series, as a seasonal adjustment instrument.

Subsequently, we focus on the use of the ARIMA forecasts as a variable, permitting one to modify the path of the seasonally adjusted series.

"A NEW APPROACH TO SEASONAL ADJUSTMENT WITH A NUMERICAL EXAMPLE"

d'Alessandro, Paolo, Istituto di Elettrotecnica, Universita dell'Aquila, - Monteluco, 67100 L'Aquila, Italy
d'Alessandro, E de Luca Istituto di Igiene, Universita di Roma, P le A Moro 5, 00185 Roma, Italy

A new method of seasonal adjustment is introduced. The main ingredient of the method is the technique of optimal smoothing of a time series, which is briefly recalled. The optimal smoothing problem leads to a convex programming problem, namely that of projecting a point on a polytope which is solved by means of a fast projection method. Because each run of the introduced seasonal adjusting method requires hundreds of optimal smoothings, the derivation of a fast algorithm was actually necessary to produce a practicable technique.

The model used for the series is the additive model with the irregular seasonal and cycle-trend components, and the filtering procedure to separate the three component is explained in detail. Finally numerical results for a time series of epidemiological data are included.

"FORECASTING SEASONAL DEMAND"

Oliver, Robert M., Dept of Industrial Engineering, University of California, Berkeley, California, USA

This paper offers a formulation for seasonal forecasting based on the assumption that an a priori forecast for total seasonal demand, N, is available and that, given N, the cumulative demand at any time within the season is Binomially distributed. Using Bayes rule and the theory of linear predictors, it is shown that the updating formulas consist of two separate parts: one furnishes an a posteriori estimate of total demand at the end of the season, the other an a posteriori Binomial demand distribution within the season. The role of the Negative Binomial distribution for demand in the remainder of the season will be discussed as well as its role in the multi-season case.

"FORECASTING SEASONAL HYDROLOGICAL TIME SERIES"

McLeod, Ian A., Department of Statistical and Actuarial Sciences, The University of Western Ontario, London, Ontario, Canada
Hipel, K.W., and Noakes, D.K., Dept of Systems Design Engineering, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada
Thompstone, R., Alcan Smelters and Chemicals Ltd, Jonquiere, Quebec, Canada

Flows from thirty rivers are used to test the forecasting ability of various time series models. The series are split into two sections and models are calibrated to the first portion of the data. The models are then used to generate one-step-ahead forecasts and forecasts errors for the second portion of the data. The forecast performance is compared using various criteria. The results suggest that a periodic autoregressive model identified using the partial autocorrelation function forecasts the best for monthly average flows.

Another investigation with quarter-monthly series (ie. nearly-weekly) shows that a transfer function-noise model performs better than so-called conceptual hydrological models when data on precipitation and temperature is available.

ROOM P102

TUESDAY
4.00-5.30

ECONOMETRIC METHODOLOGY II

APPLIED ECONOMETRICS

Chair: Sousa, R.C., DEE, PUC/RJ, Rua Marques de Sao Vicente 225, Gavea, Rio de Janeiro RJ, Brazil

"ECONOMETRIC FORECASTING MODELLING: UTILITY MAXIMISATION APPROACH"
Keng, C.W.K., Ontario Hydro and University of Toronto, 700 University Avenue, H4E26, Toronto, Ontario, Canada, M5G 1X6

This paper investigates forecasting modelling of economic time series. A rational approach to econometric forecasting modelling is developed by maximizing a forecasting modelling utility function (FMU) subject to information and other constraints. The FMU of a model is defined as the model's expected log-likelihood function with respect to future observations. This utility function is closely related to the entropy or the negative Kullback-Leibler information measure of a model. The FMU maxization principle is then shown to be equivalent to Akaike's information criterion and is thus recommended as a criterion for forecasting modelling.

"IDENTIFICATION OF MULTIPLE INPUT TRANSFER FUNCTION MODELS AND APPLICATIONS"
Liu, Lon-Mu., Department of Quantitative Methods, University of Illinois Box 4348, Chicago, Illinois 60680, USA

Although the application of multiple-input transfer function models has been increasing rapidly, it is only recently that simple procedures which simultaneously identify the transfer function structure have been developed. This paper discusses a modification of the least squares identification method proposed in Liu and Hanssens (1982). This modification allows computation of more efficient estimates of the transfer function weights and also avoids the need of ad hoc common filtering proposed in various papers. This modified method can also be applied to multi-equation time series models to determine the input variables in each equation and the form of their relationships.

"INTEMPORAL DYNAMICS BETWEEN ECONOMIC TIME SERIES"
Huth, W.L., 53 Richard Rd, Needham, MA 02192, USA

This paper describes a multivariate time series analysis of the dynamics of intertemporal relations between aggregate economic time series. The dynamic analysis is accomplished by using a statistical bootstrap of the realizations from particular stochastic process pairs. The sub-realizations for each process are used to specify the direction of the intertemporal relation between the time series and, given a succession relation, the delay parameter between an impulse in the input series and the corresponding response in the output series. Empirical results are presented for the coincident index of economic indicators, the money supply, and the index of leading economic indicators.

"ESTIMATING FORECASTING EQUATIONS IN THE PRESENCE OF LARGE MEASUREMENT ERRORS IN THE DEPENDENT VARIABLE"
Markowski, A., Central Bank of Sweden, Box 16283, S-103 Stockholm, Sweden

Swedish data on exports of invisibles comprise extremely large measurement errors due to underreporting. The exact nature of the error term is not known. A robust regression method was therefore employed in estimating a forecasting model for invisibles. The model was estimated using Iteratively Reweighted Least Squares with two weight functions, the Huber function and the Bisquare function, employed consecutively. As expected, the largest differences between the robust estimates and the corresponding OLS estimates were observed for the equation with the largest measurement error. However, probably owing to the nature of aggregate time series data, those differences were smaller than one could expect (at most 12% of the OLS estimate).

ROOM P102

TUESDAY
4.00-5.30

ECONOMETRIC METHODOLOGY II

APPLIED ECONOMETRICS

Chair: Sousa, R.C., DEE, PUC/RJ, Rua Marques de Sao Vicente 225, Gavea, Rio de Janeiro RJ, Brazil

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ROOM SG 14

TUESDAY
4.00-5.30

DEVELOPING AND TESTING MACROECONOMIC MODELS

MACROECONOMIC FORECASTING

Chair: Ash, **Colin**, Dept of Economics, University of Reading, Reading, England

"EVALUATING A MACROECONOMIC MODEL - SOME PRACTICAL EXAMPLES"
Jenkinson, N.H., Dunn, G.P., & Midgley, G., Bank of England, Threadneedle St., London, England

This paper is a collection of four largely separate papers each illustrating different ways in which a model can be tested.

The effects in the model of changes in fiscal instruments, interest rates, world activity and prices, UK money wages and the exchange rate are described. The sensitivity of the results to the wage and exchange rate responses is illustrated. Attention is drawn to various systems properties such as the extent and origins of crowding-out, the long-run effect of devaluation on output, the extent to which the law of one price holds and the stability of the model.

The relationship between the impact of a step change in a single exogenous variable, in this case the income tax rate, and the size of the step is also examined. Are the reactions symmetric and linear?

The historic tracking performance of the Bank short term model between 1974 and 1982 is also dicussed: first the usefulness of running historic dynamic simulations as a guide to model testing and model comparison, is commented on; and second results for the tracking performance of the Bank model are presented. The results indicate that the success or failure of the model to track output and inflation was critically dependent upon the period chosen.

Cross correlations between the single equation static residuals of the main behavioural equations are calculated. The reasons why residuals on separate equations may be correlated are discussed. Using procedures outlined by Harvey and Phillips (1982), the significance of relationships between residuals is examined.

"A CRITICAL ASSESSMENT OF MACROECONOMETRIC FORECASTING TECHNQIUES"
Taylor, Lawrence, W., & Sliwa, Steven, M., Investment Analysis Company, 114 Edward Wakefield, Williamsburg, VA 23185, USA

It is the purpose of this paper to assess a particular set of forecasting techniques which fall under a broadly defined category of macroeconometric techniques. A state space format is used for all of the techniques except for the most popular econometric models. Forecasting performance is analyzed in statistical terms, and where possible, in terms of ex post and actual exante forecasting errors. A twelve year period of actual forecasts of inflation and production rates for the United States is used. Theoretical error covariance matrices are used in assessing a number of simple but popular forecasting techniques.

"MODEL FOR FORECASTING THE SERVICES SECTOR OF THE US BOP ACCOUNTS"
Stekler, Lois, International Finance Division, Federal Reserve Board, Washington DC 20551, USA

Many exchange rate models include the current account as an explanatory variable. While models of merchandise trade have been explored in great detail, models to forecast the services side of the current account are less common. This paper presents a US services sector model: the components include receipts and payments on direct investment, other investments, and non-investment service income. In addition, the paper considers the accuracy of the underlying service account data in the light of the large statistical discrepancies in recent years in the US balance of payments accounts and the asymmetries in world current account balances.

"A MODEL FOR ECONOMIC FORECASTING IN THE CARIBBEAN"
Worrel, Delisle, and Holder, Carlos, Central Bank of Barbados, PO Box 1016, Treasury Building, Bridgetown, Barbados WI

This paper suggests a model for analysing stabilisation questions in small open economies. We present a system of equations to deal with economic reactions to changes in international trade and financial markets, and to varying official policies. We are specifically concerned with the short-run, effects which work temselves out during the course of a year.

The model has been derived from observations of the economies of small Caribbean island states, and it will be tested in the Caribbean context. Among its distinguishing characteristics are a prominent tradable goods sector, where price elasticities of demand are large. Domestic production capacity is small in relation to the export markets on which tradables may be sold. There is also a non-tradable goods sector, where domestic market circumstances define equilibrum. The banking sector comprises a monetary authority and a few commercial banks, each quite large in comparison with the size of the economy. Other financial institutions exist, but their contribution is quite small. There is a single economy-wide market in domestic factors of production.

CONFERENCE PROGRAMME WEDNESDAY

WEDNESDAY MORNING AT 9.00 a.m.

ROOM	SESSION	CHAIR	
LT1	Seasonality and Seasonal Adjustment II	Peter Burman	79
LT2	Energy Forecasting & Policy Making	John.B. Robinson	80
LT3	Forecasts as Option Generators	Peter.B. Meyer	81
LT4	Forecasts of Corporate Sales and Earnings: Methods and Stock Market Reaction	R.D. Nair	82
LT5	Employment Forecasting	Rob Wilson	83
LT6	Rational Expectations in Macroeconomic Forecasting	Patrick Minford	84
FBR	Industrial Applications of Econometrics IV: Forecasting in the Telecommunications Industry	Dan Kohler	85
G07	Political Forecasting II	R.E. Linneman	86
P101	Public Policy and Management I	S. Bretschneider	87
P102	Regional and Industrial Models and Forecasting	S. Biffignandi	88
SG14	Forecasting Policy: a Case Study of EEC Farm Policy	Gerald Pollio	89

WEDNESDAY MORNING AT 11.00 a.m.

LT1	Industrial Applications of Econometrics V Forecasting in Utilities	Anders Baudin	90
LT2	Approaches to Environmental Scanning with Examples	C.R. MacNulty	91
LT3	Interest Rates	Robert Lippens	92
LT4	Financial Forecasting	Larry Brown	93
LT5	Artificial Intelligence and Forecasting	Jeffrey Jarrett	94
LT6	Keynote Session in Macroeconomic Forecasting @11.10	Alan Budd	95
FBR	Multivariate Time Series Models	J. Ledolter	96
G07	The Impact of Decision Style	Randall Schultz	97

WEDNESDAY AFTERNOON AT 2.00 p.m.

LT2	What Next?	Phil Holroyd	98
LT3	Bankruptcy Prediction	Doug Wood	99
LT4	Forecasting and Analysis with Multisectoral National Models	Sw.Amrit Terry	100
LT5	Labour Markets	S.G.B. Henry	101
LT6	Forecasting Inflation	Geoffrey Moore	102
FBR	Review Paper on Judgement	Larry Phillips	103
P101	Public Policy and Management II	Wilpen Gorr	104

ROOM LT1

WEDNESDAY
9.00-10.30

SEASONALITY AND SEASONAL ADJUSTMENT II

TIME SERIES

Chair: Burman, P.; 26 Parkgate, London, SE3 9XF, England, and the University of Kent, England

"TOPICS IN SEASONAL AND TREND ESTIMATION"
Pierce, David A., Division of Research & Statistics, Federal Reserve Board, Washington DC 20551, USA

Some aspects of the estimation, decomposition and forecasting of seasonal time series are addressed, assuming the series are representable via multiplicative seasonal ARIMA models. Seasonal adjustment and trend estimation (seasonal-plus-noise adjustment) are contrasted, and alternative decomposition methods for achieving either are discussed. These are presented within both the concurrent and the projected-factor adjustment frameworks, and the expected gain from employing the former is shown. Implications for the construction of deseasonalized forecasts are drawn, and analyses of seasonal economic time series are included.

"IDENTIFICATION AND ARIMA MODEL-BASED SIGNAL EXTRACTION"
Maravall, Agustin., Bank of Spain, Alcala 50, Madrid, 14, Spain.

In the final analysis, the selection of an ARIMA model in applied work relies on: a) the quality of the prewhitening achieved (i.e. clean ACF and small variance of the residuals), b) the forecasting performance, and - when these two are about the same - c) parsimony. ARIMA models selected by these criteria are presently being used for seasonal adjustment.

By means of a "real world" application, it is seen how models which give similar results in terms of a), b) and c) above may imply remarkably different decompositions. Thus, on the one hand, ARIMA selection in signal extraction should not rely solely on the above criteria. On the other hand, by considering alternative specifications (including slightly overparametrized models), it is possible to move towards decompositions that improve the quality of the signal. In our example, this move leads us to a specification which is well known to decompose nicely.

"CALCULATING THE VARIANCE OF SEASONAL ESTIMATES USING THE KALMAN FILTER"
Wallis, Kenneth F., and Burridge, Peter., University of Warwick, Coventry, CV4 7AL, England

The calculation of the standard error of seasonally adjusted series is an open problem. This paper considers the use of the Kalman filter both to perform the seasonal adjustment and to calculate the variance of the signal extraction error in model-based seasonal adjustment procedures. The steady-state filter covariance is seen to provide a convenient basis for obtaining the variances not only of the current adjustment but also of subsequent revisions. The method is applied to the unobserved-components model we have recently proposed as a justification of the X-11 method, and to a real economic time series.

ROOM LT2

WEDNESDAY
9.00-10.30

ENERGY FORECASTING AND POLICY MAKING IV

SOCIAL & TECHNOLOGICAL

Chair: Robinson, J.B., Faculty of Environmental Studies, University of Waterloo, Waterloo, Ontario, N26 3GI, Canada

Session Overview This session will focus on methodological issues related to the production of long-term energy supply and demand forecasts and the way such forecasts are used by energy policy-makers. The papers presented will be part of an international comparative study on the politics of energy forecasting being coordinated by the Resource Policy Group, Oslo, Norway. They will consist of a general theoretical paper on the forecasting/policymaking relationship and the Canadian and the Norwegian components of that study. Topics will include the methodology and the way energy forecasts have been used in support of energy policy decisions

"FUTURE IMPERFECT: ENERGY FORECASTING AND POLICY-MAKING IN CANADA"
Robinson, John, B., & Hooker, Cliff, A., Faculty of Environmental Studies, University of Waterloo, Waterloo, Ontario, Canada, N22 34L

This paper is concerned with the utility of energy forecasting techniques as methods of making energy policy decisions. The paper begins by surveying energy forecasting in Canada since 1969 by the two main federal energy agencies: the National Energy Board and the Department of Energy, Mines and Resources. The relationships between the types of models and analyses used and the types of decisions made are examined in some detail. It is suggested that despite the fact that a significant improvement in forecasting techniques has occurred, forecasts cannot adequately deal with the problems of policy planning under conditions of strong uncertainty where there exists a considerable range of possible energy futures and choices. An alternative approach, energy backcasting, is outlined and examined in some detail with respect to its capability to resolve some of the problems inherent in forecasting approaches.

"ENERGY-MODELS AND ELECTRICITY FORECASTS IN NORWAY"
Lunde, Tormod, & Midttun, Atle, Resource Policy Group, Sagveien 21, Oslo 4, Norway

The paper presents the main trends in Norwegian electricity demand forecasts from the late 60's until today.

Main shifts in modelling techniques throughout this period are commented upon. The paper also discusses some politically controversial methodological assumptions and their consequences for forecasting results.

Both the results of forecasting and the methodological development in forecasting are related to the intitutional framework within which forecsting takes place. Both organizational, professional and political factors are shown to have great impact on methodology and forecasting results.

"MODELLING AND FORECASTING IN THEIR SOCIAL CONTEXT"
Baumgartner, T., Research Consultant, Schiedhaldenstr 6, CH-8700 Kusnacht, Switzerland
Midttun, Atle, Resource Policy Group, Sagveien 21, Oslo 4, Norway

Modelling and forecasting activities are part of a social system. They are shaped by socio-cultural, economic and political factors. They in turn affect political decision-making and legitimation processes. Specific linkages discussed are:

- the political implications of methodological and technical choices in modelling and forecasting;
- the influence on the selection of modelling methodologies, model structures and data use of organisational patterns and professional biases; and
- the ways in which forecasting may support or constrain democratic decision-making

"A TECHNICAL ANALYSIS OF THE IIASA ENERGY SCENARIOS"
Keepin, Bill, The Beijer Institute, Box 50005, S-10405, Sweden

Several shortcomings have been discovered in a major study, entitled Energy in a Finite World. The study produced detailed projections of the global energy future which resulted in urgent recommendations that have had a considerable impact in energy and policy circles. Despite the appearance of analytical rigor, these projections are found to be the direct result of informal guesswork. Moreover, the analytic structure is very fragile due to uncertainties in cost and resource estimates. This problem was recognised but not acknowledged. These findings raise serious doubts about several conclusions that were widely publicized as robust trends of the future.

ROOM LT3

WEDNESDAY
9.00-10.30

FORECASTS AS OPTION GENERATORS

SOCIAL & TECHNOLOGICAL/JUDGEMENT

Chair: **Meyer, Peter,** B. College of Human Development & EP Systems Pennsylvania State University, University Park, Pennsyvlania 16802, USA

"OPTION-GENERATING IN A LOCAL ECONOMIC DEVELOPMENT AGENCY"
Meyer, Peter, B., College of Human Development & EP Systems, The Pennsylvania State University, University Park, Pennsylvania, 16802, USA

Economic development efforts by local agencies in the U.S. have tended to confine themselves to a very narrow spectrum of alternative courses of action, concerned with local economic activity. Introduction of preliminary speculative scenarios of alternative futures to decision-makers in such organizations can transform the decision-process and behaviours of the development groups. Presentation of even the most rudimentary scenarios appears to have the immediate effect of generating new options.

This paper will use the interventions of the Local Economic Development Assistance Project of The Pennsylvania State University as the basis for its empirical discussion. The LEDA Project has a practice of initiating all interventions or assistance provision with what is, in effect, a brainstorming session on desired futures for the local area. This session creates the scenarios which, in turn, function as the action option generators.

The structuring of the brainstorming session will be described; the process of perceptual and attitudinal change deriving from this session then examined; and the new actions and priorities for forecasting, planning and action by the development groups considered, prior to a concluding section which will address the role of heuristic scenarios as demand generators for more sophisticated statistically-based forecasts.

"MACRO-ECONOMIC SCENARIOS IN A SOCIAL DEBATE ON FUTURE ENERGY POLICIES"
Vlek, Charles, Institute for Experimental Psychology, Univ of Groningen, PO Box 14, 9750 AA HAREN (Gr), The Netherlands

At the end of 1983 Holland's adventurous Public Inquiry into Future Energy Policies was concluded with the publication of a voluminous final report by the steering committee led by Mr.M.L. De Brauw, a former cabinet minister of higher education and sciences. In the first stage (1982) of the Inquiry four macro-economic models were developed which were intended to guide and facilitate the multitude of small-group discussion all over the country that were to take place in the second stage. In this paper two issues will be discussed. First, the construction and formulation of the scenarios - a combination of economic policy, diversified use of energy sources and environmental actions and consequences - met with difficulties due to various uncertainties, incomparabilities and imponderables. Secondly, macro-economic scenarios being complex models of possible future worlds, they do not easily lend themselves as bases for policy discussions. On psychological grounds one would doubt their usefulness as aids for societal decision making unless their format and representation are tailored to human capacities for processing and evaluating information. The role and ultimate fate of the scenarios developed as pivots in the Dutch Public Inquiry will be critically discussed and some lessons will be drawn.

"EVALUATION AND CONSTRUCTION OF SCENARIOS FROM A PSYCHOLOGICAL PERSPECTIVE"
Jungermann, Helmut, Institut fur Psychologie, Technische Universitat Berlin, Dovestr 1-5, D-1000 Berlin 10, West Germany

The development of scenarios has become an important tool of forecasting and planning. Typical examples are scenarios for energy policy, climate change, or communication technology. Such scenarios describe long-range possible futures under various conditionalities. The paper looks at the process of scenario construction and evaluation from a psychological perspective. First, major functions, types, and features of scenarios are described, and critical aspects of scenario construction and evaluation are demonstrated. Then, findings from cognitive psychology are presented that influence start, orientation, and end of the individual's search for information and its use for evaluation and construction. The paper will discuss the issues in relation to new information technologies.

"THE USE OF SCENARIOS IN STRATEGIC ENVIRONMENTAL ASSESSMENT: A WORLD-WIDE STUDY OF CORPORATE PLANNING PRACTICE"
Klein, Harold E., and Linneman, Robert E., School of Business Administration, Temple University, Philadelphia, PA 19122, USA

Scenarios have become the most widely used judgemental/conjectural approach for corporate environmental assessment and forecasting. World-wide scenario adoption is closely associated with analytical sophistication, experience with corporate planning and environmental instability confronting the corporation. Despite widespread adoption, most users of scenarios have not integrated the approach into their planning processes. Rather, most use is of an ad hoc nature. In this paper, we discuss and compare characteristics of scenarios use among the largest, world-wide corporations, based on an international survey (n=405). A scenario typology is suggested and linked to appropriate situational use.

FORECASTS OF CORPORATE SALES AND EARNINGS: METHODS AND STOCK MARKET REACTION

FINANCIAL APPLICATIONS

Chair: Nair, R.D., University Wisconsin-Madison Graduate School of Business, 1155 Observatory Drive, Madison, WI 53706, USA

"STOCK PRICE EVALUATION OF THE EARNINGS OF FORECASTING AND NON-FORECASTING FIRMS"
Lev, Baruch, Tel-Aviv University, Tel-Aviv, Israel
Penman, Stephen, University of California, School of Business, 350 Barrows Hall, Berkeley, California 94720, USA

It is well-documented that corporate earnings forecasts provide information that affects stock prices. There is also evidence (for example, in Penman, Journal of Accounting Research, 1980) that firms which voluntarily supply earnings forecasts are those which have "good news", on average. This paper compares the characteristics of firms which provides annual earnings forecasts in a given fiscal year with those of firms which don't. In particular, it assesses whether the omission of a forecast is interpreted as "bad news". In addition, the paper investigates the timing of the arrival at the market of information about the annual earnings of forecasting and non-forecasting firms. For both types of firms, portfolios are formed at the beginnning of fiscal years on the basis of foreknowledge of the earnings number for the year and are held until the annual earnings report date. The cumulative returns on these portfolios throughout the holding period are analyzed to assess whether information about earnings is reflected in prices earlier for forecasting firms than for non-forecasting firms. Finally, the price reaction to the annual earnings announcements of forecasting and non-forecasting firms are compared.

"INFORMATION CONTENT OF SALES AND EARNINGS FORECASTS"
Imhoff, Eugene, A., Jr., Graduate School of Business, University of Michigan, Ann Arbor, Michigan 48109, USA
Lobo, Gerald, J., University of Wisconsin-Madison, 1155 Observatory Drive, Madison, W153706, USA
Pare, Paul, V., Universite Laval, STE-FOY, Quebec, G1K 7P4, Canada

The purpose of this study is to assess the incremental information content of quarterly sales and earnings forecasts made by security analysts. To the extent that these forecasts are representative of forecasts disclosed by management under a mandatory disclosure rule, the results of this study will provide information to policy-makers that is useful in their deliberations on whether or not to require that earnings forecasts and/or forecasts of sales be disclosed by management on a regular basis.

The research design compares returns on portfolios formed conditional upon different realizations of the information variables and returns on control portfolios that are formed by random assignment of firms. To control for marketwide effects, the information and control portfolios are constructed in such a way that they have equal relative risks. The information variables are defined as the unexpected portions of quarterly sales and earnings forecasts.

"ON THE PREDICTIVE BENEFITS OF FORM 10-K BACKLOG INFORMATION"
Silhan, Peter, A., and Frecka, Thomas, J., Dept of Accountancy, University of Illinois at Urbana-Champaign, 360 Commerce Building (West), 1206 South Sixth Street, Champaign, IL 61820, USA

This paper explores the proposition that SEC Form 10-K backlog information, which is reported annually, could be used to improve extrapolative forecasts of corporate sales. A sample of COMPUSTAT firms was selected to compare the predictiveness of seven times series models. These firms were partitioned on the basis of backlog-to-sales ratio in order to assess subsample differences possibly associated with delivery period.

The results indicate that 10-K backlog information may be useful in some contexts, but not others. In general, models using only sales data performed quite well, whereas models using backlog data performed relatively poorly. Firms with the shortest delivery periods showed some promise for exploiting the new order series which can be derived from the sales-order identity.

"COMBINATIONS OF FORECASTS OF ACCOUNTING EARNINGS"
Lobo, Gerald, J., and Nair, R.D., School of Business, University of Wisconsin-Madison, 1155 Observatory Drive, Madison, WI 53706, USA

This paper compares the accuracy of combinations of forecasts of accounting earnings with the forecasts obtained from individual models. Research on accounting earnings has traditionally focused on the determination of a premier forecasting model. In this paper, all possible combinations of forecasts from seven different models and sources were considered. It was found that a considerable improvement in forecasts accuracy could be achieved by combining forecasts. The major proportion of the improvement was obtained by combining just three forecasts. The best combination was provided by a combination of forecasts using an annual earnings series, a quarterly earnings series, and analysts' forecasts.

ROOM LT5

WEDNESDAY
9.00-10.30

EMPLOYMENT FORECASTING

APPLIED ECONOMETRICS

Chair: **Wilson, Rob.**, Institute of Economic Research, University of Warwick, Coventry, CV4 7AL, England

"FORECASTING THE LABOUR MARKET"
Lindley, Robert M., Institute for Employment Research (IER), University of Warwick, Coventry, CV4 7AL, England

This paper will discuss the problems of forecasting the labour market (with special reference to the structure of employment) and the way in which these problems have been tackled by the IER for the UK economy. The paper will also examine the various sub-models of the labour market embodied in other macroeconomic models of the UK and will consider the scope for improving the treatment of the labour market in the light of current practice, the available data, and the needs of decision-makers in government and industry.

"EMPLOYMENT AND AVERAGE HOURS IN MANUFACTURING"
Henry, S.G.B., Hall, S., Payne J., and Wren-Lewis, S., National Institute of Economic & Social Research, 2 Dean Trench St, Smith Square, London SW1P 3HE, England

The paper reviews alternative econometric models of employment for the manufacturing sector. It lays particular emphasis on the twin role of expectation formation and dynamic adjustment in these models. A distinction is drawn between backward and forward looking models of expectation formation, and methods for identifying model dynamics due to expectation formation and adjustment lags are described. An assessment of the performance of the alternative models is provided, based on evidence for parameter stability and forecast performance.

"FACTOR INPUT FORECASTING AND COMPARATIVE PRODUCTIVITY ANALYSIS: SOME EMPIRICAL RESULTS IN CANADIAN TELECOMMUNICATION"
Kiss, Ferenc, & Lefebvre, Bernard J., Bell Canada, 25 Eddy St, 5th Floor, Hull, Quebec, Canada, J8Y 6N4

Multi-firm econometric cost models constitute the analytical vehicle for the comparative analysis and forecasting of factor inputs and productivity. A model is estimated for two Canadian telephone companies. The data sample covers 15 years between 1967 and 1981.

The empirical results are described and analysed. Parameter estimates are used to decompose inter-firm differences in input and productivity growth and to identify firm-specific growth characteristics. 5-year input and productivity forecasts are generated under alternative hypothetical conditions. The methodology is described and the forecasts are analysed. Potential uses of comparative analysis and forecasting are summarized in the concluding section.

RATIONAL EXPECTATIONS IN MACROECONOMIC FORECASTING

APPLIED ECONOMETRICS/MACROECONOMIC FORECASTING

Chair: **Minford, P.**, Dept of Economics, University of Liverpool, 11 Abercromby Square, Liverpool L69 3BX, England.

"RATIONAL EXPECTATIONS MODELS WITH PARTIAL INFORMATION"
Currie, David, Queen Mary College, Mile End Rd, London E1 4NS, England

Pearlman, Joseph and Levine, Paul, Polytechnic of the South Bank, Borough Road, London, SE1 0AA, England

This paper provides a general solution to the problem of partial information in linear discrete time stochastic rational expectations models. The full information case is first reviewed and the solution of Blanchard and Kahn (1980) extended. Then we consider the problem of partial information for the special case where only the current values of some variables are unobserved. The solution can be treated as a straightforward extension to the full information case. In the general problem where in addition to some current variables being unobserved, certain variables are unobserved for all lags, we provide a solution which requires the use of Kalman Filters. The paper concludes by examining the covariance properties of the rational expectations system under different informational assumptions.

"FORECASTING AND SIMULATION USING RATIONAL EXPECTATIONS ON THE BANK OF ENGLAND'S MEDIUM-TERM MACROECONOMIC MODEL"
Easton, W.W., and Matthews, K., Bank of England, Economics Division Modelling Group, Threadneedle St, London EC2R 8AH, England

The paper uses an existing neo-Keynesian annual model as a test vehicle to assess the impact of the introduction of rational expectations. The model was originally developed for medium-term forecasting and simulation exercises, but contains only backward looking expectational terms. The influences of rational expectations are highlighted by comparative dynamic simulations and forecasts using alternative versions of the model. The expectation formation mechanisms are also considered, and in particular the possibility of revising the expectation formation mechanisms as new data become available is explored.

"ECONOMICALLY RATIONAL EXPECTATIONS: COMPOSITE PREDICTORS"
Corker, Bob, London Business School, Sussex Place, Regent's Park, London NW1 4SA, England

This paper analyses an expectations mechanism that occupies the middle ground between rational and adaptive expectations. The work of Feige and Pearce (1976) introduced the notion of "economically rational" expectations. Agents require information up to the point where the marginal reduction in cost (in terms of predictive inaccuracy) equals the marginal cost of acquiring the information. Here we assume that the structure of costs that individuals face when predicting future outcomes differ. Some, we argue, use structural techniques in forecasting whereas others use relatively cheaper time series methods. The resulting aggregate prediction is a composite of adaptive and rational forms. This we claim is a more appropriate mechanism to employ in the estimation and simulation of models based on aggregate data. The predictor has properties in between those of rational and extrapolative expectations. Employing the predictor in macroeconomic models still gives the "jump property" associated with rational expectations but the weight given to the expected outcomes of exogenous variables is attenuated. Issues of identification and estimation of the composite predictor are discussed.

"MONETARY POLICY GAMES AND THE ROLE OF PRIVATE INFORMATION"
Canzoneri, Matt, Dept of Economics, University of Liverpool, 11 Abercromby Square,Liverpool L69 3BX., England.

If agents in the private sector must commit themselves to nominal wage, price or interest rate agreements before the Fed actually implements its monetary policy, then the economy may suffer an inflationary bias simply because the Fed has no credible way of precommitting itself to a non-inflationary policy. This paper discusses the tradeoff between the rule or discipline that must be imposed upon Fed operating procedures to resolve the credibility problem and the discretion or latitude required for the Fed to be able to stabilize the price level against velocity shifts. Recent work by Kydland and Prescott, Barro and Gordon, and Rogoff is reviewed in the light of private information, and a rationale for targeting is provided.

WEDNESDAY
9.00-10.30

INDUSTRIAL APPLICATIONS OF ECONOMETRICS IV: FORECASTING IN THE TELECOMMUNICATIONS INDUSTRY

APPLIED ECONOMETRICS

Chair: Kohler, D., Rand Corporation, 1700 Main St, Santa Monica, California 90406, USA

"MODAL ALLOCATION FORECASTING: A REINTERPRETATION OF THE PROBABLISTIC CHOICE MODELS WITHIN A DETERMINISTIC GENERATION-ALLOCATION SCHEME"

Curien, N., Piece 912 Tour Maine Montparnasse, 33 avenue du maine, 75755 PARIS CEDEX 15, France

This paper deals with allocation choice models where the consumer has to split a particular consumption between several available modalities. We shall first recall the usual framework of multinomial logit or probit type probablistic choice models and then reinterpret the latter within a purely deterministic microeconomic framework, based on separable preferences theory. This reinterpretation is interesting from a theoretical standpoint in at least two respects: on the one hand, the choice models can be derived from a classical optimization process without assuming bounded rationality through utility randomization and preferences cardinality. On the other hand, the separable preferences approach yields a generation model in association with the allocation model and thus allows for a comprehensive and consistent generation-allocation scheme. Though the paper's scope is quite general, a special insight is given, to ease the reading, concerning the modal choice issue in a telecommunications context.

"TRADE-OFF RELATIONSHIP BETWEEN TRAVEL AND TELECOMMUNICATIONS"

Miyahara, Yoshimoto, Co-ordination Division, Planning Bureau, Nippon Telegraph and Telephone, 1-6 Uchisaiwai-cho, I-chome, Chiyoda-ku, Tokyo 100, Japan

Telecommunications have substitutional possibilities for private information communication activities that are now performed by means of travel. (These activities will be referred to as "Daily personal travel" eg. to go and meet someone, to buy or mail something, to deliver newspapers, etc.) Those now conducted through daily personal travel are expected to form a part of the telecommunications market in the future. In this paper, I present the results of research and analysis of the actual circumstances surrounding travel and the trade-off relationship between travel and telecommunications. About 1,200 inhabitants of Hachioji City were interviewed, and results obtained in the following areas:

1. The actual circumstances regarding daily personal travel as classified by purpose.
2. To what degree telecommunications have the potential to substitute for daily personal travel, depending on the purpose.
3. Using 1 and 2, estimates of future telecommunications market size (as converted into information quantity) in Hachioji City have been made based on how much daily personal travel can be converted into telecommunications.

"MODELS OF GROWTH BASED ON THE COBB-DOUGLAS PRODUCTION FUNCTION"

Adcock, C.J., C Squared Co Ltd, 79-83 Great Portland Street, London W1N 5RA, England

This paper is concerned with growth processes which generate Poisson random variables $Y_i(t)$ which are independent over i and which have expected values given by an expression of the general form

$$\theta(t) = \prod_j \chi_{ij}(t)^{\alpha_j} \exp[\phi(t)]$$

the right hand side of the equation being an extension of the Cobb-Douglas Production Function. Such models are of use in forecasting demand for goods or services which broadly compete against one another in the same market place.

The paper considers a number of linear approximations to the above model, thus enabling estimation and prediction to be fitted within a range of standard approaches. The paper considers briefly the prediction problems which arise when (1) we wish to consider markets in which new entrants only change market share, (2) it is only necessary to predict market share rather than overall growth (3) we wish to predict the impact of new products or services, where the data of introduction lies in the future.

The paper contains a short example taken from the computer industry and concludes with pointers for further work.

SLOAN ROOM G07

WEDNESDAY
9.00-10.30

POLITICAL FORECASTING II

SOCIAL AND TECHNOLOGICAL

Chair: Linneman, Robert E., School of Business Administration Temple University, Philadelphia, PA 19122, USA

"FORECASTING GOVERNMENT POLICY FROM PUBLIC ATTITUDES: TEN YEARS OF CANADIAN DATA"
Murray, J. Alex, School of Business & Economics, Wilfrid Laurier University, Waterloo, Ontario, Canada
LeDuc, L., University of Windsor, Windsor, Canada

Multinational Corporations have a vested interest in anticipating changes in government policies that affect long term strategic investment decisions.

In Canada, government policy covering foreign direct investment has reflected changes in public attitudes that vary over time and by geographical region. Our Survey Unit (Laurier Institute for Business and Economic Studies) has annually monitored 3,000 Canadians for 10 years, and this paper reports and analyzes significant variations and relationships of government policy and public attitudes.

Of particular interest is the fortunes of the Government's Foreign Investment Review Agency which has taken dramatic turns during the past decade. The problem for Canada is that foreign investment marches to a different drum than government legislation. While legislation tends to respond to public mood, business investment is influenced more by economic factors.

It is on this note that our data (largest annual personal interview survey in Canada) becomes an important forecasting tool in which to analyze Government policy.

"FORECASTING SOVEREIGN RISKS FOR LDC CREDITORS"
Wynn, R. F., University of Liverpool, Dept of Economic & Business Studies, Eleanor Rathbone Building, Myrtle Street, PO Box 147, Liverpool 3BX L69, England

Logit analysis is used to predict the incidence of external debt reschedulings for LDC's conditional on cross-section evidence. Departures from previous work include: (i) confining observations on explanatory variables to ex ante information; (ii) an attempt to trace underlying causes of reschedulings and to make better use of information published relatively early to counter long delays in the publication of many series; and (iii) to use first-stage intra-country analyses to measure observed performance relative to feasible alternatives rather than eg extrapolations of past behaviour. Special emphasis is given to evaluating the quality of economic management w.r.t. adjustments to external shocks, notably the two 'seventies oil price hikes and their aftermaths.

ROOM P101

WEDNESDAY
9.00-10.30

PUBLIC POLICY AND MANAGEMENT: I

FISCAL FORECASTING

Chair: Bretschneider, Stuart, Maxwell School, Syracuse University, Syracuse, New York 13210, USA

"REVENUE FORECASTING BY LOCAL GOVERNMENTS IN THE UNITED STATES: A SURVEY OF PRACTICES"
Bahl, Roy, Metropolitan Studies Program, The Maxwell School, Syracruse University, New York 13210, USA
Schroeder, Larry, Metropolitan Studies Program, The Maxwell School, Syracuse University, New York 13210, USA

Over the past decade several local governments in the United States have adopted formal methods of forecasting revenues, for the purposes of budget writing and making longer term projections of the fiscal health of the jurisdiction. This paper surveys the range of techniques used in producing such forecasts, the sorts of issues faced by the jurisdictions carrying out the efforts and the forecast accuracy achieved. Particular attention is given to the approaches revenue forecasters at the city level use in trying the health of the local fisc to projections of national economic conditions.

"THE VALUE OF ADDITIONAL INFORMATION: DOES IT HELP TO KNOW FORECASTED NATIONAL VARIABLES WHEN FORECASTING LOCAL GOVERNMENT REVENUES?"
Bretschneider, Stuart, Metropolitan Studies Program, The Maxwell School, Syracuse University, Syracuse, New York 13210, USA
Schroeder, Larry, Metropolitan Studies Program, The Maxwell School, Syracuse University, Syracuse, New York 13210, USA

This paper applies a decision making under uncertainty framework to generate an approach to assessing the value of macro-economic forecasts for state and local government revenue forecasting. The general approach defines the basic decision as setting a budget level where revenue forecasts provide information inputs as to the uncertain level of future receipts. Alternative forecasts of the macro-economic activity are then evaluated against one another in terms of what they imply about the expected level of receipts and the variation in that expected value (ie., risk) for the state or local government unit. A case study of Kansas City, Missouri is used to illustrate the technique. Results indicate that time series forecasts of receipts dominate those using macro-economic forecasts for a wide range of risk levels, and that even when econometric methods are used, extrapolated value for exogenous variables produce forecasts which tend to dominate those based on commercially forecasted levels of macro-economic activity.

"QUANTILE FORECASTING FOR SHORT-TERM FINANCIAL MANAGEMENT IN STATE GOVERNMENT"
Bretschneider, Stuart, I., The Maxwell School, Syracuse University, Syracuse, New York 13210, USA
Gorr, Wilpen, L., Ohio State University, 1775 College Rd, Columbus, Ohio 43210, USA
Hsu, Cheng, Business School, Renasselaer Polytechnic Institute

This paper is on short-term forecasting for the investment of fund balances in state government. A chance-constrained programming formulation for this problem maximizes rate of return subject to maintaining liquidity with a prespecified degree of confidence. This requires forecasting regression quantiles for stochastic processes made up of particular sums of revenue collections. The regression quantiles, in effect, define the safety stock of liquid assets. We contrast three techniques for estimating regression quantiles in a case study of the Kentucky state government. These are parametric smoothing, the Quantile Estimation Procedure, and a moving window goal programming technique.

ROOM P102

WEDNESDAY
9.00-10.30

REGIONAL AND INDUSTRIAL MODELS & FORECASTING

APPLIED ECONOMETRICS

Chair: Biffignandi, Silvia, Istituto Universitario di Bergamo, 24100 Bergamo, Via Salvecchio 19, Italy

"SPATIAL TIME SERIES MODELS: TOPICS ON REGIONAL ANALYSIS AND FORECASTING"
Biffignandi, Silvia, Istituto Universitario di Bergamo, 24100 Bergamo, Via Salvecchio, 19, Italy

Regional planning is - at present - a real problem and it is faced more and more with statistical methods. In this context, regional forecasting is a basic tool for policy and programming decisions. This paper looks at some forecasting models available to the geographers and regional planners. Special attention is devoted to STARIMA models. After a short discussion on theoretical aspects of these models, the focus is on their application. Data requirement, computer availability, costs, reliability are critically reviewed and analysed in order to evaluate the performance of these models in the empirical context.

A critical review of the forecasting analyses proposed in the literature and suggestions on possible application of these models to Italian regional analysis are finally introduced.

"A REGIONAL QUARTERLY ECONOMETRIC MODEL USING RAW DATA: METRIQ"
Courchesne, Camille, and Lizotte, Sylvain, Bureau de la Statistique du Quebec, 117 rue Saint-Andre, Quebec, G1K 3Y3, Canada

Current practice in econometrics is to use seasonally adjusted data to specify, estimate and simulate quarterly econometric models. Such an approach implies that seasonality is a veil to be removed if one wants to appreciate the true behaviour of economic agents. METRIQ is a small (300 equations) short term simultaneous econometric model of the Quebec economy built using quarterly raw data. This paper presents the main features of this model. Emphasis is put on the treatment of seasonality in METRIQ, the interpolation procedure used to produce quarterly figures from annual data, if required, and the effect of seasonality when analysing or simulating the model. Empirical results are used to illustrate the various points presented.

"AN ANALYSIS OF REGIONAL UNEMPLOYMENT IN THE UK"
Holroyd, P., Dept of Industrial Economics, University of Liverpool, 11 Abercromby Square, Liverpool, England

Year on year UK regional unemployment data has been examined for the period 1965-1983 for each month of published statistics. A stable relationship containing cyclical time varying parameters is observed enabling the unemployment to be predicted for up to one year with confidence.

The cyclical parameters are deduced using a specially devised mutation process. The results suggest that the current period of little change in unemployment level will cease in 1985/86 when unemployment is predicted to increase again.

The decline of forecast accuracy is examined when the projections exceed one year. Finally, some general points are made concerning the method and its wider applications.

"THE EMPLOYMENT BASE MODEL FOR LONG-RANGE FORECASTING"
Wells, Gary R., College of Business, Idaho State University, Pocatello, Idaho 83209, USA
Hofman, C.A., Department of Economics, Idaho State University, Pocatello, Idaho 83209, USA

In 1967 a grant was received for the completion of a long range forecast of employment, population and M&I water requirement for seven regions in the State of Idaho. As a part of this study, the employment base model was used to project employment and population by region for 1980.

This paper includes (1) a critical evaluation of the employment base model as a forecasting tool; and (2) a comparison of the base model projections in the original study with actual data as derived from the U.S. Census of Population. The original 1980 projections of employment and population and the realized employment and population are analyzed in light of improving the predictions value of the employment base model.

ROOM SG14

WEDNESDAY
9.00-10.30

FORECASTING POLICY: A CASE STUDY OF EEC FARM POLICY

SOCIAL & TECHNOLOGICAL/GENERAL FORECASTING

Chair: **Pollio, Gerald,** Economics Dept, Chemical Bank, New York, USA

"ASSESSING THE IMPACT OF FUTURE EC FARM POLICY ON ABRIBUSINESS FIRMS"
Pollio, Gerald, and Riemenschneider, Charles H., Economics Dept, Chemical Bank, New York USA

Originally designed to ensure adequate domestic production in the modernization of European agriculture, the common agricultural policy has exceeded its goals. Rising production and government supported prices have created budgetary problems that, among other factors, will dictate policy changes in the future. These changes will influence the future of European agribusiness. Growing export volumes, especially in cereal will provide the impetus for growth among grain trading companies and will foster the need for increased interior storage.

US - EC trade conflicts will increase over cereal exports from the US should offset some of this conflict.

"FORECASTING C.A.P. SUPPORT PRICES IN A POLITICAL CONTEXT"
Ritson, Christopher, and Fearne, Andrew, Department of Agricultural Marketing, University of Newcastle, Newcastle upon Tyne, England

Most agricultural product markets in the European Community are so firmly controlled by the operation of the Common Agricultural Policy's market mechanisms that a successful forecast of the marketing environment facing agricultural producers now pre-supposes a successful forecast of policy decisions. This paper will explore the way policy forecasting has recently been incorporated into short term forecasting for agriculture in the UK and consider alternative approaches to longer term policy forecasting for agriculture.

Discussants:

Harris, Simon, S & W Berrisford Ltd, Berrisford House, Mark Lane, London EC3, England
Henry, Richard, International Institute of Agriculture, Cergy, Pointoise, France

ROOM LT1

WEDNESDAY
11.00-12.30

INDUSTRIAL APPLICATIONS OF ECONOMETRICS V
FORECASTING IN UTILITIES

APPLIED ECONOMETRICS

Chair: Baudin, Anders, Dept of Statistics, University of Umea, S-901 87 Umea, Sweden

"SOME NOTES ON WEATHER NORMALIZATION OF ELECTRIC LOADS FOR GULF POWER COMPANY"
Tan, J.K., Southern Company Services, PO Box 2625, Birmingham AL 35202, USA

Weather exerts a strong influence on the usage of electricity. Utility forecasters know the importance of using weather-normalized energy sales and peak demand data for long-term and short-term load forecasting. This paper presents the problems encountered while trying to improve the weather normalization methods for Gulf Power Company. Both weather normalization models and analysis procedures are addressed.

"DEVELOPMENT OF NATURAL GAS SALES FORECASTING MODELS"
Raab, Paul H., Ernst & Whinney, 14651 Dallas Parkway, Suite 302, Dallas, Texas 75240, USA

The proposed paper will report on recent efforts in the development of a natural gas sales forecasting model. The model is being designed to answer the following types of questions:

1. To what extent is fuel switching likely to impact future demand?
2. To what extent do current economic conditions impact the market for natural gas?
3. To what extent is "conservation" influencing future demand.

I propose to present a discussion of a model designed to answer these and other relevant questions which influence natural gas use and hopefully present some indication about the anticipated future accuracy of the models developed.

"PUBLIC UTILITY: GAS DISPATCH MODEL"
Pink, J.F., J.F. Pink Associates, PO Box 25, Bethayres, Huntingdon Valley, PA 19006, USA

The major source of gas for Utility use, is from a pipeline; sold under a daily Demand-Commodity rate contract. The dispatcher must forecast each day's gas requirement and arrange for added supplies/sales to Interruptible (dump) customers, in order to minimize costs/maximize sales revenue. This paper discusses the parameters involved in this forecast, and describes a successful computer model. In this model, both linear regression and exponential smoothing techniques are used with the updated actual data to develop an adaptive model of the system.

"INTEGRATING TIME SERIES AND END USE METHODS TO FORECAST ELECTRICITY SALES"
Fischler, Edward., and Nelson, R., Georgia Power Co., 333 Piedmont Ave, Atlanta, Georgia 30308, USA

Two types of forecasting methods have been receiving increasing attention by electric utility forecasters. The first type, called end use forecasting during periods characterized by technological change. The stock level of energy consuming equipment are forecast, as well as the energy consumption characteristics of the equipment. The final forecast is the product of the stock and usage characteristics.

For time periods of shorter duration technological change is static and variations are more likely to result from shocks to the environment. The shocks influence the usage of the equipment. A second forecasting approach uses time series analysis. This paper discusses the integration of the two methods into a unified system. The result is a time series model whose parameter effects become dynamic in character. An example of the models being used at the Georgia Power Company is presented. It is demonstrated that a time series model which incorporates end use stock and usage information is superior - even in short term forecasting situations - to a similar time series model which excludes the information.

"A METHOD FOR SHORT TIME LOAD FORECASTING"
Moreschini, G., ENEL Compartimento di Roma, Via Malfante, 73 Roma, Italy

This paper describes a study of the short term forecasting (with lead time of 24 hours) of the hourly load of an area of ENEL's network. After preliminary analysis of the load time series, a suitable modification of the Winters's method was applied. Such a method was tested over one year's data, to determine the appropriate smoothing coefficients and to verify its efficiency. It resulted an error of about 5% of the medium hourly load; considering the simplicity and the parsimony in the computer time used by method its performance was judged satisfactory.

ROOM LT2

WEDNESDAY
11.00-12.30

APPROACHES TO ENVIRONMENTAL SCANNING WITH EXAMPLES

SOCIAL & TECHNOLOGICAL

Chair: **MacNulty, Christine,** Taylor Nelson Associates, 457 Kingston Rd, Ewell, Epsom, Surrey KT19 0DH, England

"FORECASTING THE IMPACT OF FUTURE TECHNOLOGY ON CONSUMER SERVICE INDUSTRIES: A DATA BASE MANAGEMENT SYSTEM"
Karns, David, A., and Khera, I., Center for Consumer Studies, Wright State University, Dayton, Ohio 45435, USA

Technology plays an important role in such consumer service industries as financial services, health care, and lower priced food service. Firms in these industries should forecast emerging technological and consumer behaviour trends which will affect them. While industrial trade journals and the mass media provide data for forecasting models, the collection of such data has been principally manual and the analysis anecdotal. The paper presents the development of an industrial trend analysis package utilizing media items processed through a computer data base management and report system. The critical steps in the project were: (1) conceptualization of the coding framework for scanning and monitoring trends, (2) development of the entry, verification, data base management, and analysis computer software, and (3) implementation of the media item coding.

"HEALTH R & D SPENDING IN THE UNITED STATES: FUTURE PATTERNS"
Tyson, Karen, W., and Merrill, J.C., Centre for Health Policy Studies, Georgetown University, 2233 Wisconsin Avenue, N.W., Washington DC 20007, USA

Historically, the federal government has been the major supporter of research and development in the health care field. However, as part of a process of budgetary retrenchment by the government and increasing opportunity for the private sector, this pattern is changing. Using simple models, R & D spending by source is forecasted. The implications of changes in the source of spending are discussed. The outlook for future investment by drug and medical device manufacturers is assessed. In addition, the international competitive situation is analyzed.

The paper presents results of a study recently completed for the U.S. National Institutes of Health.

"FUTURE TRENDS OF INSTITUTIONAL PROPERTY INVESTMENT AND THE CANADIAN REAL ESTATE INDUSTRY"
des Rosiers, Francois, Faculty of Business Administration, Laval University, STE-FOY, Quebec G1K 7P4, Canada

This paper examines the impact in Canada of growing institutional property investment on the future structure and functioning of the real estate industry. The investment rationale of institutions is first looked at in the general context of capital market theory and in the light of asset-liability matching issues. Then, the characteristics of real estate as an investment are surveyed with reference to risk and return. Third, the behaviour of Canadian life companies and pension funds is analyzed. Finally, the relationships between institutional investors and the real estate industry are examined in the light of evolving market conditions; prospective elements as to their evolution over the next decade conclude the paper.

"INTERNATIONAL MANAGEMENT INTELLIGENCE SYSTEMS: APPLICATION OF THE SPECT FORECASTING MODEL"
Pliniussen John Kurt, Department of Administration, Mount Saint Vincent University, Halifax, Nova Scotia, Canada, B3M 2J6

Based on the recent findings of the European Societal Strategy Project (ESSP), a model is developed and tested which evaluates the relative perceptions of Canadian strategic forecasters in relation to the Social-Political-Economical-Cultural-Technological (SPECT) variables they integrate into their forecasting models. The perceptions of the forecasters, employed by Canadian multi-national organizations, is compared to the data outlined in the ESSP. The SPECT model is tested and results compared to data projected by the strategic forecasters using their models. Implications for international strategic forecasters, of this new SPECT forecasting model, are developed.

ROOM LT3

WEDNESDAY
11.00-12.30

INTEREST RATES

FINANCIAL APPLICATIONS/APPLIED ECONOMETRICS

Chair: Lippens, Robert, General Motors Corporation, 767 Fifth Avenue, New York, NY 10153, USA

"FORECASTING AND CONTROL OF THE TERM STRUCTURE OF INTEREST RATES"
Caravani, P., Istituto di Analisi Sistemi e Informatica, Via Manzoni 30, 00185 Roma, Italy
Figliuoli, L., London School of Economics, London WC2A 2AE, England

The three models of the term structure, classical, liquidity preference and preferred habitat and the general form of the expectations formation mechanism are studied in the comprehensive format of a state space model. In the assumption of finite horizon, advantages of the state space approach are pointed out with reference to parameter estimation and forecasting. One period current rates are then viewed as policy instruments to control the term structure. A policy based on stochastic optimal control is analyzed. Finally, theoretical implications of the state space approach are discussed with reference to the implicit information market that underlies the term structure.

"REAL INTEREST RATE DETERMINATION AND FORECASTING: THE CASE OF THE US"
Kolluri Bharat, B., and Giannaros, Demetrios S., Barney School of Business and Public Administration, University of Hartford, West Hartford, CT 06117-0395, USA

A number of economists reject the notion of a constant real rate of interest. They believe that the real rate is affected by the expected rate of inflation and a number of other monetary and fiscal policy variables like growth in the money supply, government borrowing, and the unemployment rate. The purpose of this paper is to present and estimate a forecasting model of the real rate of interest. Based on mean square errors and our own judgement, we select a useful forecasting model. Some short-term forecasts of the real interest rate based on the forecasting model will be presented.

"AN EMPIRICAL ANALYSIS OF THE UK TREASURY BILL MARKET"
Mills, Terence, C., and Stephenson, Michael J., School of Economic Studies, University of Leeds, Leeds, England.

This paper begins by testing the joint hypothesis that the UK Treasury bill market is efficient and that the expected real return on bills is constant. While the hypothesis of market efficiency is accepted, the expected real return on bills is found to evolve through time as a random walk. Using these results, a complete model of the Treasury bill market is developed. The features of this model being that both expected real returns and expected inflation follow random walks, unexpected inflation is white noise and there is a strong 'Mundell-Tobin' effect - a negative relationship between expected real returns and expected inflation. To add detail to the model, signal extraction techniques are employed to estimate time series for these unobserved variables.

"THE FORECASTING ABILITY OF MONEY MARKET FUND MANAGERS AND ITS ECONOMIC VALUE"
Kane, A., and Lee, K.L., School of Management, Boston University, 704 Commonwealth Avenue, Boston, MA 02211, USA

The model proposed by Merton (1981) to determine the value of forecasting ability is adapted to investigate changes in the yield curve by adjusting the average maturity of their portfolios in the right direction. The potential economic value of such behaviour is assessed, and it is shown that if the portfolios of all money market funds were aggregated it would appear that managers are good forecasters even if individually they possess insignificant forecasting ability. At the same time, the economic value of the aggregate portfolio will be diminished, because of the reduced net change in average maturity. Thus, diversifying into many money market funds will not attain the gain that could be realized if an individual manager has a forecasting ability equal to the quality of the average forecast.

A sample of 34 money market funds is investigated. Analysis suggests that a small fraction of the funds exhibited forecasting skills, but even they generated negligible economic value because the changes in their portfolios average maturity were too small. There appears to be no relationship between forecasting ability and economic success of money market funds as measured by asset size and growth.

ROOM LT4

WEDNESDAY
11.00-12.30

FINANCIAL FORECASTING

FINANCIAL APPLICATIONS

Chair: Brown, L., School of Management, State University of New York, Buffalo, New York, USA

"AN ANALYTIC EVALUATION OF ALTERNATIVE INTERIM REPORTING METHODS WITHIN A DYNAMIC FRAMEWORK: ADDITIONAL EVIDENCE"

Hopwood, William, S., Florida State University, PH 878 3795, 2308 Arendell Way, Tallahassee, FLA 32308, USA

Newbold, Paul, University of Illinois, Urbana-Champaign, 330 Commerce (West), 206 South Sixth Street, Champaign, Illinois 61820, USA

We evaluate the integral, discrete and combination interim accounting reporting methods within a dynamic context. We show that in the case of a single forecasting objective the choice of methods is clear. However, it may not be possible to achieve multiple simultaneous objectives if the corporation is restricted to reporting a single number. For example, if really valuable information about future cash flows is available to management, then users will be seriously deprived if the discrete approach is used.

"THE PREDICTION PERFORMANCE OF A MICROECONOMETRIC MODEL"

Wild, John, J., Michigan State University, 335 Eppley Center, East Lansing, Michigan 48824, USA

This research empirically assessed the premise that predictions based upon the structural relations of a system will be more efficient than purely extrapolative predictions. The structural relations were represented by a microeconometric model of a firm, and ARIMA time-series models were used as standards of accuracy. The results indicated that the microeconometric model was more accurate for most of the variables during the sample period, whereas the converse was true during the post-sample period. Further investigation of the formation of composite predictions from the alternative models indicated that each model made a statistically significant contribution to the superior performance of the composite.

"A COMPREHENSIVE ANALYSIS OF THE PREDICTIVE ABILITY OF ANALYSTS' AND TIME-SERIES MODEL FORECASTS OF EARNINGS PER SHARE"

Brown, L., Hagerman, R., and Zmijewski, M., State University of New York at Buffalo, School of Management, Buffalo, New York, USA
Griffin, P., University of California, Davis, California 95616, USA

This study undertakes a comprehensive analysis of the comparative predictive ability of analysts' earnings forecasts versus those generated by sophisticated time-series models. A large number of firms (233) is examined over a six-year time period (1975-1980) and the sensitivity of the results to a variety of specifications of the forecast error metric is investigated. Analysts' forecasts are shown to be superior to forecasts of time-series models under all specifications of the error metric investigated; namely, choice of deflator, truncation rule, conditioning quarter and forecast horizon. The cause of analyst supremacy is also examined. Analyst supremacy is shown to stem primarily from their contemporaneous access to a broader information set, and secondarily from their use of information released subsequent to a firm's earnings announcement.

"AN ANALYSIS OF BROKERS' AND ANALYSTS' UNPUBLISHED FORECASTS OF UK STOCK RETURNS"

Dimson, Elroy, and Marsh, Paul, London Business School, Regents Park, London NW1 4SA, England.

This paper describes an empirical study of over 4000 specific share return forecasts made by 35 UK stockbrokers and by the internal analysts of a large UK investment institution. A comparison of forecast and realised returns reveals a small but potentially useful degree of forecasting ability. A large part of the information content of the forecasts, however, appears to be discounted in the market place within the first month. Nevertheless, an analysis of some 3000 transactions motivated by, and executed at the time of the forecasts shows that the apparent predictive ability of the recommendations could be translated into superior performance by the fund's investment managers. Differences in forecasting ability between brokers do not appear to persist over time, but predictive accuracy can be improved by pooling simultaneous forecasts from different sources.

ROOM LT5

WEDNESDAY
9.00-10.30

ARTIFICIAL INTELLIGENCE AND FORECASTING

JUDGEMENT/TIME SERIES

Chair: **Jarrett, Jeffrey,** Dept of Management Science, University of Rhode Island, Kingston, Rhode Island, RI 02881, USA

"ARTIFICIAL INTELLIGENCE AND FORECASTING: AN ASSESSMENT OF POTENTIALS AND PROBLEMS"
Easterlin, John Daniel., and King, J.L., Dept of Information and Computer Science, University of California, Irvine, California 92715, USA

Recent research efforts in the field of artificial intelligence, especially in cognitive systems and expert systems, have prompted speculation about the possible application of this technology to complex tasks such as decision making and forecasting. Given the uneven record of efforts at forecasting to date, any improvements from the realm of high technology would be welcome. What kinds of applications of artificial intelligence technology might enhance the practice of forecasting? How would such systems work? What is the likelihood that the dreamed-of systems will actually materialize? And when can such marvels be expected to appear on the market shelves? This paper addresses these issues from two angles: from that of the technology and its potentials and limitations; and from that of the field of forecasting with all its hopes and frustrations.

"FOREX: A TIME SERIES FORECASTING EXPERT SYSTEM"
Goodrich, Robert L., Scientific Systems Inc., 54 Rindge Ave Ext, Cambridge, MA 02140, USA

Practical experience and several pragmatic studies (eg. Makridakis et al) have demonstrated that no single time series forecasting technique is best under all circumstances. The best all-circumstance methods tend to be simple, while the best method for a particular application is sometimes specialized and sophisticated. FOREX is an expert (production) system programmed in IQLISP for the IBM Personal Computer. FOREX helps reduce forecasting opportunity loss by selecting a technique tailored to the application. An interactive dialogue with the user about the application leads to a prescription of the most promising forecasting methods. The knowledge base was assembled from published and unpublished sources.

"FORECAST: A GENERAL PURPOSE FORECASTING AID"
Wright, G., Ayton, P., and Whalley, P., Decision Analysis Group, Psychology Dept, City of London Polytechnic, Old Castle Street, London E1 7NT, England

Here, we describe the rationale, procedures and use of a general purpose computer aid to judgemental forecasting. The program 'Forecast' aids three types of forecasting. First, of the time period or date when a specified event may happen, eg. an airliner crash with loss of life. Second, the possible outcomes of that or another event when these can be expressed in numerical terms as outcomes on a single continuous scale, eg. the number of lives lost. Third, the possible outcomes of that or another event when these can be expressed as discrete or discontinuous outcomes. eg. the airline involved. Probability assessments are monitored and policed by the probability laws and incoherence is interactively resolved with the forecaster.

ROOM LT6

WEDNESDAY
11.10-12.40

KEYNOTE SESSION IN MACROECONOMIC FORECASTING

MACROECONOMIC FORECASTING

Chair: **Budd, Alan**, Centre for Economic Forecasting, London Business School, Regent's Park, London NW1 4SA, England

"RECENT FORECASTING EXPERIENCE IN THE UK TREASURY"
Burns, Sir Terence, Chief Economic Adviser, HM. Treasury, Parliament St, London SW1, England

This paper assesses the record of forecasts and assumptions produced by the UK government as part of its annual budgetary and monetary and fiscal strategy exercises. Covering the period since 1980, which coincides with the introduction of the Medium Term Financial Strategy (MTFS), the paper shows that for the broad magnitudes - inflation and GDP - the record has been creditable. Published official forecasts signalled the strength and length of recession and the pace of disinflation.

The evolution of some important economic variables, such as trade and the balance of payments, company finance, were less accurately portrayed. An examination of these forecast errors provides some information on the behaviour of the UK economy and how it has adapted to the new policy framework.

"HAVE BAD FORECASTS CAUSED BAD STABILIZATION POLICY"
McNees, Stephen, K., Federal Reserve Bank of Boston, Boston, Massachusetts 02106, USA

Both forecast errors and perceived macroeconomic policy errors are rife. Causation is often inferred from this correlation. This paper starts by considering the logical conditions necessary for this inference to be drawn. The title of this paper presumes that policy mistakes can be identified. This, in turn, seems to imply knowledge of (1) feasible sets of macroeconomic policy goals, (2) the structure of the economy, (3) the economic forecasts and the policy assumptions on which those forecasts were based. On a more fundamental level, the question presumes that macropolicy decisions are affected by economic forecasts. The paper attempts to illustrate these controversial issues in the context of the 1965-82 experience in the United States.

FAIRBAIRN ROOM

WEDNESDAY
11.00-12.30

MULTIVARIATE TIME SERIES MODELS

TIME SERIES

Chair: Ledolter, Johannes, Dept of Statistics, University of Iowa, Iowa City, Iowa 52242, USA

"ANALYSIS & GENERALISATION OF A MULTIVARIATE EXPONENTIAL SMOOTHING MODEL"
Harvey, A.C., Department of Statistics, London School of Economics, London, WC2A 2AE, England.

The multiple exponential smoothing model of Enns, Machak, Spivey and Wrobleski is examined and it is found that its structure is such that it can be estimated by using techniques designed for a univariate exponential smoothing model. Similarly forecasts can be made using algorithms for the univariate model. The model can therefore be handled very easily. A more general univariate time series model, which can include polynomial trends and seasonal factors, is then set up and a multivariate generalisation, analogous to the multiple exponential smoothing model, is introduced. It is shown that this model can also be handled using algorithms designed for the univariate case.

"MULTIVARIATE EXPONENTIAL SMOOTHING, THEORY AND PRACTICE"
Pferrermann, D., and Alon, J., Central Bureau of Statistics, Hakirya-Romema, PO Box 13015, Jerusalem, Israel.

A multivariate extension of the Holt-Winter exponential smoothing procedure for forecasting univariate time series composed of trend, seasonality and irregularity is presented. The updated estimates of the level, slope and seasonal effects of each of the component series is obtained as a weighted average of the estimates derived by a univariate smoothing and correction factors based on the relevant information gained from the other series. The predictors share similar optimal properties to those known for the univariate case and their performance is compared to that of other common univariate and multivariate predictors using actual data.

"PARTIAL LAG AUTOCORRELATION AND PARTIAL PROCESS AUTOCORRELATION FOR VECTOR TIME SERIES"
Heyse, Joseph F., Biometrics Research, Merck Sharp & Dohme Research Laboratories, West Point, Pennsylvannia, USA
Wei, William W.S., School of Business Administration, Temple University, Philadelphia, PA 19122, USA

Two forms of partial autocorrelation for vector time series are defined and their properties discussed. The first is the partial lag autocorrelation defined as the correlation between two points in a time series, after removing the linear dependence of each on the points at intervening lags. The second is the partial process autocorrelation defined as the correlation between two components of the vector process, after removing the linear dependence of each on a third component process. They are shown to be useful tools for identifying vector ARMA models, and for determining whether an apparent relationship between two component series is due to a common dependence on a third series.

"PREDICTORS FOR TEMPORALLY & CONTEMPORANEOUSLY AGGREGATED STATIONARY PROCESSES"
Lutkepohl, Helmut., Fachbereich Wirtschaftswissenschaften, Universitat Osnabruck, Luisenstrasse 16, 4500 Osnabruck, West Germany

When a temporally and contemporaneously aggregated vector stochastic process is being forecasted there are various alternative predictors that could be used. For example, a disaggregated process could be forecasted and the forecasts could be aggregated or the aggregated process could be forecasted directly. A framework is developed in which these and other predictors can be analyzed and compared. The relative efficiencies of various predictors are derived.

Room G07
SLOAN ROOM

WEDNESDAY
11.00-12.30

THE IMPACT OF DECISION STYLE

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

"NEW CONCEPTIONS OF DECISION STYLE AND HOW THEY INFLUENCE CHOICES MADE BY CHIEF EXECUTIVE OFFICERS"

Nutt, Paul C., Ohio State University, 1583 Perry Street, Columbus, Ohio 43210, USA

This research studies how a sample of 150 CEO's made capital expansion project decisions. The study explored how two new conceptions of decision style, based on the Jungian typology, and measured by the MBTI, influenced choice behaviour. The first, extended the traditional "choice frame" of decision style, which measures preferences for data processing and data acquisition. Executives that seem likely to switch between one of the data acquisition options or one of the data processing options were determined, creating eight archetype styles. In the second, the often ignored introversion-extroversion and judgement-perception scales proposed by Jung were used to create an "action frame". The action frame was combined with the choice frame to create sixteen archetype styles. The study controlled for age, experience, and other factors specific to the individual CEO. Additional variables such as information used in the decision, the environment in which the decision was made, and the risk inherent in the decision were used for central purposes. Decision styles defined in these ways proved to be a decisive factor in explaining decision behaviour. The implications of these findings for information system design and organizational effectiveness is discussed.

"UPPER ECHELON THEORY: AN EMPIRICAL TEST OF TOP MANAGEMENT CHARACTERISTICS IN GROWING AND DECLINING INDUSTRIES"

Norburn, David, Franklin D Shurz Professor of Strategic Management, University of Notre Dame, Notre Dame, Indiana 46556, USA

Can variability of industry economic performance be forecast by analysing the characteristics of top management? In 1983, the "upper-echelons" of Hambrick and Mason theory posited that variations in organisational performance may be predicted by the behavioural characteristics of the Top Management Team. This research therefore investigated the characteristics of 354 directors of Britain's largest companies. Two groups of independent variables were analysed - those relating to the corporate environ, and those to the domestic environ.

Directors were categorised according to the economic performance of their industries - WINNERS (industries in growth), and LOSERS (industries in decline). Several differences emerged between the characteristics of directors and the economic success of their industries for which they were strategically influential. When coupled with empirical research from the disciplines of organiational behaviour, leadership theories, and strategic management, the results of this study suggest a positive association and give support to the view that the economic performance of UK industry can be predicted, partially, from analysis of the director set.

ROOM LT2

WEDNESDAY
2.00-3.30

WHAT NEXT?

SOCIAL & TECHNOLOGICAL

Chair: **Holroyd, P.**, Faculty of Engineering Science, University of Liverpool, PO Box 147, Liverpool, L69 3BX, England

"SOCIOPOLITICAL FORECASTING, PLANNING AND MANAGEMENT INFORMATION SYSTEMS"
Higgins, J. C., Bradford Management Centre, University of Bradford, Emm Lane, Bradford, BD9 4JL, England

The Bradford Management Centre has a longstanding interest in planning and management information systems and in the late 1970's began work in sociopolitical forecasting. The two areas have been brought together in a series of studies and seminars and a number of results from these operations will be discussed. In particular the main conclusions from two surveys will be cited. We have examined the methods used in practice for monitoring and forecasting the sociopolitical environment; and the ways in which these activities are linked to organisations' planning and information systems.

We have concluded that at present there are enormous differences in practice between organisations with respect to the types of techniques used and the degree of integration between their monitoring and forecasting activities and their planning and information systems. Inevitably, therefore, some of the paper is prescriptive rather than descriptive, drawing on our knowledge of what is available in forecasting methodology and on what appears to happen in best practice organisations.

"TECHNOLOGY LEADERSHIP FOR THE 21st CENTURY: A COMPARISON OF AMERICAN, JAPANESE AND EUROPEAN VIEWS"
Khera, Inder and Karns, David, Wright State University, College of Business & Administration, Dayton, Ohio 45435, USA

The proposed paper will present the results of a recent survey of high level industry executives in the US, Japan and Sweden regarding their best estimates of which countries will be world leaders in several specific technologies by the early 21st century. Additionally, which country (or region) will be the overall world leader in technology by that time. Preliminary results indicated that the race is perceived to be between Japan and USA with Western Europe being a distant third. Detailed comparative analysis including statistical significance of the differences will be included in the paper. A copy of the survey instrument is enclosed.

"THE USE OF MODEL BUILDING & SCENARIO CONSTRUCTION IN MANAGEMENT DEVELOPMENT"
Saunders, Alan, British Gas Corporation, National Management Centre, Goldicote House, Banbury Road, Stratford on Avon, Warwick, CU37 7ND, England

This paper summarises three years experience in using models and scenarios in management development programmes to help managers face the reality of the business environment and the need to change.

The building of models to aid management thinking in complex situations, and the construction of alternative future scenarios, is usually carried out by specialists in large organisations. The results are 'communicated' to line managers who do not always accept them and do not accept the need for change.

To help managers understand the rapidly changing business environment, the National Management Centre have successfully used modelling and scenario building with mainstream managers from all disciplines who have little formal training in these techniques. A successive focussing approach enables managers to see their departments and the business in a much wider context. The result is that managers are more likely to be committed to company scenarios they have created for themselves and therefore more readily accept the need for change.

The benefits are a rapid understanding of complex situations, a desire to be realistic, greater objectivity about the future and acceptance of the need for change.

"TEACHING ABOUT THE FUTURE"
Encel, S., Dept Anthropology & Sociology, Vassar College, Box 438, Poughkeepsie, New York 12601, USA

A number of universities now offer courses on social and technological forecasting. Such teaching presents large theoretical and pedagogical problems, accentuated by the diversity of backgrounds and interests among students. Those with a scientific or technological training tend to be interested in specific issues relating to resources, new technologies, or planning. Others are more concerned with general theories of social change from which forecasting models are derived. The paper discusses various strategies which can give students the chance to follow their own interests and still give the course some unifying themes.

ROOM LT3

WEDNESDAY
2.00-3.30

BANKRUPTCY PREDICTION

FINANCIAL APPLICATIONS

Chair: **Wood, D.**, Manchester Business School, Booth Street West, Manchester M15 6PB, England

"A COMPARATIVE STUDY OF MODELS DEVELOPED TO IDENTIFY COMPANIES IN DANGER OF FINANCIAL FAILURE"
Betts, J., and Belhoul, D., School of Industrial Technology, University of Bradford, Richmond Road, Bradford, BD7 1DP England.

A number of company failure models have been developed using a sample of failed companies and a sample of going concerns. Multiple discriminant analysis has been used to establish functions that can be used to classify each element in each sample, with a high level of accuracy. These functions were then used to classify failed companies not used in the model's construction. The first model has as discriminant variables, financial ratios only. The second model includes financial ratios, decomposition measures, and stability measures. The more sophisticated model surprisingly performs no better generally than the simple model, but certainly one complements the other.

The two models will be described and their performance compared. Suggestions for improving the representation of stability of financial ratios in such models will be made.

"THE USE OF THE INTEGRATIVE COMPLEXITY OF THE PRESIDENT'S LETTER IN THE ANNUAL REPORT AS AN INDICATOR OF IMPENDING BANKRUPTCY"
Euske, K.J., University of California, Berkeley School of Business Administration, 350 Barrows Hill, Berkeley, USA

This study explores the usefulness of qualitative information found in annual financial reports as an indicator of future corporate failure. The content of the president's cover letters for a sample of twenty pairs of failed and nonfailed firms over the five year period preceding the year in which the failed firm filed for bankruptcy were analyzed and scored for integrative complexity. The results of the study indicate that a firm may be identified as a candidate for bankruptcy as many as five years prior to the time of entering bankruptcy proceedings.

"THE INFORMATION VALUE OF MULTIPLE DISCRIMINANT TECHNIQUES"
Wood, Douglas, Manchester Business School, Booth St West, Manchester M15 6PB, England

This paper reviews the evidence of stock market inefficiency presented by Altman and Brenner (1981). The problems of allocating the demonstrated abnormal returns between market efficiency and environmental changes is identified and a similar level of abnormality is demonstrated for UK data without the use of any MDA information.

"BANKRUPTCY RISKS AND THE EFFECTS OF CONSERVATIVE POLICY 1979/81"
Hall, Graham, Manchester Business School, Booth St West, Manchester M15 6PB, England
Stark, Andy, College of Business, University of Maryland, College Park, Maryland 20742, USA

The objective of this research was to detect what implications the policy changes introduced by the Conservative Government after 1979 had on the type of company going brankrupt. The results showed that the characteristics of failing firms and the failure probability had not changed.

ROOM LT4

WEDNESDAY
2.00-3.30

FORECASTING AND ANALYSIS WITH MULTISECTORAL NATIONAL MODELS

MACROECONOMIC FORECASTING

Chair: **Amrit, Terry,** Sw ., Dept of Applied Economics, University of Cambridge, Sidgwick Avenue, Cambridge, CB3 9DE, England

"POLICY ANALYSIS USING A COMPUTABLE GENERAL EQUILIBRIUM MODEL: A REVIEW OF EXPERIENCE AT THE IMPACT PROJECT"
Parmenter, B.R., Dixon, P.B., Powell, A.A., and Meagher, T., Impact Project, Impact Centre, University of Melbourne, 153 Barry St, Carlton, Victoria 3053, Australia

A large-scale computable general equilibrium model of the Australian economy (ORANI) has been developed within the IMPACT Research Project. Extensive use of the model for economic policy analysis has been made both within the Project and by government and academic researchers at other institutions. We outline the crucial theoretical and empirical issues underlying the policy application of models of this type, contrasting requirements for forecasting with requirements for comparative-static policy analysis. We review a number of studies which have used ORANI for policy analysis in the areas of macroeconomic management, trade policy and structural adjustment.

"REVOLVING SECTORAL FORECASTS: THE "PREVISIONS GLISSANTES DETAILLEES (PGD)"
Passeron, Henri and Raoul, Emmanuel, INSEE, 18 Boulevard A-PINARD, 75675 Paris, Cedex 14, France

The Seventh French plan (1976-1980) stated that "a medium term annual revolving forecast should be built in order to allow firms and other users to secure their own forecasts".

After an history of the settlement of the apparatus of the PGD, the paper describes the yearly process of the making of these forecasts: a club of large firms settles the main assumptions (e.g. fiscal policy); a governmental agency (the INSEE) builds with the help of two large econometric models of macro sectoral forecast; on this basis a private office (the BIPE) calculates detailed forecasts for 200 commodities.

Finally, the diffusion of this product by a private and a public publisher is presented.

"A SMALL DYNAMIC MULTI-SECTORAL MODEL OF THE MEXICAN ECONOMY"
Brailovsky, Vladimir., Economica Aplicada SC, Monte Pelvoux 111-301, Lomas de Chaputtepec, 11000 Mexico

The article describes the steps involved in constructing an operational model based on a fully integrated accounting framework covering the real, institutional, fiscal and financial aspects of the economy at a disaggregated level. Nevertheless, the model is sufficiently compact and flexible to be managed by a small team using a micro-computer. It generates sequential annual results which may be used both for medium to long term forecasting and policy analysis. Using a Keynesian approach, judgemental elements are combined with econometric estimations to confront the practical problems of modelling an economy subject to large and sudden structural changes. Various other aspects are discussed, including the reasons for building this kind of model and its technical characteristics and structure.

"FORECASTING AND POLICY ANALYSIS WITH A LARGE-SCALE MACROECONOMIC MODEL OF THE UK"
Amrit, Terry, Sw ., and Peterson, William, Cambridge Growth Project, Department of Applied Economics, University of Cambridge, Sidgwick Avenue, Cambridge, England

The Cambridge multisectoral dynamic model (MDM) has been developed for the UK economy for the purposes of forecasting and policy analysis. The paper will report on the structure and properties of the current version of the model, concentrating on properties important in its use for long-term forecasting and policy scenarios. The paper will discuss the interactions between the markets for goods and services, labour, foreign exchange and financial stocks both in the medium-term and the long-term. It will present a forecast over the next ten years for the UK economy illustrating the issues.

"THE EFFECTS OF INCOME SETTLEMENTS ANALYSED BY THE MODEL MODAG A"
Cappelen, Adne., Statistik Sentralbyra, Research Dept, Skippberg 15, PB 8131 DEP, N-Oslo, 1-Norway

Wage and income settlements are highly centralized in Norway; wages are determined or strongly influenced by centralized wage bargaining and, at the same time, agricultural prices and government transfers to agriculture, fishing and pensioners are adjusted.

As a background for the negotiations, which involve both the government and the organizations, a study of the consequences of different possible outcomes of the income settlements is worked out.

This paper presents the main characteristics of the multisectoral model used for this purpose, and discusses some of the forecasts and analysis done in connection with the income settlements in 1983 and 1984.

Discussant **Falcke, Cai,** Sector Studies Branch, UNIDO, Vienna International Centre, PO Box 300, A-1400 Vienna, Austria

ROOM LT5

WEDNESDAY
2.00-3.30

LABOUR MARKETS

APPLIED ECONOMETRICS

Chair: **Henry, S.G.B.**, National Institute of Economic and Social Research, 2 Dean Trench St, Smith Square, London SW1P 3HE, England

"FORECASTING WAGE RATES WITH APPLICATION TO THE UNIONIZED CONSTRUCTION SECTOR IN ALBERTA"
Jenkins, A.W., Dept of Economics, University of Alberta, Edmonton, Alberta T6G ZE1, Canada

This paper develops a general model of wage formation and then estimates it using state-of-the-art statistical methodology and wage contract data for 22 Alberta construction trades, 1960-82. It then combines the estimated wage formation equation along with alternative projections of building activity and CPI inflation to forecast construction wage settlements into the 1990's. It concludes by examining these wage forecasts with a view to determining the sensitivity of wage settlements and related project costs to fluctuations in the timing and scope of future mega-projects and (state-sponsored) trades training.

"A SIMPLE APPROACH TO RECONCILE AGGREGATED VERSUS DISAGGREGATED FUNCTIONS: A VALIDATION OF THE MODEL"
Naini, A., and Worswick, J., Economics Department, Energy Resources Conservation Board, Calgary, Alberta, Canada, T2P 3G4

There are a variety of situations in which economists consider models to explain heterogeneity among cross section units with time series data. The cross section units could be demand for automobiles by engine size, housing supply by type of dwelling or labour force participation rates by sex/age groups. By this approach the indirect aggregation can be obtained as the sum of disaggregated equations. The alternative situation is direct estimation of an aggregated function. However the results of these two approaches may not be identical.

The purpose of this paper is to describe an approach to the adjustment of indirect versus direct aggregation estimates. Our empirical study is focused on the estimation of Alberta labour force participation rates by sex/age groups for the years 1962 - 1981.

"A COMPARISON OF DECOMPOSITION AND TRANSFER FUNCTION MODELS USING A LEADING INDICATOR IN FORECASTS OF INDUSTRIAL EMPLOYMENT"
Holmes, R.A., Faculty of Business Admin, Simon Fraser University, Burnaby, B.C., Canada, V5A IS6

A leading indicator developed to forecast industrial employment in British Columbia is explained and evaluated, and then employed in two separate models whose results are compared. In the first model, the trend, seasonal, cyclical and irregular components of B.C. industrial employment are forecast separately using regression and ARIMA models of the components. The leading indicator is used to forecast the cyclical component in this decomposition model. In addition, in a second model, a Box-Jenkins transfer function is employed with the leading indicator as an input variable. The accuracy of the forecasts obtained from the decomposition and transfer function models is compared, and the gain from combination of the forecasts produced by the two models is considered.

ROOM LT6

WEDNESDAY
2.00-3.30

FORECASTING INFLATION

MACROECONOMIC FORECASTING

Chair: Moore, Geoffrey, Rutgers University, 180 University Avenue, Newark, N.J. 07102, USA

"FORECASTING INFLATION RATES IN MAJOR INDUSTRIAL COUNTRIES"
Cullity, John, P., Rutgers University, Newark, N.J. 07102, USA

This paper evaluates a set of forecasts of changes in the consumer price indexes for the major industrial countries compiled by Blue Chip Economic Worldscan. Worldscan is a private publication which presents forecasts for a group of about 25 economic forecasters on a monthly basis. The forecasts relate to gross national product in real terms, industrial production, consumer prices, and other economic variables. It covers about ten major countries and the forecasts pertain to periods up to two years ahead.

Many evaluations have been made of inflation forecasts, but most have been concerned with only one country and lack comparability as between countries. This study helps to remedy this deficiency. Standard measures of accuracy are applied and efforts are made to locate the sources of error.

It is plainly important to economists, as scientists, to know how well their efforts to forecast inflation have succeeded, and to locate the sources of error so that methods can be improved. Furthermore, because government and the private sector make use of forecasts in determining their economic decisions, improved knowledge of the accuracy of price change forecasts has practical day-to-day implications for those interested in inflation prospects.

"FORECASTING THE RATE OF INFLATION BY MEANS OF THE CONSUMER PRICE INDEX"
Espasa, Antoni, Banco de Espana, Madrid, Spain

The rate of inflation of an economy should be expressed as a vector of rates for different groups of goods, because the fact that these rates, quite often, differ significantly between them has important policy implications. This conditions the statistical problem of inflation forecast, which should be directed to forecast the components.

In this paper we present the Time Series Models used for the monthly forecast of Spanish inflation and we also give measures to approximate the trend (expectations) of inflation. It is seen that the proposed approach performs much better than the direct forecast of the aggregate.

"FORECASTING INFLATION IN MARKET ECONOMIES"
Klein, Philip, A., The Pennsylvania State University, Dept of Economics, University Park, PA 16802, USA

We have recently found that inflation rate changes are not only highly sensitive to the phases of the business cycle but that we can forecast these changes in inflation in the United States by constructing a leading indicator comprising several measures of economic activity especially sensitive to subsequent changes in inflation. In our US work we have measured inflation by the percentage change in the annual inflation rate as reflected in the consumer price index. The leading indicator or inflation changes includes the percent of the working age population employed, the annual rate of change in sensitive industrial material prices, and the annual rate of change in the broadest measure of outstanding debt.

The present paper is an effort to examine the feasibility of duplicating these findings by constructing a leading index of roughly equivalent indicators, as well as an inflation change technology for a number of other market-oriented economies. We contemplate including Canada, Japan, the United Kingdom, West Germany, Italy, and France. All of the timings will be considered in relationship to the growth cycle chronologies we have previously established for each of the countries mentioned.

"A COMPOSITE LEADING INDICATOR OF U.S. INFLATION"
Niemira, Michael, P., T. Paine Webber, 140 Broadway, 25th Floor, New York, NY 100, USA.

This paper examines the logic for modelling inflation dynamics using a decision-making model and then applies the decision model to inflation forecasting. Inflation cycles are discussed from an empirical standpoint, in order to explicitly gauge timing relationships with respect to the inflation cycle. Based on these relationships, a multiple stage inflation model is formulated.

A key aspect of this investigation is to suggest a reason for varying response time between leading inflation barometers and the coincident or target inflation measure - the consumer price index. The final section of this paper evaluates the model and suggests areas for improvement.

FAIRBAIRN ROOM

WEDNESDAY
2.00-3.30

REVIEW PAPER
ON
JUDGEMENT IN FORECASTING

Chair: **Phillips, Larry**, London School of Economics, Houghton St, London WC2A 2AE, England

"MISJUDGING JUDGEMENT"

Humphreys Patrick, and Berkeley, Dina, .ondon School of Economics and Political Science, Houghton London WC2A 2AE, England

Recent concern with the efficiency or appropriateness of intuitive decision making has focussed on experimental studies designed to judge the quality of the judgements which participants in the experiments are expected to make. This paper provides a critique of ways in which this judging of judgement has been carried out, emphasising the adequacy of comparing the results of experimental subjects' intuitive judgement with those expected by the experimenter without any analysis of potential differences between the ways in which the experimenters and the subjects went about structuring and solving the decision problem. This critique is important for two reasons: first, it suggests that a radical re-evaluation may be required of the "blemished portrait of human abilities that emerges from this work", as much of it was based on an inadequate and biased analysis of people's goals and problem structuring activities; secondly, it has direct bearing on the analysis of situations where different parties to a decision may predicate their judgements on different motivations and views of the world in which the problem is located.

The argument this paper puts forward is not that people are necessarily good (or bad) decision makers inside or outside the laboratory. Instead, it argues that the quality of a decision can not be ascertained solely by comparisons with any axiomatic rule at the output level. Decision making is a creative activity which does not often reflect the unidimensionality ascribed to it within experimental environments. The context out of which decision problems are seen to arise, and in which the resulting decisions will be implemented, are of paramount importance in assessing the quality of the decision. However, assessment of quality of judgements within ill-defined decision problems can at best be only relative, depending on the judgemental framework used by the assessor.

The paper discusses five different levels at which decision makers may be conceptualising a presented problem and shows why viewing only the results of such conceptualisations from the standpoint of a normative model is not the best guide to making assertions about the quality of judgements. Decision theoretic normative composition rules are applicable only at lower levels of problem conceptualisation and their use is predicated on the particular way in which constraints have been set at higher levels in handling the problem.

Guidelines are provided for identifying differences between the way problems are conceptualised at each level in forming judgements and possibilities for reconciling or clearly displaying these differences are discussed.

Discussants

Beach, L.R., Dept of Psychology, University of Washington, Seattle, Washington 98195, USA
Brehmer, B., Institute of Psychology, University of Uppsala, PO Box 227, S-75104 Uppsala, Sweden
Hogarth, R., Centre for Decision Research, University of Chicago, 1101 East 58th St, Chicago, Illinois 60637, USA

PUBLIC POLICY AND MANAGEMENT: II

GENERAL FORECASTING

Chair: Gorr, Wilpen, L., School of Public Administration, Ohio State University, 1775 College Road, Columbus, Ohio 43210, USA

"FORECASTING OHIO'S ENERGY NEEDS: DEVELOPMENT AND EVALUATION OF FORECASTING METHODS"
Kennedy, James Lehr, Division of Forecasting and Information, Ohio Department of Energy, Columbus, Ohio 43215, USA

During the last decade, energy forecasting and energy resource development have been modified not only by world conditions, but by an advancing state of the art. Changes in Ohio's energy forecasting activities typify those that have taken place in energy forecasting in other states, as well as internationally. This paper traces the evolution of energy forecasting in Ohio in response to changing needs. It discusses the importance of state energy forecasting and the impact of state forecasting on energy suppliers and consumers.

"THE EPISTEMOLOGY OF FORECASTING IN THE POLICY SCIENCES"
Bozeman, Barry, Bretschneider, Stuart, and Majeski, Stephen, Metropolitan Studies Program, The Maxwell School, Syracuse University, Syracuse, New York 13210, USA

A universal definition for a policy science has long eluded scholars, in part because of its action or prescriptive orientation. Forecasting, like policy science, has a long tradition of prescription and consequently has often been relegated to the status of a non-science. This paper formally investigates the relationship between science, forecasting, ethics and policy science in order to better understand and make use of forecasting by the policy sciences. The results are in the form of a taxonomy of forecasting outputs (ie. knowledge) contributed to the prescriptive demands of policy scientists.

"SPATIAL ADAPTIVE FILTERING: AN APPLICATION TO FORECASTING THE SPATIAL DISTRIBUTION OF POLICE CALLS"
Foster, Stuart, A., Department of Geography, 190 N. Oval Mall, Ohio State University, Columbus, Ohio 43210, USA
Gorr, Wilpen, L., School of Public Administration, 1775 College Road, Ohio State University, Columbus, Ohio 43210, USA

Spatial Adaptive Filtering (SAF) is a new procedure for estimating multivariate models having the spatial-varying-parameter specification. This paper presents SAF's first application, on the distribution of police services in Columbus, Ohio. Modeling efforts show substantial spatial variation in estimated parameters; furthermore, maps displaying this variation provide diagnostic information for understanding police requirements.

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