ISF 94 - The Fourteenth Annual

INTERNATIONAL SYMPOSIUM ON FORECASTING

June 12 - 15, 1994
Stockholm, Sweden
at the Stockholm School of Economics
Handelshögskolan i Stockholm

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

Department of Economic Statistics
Stockholm School of Economics

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

Dear friends.

As Minister of Education and Science it is a great pleasure for me to welcome the International Symposium on Forecasting to Stockholm.

All over the world research is breaking new ground. It extends our knowledge and provides new ways to improve life for all. Your work as forecasters is part of the ongoing search for a deeper understanding of the world as well as of the process to find more sophisticated tools to describe it.

Swedish policy on education and research is in transition. Choice, diversity and quality are the keywords of a strategy which aims at a new foundation for cultural and economic growth. Current actions in the field of education and research should be seen as important and necessary investments in the human capital of our country. It is our hope that scholars and professionals from all over the world, today and tomorrow, will look to Sweden as a country which has a lot to offer.

No doubt, the future will bring change and challenge, on a national level as well as in a global perspective. It has therefore become more necessary to learn from each other in the international community. With this in mind, I am very pleased to welcome you all to ISF 94 in Stockholm.

Sincerely yours,

Per Unckel
Minister of Education and Science

HANDELSHÖGSKOLAN I STOCKHOLM
STOCKHOLM SCHOOL OF ECONOMICS

Staffan Burenstam Linder
Rektor, professor

Dear Friends,

As President of the Stockholm School of Economics I am
delighted to welcome all Participants in The 14th
International Symposium on Forecasting arranged by this School
and the International Institute of Forecasters.

We are glad that this Symposium with such an impressive
attendance can be held at the Stockholm School of Economics.

Our School was founded in 1909 and its activities have been
based in research from the very beginning. The curriculum is
analytical rather than case-oriented. The School is one of
Europe's very few private universities and we enjoy close
relationships with private industry.

I hope you will find it convenient holding this conference in
downtown Stockholm, as Stockholm is such a beautiful city. We
also like our location because it makes us accessible and
enables us to feel the pulse of economic life.

Please feel welcome and enjoy yourselves at the Stockholm
School of Economics and in the City of Stockholm.

Sincerely yours,

Staffan Burenstam Linder

THE FOURTEENTH INTERNATIONAL SYMPOSIUM ON FORECASTING

Stockholm, Sweden
June 12 - 15, 1994

MESSAGE FROM THE GENERAL CHAIRPERSON

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Dear Conferees,

On behalf of the International Institute of Forecasters, the Stockholm School of Economics, and the Organizing Committee, I welcome you to the 14th International Symposium on Forecasting in Stockholm.

We have an exciting program waiting for you, with more than 250 papers in 87 sessions grouped into 12 tracks. I am convinced both academics and practitioners will find many interesting presentations!

As usual, the papers cover a wide range of topics, with authors from more than 30 countries covering all parts of the world.
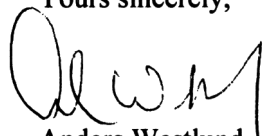
A large number of the participants will become new members of the International Institute of Forecasters. This will further strengthen the global forecasting society.

While continuing to address forecasting applications and methods of importance as in past symposiums, this symposium's theme is industrial forecasting, an area of special interest to Sweden where the export industry plays a very important role in the economy.

There are several social activities that will be taking place, giving you opportunities to meet new people and share interests. We hope you will find the visit to the Vasa museum fascinating and the dinner cruise through the Stockholm archipelago a great experience. The luncheon reception on Tuesday at the Stockholm City Hall will be in the magnificent Golden Hall. We will pass through the Blue Hall, the place of the annual Nobel Price Banquet.

Lastly, I want to extend thanks to the organizers of the conference - especially Per-Olov Edlund, Sune Karlsson, Lars-Erik Öller, Titti Unckel, and Olle Lindgren. I also wish to warmly thank the session organizers; presenters; the Stockholm Convention Bureau; and, of course, you, for making this a great conference.

Yours sincerely,

Anders Westlund
General Chairperson
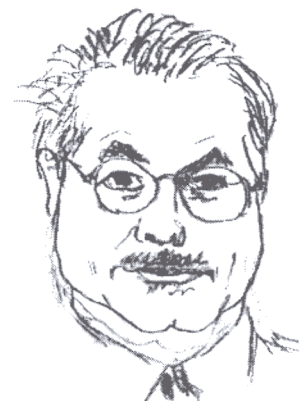
ISF 94 ORGANIZING COMMITTEE

Anders Westlund
General Chairperson

Sune Karlsson
Program Co-Chairperson

Lars-Erik Öller
Program Co-Chairperson

Per-Olov Edlund
Local Arrangements

Titti Unckel
Exhibits Chairperson

Olle Lindgren
Corporate Liaison

Jan de Gooijer
At Large

Katarina Juselius
At Large

Timo Teräsvirta
At Large

Drawings by Lars-Erik Öller

GENERAL INFORMATION

Registration

The Symposium registration area is located outside the "Aula" on Level 1. It will be open on Sunday, June 12, from 15:00 to 19:00. Later registrations can be made outside the "K.A.W." lecture hall on the Conference Level at the Conference Staff desk.

Conference Staff and Message Center

The conference staff have their desk outside the K.A.W. lecture hall on the Conference Level. Conference staff can be reached by phone +46-8-736 92 80 or fax +46-8-30 21 15.

A bulletin board will be located at the entrance to the Conference Level (on Level 1). There you will find personal messages, phone calls, announcements, changes in program, etc.

Badges

Your name badge serves as a pass for all program sessions, exhibit displays, refreshment breaks, luncheon, visit to the City Hall and the welcoming and farewell party. *Please wear your badge at all times while you are at the school.*

Coffee breaks

Coffee and tea will be available during the morning and afternoon breaks in the "Pub" (Basement Level) and outside the K.A.W. lecture hall (Conference Level).

Luncheon

The luncheon on Monday June 13, is served in the "Stora salen" (Ballroom) on Holländargatan 32, se map below.

Session Hosts

Session hosts will assist speakers and session chairs with equipment during sessions. They will also help attendants. Just ask them! The session hosts can be identified by the yellow "Session Host" ribbon attached to their badge.

Study and Meeting Rooms

During the symposium you can use the following rooms to prepare your presentation or meeting with colleagues: Room 136, Room 194, Room 342, and Room 343.

Additional Copies of Program Book

Additional copies of this Program Book may be purchased at the Secretariat desk for 40 SEK. After the conference, copies may be purchased for 60 SEK, by contacting Carin Blanksvärd, Stockholm School of Economics, P.O. Box 6501, S-113 83 Stockholm, Sweden. Make checks payable to Stockholm School of Economics (Handelshögskolan).

Official Hotels

Hotel Birger Jarl, Tulegatan 8, Box 19016, S-104 32 STOCKHOLM, ☎ 08-15 10 20, 🖷 08-673 73 66

Hotel Tegnérlunden, Tegnérlunden 8, S-113 59 STOCKHOLM, ☎ 08-34 97 80, 🖷 08-32 78 18

Victory Hotel, Lilla Nygatan 5, S-111 28 STOCKHOLM, ☎ 08-14 30 90, 🖷 08-20 21 77

Wallin Hotel (City Conference Hotel), Wallingatan 15, Box 70374, S-107 24 STOCKHOLM, ☎ 08-20 15 20, 🖷 08-791 50 50

Social Events

Sunday, June 12:

17.30: Welcoming Reception
An informal reception held at the Stockholm School of Economics. Included in the registration fee. The reception will be held in the courtyard on Level 1.

Monday, June 13:

10.00 - 14.00: Sightseeing including a visit to Skansen
This tour starts with a short sightseeing tour by bus through the central parts of the city and continues with a visit to Skansen, founded in 1891, the world's oldest open-air museum. The aim is to show how people lived and worked in the past in the different regions of Sweden. A visit to Skansen is not just a move backwards in time, it's also an excellent opportunity to "visit" Sweden, travelling from the south to the north, experiencing the provinces, each with their own culture and nature. We will also have the opportunity to see traditional craftsmen at work.

Price: 450 kronor including lunch and VAT.

18:30 - 23:30: Vasa Museum and Steam Boat Dinner
The program starts with a visit to the Vasa Museum where you will see the 17th century man-of-war Vasa. Vasa, which sank in 1628, was salvaged from the bottom of the Stockholm harbor in 1961 and is now beautifully restored. After the visit to the museum boats will take you on a dinner cruise through the Stockholm archipelago.

Price: 300 kronor including dinner and VAT. Limited space.

Tuesday, June 14:

09.30 - 12.00: Old Town Walk
The island Gamla Stan, The Old Town, is the original heart of the ancient City of Stockholm and the city's oldest and most historical area. Amazingly, the island has escaped the winds of change and thus most of its medieval lay-out and character remain intact. A wander through the narrow, cobbled streets, breathing in the historical atmosphere and spirit of this particularly fascinating Stockholm island, will give you a clear notion of what life must have been like there centuries ago. Throughout the walk, your tour guide will also relate old stories and legends of The Old Town whilst showing you the charming coffee shops, built cleverly into the old cellar-vaults, plus the antique shops and art galleries of today.

Price: 210 kronor including coffee and VAT.

12:00 - 14:30: Buffet Lunch at Stockholm City Hall.
The City of Stockholm and the Stockholm County Council invite the participants to a buffet lunch in this magnificent building. Beautifully situated on the waterfront of the Lake Mälaren in central Stockholm, the City Hall is famous as the setting for the annual Nobel Prize banquet.

Included in the registration fee.

Wednesday, June 15:

12.30: Farewell Reception
A buffet will be served at the Stockholm School of Economics.

Included in the registration fee.

PLEASE NOTE: The *Sightseeing including a visit to Skansen, Vasa Museum and Steam Boat Dinner,* and *Old Town Walk* are all paid events. If you purchased tickets when you mailed in your registration, they are included in your registration package. For conferees and spouses who would like to attend but did not purchase tickets in advance, a limited number of tickets will be available for purchase at the Conference Staff Desk at the Conference Level. The *Buffet Lunch at Stockholm City Hall* is open to all participants and spouses even if you did not indicate the City Hall reception on the Registration Form.

Transportation

Monday   *Sightseeing including a visit to Skansen*
A bus will depart from the School at 10:00.

Vasa Museum and Steam Boat Dinner
Buses leave outside the School on Sveavägen at 18:30. (If you want to go to the Vasa Museum on your own, take bus 47 from underground station T-Centralen, opposite to Åhléns department store, direction "Djurgården"). The boats will depart from outside the museum at 20:00. After the cruise buses will take you back to the official hotels (except Victory Hotel) or the School.

Tuesday   *Old Town Walk*
Participants will meet in the Old Town at the obelisk outside the Royal Palace ("Slottsbacken") at 09:30. Please see your ticket for further information.

Buffet Lunch at Stockholm City Hall
Buses leave outside the School on Sveavägen at 12:10. After the visit buses will take you back to the School leaving outside the City Hall at 14:00.

Post-Conference Tours

Baltic Cruise: June 15 - 17.
A scenic, fun-filled cruise between Stockholm and Helsinki. On board you will enjoy comfortable accommodations and the festive atmosphere of the luxurious restaurants, bars and night clubs.

Day 1: Departure from Stockholm.
Transfer at 16:30 from your hotel to the terminal. The Silja Line cruise liner departs at 18:00 to Helsinki, the capital of Finland. Dine, wine, dance and stroll the deck while the ship takes you through the incredibly beautiful archipelago with thousands of islands and skerries.

Day 2: Helsinki
After arrival and breakfast, a sightseeing tour by bus departs from the harbor. The rest of the day is at your disposal for discovering the city. Finland was once a Grand Duchy under Russia and the city offers you an exiting mixture of Scandinavian and Eastern influences. Your cabin is at your disposal during the day. Departure at 18:00 for return to Stockholm.

Day 3: Arrival in Stockholm
The cruise terminates with breakfast before arrival in Stockholm at 9:00. Transfer to your hotel.

Price: 2,100 kronor per person in double cabin with a single supplement of 900 kronor. (Minimum number of participants 20)

The price includes: • 2 Scandinavian breakfast buffets. • 2 Scandinavian buffet dinners excluding beverages • city tour in Helsinki • transfers in Stockholm as indicated.

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Midnight Sun Adventure: June 16 - June 17
(Period of midnight sun May 23 - July 15.)

Day 1

Departure at approx. 11:00 from Stockholm, Arlanda Airport for a 1½ hour flight with SAS to the town of Kiruna. On arrival in Kiruna - located above the Arctic Circle - a guide and a private coach will meet you at the airport and take you on a sightseeing tour. You will visit the church and the City Hall and be given a brief introduction to the life and culture of the Lapp people.

The tour continues along one of Sweden's most beautiful highways, heading west into the alpine areas. Check-in and dinner at Hotel Riksgränsen close to the Norwegian border. From the hotel you have a beautiful view of the surrounding area. After dinner a chair lift ride to the top of the mountain will allow you to enjoy the light at midnight.

Day 2

Breakfast at the hotel followed by a visit to the Hörnell Museum and shop next to the hotel. Here you will be shown a most beautiful slide presentation - "A journey through the eight seasons of Lapland" - by the famous landscape photographer Sven Hörnell.

After some free time, return transfer to Kiruna airport for your flight back to Stockholm. Arrival at Arlanda approx. 15:00.

Price: 3,840 kronor per person in double room with a single supplement of 470 kronor (Minimum number of participants 20)

The price includes: • air fare Stockholm-Kiruna-Stockholm • local tour escort during the full program in Kiruna and Riksgränsen • transportation by first class coach • buffet dinner and breakfast, no beverages • slide presentation • entrance fees during sightseeing • VAT

Please note: we plan to offer optional arrangements on location, i.e. golf, fishing, mountain walk and skiing.

With reservation for changes in the program and prices due to circumstances beyond our control.

Stockholm School of Economics

The Stockholm School of Economics, SSE, founded in 1909 by royal statute, is the oldest Swedish institution of university standing which offers research-based educational programs in business administration and economics.

The Stockholm School of Economics is a private university - since its foundation the only one in Sweden. Its finances are primarily based on a substantial endowment fund. The fund has been built up over the years through generous donations from private individuals and corporations. In addition, the School receives an annual government grant covering approximately 20% of the budget. Support is also given by the City of Stockholm. Considerable resources are generated through Executive Development.

The old part of the main building was inaugurated on October 22, 1926, by King Gustav V. The new part of the building, including room Torsten and room Ragnar was inaugurated in 1976. In 1986 the school acquired buildings on Holländargatan and Saltmätargatan.

The library of the Stockholm School of Economics is one of the largest libraries devoted to business and economics in the Nordic countries. The list of journals and newspapers exceeds seven hundred and is complemented by titles in full text from on-line databases, including all the leading organs of the Swedish business press. You will find the library on Level 5 above the "Aula".

Education And Training

The School is committed to an advanced economics and business studies program. Specialized education and training are offered under four headings:

Master of Science Program
leading to a "civilekonom" degree, Master of Science in Economics and Business. Selected students, fulfilling certain special requirements, also receive a CEMS Master Degree, given by the Community of European Management Schools, CEMS. The Community is made up of twelve leading Western European schools collaborating on the CEMS Master.

The *Master of Science Program* covers approximately four years of full-time studies, which corresponds to 160 credits. Some 1,600 students are currently enrolled in this program. The faculty consists of 35 full professors and some 50 associate, assistant and adjunct professors.

Competition for admittance is extremely high. About 300 students are accepted each year, from 4,000 applicants. Female students comprise some 30% of the total intake. Most students are admitted on grades alone. The grade point average of attainment for students accepted to the SSE is approximately 4.8 on a 5-point scale. However, a small number of students are accepted on "special merits", such as extraordinary language capacity and outstanding achievements in working life. Some students, with excellent grades from Economic and Business

programs at other universities, are admitted to the graduate part of the program, i.e. to the last two years.

The undergraduate period of the program - the first two years - consists of compulsory courses, covering a typical curriculum for schools of Economics and Business Administration. During the graduate period of the program - the final two years - students to a large extent compose their own programs, to widen and deepen their knowledge. They can choose from a "smörgåsbord" of courses in Economics, Business Administration, etc. Students are required to prepare a thesis - 10 to 20 credits - as part of their graduate studies.

The Stockholm School of Economics has an extensive Student Exchange Program with a number of leading universities and business schools all over the world. Some 30% of all SSE-students spend a term abroad as a part of their basic studies. A corresponding number of foreign students, i.e. almost 90, participate in courses held exclusively in English at the SSE. Such courses are currently offered in the fields of International Business, Financial Economics, Marketing, International Economics & Geography and Law.

International Graduate Program

A three semester program leading to a Master of Science in International Economics and Business.

To qualify for the International Graduate Program, IGP, students are required to have an undergraduate degree with a major in economics/business and a good command of the English language. IGP offers three specializations: International Business and Finance, Economics and Business of Europe, Economics and Business of East Asia. The program is entirely taught in English. Tuition fees are charged for this program.

Doctoral Program

leading to a Doctor of Philosophy - in some cases a Doctor of Law - or to an intermediate degree, a Licentiate.

The *Doctoral Program* is one of the cornerstones of the School. Some 150 students are currently working for their degrees within the program. Work for a Doctorate is scheduled to take four years of full-time studies (160 credits), and consists of two years of course work plus two years writing a thesis. Most doctoral students spend one year at a leading university outside Sweden. The research projects at the doctoral level, of which many are presented in this catalogue, are often supported through grants from various foundations and institutions.

The intermediate Licentiate Degree (80 credits) requires about two years of course work and research training.

Executive Development Program

Executive Development runs an *Advanced Management Program* and an *Executive MBA Program*. In addition, a number of open and in-house courses/seminars for executives and staff in corporations and government agencies are offered.

The Executive Development Programs offer specialized training for executives, specialists and key personnel. The thrust of Executive Development is directed towards internationalization, programs for top-level executives, and in-company programs. The course program covers a wide spectrum of activities ranging from academic courses of study, tailor-made for

individual companies, to one-day seminars on topics of current interest. For example there is an *Advanced Management Program* provided for business executives; a part-time Executive MBA, corresponding to an eighteen month, full-time MBA program; a set of courses for engineers assuming management functions. There is also an Eastern European Division, which so far has run programs in Estonia and Poland. The SSE Business Partners is a network of some 60 leading companies. One function of this network is to promote co-operation on research and education between the SSE and the business community .

SSE has been given Swedish public funds - and a donation from the Soros Foundation - to set up a business school in Riga, Latvia. Its centerpiece will be a 25 month program in Management Studies and Economics. The SSE in Riga will begin operations in 1994.

Research Organization

The importance of research has been consistently emphasized since the School was founded. Close contacts with industry result in an exchange of information which facilitates the integration of research findings and practice. The faculty has included a number of famous scholars. such as Eli F. Heckscher and Nobel Laureate Bertil Ohlin.

Research is carried out into a wide range of topics within the field of economics and business administration and related areas, including statistics, finance, information management and business law.

Research at the Stockholm School of Economics is organized within the School's two research institutes, The Economic Research Institute, EFI, and Institute of International Business, IIB, within the Faculty of Law and within three partly independent institutes, The Stockholm Institute of East European Economics, The European Institute of Japanese Studies and SCORE.

The Economic Research Institute, EFI
Founded in 1929, EFI is the largest institute in the Stockholm School of Economics Group, with more than 150 researchers, approximately one third of whom hold a Ph.D.

EFI's activities are highly integrated with those of the School, The Institute's Board of Directors consists of almost all of the School's professors, and the President in his capacity as chairman of the Board. Most of the researchers are doctoral students and/or teachers at the school. The professors take up the position "Head of the Institute" on rotating basis.

Research activity is undertaken in a number of research sections and programs, with a Professor as Program Director.

Institute of International Business, IIB
IIB is an independent institute of the Stockholm School of Economics, with a partly external Board of Directors.

The Head of the Institute is Professor Gunnar Hedlund. IIB has about twenty researchers of whom a significant number hold a Ph.D.

Research primarily involves strategic, technological and organizational issues within multinational companies.

Faculty of Law

The Head of the Department of Law at the Stockholm School of Economics is Professor Gunnar Karnell. The Department has about ten active researchers.

The Stockholm Institute of East European Economics, ÖEI

The Stockholm Institute of East European Economics is an independent institution for advanced research on the economies of Eastern Europe and the former Soviet Union. Research is focused on the economic transition of the formerly planned economies into market economies. The Director of the Institute is Professor Anders Åslund.

The European Institute of Japanese Studies, EIJS

The EIJS was officially inaugurated on 25 September 1992. The primary objective of EIJS is to focus on the key economic and business issues, and current and future challenges, relating to Japan, its impact on the global economy and, in particular, in regard to the Euro-Japanese relationship. Beyond Japan, however, the scope also extends to other East Asian countries, in light of the rapid growth and increasing impact of some of the economies in the region.

City Hall Stockholm

Stockholm's City Hall was built between 1911 and 1923 to the design of architect Ragnar Öst-berg. It is one of Sweden's foremost buildings in the National Romantic style. Behind the imposing facades, built with 8 million bricks, are offices, meeting rooms and banqueting halls.

Inspired by the palaces of the Renaissance, Ragnar Östberg had the City Hall built around two squares or "piazzas", the Borgargård and the Blue Hall.

The **Blue Hall** should have been painted blue, but the architect changed his mind. When he saw the beautiful red bricks, he did not want to cover them with plaster. But he retained the name Blue Hall as it was marked on all the plans of the building, and was already in common use. In the Blue Hall, which is the building's largest hall, the Nobel Prize Banquet takes place on the 10th of December every year. Here you will also find one of Northern Europe's largest organs with over 10,000 pipes and 138 stops.

In the **Council Chamber** the council meet every other Monday evening. The public gallery seats 200 people. The ceiling with its imitation opening gives one the impression of being in a Viking long-house. The furniture was designed by Carl Malmsten and the textiles by Maja Sjöström.

The **Vault of the Hundred** serves as the entrance of honour at City Hall, and leads directly to the banqueting halls. The vaulted ceiling is made up of one hundred segments. On the balcony on the wall, you can see some of the Saint George clock work figures. In the summer, at 12:00 and 18:00 these figures appear on a balcony outside, while the bells in the tower play the 15th century "Song of St. George".

The anteroom to the banqueting halls, **The Ovale**, was created for the Tureholm tapestries, woven at Beauvais in France, at the end of the 17th century. Civil weddings take place here every Saturday between 14:00 and 16:00.

The **Gallery of the Prince** is used for the City's receptions. From here one has a magnificent lake-view of Riddarfjärden. This panorama is reflected on the opposite wall in Prince Eugen's al fresco painting, the "Shores of Stockholm". The window bays in stucco were created by J.A.G. Acke

The room **Three Crowns** has been named after the three chandeliers hanging from the beamed ceiling. The northern wall is covered with silk brocades woven in China. Among the paintings in the room one sees Elias Martin's "View from Mosebacke" painted in the seven-teen-nineties.

The two magnificent copper doors leading to the **Golden Hall** each weigh one ton. The hall contains more than 18.6 million mosaic pieces made of ceramic, glass and gold. Einar Forseth has created a glistening banqueting hall seating up to 700 people. The Hall is dominated by the "Queen of the Lake Mälaren" on the northern wall which represents Stockholm being honored by the East and the West.

EXHIBITORS AT ISF 94

Exhibits will be located in the "Pub" in the basement. A wide variety of educational materials and software will be on display. Exhibit hours are 15:30 to 19:00 on Sunday, 8:30 to 17:30 on Monday, 8:30 to 18:00 on Tuesday and 8:30 to 13:00 on Wednesday.

Meeting ID badges will be required for admission. Exhibitors will wear a red "Exhibitor" ribbon attached to their badge.

Automatic Forecasting Systems, Inc.

Automatic Forecasting Systems is a leader in the development and marketing of statistical forecasting software. We will be demonstrating **AutoBox** the software used in the pre-conference workshop.

Address: Box 563, Hatboro, PA 19040, USA.
☎ +1-215-675-0652, Fax +1-215-672-2534.

Business Forecast Systems, Inc.

Business Forecast Systems, Inc. (BFS) specializes in developing easy to use forecasting software for business. BFS will be demonstrating two new products at the symposium - **Forecast Pro for Windows Version 2** and **Forecast Pro XE** (extended edition). These systems provide complete forecasting solutions for professionals in marketing, sales, finance and manufacturing. Interested attendees can receive a free demonstration package by stopping by the booth.

Address: 68 Leonard Street, Belmont, MA 02178, USA.
☎ +1-617-484-5050, Fax +1-617-484-9219.

Delphus, Inc.

Delphus, Inc. is a software, consulting and training organization specializing in forecasting applications for marketing and operational planning organizations. Delphus will be exhibiting its new, flagship product **PEER Planner for Windows** along with a variety of standalone statistical forecasting packages for time series analysis and educational uses. Free demo software will be available at the booth.

Address: 103 Washington Street, Suite 348, Morristown, NJ 07960, USA.
☎ +1-201-267-9269, Fax +1-201-285-1228,
Email 74242,1020@compuserve.com.

Elsevier Science

Elsevier Science publishes the **International Journal of Forecasting**, the official journal of the International Institute of Forecasters. Free copies are available to participants of the Symposium. Please step by our booth to pick up your free copy.

Members of the IIF, receive a subscription to the **International Journal of Forecasting** as part of their membership benefits.

Address: P.O. Box 211, 1000 AE Amsterdam, The Netherlands.
☎ +31-20-515-3225, Fax +31-20-685-4171.

National Institute of Economic Research (Konjunkturinstitutet)

The National Institute of Economic Research makes short-term forecasts for the Swedish economy, makes quarterly business tendency surveys, and does research related to econometrics and the improvement of forecasting methods. We will inform you of our publications and our time series database, and demonstrate **AREMOS**, the statistical software predominantly used at the Institute.

Address: P.O. Box 3116, S-103 62 Stockholm, Sweden.
☎ +46-(0)8-4535900, Fax +46-(0)8-4535980.

Oxford University Press

Oxford University Press will display books on econometrics and time series analysis.

Address: Walton Street, Oxford, OX2 6DP, UK.
☎ +44-865-56767, Fax +44-865-56646.

Right Information Systems Ltd

Right Information Systems Limited (RIS) publishes state-of-the-art modelling and forecasting software. Its flagship product, **4THOUGHT**, is the world's leading business analysis software package, based on neural network technology.

Address: 9, Westminster Palace Gardens, Artillery Row, London SW1P 1RL, U.K.
☎ +44-(0)71-976 0996, Fax +44-(0)71-976 0901.

WEFA Ltd (Metaplan AB)

WEFA is a leading international forecasting and consultancy group. **AREMOS** is our famous software for forecasting and analysing time series. Our financial and economic time series can easily be accessed from our extensive databases. We also present our industry sector and country by country forecasts.

Address: Jordberga, S-230 20 Klagstorp, Sweden.
☎ +46-(0)410-26001, Fax +46-(0)410-26095.

Stockholm School of Economics/Student Association

Information on Educational Programs and Research at the Stockholm School of Economics, souvenirs (sold by the Student Association).

International Institute of Forecasters

Canada will host the 15th International Symposium on Forecasting in Toronto June 4-7, 1995. The General Chairman for ISF 95 is Professor R. Joel Rahn.

Address: Sciences de l'Administration, Université Laval, Ste-Foy,
Québec, P.Q. G1K 7P4, Canada
☎ +1-418-656-7163, Fax +1-418-656-2624, Bitnet rahnj@lavalvm1.

PRE-CONFERENCE WORKSHOP

A practical workshop of forecasting methods will be held prior to the conference program. The all-day session will be held from 9:00 to 17:00 on Sunday, June 12, at the Stockholm School of Economics.

The workshop will be both theoretical, focusing on the relationships of alternative forecasting models leading to intelligent model selection, and practical with attendees receiving student copies of AutoBox 3.0. A unified approach will link extrapolative models (ARIMA), models using auxiliary series (REGRESSION with ARIMA) and the powerful multiple time series ARIMA models.

The course will be conducted by David Reilly (AFS CO.) a noted educator and software designer and Professor W.S. Wei of Temple University. Professor Wei is the author of the highly acclaimed 1990 text "Time Series Analysis".

Please Note: The workshop is not part of the regular ISF program. A separate registration fee is required. The fee is 1200 kronor and includes the software. The registration fee is payable in advance or at the registration desk.

COMMITTEE MEETINGS

DIRECTORS

Sunday, June 12, 1994
13.00-15.00
Direktionsrum (Level 1)

EDITORS AND ASSOCIATE EDITORS

Sunday, June 12, 1994
15.30 - 17.30
Direktionsrum (Level 1)

COMMITTEE MEETINGS

DIRECTORS

Sunday, June 12, 1994
13.00-15.00
Direktionsrum (Level 1)

EDITORS AND ASSOCIATE EDITORS

Sunday, June 12, 1994
15.30 - 17.30
Direktionsrum (Level 1)

Chair: *Anders Westlund*
Stockholm School of Economics, Dept. of Economic Statistics, P.O. Box 6501, 113 83 Stockholm, Sweden

Opening Remarks

Dr. Bo Rydin
AB Industrivärden, Box 5403, S-114 84 Stockholm, Sweden

Dr. Rydin is one of the most well-known industrial leaders in Sweden. Besides being Chairman of the Federation of Swedish Industries, he is also Chairman of the board of Svenska Cellulosa AB (SCA) and AB Industrivärden. He is also Vice Chairman of Svenska Handelsbanken, and member of the board of several other important companies. He furthermore contributes to academic societies and is a member of the Royal Swedish Academy of Engineering Sciences, the Royal Swedish Academy of Agriculture and Forestry, and member of the board of the Stockholm School of Economics.

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Structural Change and Economic Forecasting

James Stock
Harvard University, JFK School of Government, 79 JFK Street, Cambridge, MA 02138 0000, USA
Mark W. Watson
Northwestern University, Department of Economics, 2003 Sheriden Road, Evanston, IL 60201 USA

This paper focuses on two aspects of structural change and economic forecasting. First, it presents a systematic analysis of the stability of conventional macroeconomic predictive relations for the United States, and documents considerable instability in forecasting models for aggregate output, price inflation and a large number of other macroeconomic variables. Second, it studies the performance of forecasts constructed from stochastic time varying parameter (TVP) models. These models have been extensively studied in the academic literature over the past twenty years, and this paper argues that TVP methods are now ready to solve problems of structural stability in practical forecasting situations, even with large scale models. To show this, the paper uses analytic and Monte Carlo methods to compare alternative TVP forecasting methods across a variety of structural change specifications, and constructs a large number of empirical forecasting models to evaluate the relative performance of the TVP methods in typical small scale macroeconomic forecasting models. Finally, the paper discusses alternative approaches for constructing adaptive (time varying) large multivariate forecasting models, and presents some preliminary results.

Mark Watson is a Professor of Economics at Northwestern University, a Research Associate at the National Bureau of Economic Research, and a Senior Consultant at the Federal Reserve Bank of Chicago. He received his Ph.D. in economics at the University of California at San Diego. Professor Watson has published extensively in the fields of Econometrics, Statistics, Economic Forecasting and Macroeconomics. He currently serves on the editorial boards of the Journal of Applied Econometrics, the Journal of Business and Economic Statistics, Econometrica and the Journal of Monetary Economics.

Can Neural Networks Forecast in the Big Leagues? Comparing Network Forecasts to the Pros

Norman Swanson
    University of California at San Diego, Dept. of Economics, San Diego, CA 92093, USA
Halbert White
    University of California at San Diego, Dept. of Economics, La Jolla, CA 92093, USA

How do artificial neural network forecasts compare to those of the professional forecasters included in the Philadelphia Fed (former ASA-NBER) Survey? This talk will discuss the results of our simulations of real-time out-of-sample neural network forecasts of quarterly economic data, and compare them to the Philadelphia Fed Survey, using a number of different evaluation criteria. We also discuss the relative merits of rolling window vs expanding window forecasting methods.

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

What is the Best Method of Forecasting?

Chair: *Victor Zarnowitz*
> University of Chicago, Graduate School of Business, 1101 58th Street, Chicago, IL 60637, USA

Chris Chatfield
> University of Bath, School of Mathematical Sciences, Claverton Down, Bath, Avon, BA2 7AY, UK

The talk will review the many different time-series forecasting methods available, ranging form simple (univariate) extrapolation methods through to (multivariate) vector ARMA models. Some general recommendations are made on choosing a suitable method, illustrated by real examples, though it has to be realised that there "cannot be a universal forecasting algorithm". Advice will include the importance of clarifying objectives and of studying a clear time plot. There will also be a selective review of recent research on time-series forecasting. Topics covered will include: (1) forecasting competitions (including the recent M2- and Santa Fe-competitions); (2) structural (state-space) modelling; (3) the calculation of prediction intervals; (4) model-selection biases induced by formulating and fitting a model to the *same* data set.

Chris Chatfield is Reader in Statistics at the University of Bath, U.K. He holds a Ph.D. in Statistics from Imperial College, London. He is the author of four textbooks, including *"The Analysis of Time Series"* (4th edn., 1989, Chapman and Hall), and *"Introduction to Multivariate Analysis"* (1980, Chapman and Hall, with A.J. Collins). He is a Fellow of the Royal Statistical Society, an elected member of the International Statistical Institute, and a member of the American Statistical Association. He is a past editor of Applied Statistics, and has been an associate editor of the International Journal of Forecasting since its inception. His research interests cover time-series analysis with emphasis on forecasting, as well as the broader, general question as to how to tackle real-life statistical problems. His book *"Problem-Solving - A Statistician's Guide"* (1988, Chapman and Hall) deals with the latter topic.

Forest Sector Modelling: A Synthesis of Econometrics, Mathematical Programming and System Dynamics Methods

Joseph Buongiorno

University of Wisconsin, Department of Forestry, Madison, WI 53706, USA

Quantitative analysis and forecasting of forest product markets began in the 1950's based almost exclusively on econometric analysis of pure time series. Since then, considerable improvements have been made in the theoretical basis of the models, the statistical methods of estimation, and the coverage of the data. Especially noteworthy is the exploitation of panel data in the analysis of demand. On the supply side, however, activity analysis seems more promising than econometrics. It allows for a detailed description of the techniques of production and, therefore, a better modeling of technical change than the econometric approach. The forest sector models that are used currently for policy analysis and forecasting represent a blend of econometric and mathematical programming, with a dash of system dynamics. Econometrically estimated demand and supply functions are combined with activity analysis of production and transportation, into optimizers to calculate spatial equlibria in multi-product markets. The shadow prices of the optimization are then the key inputs in predicting capacity change by region and process, in system dynamics fashion.

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Joseph Buongiorno is Professor of Forest Management and Economics at the University of Wisconsin, Madison. He holds an Ingénieur degree from the École Supérieure du Bois, Paris, an M.S. from the College of Environmental Science and Forestry, Syracuse, and a Ph.D. from the University of California, Berkeley. He has received the Society of American Foresters' Schenk Award for Outstanding Achievement in Forestry Education (1988), the Hilldale Award of the Social Studies Division of the University of Wisconsin (1990), and the National Award for outstanding research of the Hardwood Research Council (1989). He has worked at the Food and Agriculture Organization of the United Nations, the Consiglio Nazionale delle Ricerche of Italy, the International Institute for Applied Systems Analysis, the École Nationale du Génie Rural des Eaux et des Forêts, and with the World Bank, in forest sector analysis and forecasting.

How Good Will the Information Be in the Information Age?

Nariman Behravesh
DRI/McGraw Hill, 24 Hartwell Ave., Lexington, MA 02173, USA

At a time when the world economy is being transformed by technological revolutions and vast structural changes, the statistical system set up to monitor these changes is badly out of date. For example, the system of national accounts (SNA), designed around the time of World War II, does not adequately account for: 1) the shift from manufacturing to services in the OECD countries, 2) the role of multinational corporations in international trade, 3) the importance of human capital investment (education), or 4) environmental degradation. A framework will be offered for improving the quality, relevance and timeliness of national and international statistics. Also a realistic assessment will be made of the kind of improvements we can expect in the near- to medium-term.

Specializing in international advisory services, Nariman Behravesh is responsible for counseling clients on international trade, finance, government regulations, and global market opportunities. He also directs research and consulting efforts in areas such as privatization, trade policy, and health care.

Dr. Behravesh has an extensive background in economic forecasting, consulting, and management experience, most recently as President and CEO of Oxford Economics U.S.A., Inc.. He also spent 10 years at the WEFA Group, where he held a number of positions, including Chief Economist and Group Senior Vice President. Prior to that he worked at the Congressional Budget Office and the Federal Reserve.

Dr. Behravesh has authored numerous articles in such publications as *European Affairs* and *Credit Week*, and co-authored two books, *Economics USA* and *Microcomputers, Corporate Planning and Decision Support Systems*. He has been quoted extensively in the media on such topics as export opportunities, trading blocs, and globalization.

Dr. Behravesh holds Ph.D. and M.A. degrees in Economics from the University of Pennsylvania, and a B.Sc. from the Massachusetts Institute of Technology. He has lived in Europe and the Middle East, and is fluent in Italian and French.

Forecasting in Formerly Planned Economies

Organizer and Chair: *Seppo Pitkänen*
    Lappeenranta University of Technology, P.O. Box 20, 53851 Lappeenranta, Finland

Development Scenarios in Formerly Socialist Countries

Alari Purju
    The Estonian Institute of Future Studies, Lai 34, EE-00100 Tallinn, Estonia

Development scenarios differ from other forecasting methods in that they allow analysis of relationships between rather disparate factors. The relationships may be of a hypothetical character and can be hard to prove, or even to check. They could also be between quantitative data and qualitative features.

Here we try to describe the future economic environment in Estonia for a potential investor. The scenarios forecast the influence of the relationships between the four factors: macroeconomic stabilization, privatization, direct foreign investment and the relation to CIS.

Only half of the time will be used for this prepared presentation. All participants are encouraged to participate in the subsequent general discussion.

What Should Forecasters Know?

Chair: *Herman O. Stekler*

    Industrial College of the Armed Forces, National Defense University, Fort Leslie J. McNair, Washington DC 20319, USA

Panel Members:

Robert Fildes

    University of Lancaster, Dept. of Management Science, Lancaster LA1 4YX, UK

Stuart Bretschneider

    Syracuse University, The Maxwell School, 400 Eggars Hall, Syracuse, NY 13244, USA

Hans Levenbach

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

Interest has been expressed in a certification program for forecasters. In such a program it would be necessary to determine the criteria for certification. This panel will examine some of the skills that a forecaster should possess. These include awareness of techniques, contextual knowledge, organizational awareness, evaluation procedures and their uses, and understanding of the forecasting process, for example.

Sessions in Chronological Order

Sessions in Chronological Order

Macroeconomic Forecasting using Time Series Models

Organizer and Chair: *Robert M. Kunst*

Johannes Kepler University Linz, A-4040 Linz-Auhof, Austria

Small Sample Properties of the Kullback-Leibler Index for ARFIMA Models

Michael A Hauser

University of Economics and Business Administration, Dept. of Statistics, Augasse 2-6, A-1090 Vienna, Austria

The small sample properties of the Kullback-Leibler index, KLI, are investigated for autoregressive fractionally integrated moving average processes by Monte Carlo simulations. If the associated penalty value turns out to b close to two the AIC may be applied. The penalty factor is not independent of the underlying model in sma samples. The penalty values depend on the estimator used. Especially for MA processes with roots "close" to th unit circle the penalty value is considerably larger than two. The difference of the choices by the KLI and the AI(is illustrated for estimated ARFIMA models of growth rates of international output series.

ARCH Structures in Cointegrated Systems

Robert M. Kunst

Johannes Kepler University Linz, A-4040 Linz-Auhof, Austria

Marc Saez

University of Barcelona, Dept. of Econometrics, Avda Digonal 690, 08034 Barcelona, Spain

We consider a class of cointegrated models that allows for conditional heteroskedasticity in its error structure Conditions for covariance stationarity are analyzed and strict stationarity is explored by means of Monte Carl simulation. Simulation techniques are also used to highlight the finite-sample properties of the maximum likelihood estimator and the influence of rank restrictions. Forecasting properties are illustrated using an exemplar data set.

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Issues in Financial Forecasting I

Chair: *J. Scott Armstrong*
University of Pennsylvania, The Wharton School, Philadelphia, PA 19104-6371, USA

Forecasting Bank Card Industry in France Using Univariate and Multivariate Models

Mohsen Hamoudia
Institut Supérieur du Marketing, 210, Rue du Faubourg Saint Antoine, 75012 Paris, France

The forecasting of *bank card Industry* (Credit and Debit Cards) is still limited today in France, and still without a really established process, within banks as well as within other organisations (such as GIE Carte Bleue/GIE Cartes Bancaires). Yet, *bank card Industry* represents 7 % of the banking activity in France

However, the use of *bank card Industry* will increase in the next years. It is thus necessary to perceive the evolution of this industry and to make short and medium term forecasts.

In this paper, we will lay the results of several models to determine the foreseeable evolution of this industry towards 1996 and we will place the emphasis on the choice of the optimum forecasting models and of the explanatory variables

An Evaluation of Verbal and Nonverbal Forecasting Disclosures in Annual Reports over a three year Period for fifty-five US Companies

Jay Forsyth
Central Washington University, Extended Degree Center, South Seattle, 6000 16th Avenue S.W., Seattle, Washington 98106, USA

The U.S. Securities and Exchange Commission (SEC) requires management of publicly traded companies to disclose in their annual reports any known trends or events that may adversely impact the future economic condition of the entity. These disclosures are called "Management's Discussion and Analysis (MD&A)." The SEC monitors these disclosures for the purpose of assessing compliance with their guidelines, and when necessary modification of previously issued MD&A. The U.S. Freedom of Information act makes it difficult to gain access to the work product of the SEC. The purpose of this paper is to undertake an independent evaluation of the MD&A disclosures based on SEC guidelines.

Benchmarking Sales Forecasting Performance

Chair: *Anne Koehler*
Miami University, Department of Decision Sciences, Oxford, OH 45056, USA

Benchmarking Sales Forecasting Performance

Dwight Thomas
AT & T Networks Systems, 3330 W Friendly Avenue, Greensboro NC 27410, USA
John T. Mentzer
The University of Tennessee, Department of Marketing, Logistics and Transportation, Knoxville, TN 37996-0530, USA

This session will present the findings from a comprehensive forecasting benchmarking survey, sponsored AT&T, involving over 200 companies from a number of industries and countries. Findings on issues such technique familiarity, satisfaction, usage, area of application, and evaluation criteria; forecasting compul systems; and forecasting management approaches will be presented. Particular emphasis will be given to tren over the past decade in each of these areas.

Sales Forecasting in the Scottish Electronics Industry

Moira Watson
Napier University, Dept. of Mathematics, Sight Hill Court, Edinburgh EH11 4BN, UK

In this paper the results from a questionnaire based survey of forecasting in Scottish electronics firms presented. The main findings from this survey are that the need for and practice of forecasting is not \ understood in these businesses and consequently little use is made of quantitative forecasting techniques. findings have been further explored through in depth case studies and these are reported on. Analysis of the stu point to the benefit for combining forecasting methods and the need for a re-location of the forecasting func within the organisation.

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The Quality of Macroeconomic Forecasts

Chair: *Irma Rosenberg*
    Konjunkturinstitutet, Box 2200, 103 17 Stockholm

Diversity, Uncertainty and Accuracy of Macroeconomic Forecasts

Stephen McNees
    Federal Reserve Bank of Boston, 600 Atlantic Ave., P.O. Box 2076, Boston, MA 02106, USA

This paper empirically examines the following issues:
1. Is the conformity (lack of diversity) of individual point estimate forecasts systematically related to the accuracy of those forecasts (or some central tendency of those forecasts)?
2. Is the conformity of individual point estimate forecasts systematically related to the expected uncertainty (as measured by the probability distribution) of those forecasts?
3. Is the expected uncertainty attached to a forecast related to its eventual accuracy?
4. How much does forecast uncertainty vary over time? When has it been largest? When smallest?
5. How closely related is the expected forecast uncertainty of different forecasters over time?
6. How accurate are individual's estimates of forecast uncertainty? How frequently does the actual outcome fall outside the individual forecasters estimated confidence limits?
7. Is high inflation associated with high inflation uncertainty? Is high inflation uncertainty associated with real growth or productivity growth? With nominal interest rates?

Quality Control in Macroeconomic Forecasting

Jan Jacobs, **Elmer Sterken**
    University of Groningen, Department of Economics, P.O. Box 800, 9700 AV Groningen, The Netherlands

The quality of forecasts generated by macroeconometric models depends on the quality of the model including its data, the accuracy of the prediction of exogenous developments and on the craftsmanship of the forecaster(s). This paper describes how the CCSO modelling group tries to control the quality of its forecasting activities.
    Control of forecasts made with the model consists of two components. First, the model's ability to reproduce the recent past is investigated by static and dynamic simulations. Secondly, we confront successive past forecasts with realizations and try to attribute forecast errors to their sources.

Forecasting with Non-Linear Models

Neural Networks I

Organizer and Chair: *Mirko Novak*
>Academy of Sciences of the Czech Republic, Institute of Computer Science, Pod Vodárenskou vezi 2, 18207 Prague 8, Czech Republic

Neural Networks - The Future of Forecasting in Finance?

Hans Georg Zimmerman
>Siemens AG, Corporate Research and Development, ZFE ST SN 41, Otto Hahn Ring 6, 817 39 Munich, Germany

The most well-known forecasting technique in finance is chart analysis, which only evaluates data from a specific time series in the past. In contrast, a fundamental analysis attempts to describe the actual dynamics of the market processes. The success of chart analysis is handicapped by the low volume of input information, while that of a fundamental analysis is limited by the complexity of the market and the fact that it disregards the psychological factors influencing decision making. Neural Networks can be interpreted as an interacting decision process with the ability to extract a high dimensional nonlinear structure from observations by learning. The talk will give a view on the economic interpretation of neural networks and will work out some of the key features that allow the learning of complex structures from a relatively small number of noisy training examples.

Neural Forecasting in Power Distribution

Emil Pelikán, H. Beran, Daniel Pfeffer
>Inst. of Computer Science, Pod Vodárenskov vèzi 2, 18207 Prague 8, Czech Republic

Mirko Novak
>Academy of Sciences of the Czech Republic, Institute of Computer Science, Pod Vodárenskou vezi 2, 18207 Prague 8, Czech Republic

In this contribution we discuss the problems of time-series prediction using artificial neural networks applied for electric load forecasting. We show some of the most important open theoretical and practical problems which we faced in this area and outline our approach to their solution. We also demonstrate some results which we have reached predicting the load for West Bohemian Power Co. using combining neural network based modules.

Forecasting in the Airline Industry

Chair: *Antoni Espasa*

Universidad Carlos III, Departemento de Estadistica y Econometria, 28903 Getafe, Madrid, Spain

A Forecasting Model for Flight Reservations Demand

Klaus L.P. Vasconcellos

Pontificia Universidade Catolica - PUC, Departamento de Engenharia Eletrica, Rua Marques de Sao Vicente, 225, Gavea, 22453-900, Rio de Janeiro - RJ, Brazil

This work intends to describe briefly a model that was developed for forecasting flight reservations. We criticise the methodology normally used in the literature for this kind of problem and then present the basic ideas of the model. We discuss results, obtained from simulations, which seems to indicate the theoretical adequacy of the model. Suggestions are presented for extending the theory that was developed and we also discuss the importance of the sampling interval in modelling

Traffic Forecasting for Airline Operational Planning

Sven-Eric Andersson

Scandinavian Airlines System, Research and Projects, STOPV, 161 87 Stockholm, Sweden

Operational decision making in the airline industry includes deployment of aircraft, catering and service staff. Accurate traffic forecasting is then one of the prerequisites for making proper tradeoffs between spoiled resources and service levels The allocation of space to several booking classes at some thousand daily departures similarly does request forecasts.

Efforts of implementing optimization systems for operational problems have been in process some twenty years since. In SAS there has been successful implementations of systems for passengers flown by departure, and for aggregates at higher levels. Forecasting the departure noshow has been an equally important concern. Booking barometers and reports targeted at strategic business tracking have been implemented.

The Philosophy of Forecasting

Chair: *Spyros Makridakis*
    INSEAD, Boulevard de Constance, 77305 Fontainebleau Cedex, France

The Changing Face of Randomness: Implications of Chaos Theory

Gregory Madey
    Kent State University, College of Business Administration, Kent, OH 44242, USA
Charlene Riggle
    Kent State University, Graduate School of Management, Kent OH 44242, USA

The question "is there a 'random'?" is an old one, much discussed by philosophers and scientists. Two great scientific developments have influenced belief (or lack of belief) in randomness: Newtonian determinism, in which the universe behaved with the certainty of a giant clock; and Heisenberg's uncertainty principle, which indicates that randomness is fundamental. The theory of chaos implies yet another swing of the pendulum towards determinism, but a different determinism than Newton's. We present a historical and philosophical dialogue analyzing the concept of randomness, and discuss the significance of this dialogue to forecasters.

An Historical Classification of Forecasting

Mike Metcalfe
    Adelaide University, Commerce Dept., South Australia, 5005, Australia

Astrology, examining sheep's livers and numerology were considered credible by peoples as intelligent as ourselves. Why? This paper briefly introduces the argument that many of the ancient divination methods have 'logical' origins if only as 'stress management' techniques. It uses Lewinsohn's taxonomy.

State Space Models for Time Series Analysis and Forecasting

Organizer and Chair: *Muhammad Akram*
    University of Bahrain, Business and Management Department, P.O. Box 32038, Sakhir, Bahrain

Spectral Analysis of Money Supply and Employment in the UK and Canada from a **Thermodynamic** Perspective

S. Eggert Peterson, D. Herbert Montaldo
    University of Bahrain, P.O. Box 33012, Isa Town, Bahrain

Classic thermodynamic theory is applied to the relationship between capital and labour in the United Kingdom and Canada. The economic equivalents of momentum, energy and distance are defined. Residuals after extracting trends are Fourier transformed; assuming the ergodic hypothesis, the data are viewed as samples of the possible states of the system. Results are consistent with three fundamental theorems of thermodynamics: (i) the remaining error equals the irreducible thermodynamic noise; (ii) the number of particles in the system is proportional to the volume; (iii) energy of the system is distributed as gamma. We characterize the dimensionality of the Hamiltonian phase space and the lags in the system. The implications for macroeconomic modelling and forecasting are discussed.

Modelling and Forecasting Imported **Japanese Parts Contents of US Transplants: An Error Correction and** State Space Approach

Godfrey Cadogan
    University of Michigan, Industrial and Operations Engineering/Financial Engineering, Ann Arbor, Michigan
    48105, USA

This paper examines the impact of trade policies and custom valuation procedures on estimating the time varying import content of Japanese transplant automobiles. We introduce an error correction model (ECM) and a state space VAR model to purify trade data of measurement errors induced by unobservable prices. We find that disequilibrium adjustments in imported parts relative to transplant production are corrected in one period and U.S. import of Japanese auto parts are elastic to Japanese after market sales and inelastic to transplant production. Moreover, imported parts are responsive to the cyclical behavior of Big 3 production and the debt burden of automobile consumers but not to productivity trends in the automotive industry. The model predicts that Japanese manufacturers will shift more production to the US in response to yen appreciation against the dollar and that current trade policies are ineffective in the long run

State Space Models for **Time Series Polluted with Autoregressive Type Coloured Noise Process**

Muhammad Akram
    University of Bahrain, Business and Management Department, P.O. Box 32038, Sakhir, Bahrain

For analysis and forecasting of time series polluted with autoregressive type coloured noise process, state space models are discussed. To obtain unbiased estimates of the parameters of models and generate optimum one step ahead forecasts, in the sense of mean square error and whiteness of residuals, a procedure to construct these models and apply them to polluted data is discussed. For the selection of a suitable model from a family of candidate models an identification technique based on a nonparametric test statistic is illustrated.

Room 349

Chair: *Anders Westlund*
Stockholm School of Economics, Dept. of Economic Statistics, P.O. Box 6501, 113 83 Stockholm, Sweden

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Structural Change and Economic Forecasting

James Stock
Harvard University, JFK School of Government, 79 JFK Street, Cambridge, MA 02138 0000, USA
Mark W. Watson
Northwestern University, Department of Economics, 2003 Sheriden Road, Evanston, IL 60201, USA

This paper focuses on two aspects of structural change and economic forecasting. First, it presents a systematic analysis of the stability of conventional macroeconomic predictive relations for the United States, and document considerable instability in forecasting models for aggregate output, price inflation and a large number of other macroeconomic variables. Second, it studies the performance of forecasts constructed from stochastic time varying parameter (TVP) models. These models have been extensively studied in the academic literature over the past twenty years, and this paper argues that TVP methods are now ready to solve problems of structural stability in practical forecasting situations, even with large scale models. To show this, the paper uses analytic and Monte Carlo methods to compare alternative TVP forecasting methods across a variety of structural change specifications, and constructs a large number of empirical forecasting models to evaluate the relative performance of the TVP methods in typical small scale macroeconomic forecasting models. Finally, the paper discusses alternative approaches for constructing adaptive (time varying) large multivariate forecasting models, and present some preliminary results.

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Operations Research

Chair: *Kajal Lahiri*
> Social Security Administration, Division of Economic Research, 4301 Connecticut Ave., N.W., Washington, D.C. 20008, USA

Exponential Smoothing in Practice: **Its Forecasting Accuracy and its Value**

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Exponential smoothing remains the most common univariate forecasting method, forming the basis of most, if not all, production/inventory control forecasting systems. Yet guidelines on its application, and the financial consequences of its mis-application are few. This paper summarises two pieces of work looking at the accuracy of different approaches to exponential smoothing and then examines, using a simulation of a manufacturing system whether the observed differences in accuracy are financially important.

Applications of Quality Control Methods in Forecasting

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There are a variety of ways in which statistical quality control methods can be applied to forecasting. Control charts can be applied to the forecast errors to help identify the nature of the variation in these errors. Such an identification might be used to evaluate forecasters or forecasting models. Another suggestion is to use exponentially weighted moving average control charts in an adaptive control procedure. Some of these potential applications of statistical quality control to forecasting will be demonstrated.

Forecasting Accidents of a System

Xu Huimin, Li Rui
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Every system -- whether technical and natural or social system -- has unnormal outputs. This kind of outputs we do not need in design and use can be called "accident" as we familiarize. In view of above-mentioned reasons, we can say, every system is an "accidenting generating system". Outwardly, accidents generating form a system look like random. In fact, they are regular. In this paper, a math method is used to demonstrate it reasonable that accidents of a system have their inherent regularity, then give a proof of forecasting accidents of a system. At last, the importance of this conception will be discussed.

Environmental Planning **Forecasting Emission Reduction Credits**

Martin R. Morman
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This paper presents a scenario based approach to forecasting emission reduction credits. Also provided is a discussion of the direct linkages with proactive strategic planning models. A description of situations where emission trading strategies are used is included.

Evaluating Forecasts I

Chair: *Lars-Erik Öller*
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The Consistency, Value and Relevance of Various Accuracy Measures

Michèle Hibon, Spyros Makridakis
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At present there are many accuracy measures, or loss functions, available and conflicting views about the consistency, value and relevance. This paper studies these measures using the data of the M-Competition divide into nine different subsamples, each consisting of 111 series. It first evaluates their consistency to the nii subsamples. Consequently, the value of each measure to provide useful information and its relevance to decision making are examined. The paper concludes that a modified version of MAPE (Mean Absolute Percentage Error in comparison to the accuracy of Naive 2 (random walk when seasonality has been taken into account), is the mc consistent measure, with a high value that provides the most relevant information to decision makers. Oth measures supply useful information for specific purposes and can be used to supplement MAPE.

Hypothesis Tests for the U2 and S Error Measures

Sevket I Gunter
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We consider inferences that can be made using the S-type and Theil's U2-type relative error measures f evaluating the ex ante predictive ability of forecasting or forecast combination models. Via Monte Ca simulations, the probability distributions of these measures are derived under certain simplifying assumpti. Hypothesis tests are developed to test the significance of the difference of the relative error metric from unit assuming calibrated numerator and denominator forecasts. Then, the tests are generalized to allow for uncalibra numerator and denominator forecasts based on approximation formulae for computing the tail percentiles of t distributions of the error metrics.

Is There a Consensus Among Financial Forecasters?

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    20319, USA
R A Kolb
    US Military Academy, Department of Mathematics, West Point, NY 10996-1786, USA

This paper examines the forecasts of financial analysts to determine whether, at any instant of time, there is general agreement about the direction of change of interest rates over the next six months. In other words, is the a consensus forecast? Three different methodologies are used to address this question: (1) the distribution of t forecasts; (2) a relative entropy measure; and (3) a new measure not previously used in the forecasting literatu the Kappa coefficient. The three methodologies are explained, and applied to forecasts for the period 1982-1992

Chair: *Markku*
    University

Finding the Ini
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William M Bols
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Bayesian Methods in Forecasting I

Chair: *Markku Rahiala*
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Finding the Initial Prior Distribution in The Multiprocess Dynamic Linear Trend Model with Dummy Seasonal Effects by Backcasting in the Time Reversed Model

William M Bolstad
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The Harrison-Stevens forecasting algorithm for the multiprocess dynamic linear model requires initial estimates of the parameter vector and its covariance matrix. The influence of the initial estimates and covariance matrix on the forecasts eventually dies out, but not soon enough for a short time series. An initial ignorance prior is used for the time $n+1$ parameter vector in the time reversed model to backcast the parameter vector at time 0 and its covariance matrix. These are used as the forward model initial estimates to forecast the time $n+1$ vector and covariance matrix. The output from one model are the initial estimates in the other model until the prior distribution at time 0 converges to the values that minimize the sum of squares of forecast errors. This empirical Bayes prior gives good forecasts for a short time series.

Forecasting U.S. Home Sales Using BVAR Models and Survey Data on Households' Buying Attitudes for Homes

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David J. Smyth
Lousiana State University, Dept. of Economics, Baton Rouge, LA 70803, USA

This study uses bayesian vector autoregressive models for the U.S. housing market to examine the usefulness of survey data on households' buying attitudes for homes in predicting sales of homes. We find a negligible deterioration in the accuracy of forecasts of home sales when buying attitudes are dropped from a model that includes the price of homes, the mortgage rate, real personal disposable income, and the unemployment rate. This suggests that buying attitudes do not add much to the information contained in these variables. We also find that forecasts from the model that includes both buying attitudes and the aforementioned variables are similar to those generated from a model that excludes the survey data but contains the other variables. Additionally, the variance decompositions suggest that the gain from including the survey data in the model that already contains other economic variables is small.

Further Evidence on Forecasting International GNP Growth Rates Using Unobserved Components Transfer Function Models

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Universidad Complutense de Madrid, Departemento de Economía Cuantitativa, Madrid, Spain
Antonio Garcia-Ferrer
Universidad Autonoma de Madrid, Departamento de Analisis Economico, Cantoblanco, 28049 Madrid, Spain
Peter Young
University of Lancaster, Dept of Environmental Science, Lancaster LA1 4YQ, Bailrigg, UK
Juan del Hoyo
Universidad Autonoma de Madrid, Departamento de Analisis Economico, Cantoblanco, 28049 Madrid, Spain

Forecasts of international GNP growth rates are computed using a novel, unobserved components model that allows for estimating the trend and the perturbational components in GNP data. The model is formulated in space state terms, and estimated using recursive methods of filtering and fixed interval smoothing. The decomposition crucially hinges on the choice of the Noise-Variance Ratio parameter. As in any other signal extraction method, the choice of the relevant parameters affects the statistical characteristics of the estimated components. Here, we incorporate a priori beliefs on the values of the NVR parameter leading to a decomposition with reasonable business cycle properties. Throughout the paper, forecasts comparisons are made with other Bayesian and non Bayesian alternatives.

On the Efficacy of Time Series Forecasting Using Cross-Sectionally Pooled Data

Wilpen Gorr, George T Duncan, Janusz Szczypula
Carnegie Mellon University, Heinz School of Public Policy and Management, Pittsburgh, PA 15213, USA

Previously, the authors demonstrated that Bayesian shrinkage applied to incorporate cross-sectional data into the Multi-State Kalman Filter yields much improved forecast accuracy over the single time series version of the same method. The current work introduces additional cross-sectional models (e.g., cross-sectional Holt) and comparisons with standard time series methods. We provide evidence that our cross-sectional Multi-State Kalman Filter is the most accurate under difficult forecasting conditions (short time series and/or structural changes). Bayesian shrinkage transforms the sophisticated, but unreliable Multi-State Kalman Filter into a reliable and very accurate method.

Neural Networks II

Chair: *Richard Hoptroff*

Right Information Ltd., 9, Westminster Palace Gardens, Artillery Row, London SW1P 1RL, UK

An Empirical Investigation of the Optimal Composition of Neural Net Training Sets

Charlene Riggle

Kent State University, Graduate School of Management, Kent OH 44242, USA

Frank Dull, Douglas Kline

Graduate School of Management, Kent State University, Kent OH 44242, USA

Intuitively, it would seem desirable that the training set for a neural net forecasting application consist of a representative sampling of the data; this is not the case. For example, if a net were trained on a representative sample of data in which outcome A occurred 95% of the time, the net would "learn" to forecast outcome A each time regardless of the input; the net would achieve an accuracy rate of 95%, but would be worthless. We use the security logs for the computer system of a Fortune 500 company to examine the effect of varying training set compositions on forecasting accuracy

Linear Versus Non-Linear Forecasting: A Look at Neural Networks

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Emilio Barucci

Università di Firenze, DIMADEFAS, Via C. Lombroso 6/17, 50134 Firenze, Italy

Leonardi Landi

Università di Firenze, Dipartimento di Sistemi e Informatica, via Santa Marta 3, 50139 Firenze, Italy

Recent developments of time-series analysis are concerned with capturing intrinsic non-linearities in economic phenomena. The goal of this paper is to show how starting from non-linear behavior, the adoption of Artificial Neural Networks (ANNs) may unravel patterns missed by linear models.

The methodological and empirical aspects of this paper relate to the additional information provided by the ANN with reference to a specific series, the Italian 12-month T-bill bi-monthly auction outcomes, with respect to conventional linear methods.

The results presented relate to the capability of the ANNs to capture signals in the values of the series that could help predict the 1992 EMS breakdown, or, once that breakdown is included in the training set, the latest behavior in the series.

Prediction of a Periodic Series Using Singular Value Decomposition and Neural Networks

P.P. Kanjilal, Sarbanit Palit

Indian Institute of Technology, Dept. of Electronics and ECE, Kharagpur-721302, India

A new approach for modelling and predicting nearly periodic time-series has been proposed. The prime objective is to produce one period ahead prediction. The model consists of two stages: an orthogonalization stage based on the singular value decomposition (SVD), and a subsequent stage of feedforward neural network. SVD based orthogonalization results in optimal compaction of information and the neural network permits nonlinear modelling of the orthogonalized components. This approach yields good prediction performance and at the same time is computationally robust.

Forecasting with Non-Linear Models

An Artificial Neural Network for Forecasting the Amount of Roadway Surrounding Rock Deformation

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China University of Mining and Technology, Postgraduate Dept., Doctor Class of 1993, XuZhou, JiangSu 221008, P.R. China
Wang YuJun, Yang CangLing, Lu ShiLiang
China University of Mining and Technology, XuZhou, JiangSu 221008, P.R. China

The forecast of roadway surrounding rock deformation amount is a very complicated forecast because it affected by many factors. Owing to its nonlinear character, it is difficult to set up the mathematical model by means of classical method. It is still a problem which hasn't been solving at home and abroad. This paper present the methodology and results of applying a neural network to the roadway surrounding rock deformation forecas The network is trained on spot datum under different conditions. The results show that the network learned th training set perfectly and has a comparatively high accuracy.

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Problems of For the Past and the

Lajos Besenyei
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**Problems of Inf
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Tibor Pál
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Forecasting in the Former Socialist Countries I

Organizer and Chair: *Lajos Besenyei*
University of Miskolc, Dept. of Statistics and Accounting, Miskolc-Egyetemváros, H-3515, Hungary

Problems of Forecasting in the Transforming Hungarian and Eastern European Economies (Gap Between the Past and the Future)

Lajos Besenyei
University of Miskolc, Dept. of Statistics and Accounting, Miskolc-Egyetemváros, H-3515, Hungary

Changes taken place in the economies of Hungary and other former socialist countries caused a new and unprecedented situation in the economic decision making processes. The connection between the past, the present and the future came to a break both in macro- and micro level, because processes in the past do not or partly continue in the future. Economic time-series became unusable and the classic forecasting methods became out of date (provisionally). Essential social changes moved in line with economic changes, or sometimes got ahead of them, so the development of the economic-business view about the future has been further extended with significant level of uncertainty (privatisation, foreign direct investment).

What are the present and future prospects for business forecasting in Hungary and other Eastern-European countries? That will be the topic of my paper

Problems of Information Gathering Coming from the Different Characteristics of Enterprises in the Present Hungarian Economy

Tibor Pál
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During the last couple of years information became more and more important for enterprises in the Hungarian economy and especially in the Northern region of the country. This region on one hand is characterized by significant number of bankruptcy and liquidation activities, while on the other hand by the growing number of new enterprises.

Within a relatively short period small and medium size enterprises became the major "source and user" of information in Hungary.

Although there is a growing demand for financial and other information about the enterprises' performance, the official reporting system presently is unable to provide all the required information.

The development of changes in the content and structure of information and in the fore of information brings a challenge for the Hungarian managers.

This paper concentrates on how the changes in the demand for information and in the data required for forecasting can be characterized and categorized to help this change process.

Dilemmas on Using Forecasting Methods in the Analyses of Present Hungarian Economy

Csaba Ilyés
University of Miskolc, Dept. of Statistics and Accounting, Miskolc-Egyetemváros, H-3515, Hungary

The present Hungarian economy lives under changing conditions. Experts, who want to obtain a comprehensive view about the Hungarian economy to make forecasts, find a particular situation. In this paper I would like to survey these characteristics of the present Hungarian economy from the point of view of using business forecasting methods.

First I will show the most important socio-economic changes and their consequences emphasising the economic structure of a country in transition period, the tendency of economic processes and time-series, the economic effects of new occurrences, etc.

Then I will analyse what kind of problems may occur during the application of forecasting methods in these economies.

Finally I would like to suggest methods that can be used successfully in this transition period.

Forecasting Energy Demand

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

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Combining Economic and Cointegration Restrictions in the Forecasts of Energy Demand

Andreas Yannopoulos, Ian D. McAvinchey
    University of Aberdeen, Dept. of Economics, Edward Wright Building, Dunbar Street, Old Aberdeen AB9
    2TY, UK

Philip Klein
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Energy input demands (oil, gas, coal and electricity) for UK industry are obtained from a translog cost functio U.S Bureau of N
as a non-singular system of three share equations which are then tested as a cointegrated system. A consistent index relate to:
estimated error correction model (ECM) suffers from finite sample bias and inefficiency, so the Granger and Yo furnaces and b:
(1987) (GY) adjustment is applied to the system. In forecasting, two sets of restrictions are applied to a VA tracking cyclica
version of the model, (i) those from the cost function; and (ii) those from cointegration; allowing four sets growth rates in i
forecasts (a) the unrestricted VAR; (b) the VAR with restrictions (i); (c) the VAR with restrictions (ii); and (d) th the relation of si
VAR with restrictions (i) and (ii); each to be evaluated along with the GY adjustment.

Inflation Cycle:

Stochastic Intersectoral Model for the Analysis and Forecasting of Energy Consumption

John Cullity
Rutgers Un

Nickolay V. Simakov
    Russian Academy of Sciences, Central Economic & Mathematical Institute, Krasikova Str. 32,   7 418
    Moscow, Russia

Geoffry H. Moo:
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The paper addresses problems of energy-economy interaction under uncertainty. One of the important proble   A critical pro
of this research is to estimate the structure of energy demand in various scenarios of development of economy. 1 products. This p
impact of energy consumption on the rate of economic growth is also considered. The stochastic intersecto prices. The Cen:
model is used to solve these problems. The system is functioning under uncertainty, parameters being determit track future chat
by intervals. To determine solution we use the modified Kalman filter algorithm. Different schemes of t the various com;
algorithm for estimation of parameters of the model are considered in the paper- The model was implemented determine which
IBM PC AT in the form of interactive system. The interactive regime is effective in the multiple variants analv
of sector output dynamics corresponding to the given trajectory of economic growth.   **The Continuing**

Improved Probability Forecasts Derived from Theoretical Distributions

Victor Zarnowitz
University:

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

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Forecast distributions for daily electricity peak loads, a set of extreme values, have previously been develo; sharp contrast in
Parameters for the normal, gamma and Weibull distributions have been estimated by maximum likelihood: alternating inflat
method of moment procedures, with the Weibull providing the best results among the three when attemptin; very few, small:
obtain well-calibrated, post-sample forecasts of daily peak loads. Additional work indicates that (1) the Ca; only when differ
and beta distributions may be even better than the Weibull and (2) the kernel method of density estimation: Historically, def!
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Forecasting Economic Activity in Metals Industries I

Organizer and Chair: *Philip Klein*
> Pennsylvania State University, 516 Kern Graduate Building, University Park, PA 16702, USA

Economic Indicator Forecasting for the Steel Industry

Philip Klein
> Pennsylvania State University, 516 Kern Graduate Building, University Park, PA 16702, USA

The Center for International Business Cycle Research has constructed leading and coinciding indexes for the U.S Bureau of Mines which are published monthly in *Metal Industry Indicators*. The components of the coincident index relate to: (1) the production of basic steel and mill products; (2) the value of shipments of steel works, blast furnaces and basic steel products. This paper examines the recent effectiveness of the steel leading index in tracking cyclical movements in these measures of overall acivity in the steel industry. It also tests the ability of growth rates in the leading index to forecast growth in the coincident index and its components. Finally it considers the relation of steel cycles to business cycles.

Inflation Cycles and Metals Prices

John Cullity
> Rutgers University, Department of Economics, Newark, NJ 07102, USA

Geoffry H. Moore
> Columbia University, New York, USA

A critical problem in management decision-making is what is ahead for prices of raw materials and finished products. This paper describes experiments designed to develop tools which may be useful in monitoring metals prices. The Center for International Business Cycle Research has already developed a leading inflation index to track future changes in the consumer and producer prices. This paper examines in detail the relationships between the various components of the CIBCR leading inflation index and the Journal of Commerce metals price index to determine which may be of use in constructing a leading composite index for metals prices.

The Continuing High Cyclicality of Both Prices and Real Activity in Primary Metals Industries

Victor Zarnowitz
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The long trend in the index of U.S. metals prices in 1948-94 resembles broadly the concurrent evolution of general price levels as measured by the U.S. consumer and producer price indexes (CPI and PPI). But there is a sharp contrast in cyclical behaviors. Whereas the metals price index fluctuates up and down around its long trend, alternating inflationary rises with deflationary declines in a clear procyclical pattern, the PPI and CPI show only very few, small and short declines. They are dominated by smooth upward trends, that is, secular inflation, and only when differences reveal a procyclical but irregularly lagging pattern of alternating faster and slower inflation. Historically, deflation often occurred during and following cyclical slowdowns and contractions (particularly the major ones, and so in the PPI and in the CPI), but in the last half-century disinflation generally replaced deflation in this role. In other words, most product prices, along with wages, show much increased downward rigidity. However, for metals (as well as other raw materials and assets) the old cyclical price dynamics still applies: prices vary with demand and supply in the short run, with costs in the long run.

According to some theories, greater cyclical flexibility in prices should reduce the cyclical variability in quantities (real orders, production, shipments, inventories). But real activity is more, rather than less, cyclical and volatile in the primary metals sector than overall or in the rest of the economy. This is evident from comparisons of the metals coincident index with the U.S. coincident index and with U.S. industrial production. All this applies to the business cycles and to the growth cycles perspective alike. The paper will consider some possible explanations of these phenomena.

Time Series Methods

ARMA and VAR Models

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Some Results on Specification Search and Pre-Testing in the Box-Jenkins ARMA(1,1) Model

Timothy Oke
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The Box-Jenkins ARMA(1,1) is considered as our true model in a Monte Carlo design. As this true model is generally not known in advance, there is a question of either to just estimate the model as ARMA(1,1) or AR(1), or to perform some test of significance on parameters prior to the specification of the model. The latter alternative is a common practice and defines the specification pre-test. Using the usual t-test in our pre-testing scheme we investigate estimation, testing and forecasting after this pre-testing. We find that the pre-test estimator is not always dominated by the others.

Maximum Likelihood Estimation of an Exact ARMA Model; Asymptotic Behavior of the ARMA Model

Jan van der Leeuw
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First a closed form for the exact covariance matrix of the ARMA(p,q) model is presented. Based here upon first order conditions for the ARMA-parameters are derived and solved. Analytic expressions for the second derivatives of the ML function have also been derived.

Asymptotically estimates of regression coefficients can be based upon a simple form of the covariance matrix. The ML estimates of the ARMA parameters depend upon the limit of the determinant of the covariance matrix, which has not a simple form.

The solutions for the AR and MA parameters are in general conditional. Only in the pure MA and AR case of a time series model direct solutions are found.

Parameter Reduction in Long-Term VAR Forecasting Models

Ronald Bewley, *Minxian Yang*
University of New South Wales, Dept. of Econometrics, PO Box 1, Kensington NSW 2033, Australia

Vector Autoregressive (VAR) modelling has become increasingly popular as a method for forecasting multiple time series. However, one major problem that frequently occurs in such modelling is that a large number of parameters have to be estimated from relatively small samples. A number of suggestions have been made to reduce the parameter space. In one line of research, the VAR model is reparameterised and a subset of parameters are excluded from this new space [Box and Tiao (1977), Ahn and Reinsel (1990]. In another line of research, Bayesian priors are imposed, but typically in a manner which implies that no long-run economic relationships exist [Doan Litterman and Sims, 1984]. In this paper we consider an approach that preserves any cointegrating relationship while reducing the parameter space for the short-run dynamics. Tests for and estimates of cointegrating relationships are conducted within the Box-Tiao framework following Bewley, Orden, Yang and Fisher (1994) and Bewley and Yang (1993). The approach is illustrated using an eight equation VAR of the components of the Australian current account deficit and evaluated in a Monte Carlo study.

Time Aggregation and VAR Forecasts. Some Empirical and Monte Carlo Results.

Dikaios Tserkezos

Hellenic Industrial Development Bank S.A., 18, Panepistimou Ave., 106 72 Athens, Greece

Although numerous articles examine the effect of VAR forecasts from changes in the variables included in the model, and from changing the lag structure, little has been done to examine the effect of different time aggregation (disaggregation). This paper using empirical and Monte-Carlo results confirms the well known property that as we move from high to low frequency data we lose information and this is reflected on the accuracy of both the estimates we get and the precision of the forecasts we make.

Forecasting Profitability on Micro and Sectoral Levels

Organizer and Chair: *Pentti Vartia*
  Research Institute of the Finnish Economy, Lönnrotinkatu 4 B, SF-00120 Helsinki, Finland

Chair: *Stefan*
Florida

Measuring and Forecasting Profits in an Experimentally Organized Economy

Gunnar Eliasson
  IUI, Box 5501   14 85 Stockholm, Sweden

Ronald Mah
Univers

  The experimentally organized economy features firms with limited possibilities of forecasting profits throug traditional statistical methods. Subjective business intuition and beliefs dominate. What does that mean for firm organization behaviour and control? How does an economic environment frequently exhibiting disorder ("chaotic") behavior affect the possibilities of measuring profits and capital? The presentation will be bol theoretical and practical with illustrations from the organization and use of information systems in firms.

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Price Development in World Metal Markets

Lars Mathiesen
  Norwegian School of Economics and Business Administration, Foundation for Research in Economics and
  Business Administration, 5030 Bergen-Sandviken, Norway

Peter Pauly
Univers

  Marshallian supply and demand is used to infer how prices develop over time in markets for commodity-lik products and services, e.g. metals and crude-oil shipping. In industries where demand shifts while costs a capacities are stable, there is a strong tendency towards overcapacity. Individual producers have strong motives become more cost-efficient whereby the industry becomes more competitive. Although there are large variation over time, prices and profitability are low most of the time. A PC-based model with n producers of a homogeneo product selling in m segments of the market is proposed as a tool for understanding market mechanisms and pri formation.

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Forecasting Profitability by Branch

Forecasting

Olavi Rantala
  The Research Institute of the Finnish Economy (ETLA), Lönnrotinkatu 4B, 00120 Helsinki, Finland

Stefan C.

  The paper presents the methods used by the Research Institute of the Finnish Economy (ETLA) in forecastin profitability by branch in Finland. This profitability analysis is made twice a year for the manufacturin construction, trade and transport branches. The forecasting framework is based on statistics from financi statements and on the National Accounts. The latter statistics enable us to analyse the changes in corporate profi (gross operating surplus in the N.A.) on the basis of the volume of production, labor input, unit labor costs a production prices which are evaluated in our macroeconomic and sectoral forecasts. The gross operating surplus different branches determined by these underlying factors is then used to forecast the operating margin, which i standard profitability indicator in the financial statements and familiar to corporate analysts.

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Exchange Rate Forecasting I

Chair: *Stefan C. Norrbin*

Florida State University, Department of Economics, 475 Bellamy Building, Tallahassee, FL 32306, USA

Forecastability of Exchange Rate Volatility: the Stochastic Volatility Case

Ronald Mahieu

University of Limburg, P.O. Box 616, 6200 MD Maastricht, The Netherlands

In this paper exchange rate volatility is modeled stochastically, as opposed to ARCH-like models. We investigate the statistical properties of the models using different specifications of the volatility equation. Inclusion of exogenous variables in volatility leads to significant improvements. The models are presented in state-space form, which allows us to use Kalman Filter type algorithms to estimate latent volatility. Besides quasi maximum likelihood methods we use the simulated EM algorithm described by Shephard (1993). This method provides us with efficient estimators of the parameters of interest. The models are used to price currency options.

Random-Coefficient Autoregressive Modeling of Non-Linear Time Series: The Case of Exchange Rates

Peter Pauly

University of Toronto, Institute for Policy Analysis, 140 St. George St., Toronto M5S 1A1, Canada

In recent years, the time series properties have been shown to be close to random walks, but with significant non-linearities. In this paper, we examine the random-coefficient auto-regressive (RCA) model and its properties as a useful approximation to such processes. The model can be shown to encompass several competing specifications of near-unit root models. The RCA model generates a rich class of processes that are mean zero, symmetric and leptokurtic, whose temporal aggregates approach asymptotic normality, and which has increasing variance in time We discuss the properties of the model, in particular how it captures known salient features of high-frequency asset market data. We then demonstrate maximum-likelihood estimation of the state-space form of the model using the Kalman filter and present results based on monthly exchange rate data for several currencies.

Forecasting Exchange Rates Using PPP

Stefan C. Norrbin, *Kevin L. Reffett*

Florida State University, Department of Economics, 475 Bellamy Building, Tallahassee, FL 32306, USA

If PPP is a cointegrated relationship, then a VECM can be derived that has as part of the system a spot rate forecasting equation. In this paper we show that this equation is analogous to the forecasting experiment in Bilson (1984), where he showed excessive returns to investors using PPP disequilibria as a trading rule. We show that Bilson implicitly assumes that prices are exogenous, whereas our results show that spot rates are strongly exogenous in the system. Furthermore we show that Bilson's investment strategy is, in fact, a type of threshold cointegration process that can be modeled as a smooth transition function. We use this transition function as a forecasting strategy

Comparison of Forecasting Performance of Exchange Rate Models: Random Walk Versus the Monetary Models Estimated Using a Multicointegration Approach

Fatma Taskin
    Bilken University, Dept. of Economics, Bilkent, Ankara 06533, Turkey

The objective of the study is to compare the forecasting performance of random walk models with the monetary models of exchange rate determination when multicointegration estimation technique is used. Meese and Rogof (1983) have shown that random walk models perform better than the monetary exchange rate models in predicting nominal exchange rates. The paper focuses on the Turkish Lira (TL)/US dollar ($) and TL/Deutsche Mark (DM) exchange rates for the period 1988(8)-1993(12), during which Turkey followed a market determined exchange rate regime. In preliminary forecasts conducted with reduced form exchange rate equations, it was found that no one specific model outperforms the other consistently. This paper estimates the flexible price, sticky price and trade balance variable augmented versions of the monetary models and evaluates the forecasting performance of these models when multicointegrating relationships are included.

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Issues in Demand Forecasting

Chair: *Roderick J. Brodie*

The University of Auckland, Department of Marketing and International Business, Private Bag 92 019, Auckland, New Zealand

Forecasting Competitors' Actions When Analysing Market Share: Theoretical and Empirical Results

David Griffith

The University of Auckland, Department of Marketing and International Business, Private Bag 92 019, Auckland, New Zealand

Peter Danaher

University of Auckland, Department of Marketing & International Business, Private Bag 92-019, Auckland, New Zealand

Roderick J. Brodie

The University of Auckland, Department of Marketing and International Business, Private Bag 92 019, Auckland, New Zealand

An important but neglected problem when analysing market share is how to accurately forecast competitors' actions. Only two empirical studies have explicitly investigated this problem. The first study by Alsem, Leeflang and Reuyl (1989) compared the accuracy of simpler and more sophisticated models to forecast competitors actions and concluded the simpler models were just as accurate. The second study by Brodie and Bonfrer (1993) compared the forecasting accuracy of causal econometric market share models with a naive model of lagged market share. Their results showed that if competitors actions were known then a causal market share model had greater forecasting accuracy than the naive model. However for the more realistic case when it was necessary to also forecast competitors actions the naive model was more accurate.

This paper replicates and extends the Brodie and Bonfrer study. First the theoretical conditions are derived for the case when causal market share models are expected to have greater forecasting accuracy than a naive model. Second a greater variety of models to forecast competitors actions are developed and third the forecasting accuracy of these models are examined using a more representative sets of data.

A Framework for Demand Forecasting Decisions

Nils Rudi

The Wharton School of the University of Pennsylvania, Operations and Information Management, Philadelphia, PA 19104, USA

Other than forecast accuracy, the efficient presentation of the forecasting model, any relevant outside information, and the forecast driven managerial decisions are also important practical aspects of a total decision framework. Recent developments in information technology have facilitated new approaches to decision making. Based on these new opportunities, we propose a framework for demand forecasting. To illustrate the framework, we demonstrate a decision support system developed in cooperation with Minard Development AS. Experience with the framework in real world settings is discussed. The principles behind the framework are transferable to other areas of forecasting or decision making.

Room 336

Functional Relationships for the Estimation of Demand Variance

John Edward Boylan
Buckinghamshire College, Business School, Newland Park, Chalfont St Giles, Buckinghamshire, HP8 4AD, UK
Frank Roy Johnston
University of Warwick, Business School, Coventry CV4 7AL, UK

In forecasting for inventory management, the demand variance for each stock-keeping unit must be estimated. Direct estimation of variance from the data is problematic and many systems use a relationship linking the variance of demand to its mean. In this paper, a theory of such functional relationships is developed for compound Poisson demand. The assumptions behind the compound-Poisson model are examined and the robustness of functional relationships to departures from those assumptions are analysed. The paper concludes with a discussion of the relevance of the results to single-item demand forecasting and aggregate inventory planning.

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Business Survey Data and the Kalman Filter in Short-Term Forecasting of Industrial Output

Organizer and Chair: *Timo Teräsvirta*
Copenhagen Business School, Dept. of Statistics, Julius Thomsens Plads 10, DK-1925 Fredriksberg C, Denmark

Forecasting Industrial Production with Business Survey Data: Experience from the Finnish Recession 1990 - 93.

Eija Kauppi, Jukka Lassila
The Research Institute of the Finnish Economy (ETLA), Lönnrotinkatu 4 B, FIN 00120 Helsinki, Finland

The Finnish recession in the early nineties provides an interesting testing ground for forecasting models specified and estimated before the recession. We use recent data to evaluate some short-term forecasting models for industrial production. The main explanatory variables are from business surveys and the models themselves are based on the use of Kalman filter. The "recession test" was demanding especially in branches connected with the domestic market. These markets were hit harder by the recession, and the forecasting models also behaved poorly compared to earlier post-sample forecasts. The more export-oriented branches came out of the recession more quickly, and their forecasting models also seem to work better. In forestry the forecasting performance was actually slightly better than in earlier periods. In earlier studies it has been found that the improvement in prediction accuracy after taking account of relevant business survey information is significant in most branches when the precision of autoprojective forecasts is used as a baseline. For the new data this, however, only seems to hold for some export branches.

Smooth Indicators for the Swedish Economy, based on Statistical Data and the Business Tendency Survey

Lars-Erik Öller, Christer Tallbom
National Institute of Economic Research, P.O. Box 3116, 103 62 Stockholm, Sweden

Official statistics (OS) on manufacturing, exports etc. is generally regarded as accurate, as compared to eg. business tendency survey data (BTS). However, some OS data arrives with a considerable delay and is after that substantially revised. Also, OS may be so contaminated by high frequency noise as to make it unreliable for short term monitoring and forecasting.
Here, BTS data is used to help AR updating of OS. A low pass exponential smoothing filter is incorporated into the Kalman algorithm used. The ultimate goal is not to "forecast" OS by BTS but to construct new low noise indicators providing both coincident and leading signals of the business cycle.

Business Survey Data in Forecasting the Output of Different Branches of the Industry: Two Kalman Filter Approaches

Markku Rahiala
University of Oulu, Dept. of Applied Mathematics and Statistics, 90570 Oulu, Finland

Two possibilities to make use of business survey data in forecasting the output of different branches of the industry will be discussed. Both methods take the business survey answers as indirect observations on the output volumes and are based on the use of linear system models and the Kalman filter. To our surprise, the simpler method clearly outperformed the more sophisticated approach in practice. Results obtained by the simpler method with Finnish and Swedish data have already been reported in Rahiala and Teräsvirta (1993). Reasons for the failure of the more sophisticated model will also be discussed.

Judgemental Forecasting I

Chair: *Derek W. Bunn*
London Business School, Sussex Place, Regent's Park, London NW1 4SA, UK

Does It Matter Who Revises an Initial Forecast? The Case of EPS Forecast Revision

Kamal M El-Sheshai
Georgia State University, Department of Decision Sciences, University Plaza, Atlanta, GA 30303, USA

Security analysts and brokers often revise, at least once, initial forecasts of earnings-per-share (EPS)
Frequently, the same analyst makes the initial and the revised forecasts. Sometimes, however, an analyst revises a
initial forecast that was issued by another analyst from the same brokerage or research firm. This study examine
three related issues. The first is the effect of "who" revises a forecast on the forecast accuracy of EPS. The secon
is the effect of an analyst prior accuracy performance on the amount and the accuracy of the revision. The third
to test the hypothesis that analysts use an anchoring and adjusting process in revising their forecasts. The results
this study are based on analysis of data obtained from IBES (Institutional Brokers Estimate Systems).

Road Closure: Combining Data and Expert Opinion

Richard Fowles
University of Utah, Dept. of Economics, Salt Lake City, Utah 84112, USA

Decisions to close the Little Cottonwood Canyon Highway to vehicular traffic are made by avalanch
forecasters. These decisions are based on professional experience and on careful monitoring of the prevaili
conditions. Considerable data on weather and snowpack conditions exist. These data are informally employed
the forecasters in the road closure decisions but presently they do not use formal statistical methods. This pap
attempts a more formal statistical analysis to determine to whether this might facilitate the road closure decisio
The conclusion is that the statistical model provides information relevant to the road closure decision that is n
identical to that of the experts. When the expert decision is augmented by the statistical information, bett
decisions are reached compared with decisions based on either the expert opinion alone or the statistical model.

Judgemental Factors as Necessary Components of Economic Forecasting Models

Vladimir J. Simunek
St. John's University, Dept. of Economics and Finance-CBA, Jamaica, New York, NY 11349, USA

Judgmental factors of psychology, physiology, arts, and rationality such as creativity, intuition, imaginati
vision, faith, decisions, expectations, intentions, strategies, and others are assembled in a system which a
includes mechanical structures. Necessity of judgmental factors as integral components of any econo
forecasting model is demonstrated. Conclusions are based on practical experience with models' building and use

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Chair: *Robert Fildes*

University of Lancaster, Dept. of Management Science, Lancaster LA1 4YX, UK

Can Neural Networks Forecast in the Big Leagues? Comparing Network Forecasts to the Pros

Norman Swanson

University of California at San Diego, Dept. of Economics, San Diego, CA 92093, USA

Halbert White

University of California at San Diego, Dept. of Economics, La Jolla, CA 92093, USA

How do artificial neural network forecasts compare to those of the professional forecasters included in the Philadelphia Fed (former ASA-NBER) Survey? This talk will discuss the results of our simulations of real-time out-of-sample neural network forecasts of quarterly economic data, and compare them to the Philadelphia Fed Survey, using a number of different evaluation criteria. We also discuss the relative merits of rolling window vs expanding window forecasting methods.

Forecasting the Market for Pharmaceuticals

Organizer and Chair: *Panos Kontzalis*
    Sandoz Pharma AG, Market and Business Analysis Department, CH-4002 Basel, Switzerland

'Resource Allocation' - A Role for Forecasting?

Allan Bowditch
    MH-GAMMA Consulting Ltd., Mulberry House, 36 Smith Square, London SW1P 3HL, UK

Within the Healthcare ethical market achieving the level of sales success required in the 70´s and 80´s, while never easy, will be considerably more difficult to achieve over the next decade and beyond.

Within the highly competitive consumer markets, understanding the various marketing and promotion activities that result in a certain level of sales has been a focus for product managers for many years The modelling approaches that help identify these variables include time series, multiple regression and econometric analyses.

Establishing the elasticity of the independent variables via multiple regression and econometric systems identify the historic turning points is important. Using this derived model which is often based on 3 to 5 variable provides the best estimate of future brand behaviour when the marketing dynamics are used as input.

The paper will be illustrated with a number of examples to demonstrate the use of these modelling approaches and the way the methodology can be used in short term tactical planning/brand management.

Modelling the Future: The Quest for the Holy Grail, How Close Are We?

Phillip Cartwright, John Hudson, Gerry Halls, Caroline Vincent
    Medical Market Studies Ltd., 130 Marsh Road, Pinner, Middlesex HA5 5LX, UK

Our mission is to support pharmaceutical companies in their overall corporate strategy. Taking our mission a step further, we have developed a forecasting system established from a comprehensive information base that will allow each pharmaceutical corporation
- to forecast its market share at the product level,
- to anticipate the market that will be captured by new drugs.

We have developed a model, using a range of explanatory variables, taking into account the stage of the product life cycle, prescribers attitude and differences between countries.

The traditional four Ps (Product, Place, Price and Promotion) have been broken up into different components order to identify the key variables which will influence the future trend of the market.

It is a flexible and interactive tool allowing users to forecast under a range of different scenarios.

Matching Pharmaceutical Forecasts to Customers Values and Needs

Panos Kontzalis
    Sandoz Pharma AG, Market and Business Analysis Department, CH-4002 Basel, Switzerland

The Market and Business Analysis Dept. of Sandoz Pharma in Basel is actively involved (since 1990) in the development of customer-driven forecasting models that can be used to predict future financial outcomes reduce the risk of misdirected R&D efforts.

The paper is referred to a market simulation model that was initially developed for the sales forecast of a "high tech" product being under R&D but the technique may apply to all ethical pharmaceutical products.

By means of both qualitative and quantitative market research it was possible to identify the customers (physicians') values and needs, to rank them according to importance (utility values) by using the conjoint analysis technique, and build up a market simulation model that can be used to:
- predict the likely market share to be attained by the new product in the disease area under discussion
- estimate the "brand share loss" for each of its main competitors
- identify critically important features (prescribing motivators) for optimal market penetration

- guide R&D efforts
- develop marketing and communication strategies.

The derived model proved to be an invaluable marketing tool for short term forecasting (i.e. one to two year after introduction) with a very close match of the predicted values to actual results.

The Performance of Various Methods in the M2-Competition

Spyros Makridakis
   INSEAD, Boulevard de Constance, 77305 Fontainebleau Cedex, France

The data used in the M2-Competition came from different industries. In this talk differences in forecasting accuracy between the methods and their ability to predict the data coming from various industries are discussed. Particular emphasis is placed on the pharmaceutical industry as the life cycle of its products is short and the data is greatly influenced by promotions and other environmental factors. The talk concludes by suggesting ways of improving forecasting accuracy for different industries when the data is influenced by short life cycles and special events/actions.

Forestry Forecasting I

Organizer and Chair: *Anders Baudin*
SIMS, Statistical Insitute, 901 87 Umeå, Sweden

Constrained Estimation of Forecasting Models

William McKillop
University of California, College of Natural Resources, 145 Mulford Hall, Berkeley, CA 94720, USA

Econometric techniques that combine sample information and accurate non-sample information (such as restrictions on coefficients) are statistically more efficient than those that depend only on sample information. Conventional approaches to constructing econometric forecasting models frequently require substantial structural revisions to obtain models with correctly-signed parameters. Lagrangian methods are not applicable when restrictions take the form of inequalities such as upper or lower bounds on demand and supply elasticities. Quadratic programming techniques permit the handling of both equality and inequality restrictions, and have the potential to be computationally and statistically more efficient.

Forecasting the Output of Japanese Private Forests

Peter Blandon
London Guildhall University, Department of Business Studies, 84 Moorgate, London EC2M 6SQ, UK

Japan, 70 % forest covered, imports 75 % of its timber and is significant in international timber trade. This paper reviews the Japanese government's forecasts and methodology and suggests some improvements.

The Japanese use a large forecasting model within which probabilistic felling models based on felling age distributions are applied to private forests. A more accurate estimation method based on censored sample theory is explained. The remaining inaccuracies in the improved method result from an inability to forecast movements in the distributions' parameters. Logit analysis and models involving imperfect markets are suggested as way forward. These forecasts are less optimistic than the Japanese government's.

A Model to Forecast the Wood-Fiber Procurement of the Finnish Forest Industries

Jussi Uusivuori
Pellervo Economic Research Institute, Revontulentie 8, 02100 Espoo, Finland

Pellervo Economic Research Institute releases annual forecasts on the Finnish economy. Main economic indicators on the real side of the economy, as well as on the monetary economy are studied and analyzed. As part of the work, forecasts are produced also for the agricultural sector and the forest sector in Finland. In this paper we report a wood-fiber model to forecast the annual purchases of timber from the non-industrial forest owners. Key elements in the model are the development of forest products demand, the rotation of wood residues with the forest industries and the changes in the cut-down timber inventories and the growing timber inventories. The motivation for the model grew from an increased need by the non-industrial forest owners for information on the annual timber demand in Finland. The need for this information increased rapidly since the collapse of the negotiations system between the representatives of forest industries and forest owners.

Forestry Forecasting I

Organizer and Chair: *Anders Baudin*
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Forecasting the Output of Japanese Private Forests

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    London Guildhall University, Department of Business Studies, 84 Moorgate, London EC2M 6SQ, UK

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Bayesian Methods in Forecasting II

Organizer and Chair: *Herman K. van Dijk*

Econometric Institute and Tinbergen Institute, Erasmus University Rotterdam, PO Box 1738, 3000 DR Rotterdam, The Netherlands

Some Remarks on Forecasting with $I(0)$, $I(1)$ and $I(2)$ models

Herman K. van Dijk

Econometric Institute and Tinbergen Institute, Erasmus University Rotterdam, PO Box 1738, 3000 DR Rotterdam, The Netherlands

Peter C. Schotman

University of Limburg, Dept. of Business Economics 2, P. O. Box 616, 6200 MD Maastricht, The Netherlands

In this paper we perform an out-of-sample forecasting comparison between a set of stationary AR models and the same models after imposing a unit root. The models are taken from Nelson and Plosser (1982), and the forecasting exercise uses the extension of the Nelson/Plosser data. The first conclusion of the paper is that the unit root issue is of much less importance than the apparent shift in the trend growth rates in most of the series, which are the main source of the large long term forecasting errors. The second part of the paper considers I(2) models, which can accommodate the changing trends.

Forecasting Asset Prices for Option Valuation Using GARCH

Herman K. van Dijk, Frank R. Kleibergen

Econometric Institute and Tinbergen Institute, Erasmus University Rotterdam, PO Box 1738, 3000 DR Rotterdam, The Netherlands

The use of GARCH-models for forecasting asset prices for option evaluation and their volatility is investigated.

The UK Industrial Forecasts Adopting New SIC Codes - Bayesian Approach to Error Correction Modelling

Peijie Wang, Neville Topham, Jim Twomey

Salford University Business Services Ltd., Enterprise House, 31 Salford University Business Park, Salford M6 6AJ, UK

We present in this paper the UK industrial forecasting under the new SIC (Standard Industrial Classification) Code. We specifically adopt an approach to industrial forecasting of Bayesian Error Correction Mechanism (BECM) which is a logical development of BVAR and cointegration and error correction models, and seems particularly sound in multivariate sectoral forecasting applications. The results compare favourably to those from the stationary BVAR and unrestricted ECM specifications.

Forecasting Economic Activity

Chair: *Antonio Garcia-Ferrer*
>Universidad Autonoma de Madrid, Departamento de Analisis Economico, Cantoblanco, 28049 Madrid, Sp

Forecasting the Economic Development of Yunnan Province by the Year 2000

Ming Guo
>Yunnan Economic Information Center, 156 East Dongfeng Road, Kunming 650041, The Peoples Republic China

This paper applies econometric models to forecast the economic development of Yunnan Province by y 2000. The forecast was used to map out the Eighth Five-Year plan of Yunnan Province.

Forecasting the 1992 Turn Around of the US Economy with the Analytic Hierarchy Process (AHP)

Thomas L. Saaty
>University of Pittsburgh, 322 Mervis Hall, Pittsburgh, PA 15260, USA

We used the Analytic Hierarchy Process in January 1992 to forecast that the U.S. economy would turn aro in October-November of 1992 as actually appears to have happened. We also forecast at that time a weak reco at 3.60 GNP growth rate, far below the rate following previous recoveries. The AHP departs from traditio approaches to forecasting by using hierarchic structures. It is a ratio scale approach applied in the form judgments and hard data to compare homogeneous elements and uses clustering to combine nonhomogene measurements.

Forecasting Performance of Structural Time Series Models: A Case Study for Austrian and German Industrial Production

Gerhard Thury
>Austrian Institute of Economic Research, PO Box 91, A-1103 Vienna, Austria

In the present paper, we compare the forecasting performance of structural models for the Austrian and Ger industrial production with that of traditional ARIMA models. For this purpose, we generate 120 genuine ex predictions with forecasting horizons of 1, 6, 12, 18, and 24 months. As far as numerical accuracy is concer even 24-months-ahead forecasts might be classified as highly accurate according to international standards. length of the forecasting horizon and the forecasting method have significant effects on the numerical accu The committed errors increase with the length of the forecasting horizon, and structural models are superio ARIMA models.

Forecasting Economic Activity Rates for the Spanish Economy: Preliminary Results from the Eriste Proj

A. Novales
>Universidad Complutense de Madrid, Departemento de Economía Cuantitativa, Madrid, Spain

Carlos Sebastián
>Universidad Complutense de Madrid, Departemento de Economía Cuantitativa, Campus Somosaguas, 28 Madrid, Spain

Antonio Garcia-Ferrer, Juan del Hoyo
>Universidad Autonoma de Madrid, Departamento de Analisis Economico, Cantoblanco, 28049 Madrid, S

The ERISTE project is a joint research activity carried out by the two Departments of Economic Analys both the Complutense and Autonoma's Universities in Madrid. Over the last year, we have been analyzing up monthly and quarterly economic variables in order to produce monthly reports for the Spanish economy (as w some basic economic international indicators) providing forecasts for 18/24 months ahead using se

forecasting methodologies. Even though the preliminary forecasting results have been very encouraging, further developments of this project seek the construction of **composite leading indicators** that might provide better alternatives to the present methodology.

Exchange Rate Forecasting II

Organizer and Chair: *Horst Kraeger*
    University of Mannheim, Institut für Aufbaustudien, 68131 Mannheim, Germany

Nonlinear Dynamics of Spot and Forward Exchange Rates: An Application of a Seminonparametric Estimation Procedure

Chien-Te Hsu, Peter Kugler
    Universität Wien, Institut für Wirtschaftswissenschaften, Hohenstaufengasse 9, A-1010 Vienna, Austria

This paper applies the method proposed by Gallant, Rossi and Tauchen to weekly data for the Swiss Franc/U exchange rate over the period 1977-1991. The corresponding nonlinear impulse-response dynamics of conditional mean shows a symmetric reacting pattern of the spot rate to its own positive and negative sho whereas the forward premium reacts asymmetrically to spot rate shocks. We also found that the conditic variance of the spot rate exhibits a rather low persistence with respect to spot rate shocks. This finding contrac the result of numerous applications of ARCH to high frequency exchange rate data.

Forecasting Exchange-Rate Volatility

Juergen Kaehler
    University of Exeter, Centre for Management Studies, Thornlea, Exeter EX4 4JZ, UK

This paper explores the forecastability of exchange-rate volatility. Three ARCH-type models (GARC GARCH-t and EGARCH) and the Markov-switching model are used to capture the heteroskedasticity of the d To evaluate the forecasting performance of these models, they are compared with a 'naive' model which uses historical volatility and assumes that it is constant. The forecasting experiments are based on daily and weekly of four dollar exchange rates (German mark, British pound, Swiss franc, and Japanese yen) in the period from 1974 to December 1987. The results show that some heteroskedasticity models can outperform the naive m with respect to mean errors (unbiasedness) but that the models are not superior to the benchmark with respec root mean square errors (precision).

Exchange Rate Forecasting Using MARS

Horst Kraeger
    University of Mannheim, Institut für Aufbaustudien, 68131 Mannheim, Germany
Jan G. de Gooijer
    University of Amsterdam, Faculty of Economics and Econometrics, Roeterstraat 1 1, 1018 WB Amsterdar
    The Netherlands

In this paper Friedman's multivariate adaptive regression splines (MARS) methodology is used to estimate forecast weekly exchange rate changes of four major currencies during the eighties. The methodology is appli three steps.

First, univariate MARS models are fitted to the data and the residuals are checked for outliers. Since signifi outliers were spotted in all four currencies, the MARS methodology is reapplied in the second step with dum variables representing the outliers.

The empirical residuals of the models thus obtained pass the usual tests for linearity and nonlinearity moreover, are close to normally distributed i.i.d. variables. Finally, the out-of-sample forecasts generated b MARS models are compared with those obtained from a pure random walk.

Manpower Forecasting I

Chair: *Tomas Nordström*
National Institute of Economic Research, Box 3116, 103 62 Stockholm, Sweden

Manpower Forecasting and the Aggregation Issue: A Microeconomic Approach

Patrick van Eijs, **Lex Borghans**
Research Centre for Education and the Labour Market, P.O. Box 616, 6200 MD Maastricht, The Netherlands

This paper deals with the use of RAS in manpower forecasting. Starting point is a microeconomic allocation model of the firm in which the optimal employment by education is determined. Two restricting hypotheses, dealing with the uniformity of wage changes and technologies over industries are formulated. Several variants of the allocation model differing with regard to accepting these hypotheses are investigated. It is shown that these variants can all be rearranged to obtain the RAS-structure. The performances of the RAS variants indicate the validity of the hypotheses. It is concluded that both hypotheses cannot be rejected.

Forecasting the Educational Structure of Occupations: A Manpower Requirement Approach with Substitution

Hans Heijke, **Lex Borghans**
Research Centre for Education and the Labour Market, P.O. Box 616, 6200 MD Maastricht, The Netherlands

In the manpower requirement model a forecast of the future labour market situation of types of education is made, in which demand and supply are forecasted independently. Although actually there will be adjustments, the gap between supply and demand can be used as an indicator of tensions at the market. The problem is, however, that similar adjustments in the past are ignored, since forecasts for requirements are based on data of actual outcomes. In this paper forecasts of the future labour market situation of types of education are made within the requirement tradition, but in which this difference between requirement and demand is treated consistently.

Learning from Forecasting Competitions

Chair: *Chris Chatfield*
> University of Bath, School of Mathematical Sciences, Claverton Down, Bath, Avon, BA2 7AY, UK

Forecasting Competitions: What do They Tell Us

Keith Ord
> Pennsylvania State University, College of Business Administration, 303 Beam BAB, University Park, PA 16802, USA

The paper identifies some of the conclusions that may be drawn from forecasting competitions that hav appeared in the literature, particularly during the eighties. Primary attention focuses upon the comparison univariate procedures, although there is also some discussion of econometric models relative to univari schemes. A partial synthesis between the model based procedures, such as ARIMA, and more heuris approaches, is attempted.

Improving the Forecasting Performance of Extrapolative Methods: Learning from Empirical Accuracy Studies

Robert Fildes
> University of Lancaster, Dept. of Management Science, Lancaster LA1 4YX, UK

Spyros Makridakis
> INSEAD, Boulevard de Constance, 77305 Fontainebleau Cedex, France

This paper examines a specific area of social science, time series forecasting, which permits objectiv replicable and controlled experimentation through empirical studies using real-life data. Earlier work by authors concluded that theoretical statisticians and empirical analysts had ignored each others' finding but t working together they could potentially learn from each other. By examining the results of many empiri analyses major anomalies were shown to exist between theoretical and empirical work. This presentation v attempt to stake out the common ground between theory and practice with the aim of identifying fruitful area research. With well-specified hypotheses established, forecast competitions can provide researchers with experimental test-bed that can direct the progress of their discipline.

Chaotic Time Series: Do They Bias The Results of a Forecasting Competition?

Gregory Madey
> Kent State University, College of Business Administration, Kent, OH 44242, USA

Charlene Riggle
> Kent State University, Graduate School of Management, Kent OH 44242, USA

Comparisons between various forecasting methods have shown that the choice of forecasting method shoul situation-dependent (e.g., type of series, accuracy measure, forecast horizon). We examine whether the inclusi chaotic data sets among the samples creates a bias in such comparisons, and whether the removal of chaotic results in increased measures of performance in traditional forecasting methods. Additionally, we examine whe such bias is uneven, implying that the removal of chaotic sets from the test samples may permit a better choic forecasting method.

Demographic Forecasting

Chair: *Petter Lundvik*

Natl Inst of Economic Research, Box 3116, 103 62 Stockholm, Sweden

Confidence Intervals for **Small Area Population Forecast Error: A Repeated Sampling Approach**

Edward A. Schafer

Portland State University, Center for Population Research and Census, P.O. Box 751, Portland, OR 97207-0751, USA

Lawrence R Carter

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Most of the work on assessing the accuracy of population forecasts pertains to national, state, and county geographic areas. Little is known about the behavior of small area forecast errors. The few studies which have examined forecast error for small areas only evaluate point estimates of the error. Interval estimates for small area forecast error are difficulty to develop due to the lack of previous forecasts. Also, small population sizes inhibit the calculation of reliable statistical parameters. This paper develops and illustrates a method for generating confidence intervals for small area forecasts based on repeated sampling. A generalized equation is then developed for estimating error in small area forecasts, regardless of size.

Structural Demographic Modeling and **Forecasting of U.S. Fertility**

Lawrence R Carter

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This paper presents a basic structural model that combines mathematical and statistical demography with statistical time series analysis to generate forecasts of US fertility. The basic fertility model is $f(x,t) = a(x) + b(x)f(t) + e(x,t)$, where $f(x,t)$ is the birth rate for women age x at time t; $a(x)$ is the average level of fertility at age x, $b(x)$ is the shift in the fertility trajectory by age, $f(t)$ is the index of fertility that is forecasted, and $e(x,t)$ is an error term. The model for the sample period 1917 to 1987 is forecasted to the year 2065. This structural approach is juxtaposed to stochastic time series models to see how their forecasts compare to the outcomes that Easterlin fertility cycles presage.

Between a Rock and a Hard Place: **The Evaluation of Demographic Forecasts**

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Jeff Tayman

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Forecasting, in general, has been described as an unavoidable yet impossible task. This irony, which comprises the "Rock" and the "Hard Place" found in the title, creates a high level of job-related stress for forecasters. Why? Because the forecasted numbers that are invariably accorded a high degree of precision inexorably reveal their inevitable imprecision when the numbers forming the actuality finally take place and the numbers comprising the forecasts's errors are precisely measured. The current state of the art in demography for reducing this stress primarily consists of two strategies. One is to provide a series of "projections" based on different scenarios and placing the decision on a user to select one as a "forecast". The other is to incorporate uncertainty into forecasting using measures ranging from informal (judgments of "high", "medium" and "low") to highly formal (e.g., forecast

intervals). We argue that these stress-reduction strategies have been less than successful and, further, th demographic forecasting can be characterized among both producers and users as an activity with a high level cognitive dissonance. To reduce stress and the level of cognitive dissonance, we propose a strategy that is direct aimed at the cause of these problems: evaluations primarily focused on absolute accuracy. Our strategy is change this focus by using the family of measures known as "Proportionate Reduction in Error (PRE), of which t "percent better" approach is a member. We discuss the benefits of using the PRE-type approach in evaluations a illustrate our arguments with examples from demographic forecasting. We conclude that placing the evaluation demographic forecasts within a PRE-type context offers the potential to greatly reduce stress and cognit dissonance. We also argue that our findings can be applied not only to demographic forecasting but also to ot forecasting fields in which evaluations are primarily focused on absolute accuracy.

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Judgemental Forecasting II

Chair: *Fred Collopy*

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

IFIS: An Intelligent Forecasting Information System

Vassilis Assimakopoulos, I. Linardopoulos, G. Mentzas, D. Tzerkezos

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This paper presents the architecture of an intelligent Forecasting Information System (I.F.I.S.), as an effort to
integrate the existing automatic software systems with the incorporation of judgement, meaningful feedback and
learning mechanism. For the design of the I.F.I.S. the following steps are taken.

The first one is the systematic and detailed definition of the forecasting process model. Such a model consists of
a sequence of tasks one has to follow while forecasting. This facilitates the next step concerning the detection of
the specific tasks that call for the structured incorporation of Knowledge-Based techniques in order to introduce
judgement, learning and refinement procedures into forecasting process. Finally, a prototype based on the I.F.I.S.
architecture is developed in an Export Systems building tool

An Evaluation of a Decomposition Strategy for Judgemental Adjustments to Statistical Forecasts

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1QY, UK

Judgmental adjustments are frequently applied to statistical forecasts and decomposition in the form of the
Analytic Hierarchy Process (AHP) has been suggested as a method for making these adjustments. An experiment
was carried out to assess whether judgmental adjustments derived from the AHP are more accurate than those
obtained by holistic adjustment. It was found that the use of the AHP did not lead to greater accuracy and that it
tended to lead to under adjustment from the statistical forecasts. The implications for the application of the AHP
and decomposition in judgmental forecasting are discussed.

Adjustment of Forecasts with Model Consistent Expectations

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Ahti A. Salo

    University of Mannheim, Lehrstuhl für ABWL, 68131 Mannheim, Germany

This paper provides a theoretical basis and practical procedure to support the judgemental adjustment of
multivariate statistical forecasts, for the class of problems where judgement is necessary to compensate for omitted
variables in the model. The analysis suggests that many casual adjustments in practice may be prone to a double-
counting bias, and that the use of **model-consistent expectations**, for the omitted variables, should provide a basis
for judgemental adjustments free of such bias. The procedure is applied to a real case study, from the petroleum
industry, based upon capital cost forecasting for major offshore facilities

Neural Networks III

Organizer and Chair: *Mirko Novak*
Academy of Sciences of the Czech Republic, Institute of Computer Science, Pod Vodárenskou vezi 2, 1820?
Prague 8, Czech Republic

Simple Recurrent Networks for Prediction: An Alternative

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Electricité de France, 1 avenue du General de Gaulle, 92300 Clamart, France

We present a neural network approach for the forecasting of the electric load in France. The model belongs the family of recurrent neural networks but is simpler in the sense that only the forward connections are learned. Our first studies concern the memory abilities and the variable selection capacities of these types of model. Accordingly, a potentially powerful architecture has been designed and used on the EDF (Electricité De France data. one-step (half-hour) predictions of the consumption, favourably compares to the performance of the ARM model, presently in use at EDF.

Modelling Nonlinear Behaviour with Neural Networks

Jonas Sjöberg
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Given a set of data from a system and with the intention to build a model explaining the data, the choice model set becomes the key issue. The model has to be flexible enough to describe the system, but s parsimonious in the number of parameters to avoid over-fitting. We will discuss how neural nets can contradict paradigm of parsimoniousity and still give good models. This is explained by regularization. Since neural re often are ill conditioned the regularization can also be successfully implemented by a premature termination of t numerical estimation algorithm before the true minima of the criteria of fit is reached. This way of implementi regularization also explains overtraining, *i.e.*, the model becomes worse again after a certain number of iteratio of the estimation algorithm.

Designer Networks for Forecasting

Lars Kai Hansen**, Carl Edward Rasmussen, Claus Svarer, **Jan Larsen
Technical University of Denmark, Electronics Institute, B 349, DK-2800 Lyngby, Denmark

We study design and evaluation of feed-forward networks for forecasting. The tools developed are based pruning by Le Cun's "optimal brain damage" and on optimal regularization by minimization of the estima generalization error. We present results for several time series including sunspots, Mackey-Glass dynamics, channel equalization.

Forecasting Economic Activity in Metals Industries II

Organizer and Chair: *Philip Klein*
Pennsylvania State University, 516 Kern Graduate Building, University Park, PA 16702, USA

Forecasting U.S. Metals Exports Using A Leading Export Index

Anirvan Banerji
Columbia University
Lorene Hiris
Long Island University

A leading export index for the U.S. has been developed using long-leading indexes for five countries and a dollar exchange rate. The five countries are the U.K., Germany, France, Japan, and Australia. The economic rationale for this new index is that the long-leading indexes are designed to predict future changes in economic activity and when such activity expands or contracts imports in these countries will move correspondingly. The long-leading indexes will then indicate in advance these changes. The five components of the leading export index can be weighted by the volume of U.S. exports of metals to these countries. Using a regression analysis, this leading export index can then be used to forecast the volume of U.S. metals exports to the major industrial economies.

Building Cyclical Composite Indexes for two U.S. Aluminum Industries

George Swisko
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The U.S Bureau of Mines and the Center for International Business Cycle Research (CIBCR) produce cyclical indexes for two aluminum industries and three other metal industries. Construction of the aluminum indexes provided several challenges. The Bureau and the CIBCR found that precise definition of aluminum coincident activity is essential for finding and testing reasonable leading indicators. Input-output tables can help identify leading indicators. Forecasting annual growth of shipments and production with leading-index growth rates is one way to check the performance of leading and coincident indexes.

Leading and Coincident Indicators for Australia's Metals Industries

Ernst A. Boehm
University of Melbourne, Westpac-Melbourne Institute Centre for Business Cycle Analysis, IAESR, Parkville, Victoria 3052, Australia

This paper explores the material available and develops leading and coincident indexes for Australia's primary metals industries. A comparison is made of the cycles experienced by the metals industries with the corresponding cycles in Australia's leading and coincident indexes, and in Australia's growth and classical cycles. Special attention is given to the fluctuations experienced in Australia's major metallic minerals of iron and gold ores. An examination is also made of the rates of inflation in general and the changes in metals prices.

A major objective of this research is to furnish ways of monitoring the fluctuations in current activity in Australia's metals industries and the foreshadowed changes in the months ahead.

Time Series Methods

Issues in Time Series Modelling I

Chair: *M.A. Kaboudan*
Penn State University, Management Science & Information Systems, Allentown Campus, 8390 Mohr Lane, Fogelsville, PA 18051, USA

Global and Local Diagnostics in Time Series with Application to Global Warming

John Haslett
Trinity College, Department of Statistics, Dublin 2, Ireland

Recent research on residuals for the linear model with arbitrary covariance structure has shown that both marginal residuals (from global aspects of the model such as the long term trend) and conditional or 'leave-k-out cross-validation residuals (which depend on very local aspects of the model) play an almost dual role in the lack of-fit, and thus provide new and very general insights on diagnostics. These are illustrated in a bivariate time series context by reference to data since 1861 on the temperature of the Earth.

A Relative Complexity Index to Classify Discrete Time Series

M.A. Kaboudan
Penn State University, Management Science & Information Systems, Allentown Campus, 8390 Mohr Lane, Fogelsville, PA 18051, USA

An index (Γ) to quantify the degree of complexity of an observed time series, X_t, is developed. The proposed measure permits classifying and ranking series according to the complexity of the process. It is an index that compares an estimate of noise-to-signal ratio of X_t as a measure of the series' complexity with that of a stochastic process obtainable by randomly shuffling the observed series. To estimate noise-to-signal ratio, the notion of correlation integral is used. The relative complexity index is constructed such that $0 \leq \Gamma \leq 1$, where $\Gamma = 1$ if X_t is a purely random process, and Γ - 0 if X_t is a signal free from noise.

Stochastic Modelling of Aggregates and Products of Variable Failure Rates

Naunihal Singh
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This paper develops an unconventional but powerful approach to analysing the observed and/or estimated failure rates of complex systems that operate in series and/or in parallel under varying operational and environmental conditions. Consequently such failure rates can be construed as time series. Obviously, the time series thus generated are complex in the sense that either they are aggregates or products (or both) of two or more time series. Hence special time series techniques are required for their analysis.

Forecasting Rainfall Using a Gamma Model

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This article presents a dynamic model for time series of gamma observations. The model is characterized by constant shape parameter and a time varying scale parameter which evolves according to a multiplicative random walk. By use of an exponential link function we introduce effects such as time trend, cycles and explanatory variables. The model was fitted to data on rainfall in Fortaleza, Brazil, which has shown to have a cycle approximately 13 years. We compare our model to a Gaussian model fitted to the same data.

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Forecasting on a Disaggregated Level: High Frequency and Regional Data

Chair: *Anders Christoffersson*
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Modelling Daily Series of Economic Activity

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The behavior of daily series of economic activity like the consumption of electric energy, cash withdrawn from financial institutions, number of passengers in a transport service, pollution and traffic levels, sales, etc., is very often characterised by showing oscillating levels or trends and several complex seasonalities. Besides, these series are sensible to: (1) the presence of holidays; (2) vacation periods and; (3) the end and beginning of month. Finally, these series suffer, in general, from the influence of meteorological variables and in many cases the effects are nonlinear, dynamic and change with the type of the day - weekdays or weekends or holidays - and season of the year.

The levels of these series show so complex trends and oscillations that the process of their modelling becomes very difficult. Nevertheless, because such oscillations correspond to behaviour patterns of the economic agents the modelling task is not only feasible but also very rewarding.

The paper specifies the main characteristics of daily series of economic activity; analyzes how these features can be explained by a quantitative model; proposes a strategy for the construction of those models; illustrates their use for forecasting and control purposes and shows examples of models already in active use for several years that have up to almost two hundred estimated parameters employing several thousand observations.

A DGP Model for the Turkish Private Sector Manufacturing Industry Price Index: A Forecast Comparison with the CB Model

Kivilcim Metin
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The standard results on selecting models for forecasting do not generalize to estimated dynamic models. Empirically to test this result, we examine the forecast performance of a correctly specified monthly econometric model, DGP, for the Turkish private sector manufacturing industry whole sale price index. The model is estimated over the period 1987:1-1992:12. A comparison of the performance of the DGP model, the Central Bank (CB) model, VAR, is made on the basis of the one-to-six steps ahead forecasts produced for this period.

The Newly Revised Index of Leading Indicators: How Useful as a Regional Employment Forecasting Tool?

Barry R. Weller
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Recently the U.S. Composite Index of Leading Indicators (CLI) was significantly revised to incorporate methodological changes and comprehensive revisions in the component series. The old CLI, used in conjunction with the transfer function methodology, was shown to be very useful in increasing the accuracy of employment forecasts at the small region level. This study seeks to determine whether the new CLI maintains, or improves upon, that usefulness. The new CLI is evaluated by comparing the accuracy of regional employment forecasts from simple ARIMA models and transfer function models based both on the old and the new CLI. Forecast accuracy is examined for several small MSAs, over forecast horizons ranging from one to twelve months ahead, and over intervals of varying degrees of instability.

Forecasting in the Health Sector

Chair: *Peg Young*

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Forecasting Health Benefits Populations

David A. Swanson

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Hallie J. Kintner

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Unlike their counterparts in other industrialized countries, most U.S. residents receive health care covers
through an employer. Employer health care costs are integrally tied to the number and characteristics of the gra
of individuals affiliated with an employer, and their dependents. This paper evaluates extrapolative, headship, i
cohort-component methods for forecasting the size and age-sex composition using data about the General Mot
salaried health benefits population 1983-1993. We use 1988 as a jump-off year, forecast the population 198
1993, and compare forecasts to actual annual data using standard measures such as MAPE, RMSE, and utility
each forecast method.

The Impact of OTC-switches on the Product Life Cycles of 15 Pharmaceutical Products in Sweden

Stefan Höög

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Reinhold Bergström

Uppsala University, Dept. of Statistics, Box 513, 751 20 Uppsala, Sweden

During the period 1972-1990 15 OTC switches (an OTC switch means that it became possible to sel
pharmaceutical product without prescription) occurred in Sweden. The effect on sales of these switches i
analyzed on the basis of quarterly data using different time series techniques. The theoretical basis for the stud
the product-life-cycle theory. The time-series models considered are deterministic trend models with and with
adjustment for autocorrelation in the residuals and intervention models based on the Box-Jenkins methodology.
find clear effects on sales of the switch in more than half the cases analyzed. In several cases the effect is doub
and there are cases where the switch did not seem to influence sales at all. In general the results are robust w
respect to the analytic method used, but there are also cases where the opposite is true.

Patient Preferences for Information Disclosure and Role in Decision Making in the Medical-Health Care Industry

Dennis J. Mazur

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To ensure optimal informedness of patients as consumers and decision-makers, the medical-health care indu
must evaluate patient preferences regarding information disclosure and decision making. Three hundred pati
(mean age=66) underwent structured interviews to answer 3 questions: (1) how do patients prefer to rece
probability information, (2) what role do patients want in decision making, and (3) whether the severity of pati
medical conditions influence their preferences for (1) and (2). Forty-two percent wanted probabilistic informa
numerically; 32 % verbally; 14 % both; 8 % either; 5 % no disclosure. Fifty six percent wanted shared deci
making; 28 % physician only; 12 % patient only; 4 % otherwise. The severity of patients' conditions influe
their preferences for probabilistic information disclosure and decision making (p < .001).

Using Forecasting Techniques for Quality Control: A Case Study in the Health Care Industry

Peg Young, Alastair M. Connell, George W. Wesley
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The field of health care utilizes a vast number of quality control techniques to monitor the 'quality' of the medical care provided. The techniques that presently exist review health care over time with indicators identified to monitor quality, but these techniques disregard the autocorrelated errors that occur in the data. This paper presents a new methodology, with time series techniques, to make considerable improvements in the ability to highlight shifts/changes/interventions in the data. An empirical study is performed which compares the results of traditional quality control techniques against the new time series procedure for a variety of quality measures to illustrate the strength of the new techniques.

Evaluating Forecasts II

Organizer and Chair: *Lars-Erik Öller*
National Institute of Economic Research, P.O. Box 3116, 103 62 Stockholm, Sweden

Is There Expertise in Interest Rate Forecasting?

Roy Batchelor
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This paper uses a large data-base of professional forecasts of 3-month Treasury bill yields to test a number of propositions about their ability to beat the market. We find that some forecasters are significantly more accurate than others, and that their superior accuracy can be translated into with superior profit performance by following a simple trading strategy in the T-bill futures market. The average "consensus" forecast and the naive no-change forecast are also more accurate than most individual forecasts, but do not necessarily generate more profit.

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An Empirical Study of Combinations of UK Economic Forecasts

John L. Thompson
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Ken Holden
Liverpool John Moores University, The Business School, 98, Mount Pleasant, Liverpool, L3 5UZ, UK

Different ways of combining economic forecasts for the UK from econometric models, vector autoregression models and naive models are examined for their accuracy. The economic models are based on varied theoretical structures. Both linear and non-linear combinations are formed as well as stepwise optimal combinations.

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Cointegration and Forecast Evaluation: Some Lessons from National Institute Forecasts

Nigel Pain
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The recent experience of macroeconomic forecasting in the United Kingdom has prompted renewed interest the evaluation of economic forecasts. This paper uses cointegration tests to investigate what can be learnt from the forecasts produced by the National Institute of Economic and Social Research (NIESR) over the last two decade. Whilst the forecasts and outturns are found to be cointegrated, there remains evidence of systematic relationship between a number of forecast errors. Our results also fail to reject non-cointegration between different vintages data, suggesting that considerable care should be exercised in both the choice of realisation data used and in the means by which efficiency is tested.

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Economic Forecasts in Sweden

Olle Sundberg
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There has been a rapid growth in the number of forecasts for the Swedish economy, published each year. 1970, three forecasting agencies published five forecasts. By 1993, the number of forecasters had reached 20, the number of forecasts were 40. In this project all forecasts have been compiled into an easily accessible database, where they are now being compared and analyzed. After a general presentation of the data base, some results of the comparison are discussed. The strong tendency of consensus makes it difficult to make any systematic ranking of the forecasters.

Forecasting Methods

Chair: *Per-Olov Edlund*

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A Comparison of Stein-like Procedures for Prediction and Forecasting of Multicollinear Data

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Dennis Oberhelman

University of South Carolina, School of Business Administration, Columbia, SC 29208, USA

This paper compares several Stein-like estimation methods for prediction and forecasting with multicollinear data. The criterion function was the mean-squared error of prediction and the parameter of interest was the mean of the response variable at the sampled values of the control variables. Large sample simulation techniques were used to evaluate the mean-squared error of the predictions. The parameters of interest were varied systematically over wide ranges.

Regression-Based Forecast Combination with Mixed Frequencies

Peter Pauly

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In this we extend the well-known regression-based approach forecast combination to the case of mixed-frequency constituent forecasts. We shall examine two alternative frameworks: a standard discrete-time linear combination model with missing observations, and a continuous-time regression model. The basic framework employed is that of a standard linear model with missing observations. It has been shown that in such a context efficiency gains are related to the information contained in the correlation between series of different frequency at overlapping observations. It turns out that in both cases the technical difficulties are related to the joint treatment of stock and flow variables, and the multi-period forecast problem involved. We shall present estimation procedures for both cases, and illustrate the superiority of combined forecasts with an example.

Comparing the Performance of Statistical Forecasting Tools - A Systems Reliability Approach

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Tony Rollo

Suffolk College, School of Information Systems Engineering, Rope Walk, Ipswich, Suffolk IP4 1LT, UK

In this context a "forecasting tool" is defined as the combination of a statistical modelling technique and the software through which it is implemented.

Much discussion takes place between statisticians on the comparative performance of forecasting methods but this has little impact on the work of those who have the practical task of producing forecasts for their businesses. Faced with the need to select forecasting methods they are offered little useful guidance from the forecasting literature.

This paper offers an alternative approach to the evaluation of forecasting tools which draws on well established concepts and procedures from systems reliability engineering.

ARMA Models and the Box-Jenkins Methodology

Michèle Hibon, Spyros Makridakis

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ARMA models were made popular through the work of Box and Jenkins (1970) who proposed a methodology to identify an appropriate ARIMA (p, d, q) model and its seasonal equivalent, estimate its parameters and perform a diagnostic check to decide whether or not such a model was adequate. Empirical studies have shown that the post-sample forecasting accuracy of the Box-Jenkins methodology has been poor and in the great majority of cases worse than that of simple methods. This paper studies the Box-Jenkins methodology to discover the reasons for its poor empirical showing. It concludes that two aspects of the methodology account for the largest part of its poor performance: (a) differencing the series to achieve stationarity in its mean and (b) the way seasonal series are modelled. When stationarity is achieved by detrending the data through other means than differencing, and when the data is deseasonalized, an ARMA (p, q) model used, and its forecasts reseasonalized, the post-sample forecasts of this approach are superior to those of the Box-Jenkins methodology. Suggestions for using the proposed approach are made and its advantages and drawbacks vis-á-vis other methods are discussed.

Non-linear Time Series

Chair: *Kurt Brännäs*
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Nonlinear Signals Forecasting

Ewa M Bielinska
The Silesian Technical University, Institute of Automation, Akademicka 16, 44-100 Gliwice, Poland

The paper is concerned with prediction of signals that are of nonlinear nature. Three different methods of prediction are considered.

Firstly constrained polynomial model K-G(2,N) is assumed and Generalized Method of Data Handling is applied to choose the most significant parameters of the model. Then the predictor is designed, basing on the obtained model.

Next, bilinear time series model is applied and minimum variance bilinear predictor is designed. Bilinear prediction is compared with the results of GMDH predictions. An alternative method of signal prediction, neural network predictor is applied.

The number of experiments indicated that the best results were obtained with the use of bilinear predictor. Hence, problem of identification of bilinear predictor's structure arises.

In the paper three methods of bilinear model structure's identification are proposed.

Simulation and real data examples of prediction are enclosed.

Combining Provisional Data and Forecasts in Nonlinear Models

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Roberto S. Mariano
University of Pennsylvania, Dept. of Economics, 3718 Locust Walk, Philadelphia, PA 19104-6297, USA

In spite of widespread criticisms, macroeconometric models are still most popular for forecasting and policy analysis.

Since several provisional estimates of the value of a certain variable are available before the data are finalized, in this paper they are seen as repeated predictions of the same quantity to be exploited in a forecast combination framework. The components of the asymptotic bias and of the asymptotic mean square prediction error related to data uncertainty can be reduced or eliminated by using a forecast combination technique which makes the deterministic and the Monte Carlo predictors not worse than either predictor used with or without provisional data. The precision of the forecast with the nonlinear model can be improved if the provisional data are not rational predictions of the final data and contain systematic effects.

Estimation and Testing in Integer-Valued AR(1) Models

Kurt Brännäs
Umeå University, Department of Economics, 901 87 Umeå, Sweden

The paper studies the integer-valued autoregressive model of order one and suggests a specification for panel data. Test statistics of under- or overdispersion within a generalized Poisson model are obtained. Predictors and prediction error variances are given for univariate and multivariate models. The small sample performance of maximum likelihood and new generalized method of moments estimators and tests are evaluated and compared. An empirical illustration based on the number of firms in sectors of the Swedish forest industry 1970-1992 is included.

Batch Forecasting

Chair: *Thomas J. Nunn*
Nevamar Corporation, 2039 East Lombard Street, Baltimore, Maryland 21231, USA

Automatic ARMA Identification for a Large Number of Time Series

E. Borghers
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The general known approach for the identification of ARMA models would be time consuming and not cost effective if a large number of time series is involved.

In this paper an alternative method is proposed. The method consists in the identification, within a large set of weak stationary time series, of subsets of series characterised by the same model structure but for which the model coefficients may vary. The proposed method is based on - the recursive use of - the Principal Component technique, applied to a similarity matrix.

The recursive algorithm is illustrated and commented by using simulated data. Although a lot of questions remain, these first preliminary results look very promising.

Modelling Unit-Values Series - A Time Series Approach to Improve Price Indices in Foreign Trade

Winfried Stier
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This paper is a report on a rather unusual application of time series modelling, on a project sponsored by the Federal Custom Agency, Bern. Its goal is an improvement of im- and export price indices based on unit-values. A disadvantage of these indices compared to those based on a fixed basket of goods is their high volatility for which there are many possible causes which in practice usually cannot be identified. Until recently the agency used some "quick and dirty" methods for dampening the price series spoiled by outliers. The improvement mainly consists in purging them after detecting and estimating the impact of the outliers on the series. The unit-values are modelled by ARIMA-models allowing for pulses and steps. Since about 14 000 import- and export series have to be modelled each month, this has to be done automatically. A version of AUTOBOX is used whose output gives additionally a lot more information which is used for classification of unit-values. The results of the first stage of the project show that by using time series methods price indices can be gained, which are superior to those computed by the agency until recently.

Managing Forecast Error

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A double exponentially smoothed forecast of over 10,000 line items is reviewed for effective SAFETY STOCK. "Fillrates" of 90 % are established on stocked items. Multiple stocking locations from a single limited source are considered individually by "ABC" class with emphasis on avoiding excessive inventory and obsolescence.

The control technique uses a unique "Hit Rate" performance per cent to determine effectiveness and required safety stock to improve.

Sales margins and inventory carrying costs are also considered.

End of month overall summary of FORECAST performance factors are reviewed for Safety Stock levels, ABC classes, percent of demand forecasted and outliers.

Forestry Forecasting II

Organizer: *Anders Baudin*
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Chair: *William McKillop*
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A Multiple Equation Approach to Modeling and Projecting Forest Products Demand, Supply and Trade

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Anders Baudin
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A multiple equation framework is developed to model demand, supply, and trade of solid wood forest products in selected European countries. Demand models rely on prices and a composite indicator of end use activity to explain consumption; supply is explained using prices and costs. Separate models are estimated for domestic markets, imports, and exports. Demand and price elasticities vary by source of supply and by market thereby examining substitution behavior in both consumption and production. Demand, supply, and trade elasticities are estimated and reported for sawn wood, plywood, and particleboard in 10 European countries. Preliminary projections for consumption, production, and trade 1990-2010 are developed.

Forecasting Nonindustrial Private Forest Owners' Timber Supply with Survey Data Including Owners' Forestry Goals

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This paper investigates the timber supply of nonindustrial private forest owners who value the nonmarketed amenities of the forest and perceive imperfections in the capital markets. The derived supply function is estimated using a cross-sectional Tobit model and survey data on 206 Finnish forest owners in 1986-91. Significant effects are obtained for the interest rate, net timber prices, standing stock, and owner's age and wealth. Owners were grouped into four categories according to their forestry goals by K-means clustering, and dummy variables indicating cluster membership were included into the supply function. According to the results, "multi goal" owners harvest significantly more than the other groups, especially "recreationist" owners. The use of expected changes in explanatory variables in forecasting the trends in nonindustrial private "notational" timber supply are discussed.

Quarterly Export Demand Model for Finnish Printing and Writing Papers to the United Kingdom

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The paper investigates the demand for Finnish printing and writing papers in the United Kingdom. Empirical demand equations are derived using the Armington export demand model. Quarterly data from the British foreign trade statistics is used. The properties of the time series are examined to guarantee the validity of statistical inference. Seasonal integration tests indicate that both coated and uncoated papers may have unit roots at zero frequency, moreover there appears to be seasonal unit roots in the series of the uncoated papers. Based on cointegration tests an error correction model for both paper grades is estimated and the results discussed.

Forecasting Prices and Exports of Paper Products Not Using Minimum Autocorrelation Factors

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The purpose of the present study is to use a multivariate time series approach to forecast prices and export volumes for several paper qualities. The idea, which originates from remote sensing and in the forecasting of macroeconomic variables, is to split the information in the time series into important and unimportant information. The important part is used to forecast the time series, while the unimportant part is thrown away. More particular we use maximum autocorrelation factors created from linear combinations of the time series of prices and volumes to forecast the time series themselves. The forecasting equations are evaluated through a within sample simulation exercise.

Issues in Forecasting

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Nonparametric Hazard Rate Estimation

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It is shown that the likelihood function for duration models can be written in terms of the hazard rate, the moment generating function (MGF) of the distribution of unobserved heterogeneity, and the MGF's derivative. For three semiparametric methods to estimate hazard rate models we specify the log hazard rate as the weighted sum of Legendre polynomials and allow covariates to interact with duration dependence. Consistency proofs and results of Monte Carlo experiments are provided. An empirical example on psychiatric episodes includes a forecasting exercise.

Projection of Election Results Based on Partial Counting

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This paper addresses the problem of forecasting the final results of an election while counting is being done. Forecasts are produced at each instant as a function of the already counted votes and the data of previous elections, both considered to be available separately by electoral neighborhood centers (ENC).

We compare several methods where the forecast is given by a weighted average of the results on the already tallied ENC's, with weights obtained from a cluster analysis of the results of previous elections. We show that problems related to clusters with no data, occurring in the early stages of the talling process, can be attenuated by performing a dynamic clustering.

Scientometrics Forecasting of Science Development in Russia

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The IINC Data and Knowledge Bank "A. Nobel and Nobel Prizes. Nobel Prize Winners in Physics, Chemistry, Physiology or Medicine, Literature, Peace, Economics" (contains 20 problem-oriented data and knowledge bases) allowed us to work out the methods for scientometrics forecasting of individual scientific trends development. The workstation for forecasting of science had been created at the base of these methods. The scientometrics forecast for mathematics, physics, chemistry, biology and economics in Russia (1994-2014) had been calculated. There are the following final dynamic characteristics of forecast: size and geography of scientific associations, demography and migration of scientists, size of scientific production (publications, theories, discoveries, etc.), value of scientific data, intercommunication of sciences, publication activity models, etc.

Forecasting Tourist Flow at the Costa del Sol

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The aim of this paper is to forecast foreign passengers time series deplaned in Malaga airport, as an indicator of tourist flows. For this goal both econometric and structural time series models are formulated, estimated, and compared. As explanatory variables we use those related to the demand of tourism: income and prices. The former is measured by an index of the weighted real income of visitors countries, taking into account the corresponding exchange rate. Regarding prices we consider two variables: a Spanish consumption price index relative to visitors and a competitors price index relative to visitors.

Issues in Time Series Modelling II

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Specification Tests in the Basic Structural Model

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In the recent years structural time series models have gained popularity among statisticians and econometricians. In his monograph Harvey (1989) defined the Basic Structural Model (BSM). In this paper specification tests are proposed to find which stochastic components in BSM (level, trend, seasonal or irregular) could, in fact, be modeled in a non-stochastic manner. The test statistics have nonstandard distributions, but suggestions are given to overcome these difficulties. Finally, applications to Finnish socio-economic data are shown.

Bias in Model-Based Forecasts when the Cost-of-Error Function is Asymmetric

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It is well known that in most commercial situations, the utility function is asymmetric and the use of symmetric mean square error as a criterion of forecast accuracy is thus unjustified. Assuming that the predictive density is normal, that the cost-of-error function is asymmetric and odd/even power of the forecast error, we derive expressions for the optimal forecasts which are biased for the future observation.

It is shown that the magnitude of bias in the forecast for a fixed lead time monotonically increases with asymmetry but decreases with the degree of the assumed polynomial loss structure.

Expressions for the optimal forecasts area also obtained when the cost-of-error function is proportional to

   (i)   percentage forecast error

and (ii)   squared percentage forecast error.

A Study of the Effectiveness of the H-P Filter via Structural Models

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This paper makes use of the structural models approach to check on the effectiveness of the Hodrick-Prescott (H-P for short) filter applied to Brazilian macro-economic time series; however, in some situations it introduces spurious cycles, leading the user to wrong conclusions about the data. This paper not only checks on that, but also provides means to avoid it.

Commodity Prices

Organizer and Chair: *Ivonia Rebelo*
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Primary Commodity Prices and Macroeconomic Variables

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This paper presents the results of research undertaken to quantify the impact of changes in macroeconomic variables on some aggregate indices of commodity prices and also to explore the forecasting ability of macroeconomic variables on these commodity price indices. The research is based on establishing a long-run relationship between commodity price indices and macroeconomic variables and if such a relationship is found, error-correction models (ECMs) are specified. The specified ECMs indicate a strong relationship between the two sets of variables and also that macroeconomic variables have good forecasting abilities on commodity prices. Causality tests demonstrate strong causality from macroeconomic variables to commodity prices but not vice-versa. However, commodity prices seem to have an effect on inflation as measured by changes in the consumer price index. OECD fiscal deficits have negatively influenced commodity prices. Statistical analysis found the existence of co-movement among commodity prices. This co-movement can be mostly attributed to common macroeconomic shocks rather than herd behavior among commodity traders or fads as it has been previously suggested.

Analysis of Long-Run and Short-Run Price Behaviour of Related Agricultural Commodities for Modelling and Forecasting

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The short-run and long-run price behaviour of the related agricultural commodities coffee, cocoa, tea and sugar are investigated. We often observe similar behaviour of these prices, apparently caused by occurences on only one of the commodity markets. The similar behaviour may have its impact on modelling or forecasting the price of one commodity market in a more accurate way. For this purpose we analyse the long-run behaviour by applying integration and co-integration tests, and estimate short-run error-correction models in various ways. Methods and results from the recent literature in this area will be used in this analysis. The results are informative for empirical economists, who are modelling or forecasting the price of one commodity and are confronted with price movements which cannot be explained by the involved relevant variables of that particular market.

The Behaviour of the IPE Gas Oil Futures Price

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This paper examines the behaviour of the IPE gas oil futures prices. The objective is to examine the market price discovery role and to compute the optimal hedging ratios. Causality tests are used to determine the lead-lag relationships and cointegration analysis is used to analyse the price dynamics. The price variability and volume relationship is investigated via a GARCH model.

Forecasting Corn Prices

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This paper presents a supply and demand model for corn. It examines several approaches to forecasting corn future prices. The model uses data from the Chicago Board of Trade.

Economic Effects of Accounting Forecasts

Organizer and Chair: *Gerald J. Lobo*
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Informational Characteristics of Earnings Report, and Predictive Accuracy and Dispersion of Analysts' Forecasts of Earnings

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This study shows that the prediction error and the dispersion of analysts' forecasts of accounting earnings (i) decreases with the degree of permanence of the previous period's earnings and (ii) is greater (smaller) when the earnings news contained in the forthcoming earnings report is bad (good). The above results hold even after controlling for previously identified determinants. These results contribute to the literature on the determinants of the predictive accuracy and the dispersion of analysts' forecasts, and are consistent with the discretionary disclosure theory by Verrecchia (1983).

The Stock Return Behaviour Associated with Corporate Filings with the SEC

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This study examines the stock return behavior at the time when publicly traded firms file their 10-K Reports and/or Annual Reports to Shareholders with the Securities and Exchange commission. The existing evidence with respect to the informativeness of corporate financial statements are mixed depending on how financial statement information is measured and over what event periods that stock returns are cumulated. In this study we translate various financial statement variables into a single predictor of future earnings changes and analyze the stock returns at several possible event dates. The results suggest that corporate filings are informative to investors as demonstrated by the correlation between stock returns and the likelihood of earnings increase or decrease indicated by the summarized earnings predictor.

An Empirical Study of the Impact of Product Diversity on Scope Economies in the Banking Industry

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    National Chengchi University

Economies of scope describe the impact on total costs to the production of more than one product (Scherer and Ross [1990]). In this study we devise measures of product diversity which proxy for product commonalities, such as common inputs, processes or knowledge, which influence scope economies (Baumol, Panzar and Willig [1982]). Although prior accounting studies have examined the relation of product diversity and operating cost efficiency, they did not differentiate between the joint production of similar products (related product diversity) that may lead to economies of scope from the multiple production of dissimilar products (unrelated product diversity) that drive scope diseconomies. We conduct our empirical analysis in the banking industry. We differentiate related product diversity from unrelated product diversity and empirically demonstrate that related (unrelated) product diversity is associated with higher (lower) operating cost efficiency.

Information Content of Components of Bank Earnings

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This study investigates the differential information conveyed by accounting earnings components that is relevant for pricing shares of stock in the banking industry. Components examined include loan revenue nonloan interest revenue, stable interest expense, borrowed interest expense, loan loss provision, and other income per unit. Our results show that loan revenue and stable interest expense cause the largest change in bank share prices, nonloan interest income and borrowed interest expense the next largest change, and loan provision the smallest change

Chair: *Victor Zarnowitz*
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What is the Best Method of Forecasting?

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The talk will review the many different time-series forecasting methods available, ranging form simple (univariate) extrapolation methods through to (multivariate) vector ARMA models. Some general recommendations are made on choosing a suitable method, illustrated by real examples, though it has to be realised that there "cannot be a universal forecasting algorithm". Advice will include the importance of clarifying objectives and of studying a clear time plot. There will also be a selective review of recent research on time-series forecasting. Topics covered will include: (1) forecasting competitions (including the recent M2- and Santa Fe-competitions); (2) structural (state-space) modelling; (3) the calculation of prediction intervals; (4) model-selection biases induced by formulating and fitting a model to the *same* data set.

Forecasting with Latent Factors

Chair: *Sune Karlsson*
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Detection of Optimum Set of Regressors for AR Models

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In identification, often the problem is the choice of the appropriate set of candidate regressors. A common approach is to use AIC (Akaike Information Criterion) with an exhaustive selection of regressors and choose the one that produces the minimum value of AIC. This paper proposes the use of singular value decomposition (SVD) and QR with column pivoting factorization (QRcp) for extracting a reduced subset from the exhaustive candidate set of regressors and to use AIC on the reduced subset to obtain the optimum set of regressors for an AR model. The advantage is that the optimum model can be arrived at through much reduced search. The validity of the proposed method is demonstrated through examples.

A Dynamic Forecasting Model for Correlated Time Series

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In this paper we develop a dynamic regression method that allows us to forecast the behaviour of a time series by another time series which is known to be correlated to the first one. The basic tools for this procedure are the decomposition of a time series by means of its principal components and the linear regression performed on these components.

The behaviour of this method is compared with forecasting by classical dynamic regression models. We consider as input a simulated series following an AR(2) model. The output is obtained as an orthogonal decomposition of the time series through its principal factors and the principal components estimated by linear regression.

Another comparative study is set up by using real data. We deal with two real time series in order to build a model as the one proposed by us and as the one proposed by Pankratz (1991).

Continuum Regression and MAF

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When forecasting multivariate time series it may be wise to look for a few latent factors having good predictive properties. These factors could be used to forecast the original time series. This ought to give more accurate and robust forecasts than using only the individual components of the multivariate time series. Here the factors are linear combinations of the original time series. Inspired by Stone & Brooks' paper (*JRSS* B, 1990) on continuum regression, time series factors with maximum autocorrelation (MAF), autocovariance (MAC) and variance (principal components) as special cases are considered. Their respective forecasting performances are studied on macroeconomic data.

Neural Networks IV

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Forecasting and Modelling Using Neural Networks: High Performance with Small and Poor Quality Datasets

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Neural networks have established a reputation as useful forecasting and modelling tools, with particular relevance to nonlinear modelling. This paper describes a secondary advantage of the neural network approach, when combined with a "best predictive ability" measure of performance rather than "best fit to the data". This secondary advantage is that their models exhibit superior performance in the domain of small and poor quality (i.e. noisy or near-colinear) datasets. It is shown that the approach may extend to other forecasting and modelling methodologies, too.

Neural Networks Versus Time Series: A Forecasting Exercise

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This paper presents an empirical exercise in economic forecast using traditional time series methods, such as ARIMA and unobservable components models (UCM), and artificial neural networks (ANN). We argued that ARIMA models are not a proper benchmark for comparison with ANN. An artificial neuron network is a biological inspired attempt to model the human brain. The network is trained, to be able to recognize pattern and regularities in the data. The "estimation" of an ANN involves a learning process whereas in the ARIMA case there is no such thing. A better benchmark could be the UCM in both classical or bayesian fashions. We use monthly gross industrial output data for the state of Rio Grande do Sul (Brazil) to performance a comparative exercise and access the relative performance of the different forecasting methods.

Time Series Neural Network Forecasting Methods

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This paper has discussed the possibility and key problem to construct the neural network time series model, and three time series neural network forecasting methods have been proposed. That is, a neural network nonlinear time series model, a neural network multi-dimension time series model and a neural network combining predictive model. These three methods are applied to real problems. The results show that these methods are better than the traditional one. Furthermore, the neural network compared to the traditional method, and the constructed model of intellectual information forecasting system is given.

Forecasting in the Former Socialist Countries II

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Doing Business in Hungary

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The Hungarian economy, like the economies of former socialist countries in Europe is in transition. Whether this transition will be successful or not greatly depends on the inflow of Foreign Direct Investment (FDI) since the Hungarian firms lack the money, technical and managerial knowledge what is necessary to develop competitive advantages.

In the situation when the impact of FDI on the whole country is so significant, it is important to know what the Hungarian government can consider in aiming to attract more FDI. The government needs to have a clear idea about why firms chose Hungary to invest in, why Hungary is attractive for inward investments and what causes problems for investors in Hungary.

This paper, which is based on a questionnaire distributed to British firms with investment in Hungary, is aiming to highlight these important aspects of FDI in Hungary.

Decision Making Problems Arising From the Underdeveloped Information System During the Transition Period of the Hungarian Economy

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The centralized economies where characterized by inflexible structure and big state-owned companies. These firms provided information compulsory to the Hungarian Central Statistical Office (H.C.S.O.) and other top authorities.

This structure collapsed as a consequence of the change of regime. At the present a lot of occurrences demand attention that did not exist in Hungary previously (e.g. unemployment, inflation). The former information system, which was built on compulsory information supply, became unable to provide up-to-date and reliable statistics.

This new situation requires changes in the approach of data collection and wider uses of representative observations.

This paper analyses the possibilities of the realisation of these new requirements.

Statistical and Accounting Methods of Business Forecasting with Special Regards to Borsod-Abaúj-Zemplén County

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The changes in the ownership structure of the Hungarian economy made the modernisation of the Accounting-Financial information system inevitable.

In the first part of my paper, I will analyze the effects of political and economic changes on the ownership structure of enterprises in Borsod-Abauj-Zemplen county.

Then I would like to find out whether the changes in the ownership structure of firms brought more emphasis on the forecast of future events, and what are the reasons of insufficient use of statistical information.

Finally I would like to emphasize the problems arising from the development of the market economy in B-A-Z county, and the way in which these problems can be solved.

Determining Company Trading Preference For a Trading Bloc: A Study of Canada's Technology Triangle Firms

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Several studies indicate that size, product/service and financial success, in addition to international management skill, are important determinants for a company organizing a trading initiative. With the finalizing of NAFTA and the Single Market Agreement, it would appear that firms in North America and particularly Canada, would be more prone to initiating trading arrangements with companies and customers within established regionalized blocs. Why then, are Eastern European countries emerging as attractive trading and investment partners in the 1990's?

This question was researched as part of a Business Confidence and Strategy Study with 300 firms in Canada's Technology Triangle (Ontario, Canada), with queries focused on offshore trading patterns and agreements.

Results indicate that companies still look at the European Union as a trade fortress and Mexico as a developing consumer market and a long term investment opportunity. What emerged is strong, current interest and activity in Eastern European countries and their economies.

Technological Forecasting

Chair: *Keith Ord*

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Forecasting Product Sales in a High Technology Environment

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In this paper planning decisions which are undertaken by a manufacturer of electronic sensor devices are explored. The process of planning has become difficult due primarily to the impact of new technology which has shortened product life cycles and rendered components obsolete. To improve material purchasing performance and meet customer deadlines the company is investigating the use of statistical forecasting techniques. However, the length of data series are short so limiting the application of time series approaches. The paper concludes with a review and an evaluation of methods applied to date.

A Simulation Study for Evaluating Forecast Accuracy for Technological Forecasting

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Sam Lowe

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A simulation study was performed to examine several issues in technological forecasting that influence forecast accuracy. Data are generated form the Logistic and Gompertz models, different configurations being characterized by their generating method, end adoption level, series length, and error magnitude. Models are fitted using both known transformations and maximum likelihood estimates; forecasts are evaluated using several performance measures. The forecast accuracy resulting from data-based transformations is examined in some detail. In particular, we find that the end adoption level exerts considerable influence upon forecast accuracy.

Growth-Cycle Decomposed Diffusion Model for Forecasting the Air Con Demand in Korea

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The annual air con sales in Korea have fluctuated very much in the past few years. Thus it has been seriously discussed for production planning in the industry that this change comes from the major growth of this market or the short term cycle. We develop the diffusion model consisting of both the S-shaped cumulative growth and the cyclical fluctuation, where the major growth is made by the innovation and imitation effects; the cycle affected by the external variables such as the business cycle booms and recessions, the temperature changes in the summer season, the marketing mix and other qualitative factors.

Prediction Intervals for Growth Curve Forecasts

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Since growth curves are often used to produce medium to long term forecasts for planning purposes, it is obviously of value to be able to associate an interval with the forecast trend. The problems in producing prediction intervals are well described by Chatfield (1993), the additional problems in this context are the intrinsic non-linearity of the estimation procedure and the requirement for a prediction region rather than a single interval.

The approach adopted starts with a Taylor expansion of the variance of the forecast values. Several formulations for the distribution of the error term are examined and some results, based on simulations, will be demonstrated.

Forecasting Economic Activity in Metals Industries III

Chair: *Erik Ruist*
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Commodity Price Forecasting in the International Mining Industry

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Commodity price forecasts are used by a number of different groups of individuals (e.g. speculators, producers, buyers) in the mining industry. This industry is characterised by producers having little control over prices and thus revenues. This paper presents the results of an international survey of 102 mining companies. Issues examined include:

- forecasting techniques used for the short, medium and long term;
- functional responsibility for forecasting;
- claimed accuracy of forecasts by term, function and technique.

Several series that are commonly forecasted were examined to judge the appropriateness of techniques used. The gap between forecasting academia and practice was confirmed.

Analyzing the Errors of a Long-Range Forecast: Lessons from Forecasting Steel Consumption

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Estimation of long-range forecasts must be made on a more individual basis than recent large-scale comparisons between different short-term forecasting methods. Nevertheless, it is important to scrutinize the outcome of long-term forecasts in order to improve the models used.

We have investigated a steel consumption forecast made in the middle 70's which gave far too high figures for 1980 and 1985. Still, the same model is often used by steel economists. We have made a new forecast for 1990, using data up to 1980, and then confronted it with the outcome. The result contributes new aspects to the model.

Modelling the Great Lakes Freeze: Forecasting and Seasonality in the Market for Ferrous Scrap

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Recycled ferrous scrap is a widely traded commodity used in the steel and foundry industries. This paper considers the problems of forecasting scrap prices in the UK and US markets. Scrap prices display highly seasonal behaviour as a result of weather and patterns of industrial production.

We consider three ways of modelling this seasonality; the use of dummy variables, the concept of seasonal integration and use of seasonal vector autoregression. A seasonal VAR is developed. Here the quarterly series is decomposed into four annual series - one for each quarter. We regress each of the resultant series on its own lags and lags of other series, so developing a periodic autoregressive model. We compare forecasts from this method with those from an ARIMA model of the original quarterly series.

Model Specification

Chair: *Tarmo Pukkila*
Ministry of Social Affairs & Health, P O Box 267, 00171 Helsinki, Finland

Model Selection of Multivariate Time Series Using Certain Criteria for the WPI Data

Resat Kasap
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In this paper we compare several multivariate models for some time series data. The data are the wholesale price indices (WPI) on four subsets for Turkey and have been used for illustration in a recent methodological paper. All of the models come from VARMA process. So that comparison between them can easily be made using criteria as AIC and its modification for ARMA model. It is particularly interesting to compare the models produced by relatively complicated model selection procedures with using those techniques to see more satisfactory results.

The Diagnosis and Forecasting of Non-Stationary Time Series and Its Applications

Wang Jingqin
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Outliers and structural changes are common in non-stationary time series. In this paper, sequential processing method is applied for outlier diagnosis, which provides a unified approach to both outlier diagnosis and parameter computation. Structural change is detected and expressed by the state-pace model or called structural model.
There are three sections in this paper. First section gives Bayesian diagnosis and forecasting formula. Second section is about the construction of structural model. Third section gives an example.

Model Selection in Univariate Time Series Forecasting

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A number of studies, in the last couple of decades has attempted to find the "best", in terms of post sample accuracy, forecasting procedure for a given time series. A general conclusion, based on empirical studies, has been that no one forecasting procedure is better than all others for all series in the data set. In other words, the name of the game is "horses for courses". This paper investigates several multivariate methods for model selection. The results on the quarterly time series of the M-Competition data set show that the method is significantly better than the within-sample-mean-squared-error criterion at selecting the most accurate forecasting procedure.

Forecasting the Business Cycle

Chair: *Nigel Pain*

National Institute of Economic and Social Research, 2 Dean Trench Street, London, SW1P 3HE, UK

Interest Rate Spreads as Predictors of Business Cycles

Kajal Lahiri

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The performance of a number of interest rate spreads as predictors of business cycle turning points is studied using a non-linear two-regime Markov switching model. We concentrated on the difference between the Federal funds rate and the 10-year Treasury bond rate, between the one-year Treasury bill rate and the 10-year Treasury bond rate, and between the commercial paper and Treasury bill rates at six months maturity. Over 1953-1993 the second did the best - it signaled all turning points without any false signal. All earlier studies have emphasized the success of the spread variables in predicting peaks and seldom looked into their performance in predicting recoveries. We show that the characteristics of a recessionary regime are different from those of an expansionary regime, and that optimal forecasting horizon for predicting a recession is apt to be much longer than that in predicting an expansion.

A Neural Network for Analyzing Business Cycle Indicators

Keshav P. Vishwakarma

La Trobe University, School of Economics, Bundoora, Victoria 3083, Australia

Business cycle analysis entails simultaneous examination of several indicators. The state space formulation is adopted here for handling such multiple time series cases. And a neural network is employed to characterize their nonlinear dynamics. A case study involving three important variables demonstrates the approach. In it monthly U.S. data for industrial production, employment and income over 1965-1989 are used for training. During this phase the dates of cyclical peaks and troughs are also identified. These turning points agree with the official chronology. Equally significantly, the method allows forecasting. Out-of-sample forecasts over 1990-1992 show that the system possesses sound generalization capability.

State-Space Methodology as a Tool for Economic Policy

Carlos Sanchez

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The main purpose of this paper is to show how state space methodology can be a useful tool to represent and analyze dynamic evolution of the economy. We will consider the economy as a whole to be represented into a state vector including all relevant variables related to most important magnitudes policy makers are interested in. Public sector and private agents are interacting in the model, and the way they form their expectations, and how limited are the sets of relevant information each of them are using, conforms different optimal policies to be adopted by economic authorities as well as different final state variable values.

Forecasting for Public Sector Organizations

Organizer and Chair: *Stuart Bretschneider*

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Effects of Legislative Budget Review on Revenue Forecasting

William Powell, *Taihwan Yin*

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Stuart Bretschneider

Syracuse University, The Maxwell School, 400 Eggars Hall, Syracuse, NY 13244, USA

This paper examines the effects of the legislative budget review process on forecasting state revenues in four states. further, it compares the estimates of the executive with the adjustment made by the legislative branch of government after controlling for political and institutional factors. Three models are developed that help determine the impact of legislative action on initial executive estimates through the traditional budget development process. Model builds on the work of Bretschneider and Gorr (1987) by examining the revenue estimate of the governor. Model 2 examines the revenue estimates of the Legislature. Finally, model 3 examines whether differences in the estimates between governor and legislative estimates relate to the time interval between executive submission and when the appropriation's bill becomes law, i.e. the time horizon of the forecasts. The results suggest that after controlling for reduction in time horizon of forecast, general economic trends, and differences between states, the legislative process helps to produce more accurate forecasts.

Federal Forecasting: Occupation or Analytical Tool?

Karen S Hamrick

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Fred Mills

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Should forecasting be recognized as an occupation in the United States Federal Government? Forecasting has developed into its own area of research in the last 10 years, yet the Federal personnel system does not recognize it either as an occupation or as a specialized discipline with unique requirements and qualification standards. Currently economists, statisticians, and other area specialists are hired by agencies as forecasters, with each agency applying its own definition of forecasting in establishing qualification, selection, and training criteria. With the increased emphasis on foresight in government comes the potential for expanded roles and responsibilities for forecasters which will require a more rigorous, systematic approach. This paper outlines the type of forecasting tasks Federal forecasters do, and presents a method for formalizing forecasting in the Federal government.

Organizational Pressures on Forecast Evaluation: Managerial, Political, and Procedural Influences

Vernon Dale Jones

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Wilpen Gorr

Carnegie Mellon University, Heinz School of Public Policy and Management, Pittsburgh, PA 15213, USA

This paper proposes a theory to explain why some forecasting organizations institutionalize forecast accuracy evaluation while others do not. The theory considers internal and external aspects of managerial, political, and procedural factors as they effect forecasting organizations. The theory is then tested using data from a survey of the Federal Forecasters Group. Though some support for the theory is developed, multiple alternative explanations for results and the "public" nature of the sample organizations prevent wide-scale generalization. The results

Forecasting and Evaluating Risk

Chair: *Merle Sandler*
> University of the Witwatersrand, Graduate School of Business Administration, 2 St Davids Place, Parktown, Johannesburg 2193, South Africa

The Use of Neural Networks in Predicting Company Failure

Merle Sandler, J.C. Arron
> University of the Witwatersrand, Graduate School of Business Administration, 2 St Davids Place, Parktown, Johannesburg 2193, South Africa

There have been several published results of successes in the UK and USA using neural networks to forecast share price and exchange rate movements. This paper examines whether a neural network approach to predict company failure in South Africa is more successful than established methodologies. The predictors of future company performance are the financial ratios derived from published accounts. The propositions tested are:

- the predictive powers of neural networks surpass those of multiple discriminant analysis;
- the predictive power of a neural network is further improved by incorporating several years worth of financial ratios.

Credit Granting Decisions: An Empirical Investigation

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Credit granting decisions have received a widespread attention over the years. Such popularity is due to the role of credit in financing economic activities. Previous credit granting decision models have used different borrower attributes - quantitative as well as qualitative - as explanatory variables. The results of these models provided insufficient evidence regarding the best set of variables for predicting the likelihood of granting credit.

The purpose of this study is to examine the financial and nonfinancial characteristics of borrowers that are related to the likelihood of receiving bank credit.

The study sample includes 90 loan applications reviewed by three leading Bahraini banks during the 1986-1990 period. The loan applications reviewed are limited only to business loans. A logit regression model is used to examine the simultaneous effect of the selected independent variables - a set of financial and nonfinancial variables - on the dependent variables (the likelihood of granting credit). The results of the logit model are reported and the regression coefficients as well as the associated t-values are evaluated. The overall classification accuracy of the model will be compared to the classification accuracy produced by a chance model. The study sample is divided in two subsamples: an analysis sample and a holdout sample to allow for the regression function developed from the analysis sample to be used for predicting the cases in the holdout sample.

An Investigation of Individuals' Risk Premia

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Using a fully disaggregated international survey database of exchange rate forecasts we construct time series of individuals' risk premia for a range of currencies across different time horizons. We demonstrate the degree of heterogeneity exhibited by these series, and discuss the problems of deriving "the" risk premium from the mean response to a survey. We decompose the forward discount bias into expectational errors and risk premia for each panel member and test which of these two components accounts for the bulk of the bias. Finally, we show that practically all forecasters are "overly excitable" and would perform better by placing more emphasis on the spot exchange rate.

suggest that larger organizations are more likely to have some form of forecast evaluation compared to smaller units. The institutionalization of forecast accuracy evaluation is closely linked to internal managerial and procedural factors, while external political pressure tends to reduce the likelihood of institutionalization of evaluation of forecast accuracy.

Modelling the Long Run

Chair: *David A Peel*
University of Wales, Dept of Economics, Aberystwyth, Dyfed, SY23 3DB, UK

A P-S Model for Forecasting Coal Exploit Scale in 2050

Zhang YuXiang
China University of Mining and Technology, Postgraduate Dept., Doctor Class of 1993, XuZhou, JiangSu 221008, P.R. China
Han KeQi, Wang YuJun
China University of Mining and Technology, XuZhou, JiangSu 221008, P.R. China

On the basis of forecast studies on some factors restricting coal exploit scale such as investment situation, transportation conditions, water resources, marketplace requirement etc., this paper forecasted the coal exploit scale by means of P-S model, and defined the rational degree of coal exploit scale relative to each restriction factor. Therefore, this paper could provide foundation for future decision of Chinese coal exploit.

Short, Medium and Long Term Forecasting Models

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A general class of models is introduced to provide robust and practically simple short, medium and long-range predictions of future outcomes. These are obtained in the presence of both high and low frequencies in the data. A submodel is constructed to estimate low frequency state parameters and the results obtained are used as conditional information in modelling the high frequency parameters. All parameters have probability distributions and the discount principle of Ameen and Harrison (1985) is used in the posterior-prior state distribution transitions. A number of limiting results and special cases are also discussed.

Forecasting and Estimating of the Parameters in the ARIMA(p, d, q) Model for $d \in$ (-0.5, 0.5)

Valderio A. Reisen
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In recent work on time series analysis considerable interest has been focused on series having the property of long memory. Long memory is a characteristic of time series in which the dependence between distant observations is not negligible. The Autoregressive Integrated Moving Average, ARIMA(p,d,q) process shows in some situations properties of long memory. Our study is based on the ARIMA(p,d,q) model when d takes any real non-integer value between (-0.5, 0.5). For estimating d we suggest an estimator based on the smoothed periodogram. Using an empirical approach we compare this estimator with others which are well-known in the literature of long memory models. We also present studies of forecasting the ARIMA(p,d,q) when d is fractional.

Merging Short- and Long-run Forecasts in Time Series Models - A Comparison of Three Methods

Ilkka Karanta
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Utilizing forecasts given by a long-run model in a short-run, or high sample-rate, model may improve forecast quality. Let the lower sample rate (or aggregate) forecasts be given together with their autocovariance matrix, and an ARMAX model be known for the higher sample rate. Two methods are proposed: an application of Kalman filter, and one based on time series interpolation. These, together with a third approach based on regression

modeling presented elsewhere, are compared. An application in electrical load forecasting, utilizing daily peak load forecasts to improve the quality of hourly load forecasts in the long run, is described.

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Rule-Based Forecasting

Chair: *Roy Batchelor*
   City University Business School, Frobisher Crescent, Barbican, London, EC2Y 8HB, UK

A Smart Automated Macroeconometric Forecasting System

Michael Artis
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Scott Moss, Paul Ormerod
   Manchester Metropolitan University, Centre for Policy Modelling, Aytoun Building, Manchester M1 3GH, UK

A smart, automated forecasting system is a kind of expert system for generating forecasts wholly or partly without human intervention. A pilot-scale system is reported in which the interventions are made by a rulebase which describes the actual intervention procedures of the London Business School Centre for Economic Forecasting on one of the major macroeconometric forecasting models of the UK economy. The rulebase is sufficiently general as to be applicable to any forecasting model. One difference between the system reported in this paper and conventional forecasting models is that policy behaviour is described entirely by rules rather than equations. This allows the use of thresholds, floors, ceilings and discontinuities.

Effects of Model Screening on Forecasting Accuracy: Evidence from the M2 Competition

Len Tashman
   University of Vermont, Burlington, Vermont 05405, USA

Like its predecessors, the M2 competition applied each forecasting method under study to every one of the data series collected. In doing so, a method is being evaluated, inter alia, on data for which it may not be at all a plausible selection (for example, linear trend methods tested against trendless data).
   This study uses each of three screening protocols to distinguish between a plausible and implausible application of a method. Comparisons of each method's forecasting accuracy are made between the group of data series for which the method is deemed to be plausible and that for which it is considered implausible. Our results provide a new type of evidence for understanding the nature of forecasting competitions and , more generally, for judging the benefits of model selection rules.

Qualitative Features and Method Selection

Vassilis Assimakopoulos, I. Linardopoulos
   National Technology University of Athens, Dept. of Electrical & Computer Engineering, 42, 28th October Street, 10682 Athens, Greece

There is much evidence that the accuracy of a forecasting method depends on the particular qualitative features of the given time series. This paper suggests a variation to the problem of method selection. The idea is to emphasise on the evaluation of the qualitative features of time series.
   The first step of the suggested procedure is to cluster a multitude of actual time series into several groups, employing Boolean parameters. Each group consists of time series which share common features. The next step is to identify the best forecasting method for each group, using the appropriate accuracy measure
   The basic idea that underlies this technique is the immediate correlation between the time series' inherent qualities and forecasting.

Theoretical Foundations for Developing Rules for Extrapolation

Fred Collopy
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J. Scott Armstrong
    University of Pennsylvania, The Wharton School, Philadelphia, PA 19104-6371, USA

The forecasting literature has developed to the point where it is possible to formulate a set of principles or theoretical foundations for the selection of forecasting methods. We show how these principles can be used for the selection of extrapolation methods. These principles rest upon four types of information: domain knowledge, trend estimates, structural stability, and uncertainty.

Telecommunications Forecasting I

Organizer and Chair: *Hans Bergendorff*
Telia AB, 123 86 Farsta, Sweden

Elasticities in Telecommunications: Empirical Evidence from Applied Demand Analysis in the U.S. and Canada

Dieter Elixmann
WIK, Postfach 2000, D-53588 Bad Honnef, Germany

The presentation focuses on four important issues of telecommunications demand analysis: 1. The effects of rebalancing of tariffs on telephone penetration, 2. Structural characteristics of long-haul toll demand, especially price elasticities, 3. The effects of competition and regulation on prices and traffic volume in the U.S., 4. Applied demand analysis as a source of information with respect to a carrier's price and product policy. On the basis of a detailed examination of a bulk of papers of the past decade relying on data of the U.S. and Canada we will outline key methodological features and present empirical highlights.

Forecasting the International Telecommunication Demand

Peter Hackl
Wirtschaftsuniversität Wien, Augasse 2-6, A-1090 Wien, Austria

Forecasting the international telecommunication demand is complicated by the fact that the effect of relevant variables such as economic conditions, the technological quality of the telecommunication system, the price for using it, etc. change over time due to factors like the technological development, changes in the price policy, and others. In this situation, a model with time-varying coefficients is appropriate. The forecasting ability of a moving local regression model is demonstrated on the basis of data for telecommunication between Sweden and the destination countries Germany, UK, and USA.

Global Market Research in a Large Telecom Company

Eberhard Reik
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In the course of its strategic planning process Alcatel compiles, in a strictly organized way, global data on telecommunications markets along the lines of its strategic interests.
The corporation's worldwide presence and its matrix like organization structure are decisive elements in the process of market information retrieval and market/product segmentation.
Based on Alcatel's organisation structure the need for worldwide market data, its structure, and retrieval organisation is shown. This leads to the various levels of data detail obtained, and the geographical detail required.
Interlinkage with the Strategic Plan and Competitor analysis provide specific extension into market position analysis.
Selected examples are presented.

Chair: *Hans Levenbach*
Delphus Inc., Suite 348, 103 Washington Street, Morristown, NJ 07960, USA

Forest Sector Modelling: A Synthesis of Econometrics, Mathematical Programming and System Dynamics Methods

Joseph Buongiorno
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Quantitative analysis and forecasting of forest product markets began in the 1950's based almost exclusively on econometric analysis of pure time series. Since then, considerable improvements have been made in the theoretical basis of the models, the statistical methods of estimation, and the coverage of the data. Especially noteworthy is the exploitation of panel data in the analysis of demand. On the supply side, however, activity analysis seems more promising than econometrics. It allows for a detailed description of the techniques of production and, therefore, a better modeling of technical change than the econometric approach. The forest sector models that are used currently for policy analysis and forecasting represent a blend of econometric and mathematical programming, with a dash of system dynamics. Econometrically estimated demand and supply functions are combined with activity analysis of production and transportation, into optimizers to calculate spatial equlibria in multi-product markets. The shadow prices of the optimization are then the key inputs in predicting capacity change by region and process, in system dynamics fashion.

Model Selection Issues

Chair: *Jan G. de Gooijer*
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Statistics after Model Selection - a Time Series Illustration

Urban Hjorth
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Selecting a model from its fit to data gives a random result which affects the distributions of parameter estimates. Some large such effects are illustrated for time series.

Model-Selection Biases in Time-Series Modelling

Chris Chatfield
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Traditional statistical inference assumes a *known* statistical model. In practice time-series model-building is an iterative procedure involving formulating, fitting and checking a model using the *same* data. Modern computing power allows the analyst to consider a large number of models and pick the "best" one using some criterion such as AIC. Inferences are then generally made as if the selected model is known to be true. This induces various biases such as those resulting from multiple regression subset selection. For example prediction intervals, calculated on the assumption that the model is "known", are typically too narrow in not allowing for model uncertainty. Methods of assessing and overcoming model-selection bias will be reviewed, including resampling methods and Bayesian model-averaging.

Restricted Forecasts

Organizer and Chair: *Victor M. Guerrero*
   Instituto Tecnologico Autonomo de Mexico, Rio Hondo #1, Mexico 01000, DF, Mexico

Constrained Forecasting in Time Series Models: Bayesian Analysis

Enrique de Alba
   Instituto Tecnológico Autónomo de México, Rio Hondo No. 1, México, D. F. 01000, Mexico

   A Bayesian approach is used to derive constrained and unconstrained forecasts in time series models. Both are obtained by formulating the time series model in such a way that it is possible to numerically compute the predictive distribution for any number of forecasts. An approximate likelihood function is used to derive the predictive distributions. The types of constraints considered are that a linear combination of the forecasts equals a given value. This kind of restriction is applied to forecasting quarterly values whose sum must be equal to a given annual value. The constrained forecasts are generated by conditioning in the predictive distribution of the unconstrained forecasts. The procedures are applied to a simulated series and to the Quarterly Unemployment Rate for the United States.

Recursive Approach for Estimating Missing Observations in a Time Series when the ARIMA Model for the Process is Known

Jorge Martínez
   National University of Colombia, Dept. of Mathematics and Statistics, Bogotá D.C., Colombia
Fabio H. Nieto
   National University of Columbia, Dept. of Mathematics and Statistics, Bogotá D.C., Colombia

   A linear recursive technique is proposed here for estimating missing observations in a univariate time series when its ARIMA model is known. The procedure uses the idea of restricted forecasts (Guerrero, 1989) and it does not need the dual autocorrelation function of the process for computing the missing data estimates. The recursive linear estimators are optimal in the sense of minimum-mean-square error.

Restricted Forecasts of Electricity Consumption with Extra-Model Information Provided by the Users

Edmundo Berumen-Torres
   Berumen y Asociados, S.C., #129 Col Hipodromo Condesa, Del Cuauhtemoc CP 06140, Mexico
Victor M. Guerrero
   Instituto Tecnologico Autonomo de Mexico, Rio Hondo #1, Mexico 01000, DF, Mexico

   Univariate time series models make efficient use of available historical records of electricity consumption for short-term forecasting. However, the information provided by electricity users in an energy-use survey (expectations) even though qualitative, was deemed specially important in this case, because users' perception of the future takes into account the changing economic conditions in Mexico, for medium and long range forecasting. Our approach to forecasting electricity consumption combines historical data with expectations of the users in an optimal manner, through the technique of restricted forecasts.

Restricted Forecasts

Organizer and Chair: *Victor M. Guerrero*
Instituto Tecnologico Autonomo de Mexico, Rio Hondo #1, Mexico 01000, DF, Mexico

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On the Estimation of Missing Observations in a Time Series Using Restricted Forecasting

Jorge Martínez
    National University of Colombia, Dept. of Mathematics and Statistics, Bogotá D.C., Colombia
Martha Castañeda
    Departamento Administrativo Nacional de Estadistica (DANE), Bogotá, Colombia

This paper considers a procedure to estimate missing observations in a time series using the conditional ARIMA forecasts proposed by Guerrero (1989). The restrictions for the estimation process are the data points observed after the period with missing observations. It is shown that in an AR(p) process the estimated observations depend on the p data points observed immediately after the last missing observation.

Forecasting Using Large Scale Econometric Models

Organizer and Chair: *Ådne Cappelen*
> Statistics Norway, Research Dept., Box 8131 Dep, 0033 Oslo, Norway

Using Mixed Techniques in Industry Forecasting (The WEFA Group Industrial Analysis Model)

Mohsen Bonakdarpour
> The WEFA Group, 401 City Avenue, Ste 300, Bala Cynwyd, PA 19004, USA

The WEFA Group's Industrial Analysis Model uses a combination of Input-Output and Stochastic techniques in forecasting activity, cost and profitability in 117 U.S. industries, covering all sectors of the U.S. economy.

The input-output block in the core of the model translates macroeconomic forecasts from The WEFA Group's short- and long-term macroeconomic models into demand by industry. The input-output matrices are employed in the calculation of input cost indexes by industry, used in forecasting prices.

The model forecasts demand, industrial production indexes, shipments, inventories, value of production, prices, man hours, productivity, average hourly earnings, material cost, and gross operating margin for each industry.

The industry aggregation includes 73 manufacturing industries - basically a three-digit U.S. Standard Industrial Classification (SIC) aggregation - and a largely one- to two- digit SIC scheme for 44 nonmanufacturing industries.

The model forecasts quarterly-frequency industry indicators, and forecasts are updated each month. Historical data for the most part are monthly series released by various U.S. government agencies, which are typically up to date within two months of forecast time.

Fiscal and Monetary Policies and their Impact on Unemployment: A Simulation Based Analysis Using NIGEM

James Sefton, Jan in't Veld, **Ray Barrell**
> National Institute of Economic and Social Research, 2 Dean Trench Street, Smith Square, London, SW1P 3HE, UK

Forecasts using large scale econometric models depend upon the properties of the model. This paper uses the National Institute Global Econometric Model (NIGEM) to analyze the effects of fiscal and monetary policies on unemployment. The model has forward looking financial, foreign exchange and labor markets as well as well specified NAIRU's. This enables us to analyze policy relevant issues such as the effects of German unification or the Clinton fiscal package in a theoretically coherent but empirically based framework. Standard simulations under various monetary and fiscal policy rules are presented for each of the major 7 economies, and the implications of increased money supply, increased government deficits and devaluations are fully explored.

Forecasting Labour Market Imbalances

Ådne Cappelen, Nils Martin Stølen
> Statistics Norway, Research Dept., Box 8131 Dep, 0033 Oslo, Norway

High and rising levels of unemployment are on the policy agenda in most OECD countries. It is generally acknowledged that unemployment is higher among unskilled than skilled labour. Using a large-scale disaggregated macroeconometric model of the Norwegian economy, we describe the present imbalances in the Norwegian labour markets and forecast possible changes in these imbalances during the 1990s. The effect of some standard policy simulations on these imbalances are also presented.

Macroeconomic Performance and Fiscal Policy Adjustment in the Medium-Term

Pete Richardson

OECD, Economics Department, 2 rue Andre-Pascal, 75775 Paris, Cedex 16, France

This paper describes a number of alternative medium-term scenarios for the OECD economies and related policy simulations using the OECD world model INTERLINK. The starting point of the analysis is a reference scenario featuring a general recovery of the OECD economies to steady state non-inflationary growth. The paper then goes on to examine the implications of slower growth for the paths of fiscal balance and public debt, and the changes in policy mix which might be necessary to restore announced fiscal policy objectives whilst limiting damage to the wider range of policy objectives. A further section goes on to examine the simulated effects of changes of fiscal and monetary policy stance on output, employment, inflation and public debt over the medium-term.

Macroeconomic Performance and Fiscal Policy Adjustment in the Medium-Term

Pete Richardson

OECD, Economics Department, 2 rue Andre-Pascal, 75775 Paris, Cedex 16, France

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Forecasting for the Supply Chain

Organizer and Chair: *Hans Levenbach*

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

Efficient Automated Short-Term Forecasting for the Supply Chain

Klaus Zoller

Universität der Bundeswehr Hamburg, Maria Louisen Str. 84, D-22301 Hamburg, Germany

The paper addresses problems of routinely forecasting period and lead time demands or requirements for large numbers of SKU's. This task arises in the context of optimising simultaneously the parameters of replenishment policies for SKU's sharing limited resources (storage space, replenishment capacity, capital investment). Emphasis will be on forecasting reliability requirements vs. computational effort, raw data analysis, model selection, and selective model revision. The presentation is intended to expose concepts and results of an on-going research project to critical comment, and to invite co-ordinated research.

Design Issues for a Forecasting System in Operations

Hans Levenbach

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

Traditional forecasting systems have emphasized statistical forecasting techniques. More recently, forecasting methods for handling large volumes of end item (such as stock-keeping units or SKUs) and sales demand data (such as product lines) have utilized elements of artificial intelligence (AI) or expert systems logic for automatic model selection. This paper discusses developments in forecasting system design driven by changes in the way a forecasting process must operate in a modern, supply-chain driven environment.

Was the Sales Promotion Successful?: Reallocation Outliers in Time Series

J.R.M. Hosking

IBM Research Division, T.J. Watson Research Center, Yorktown Heights, New York 10598, USA

Nalini Ravishanker

University of Connecticut, Department of Statistics, U-120 MSB 428, 196 Auditorium Road, Storrs, CT 06269-3120, USA

Lillian Wu

IBM Research Division, T. J. Watson Research Center, Yorktown Heights, NY 10598, USA

When a promotion is offered to customers, it is common for sales to rise during the promotion period and afterwards to fall below their pre-promotion level. If the rise and fall balance each other, then the promotion has had no positive effect but has merely moved sales from one time period to another. We call this a "reallocation". Indeed, many economic and business time series contain a block of unusually high values followed by unusually low values, or vice versa. We have derived tests for deciding whether such a block of outliers is a reallocation, and assessed the effect on forecasts and forecast intervals of ignoring them. In the sales promotion example, we can decide whether the promotion has been effective, and, if so, we can estimate how large its effect on sales really was.

Forecasting for the Supply Chain

Organizer and Chair: *Hans Levenbach*

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

Efficient Automated Short-Term Forecasting for the Supply Chain

Klaus Zoller

   Universität der Bundeswehr Hamburg, Maria Louisen Str. 84, D-22301 Hamburg, Germany

The paper addresses problems of routinely forecasting period and lead time demands or requirements for large numbers of SKU´s. This task arises in the context of optimising simultaneously the parameters of replenishment policies for SKU´s sharing limited resources (storage space, replenishment capacity, capital investment). Emphasis will be on forecasting reliability requirements vs. computational effort, raw data analysis, model selection, and selective model revision. The presentation is intended to expose concepts and results of an on-going research project to critical comment, and to invite co-ordinated research.

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On the Use of Survey Data in Forecasting

Organizer and Chair: *Reinhold Bergström*
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Forecasting Car Expenditures Using Household Survey Data - A Comparison of Different Predictors

Bo Jonsson
Uppsala University, Dept. of Statistics, P.O. Box 513, 751 20 Uppsala, Sweden

Time series data based on surveys contains sampling errors. In this paper the predictive ability of household survey data (concerning attitudes about the economic development and car buying intentions) on consumer expenditure on automobiles in Sweden is studied. This is done for some proportion variables on different levels based on the survey data and thus these regressors contain errors. The paper focuses on a comparison of the OLS predictor, a predictor based on consistent estimation and one based on a modified OLS estimator. It turns out that the OLS predictor often is the best overall predictor.

Quantitative Production Data Compared with Qualitative Business Tendency Series - Some Further Experiences from Sweden

Reinhold Bergström
Uppsala University, Dept. of Statistics, Box 513, 751 20 Uppsala, Sweden

The quantification of qualitative business tendency survey data by the Carlson-Parkin method and direct regression methods of the ADL type is compared based on Swedish data from 1968-1992. In addition, the performance of earlier established relationships during the major early-1990s recession is tested. It is found that the difference between different quantification techniques is not great, while models established before the 1990s recession perform excellently in many cases in true ex ante forecasting during this recession period.

Forecasting Manufacturing from BTS (Business Tendency Survey) Series Using Frequency and Complex Demodulate Methods

Anders Christoffersson
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Roland Roberts
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A significant and clear relationship exists between some BTS series and manufacturing production, but only within some frequency bands and primarily at low frequencies. Complex demodulation produced using minimum phase (causal) filters offers an alternative to the more traditional time-domain methods (ARMAX, Box-Jenkins etc.) for short term forecasts.

Judgemental Forecasting III

Organizer and Chair: *Michael Lawrence*
University of New South Wales, School of Information Systems, Kensington 2033, New South Wales, Australia

An Examination of Sales Forecasting Accuracy Achieved in Practice

Marcus O'Connor, **Michael Lawrence,** *Bob Edmundson*
University of New South Wales, School of Information Systems, Kensington 2033, New South Wales, Australia

Fifteen Australian and international manufacturing oriented organisations took part in a two year study of their sales forecasting practice. Each organisation used a judgementally based rolling forecasting approach. Sales forecasts were collected for important products or product groups for lead times from one month ahead to a maximum of 12 months ahead. The actual sales realised for each month were also collected. This data allowed the calculation of forecast accuracies. These were analysed to measure the relative change of accuracy over forecast horizon and to measure the accuracy in absolute terms by comparing with the naive method. The results were most surprising, showing an alarming lack of accuracy despite evidence of considerable investment of effort.

Judgemental Decomposition of Special Events in Time Series Forecasting: The Influence of Seasonality and Event Homogeneity on Forecast Accuracy

Marcus O'Connor, **Richard Webby,** *Bob Edmundson*
University of New South Wales, School of Information Systems, Kensington 2033, New South Wales, Australia

The role of contextual information in time series forecasting has been emphasised recently in both the empirical literature and through direct observation of forecasting practice. This paper proposes and evaluates a decomposition-based method, implemented in graphical interactive software, which structures the judgemental integration of contextual 'event' information and time series data. Our earlier work showed that this method was more accurate than holistic judgement, but, surprisingly, was not appreciably more effective with additional events. The experiment reported here extended that investigation, finding that decomposition was best for seasonal series with homogeneous events.

Modelling the Decision Maker: An Alternative Approach for Designing a Forecasting Decision Support System

Marcus O'Connor, **Michael Lawrence**
University of New South Wales, School of Information Systems, Kensington 2033, New South Wales, Australia

Forecasting decision support systems have not achieved a significant penetration in sales forecasting practice which continues to be dominated by judgemental approaches. One possible reason is the fact that the core statistical models in the DSS's are no more accurate than unaided judgement and so are not perceived to be valid alternatives. However, over twenty years research on cognitive biases and limitations has built a strong case demonstrating that a model of human judgement is superior to the judgement itself. This study builds a model of the judgemental forecaster (a "model of man") as an alternative approach to the construction of the core model of a forecasting DSS. The accuracy of this "model of man" is compared to the accuracy of the judgemental forecaster using a sample of 111 real life time series in order to assess its suitability for a forecasting DSS. Over the practical time series used, the model of man was, contrary to the overwhelming results to date, inferior to man when measured by forecast decision accuracy.

Neural Networks V

Organizer and Chair: *Mirko Novak*
Academy of Sciences of the Czech Republic, Institute of Computer Science, Pod Vodárenskou vezi 2, 18207 Prague 8, Czech Republic

Error Prediction in Large Electronic Systems by Neural Networks

Vaclav Prenosil, *Petr Musilek*
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The problem is discussed how to predict an occurrence of a hard error in large electronic system. As a symptom a number of occurrence temporary errors is used. A prediction is realized by neural network.

Stock Performance Modeling Using Neural Networks: A Comparative Study with Regression Models

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A. ZapranisGavin Francis
County NatWest Investment Management, 43/44 Crutched Friars, London EC3N 2NX, UK

We examine the use of neural networks as an alternative to classical statistical techniques for forecasting within the framework of the APT (Arbitrage Pricing Theory) model for stock ranging. We show that neural network outperform these statistical techniques in forecasting accuracy terms, and give better model fitness in-sample by one order of magnitude. We identify intervals for the network parameter values for which these performance figures are statistically stable.

Neural networks have been criticised for not being able to provide an explanation of how they interact with their environment and how they reach an outcome. We show that by using sensitivity analysis, neural networks can provide a reasonable explanation of their predictive behaviour and can model their environment more convincingly than regression models.

Optimizing Neural Network Architectures for Time Series Applications

Jan Larsen
Technical University of Denmark, Electronics Institute, B 349, DK-2800 Lyngby, Denmark

The talk addresses optimization of neural network architectures for time series applications. It is suggested to optimize the architecture by selecting the model with minimal estimated averaged generalization error - or prediction risk.

The employed generalization error measure is briefly presented and various estimates are characterized and evaluated, In particular, we will focus on the GEN-estimator (Larsen 92) with validity for nonlinear, incomplete models. The possibility of estimating the performance of incomplete models is particularity important when considering neural network models. The performance of the suggested method for model optimization is demonstrated by comparative numerical studies.

Forestry Forecasting III

Organizer: *Anders Baudin*
SIMS, Statistical Insitute, 901 87 Umeå, Sweden
Chair: *David Brooks*
Forest Service - USDA, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331, USA

Conditional Long-Term Forecasts for Austrian Solid Wood Product Consumption and Production Based on a Simulation Model and on Econometric Equations

Peter Schwarzbauer
Universität für Bodenkultur, Institute for Forest Economics and Forest Policy, Gregor-Mendelstr. 33, A-1180 Vienna, Austria

The paper presents conditional long-term forecasts for Austrian solid wood product consumption and production (coniferous sawnwood, non-coniferous sawnwood, reconstituted panels) for 2010, based on two different approaches. One involves single supply and demand equations with econometrically estimated parameters. In the other approach, the same equations are built into a sophisticated simulation model of the entire Austrian forest sector (from wood increment to paper consumption) with more than 1300 interrelated equations. Although both types of forecasts were made with the same assumptions for the exogenous variables, the results differ significantly. The underlying reasons are discussed here.

The Role of Forecasts in Forest Industries' Vision Building

Annele Eerola
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The paper re-examines the role of forecasts in forest industries' strategic planning and decision-making. In particular, the indirect and diffuse links between expert forecasts and managerial visions are discussed, enlightening some confusing paradoxes that forest industry experts and managers experience in their work. The discussion is based on an empirical study in Scandinavian pulp and paper companies. The findings suggest that forecasting research should pay more attention to organizational learning and behavioural perspectives of decision-making. On the other hand, management research should have a more open view on the relation between analytical information (like forecasts) and intuitive beliefs (commitment and visions).

Modelling and Forecasting the Demand for Sawnwood in West Europe from an End-Use Perspective

Anders Baudin
SIMS, Statistical Insitute, 901 87 Umeå, Sweden

Traditional analysis of sawnwood demand is based on the aggregate relationship between sawnwood consumption and GDP. Sawnwood is, however, used in a variety of sectors and consequently sector models are applied. A sector classification is made, a data base is constructed and econometric models are specified by sector, where models are specified for (i) the sector development (ii) sawnwood market share in the sector to account for substitution. The approach has been used in analysing and forecasting demand for sawnwood in Sweden, Norway, United Kingdom and Germany. In some of the applications Seemingly Unrelated Regressions (SUR) have been used.

An Econometric Model for Estimating Substitution Elasticities in the UK Sawnwood Import Markets

Riitta Hänninen

Finnish Forest Research Institute, Unionkatu 40 A, SF-00170 Helsinki, Finland

The purpose of the paper is to estimate long-term substitution and own-price elasticities between importing countries or country groups in the United Kingdom sawnwood market. A model of sawnwood import demand is formulated basing on production theory. A two level demand and a translogarithmic cost function for total sawnwood input are assumed. Import cost share functions (sawnwood import demand) for each supplier are derived. The model is estimated using annual time series data on sawnwood imports to the United Kingdom during 1961-1990. Morishima substitution elasticities are derived and the implications of the model for forecasting country specific sawnwood import demand to the United Kingdom are discussed.

Chair: *Olle Lindgren*
Makroekonomisk Rådgivning AB, Kapellbacken 6, 181 65 Lidingö, Sweden

How Good Will the Information Be in the Information Age?

Nariman Behravesh
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At a time when the world economy is being transformed by technological revolutions and vast structural changes, the statistical system set up to monitor these changes is badly out of date. For example, the system of national accounts (SNA), designed around the time of World War II, does not adequately account for: 1) the shift from manufacturing to services in the OECD countries, 2) the role of multinational corporations in international trade, 3) the importance of human capital investment (education), or 4) environmental degradation. A framework will be offered for improving the quality, relevance and timeliness of national and international statistics. Also a realistic assessment will be made of the kind of improvements we can expect in the near- to medium-term.

VAR Modelling and Forecasting

Organizer and Chair: *Ken Holden*

Liverpool John Moores University, The Business School, 98, Mount Pleasant, Liverpool, L3 5UZ, UK

Causal Approaches to Forecasting with a VAR

David Byers

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VARs are usually regarded as providing an agnostic approach to modelling and forecasting though analysing the response of the system to shocks requires some means of handling contemporaneous correlations of the errors. A common, but arbitrary, approach is to assume a recursive structure. Alternatively, 'Structural' VARs allow the investigator to impose a causal structure and examine its implications. Recently, Granger and Swanson have suggested a data-determined approach to modelling contemporaneous correlation. This paper examines data-derived causal orderings from the point of view of forecasting.

A Structural VAR Model for a Rapidly Changing Economy

Anupam Rastogi

Indian Institute of Management, Vastrapur, Ahmedabad - 380 015, India

Economic forecasting using an econometric model is difficult to do when economic reforms, which are set to transform the structure of an economy, are in progress. However, a structural VAR model based on economic theory can be estimated using post-reform data incorporating the changes brought about by the reforms, and can be used to forecast the economy. As the parameters are estimated by imposing contemporaneous structural restrictions, forecasts from the model can be given a structural interpretation. This type of model is estimated using post 1991 quarterly data on the Indian economy and short-term forecasts are made using the estimated model to test the hypothesis.

Linear and Non-linear Modelling for UK Leading Indicators

David A Peel

University of Wales, Dept of Economics, Aberystwyth, Dyfed, SY23 3DB, UK

Ken Holden

Liverpool John Moores University, The Business School, 98, Mount Pleasant, Liverpool, L3 5UZ, UK

The monthly series used as the coincident, shorter and longer leading indicators in the UK are tested for non-linearities, as are their main component series. Univariate, vector autoregressive and non-linear models are formulated as alternative predictors and their accuracy compared with the official series.

Issues in Macroeconomic Forecasting

Chair: *Lois E. Stekler*
Board of Governors of the Federal Reserve System, Division of International Finance, Washington D.C. 20551, USA

Forecasting US Trade: A Model with Multinational Firms

Lois E. Stekler
Board of Governors of the Federal Reserve System, Division of International Finance, Washington D.C. 20551, USA
William Helkie
Board of Governors Federal Reserve System, Washington D.C. 20551, USA

This paper develops a model for forecasting U.S. exports and imports that takes into account the role of multinational firms. The traditional models assume that goods produced in the United States and abroad are imperfect substitutes. However, multinational firms can, and frequently do, produce the same product in several countries (for example, Honda Accords). Factors influencing the location decisions of multinational firms are, therefore, important determinants of trade flows and are included in the model. The forecasts of this model are compared with those of traditional models.

TS/CS Model for Forecasting Consumption Structure

Fang Shi, Genggui Zhou
Zhejiang University of Technology, School of Management, Hangzhou, P.R. China

Some potential variables in forecasting consumption structure have distinct influence over the variables explained of the forecasting models. If they are omitted, the accuracy of the forecasting models will directly be lowered. Adapting the model that is combined time series with cross section (TS/CS) can resolve the problem of the potential variables in forecasting. This paper builds a type of TS/CS forecasting model. It is used dynamically to analyse the impact of income degree and the time factors on the consumption structure of the Chinese inhabitant. The model is also applied and evaluated in forecasting the Chinese consumption structure from 1995-2000.

The Accuracy of the Swedish National Budget Forecasts 1955-92

Reinhold Bergström
Uppsala University, Dept. of Statistics, Box 513, 751 20 Uppsala, Sweden

In connection with the presentation of the budget in early January each year, forecasts are presented for a number of important macroeconomic variables, the PNB (Preliminary National Budget) forecasts. A revised set of forecasts is given about three months later, the Revised National Budget (RNB) forecasts. The accuracy of these forecasts is analyzed for the period 1955-92 using descriptive measures and regression models. With two exceptions the PNB-forecasts of the variables considered are found to be unbiased and efficient. They outperform naive forecasts. The variability of the forecasts is smaller than that of the outcomes indicating cautiousness in the forecasting process. The two variables where the PNB-forecasts are less accurate are wages and prices, where a systematic underestimation of changes is noticeable. More pronounced changes over time in the forecast accuracy are not found, although there is a tendency towards improved forecasts. The RNB-forecasts are based on more information than the PNB-forecasts, which is reflected in more accurate forecasts.

Long Term Forecasting in terms of Government Debt

William Vickrey

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Long-term forecasting for mature industrialized countries requires attention to long-term underlying trends in two basic ratios, the ratio of private sector profit-seeking net invested capital to GDP, and the ratio of the level of asset accumulation to which individuals aspire to disposable personal income and indirectly to GDP.

Recent trends in these two ratios have left a gap which cannot be closed by interest rate adjustments or private sector capital market operations, but must be filled by appropriately growing government debt if satisfactory growth is to be maintained. Meaningful long-term forecasting must take into account the extent to which this relationship can become politically acceptable in the face of widespread ideological insistence on deficit reduction as a prime objective of government policy.

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Forecasting Stock Prices

Chair: *Lars-Erik Öller*
> National Institute of Economic Research, P.O. Box 3116, 103 62 Stockholm, Sweden

An Empirical Investigation of the Causal Relationship between Stock Prices and the Short Ratio

Erdal Gunay
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Celal Aksu
> University of Pennsylvania, The Wharton School of Management, Steinberg Hall-Dietrich Hall, Philadelphia, PA 19104-6365, USA

We investigate the existence and direction of temporal causality between the S&P 500 Index (SP) and Short Ratio (SR) [the short interest on the NYSE divided by average trading volume].

On the claim that changes in SR cause changes in SP, previous studies provide conflicting evidence, possibly because the variables are cointegrated, rendering both the level and first-difference specifications inappropriate.

We find SP and SR to be cointegrated of order 1,1 [$CI(1,1)$]. A series of estimated error-correction models indicate that the variables are dynamically linked with SP causing delayed changes in SR, but not the other way around.

Modelling Heteroscedasticity in Time Series

Rune Höglund
> Åbo Akademi, Dept. of Statistics, Åbo, Finland

Ralf Östermark
> Åbo Akademi, Dept. of Accounting, Åbo, Finland

Economic time series, especially financial series, are frequently heteroscedastic. In the paper we explicitly model the heteroscedasticity of the Finnish Stock index and Stock index futures returns, using a set of alternative ARCH-specifications. Our results indicate that an ARCH(2) model suffices to capture the heteroscedasticity of the time series studied. The ARCH-models are compared to results obtained by the Generalized Method of Moments (GMM), which are robust to heteroscedasticity.

Chaos Theory and It's Application to Forecasting the Shanghai Stock Market

Xuefeng Song
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In recent years, there has been rapid progress in the study of deterministic chaos, random behavior generated by deterministic systems with low dimensionality. Chaotic models have been applied to a variety of dynamic phenomena in the areas of fluid dynamics, optics, chemistry, climate, and neurobiology. Applications to economic theory have also been developed.

In this paper, firstly the chaos theory is reviewed briefly, secondly we apply the theory to analyze Shanghai stock market, and finally, the short index of the stock market is forecasted by chaos theory.

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Manpower Forecasting II

Organizer: *Murray Rowe*
Navy Personnel Resarch & Development Center, 53335 Ryne Road, San Diego, CA 92152-6800, USA
Chair: *Donald M. Atwater*
DMA Incorporated, 13750 Raywood Drive, Los Angeles, CA 90049-1227, USA

The Use of Domain Knowledge to Improve Navy Personnel Forecasts

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

This paper applies our work on rule-based forecasting and causal forces to the problem of forecasting the number of U.S. Navy personnel who will reenlist, seek contract extensions, or leave the service. The performance of approaches that make use of simple domain knowledge is compared with that of the method that is currently used and alternatives that have been proposed.

A Compendium of Human Resource Forecasts for the Year 2000

Richard J. Niehaus, *Donald M. Atwater*
DMA Incorporated, 13750 Raywood Drive, Los Angeles, CA 90049-1227, USA

Like other forecasting disciplines, human resource (hr) forecasting can be described as a multiple cycle process. The first cycle, which we call the vision cycle, focuses on high level or macro views of human resource groups in ten or more years. In the modeling cycle, hr forecasting becomes more parameter driven and quantifiable. For example, five to ten year movements in the size and mix of human resource groups for predefined occupations across local geographic labor markets can be estimated using econometric regression models. Finally, one to five year tactical human resource forecasts are prepared for businesses in the decision application cycle.

Forecasted movements of hispanic males and females into local labor markets in the United States by the year 2000 are examined in this paper to illustrate the scope and complexity of forecasting methods and applications in each of the three hr forecasting cycles. Such movements are important in the United States as measures of progress in government programs such as Affirmative Action and Equal Employment Opportunity. Companies are also interested in such information to determine the cost competitiveness of their work forces and to plan future changes in the composition of their work forces.

In the vision cycle, forecasts of cultural diversity presented by the Hudson Institute in their Workforce 2000 study are revisited. In the modeling cycle, numerical forecasts from the AVAIL model are shown for selected local labor markets. The AVAIL model which is a parameter driven, probit regression model is described. Technical and mathematical references are cited, but are not duplicated. In the third cycle, industrial decisions based on increases in the numbers of high school educated hispanic workers, the elimination of cultural (family) barriers to begin work for hispanic women and the hiring of "cheaper" hispanic workers as replacements for higher skilled and higher priced white males are charted using case studies.

A Community Simulation Model for Surface Warfare Officers in the U.S. Navy

David Rodney
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U.S. military manpower planners make use of a variety of inventory projection models for policy analyses and to obtain inventory forecasts. Most of these models categorize personnel by attributes such as length of service, and project aggregate behavior. Forecasts utilize transition rates derived from historical observations. Such models work well in situations where inventories are large enough to ensure acceptable reliability in the transition rates. In particular, enlisted personnel managers have made extensive use of these aggregate models in the past twenty years. Unfortunately, officer inventories are much smaller than enlisted inventories and officer management is frequently more detailed than enlisted personnel management. Other techniques are required in this situation.

This paper describes a simulation model for surface warfare officers in the U.S. Navy. The model, called COSMOS, is a discrete entity simulation and models the behavior of individual officers. COSMOS is written in the simulation language GPSS and runs on a PC. COSMOS forecasts inventories ten years into the future and produces a variety of projections, including length of service distributions, accessions, promotions, and the distribution of personnel among the various jobs in a U.S. Navy career. A user is able to vary policies and simulate the effect on future inventories.

This paper describes the model design, the variability in model projections resulting from its Monte-Carlo design, and the results of an example application.

Stability, Modeling & Forecasting Structural Change

Organizer and Chair: *Wladyslaw Milo*
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A Varying Parameter Regression Approach to Investment Modelling in South Africa: Estimation, Stability Testing and Prediction

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Due to the rapidly changing economic and political environment in South Africa it is shown that a substantial number of investment models fail one or more tests for structural stability. In this case the model needs to be modified to assimilate the structural change and, hence, it is demonstrated why the Watson/Engle varying parameter regression (VPR) technique, which is based on the recursive application of the Kalman filter, is well suited to predict future values of investment. The forecasting problem is analyzed and various criteria of prediction is considered. It is shown that the VPR model can substantially reduce out-of-sample forecasting errors compared to its fixed coefficient counterparts.

Numerical and Statistical Stability of Financial Market Models

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Instability of economic systems (ES) is studied here through models. We follow the view that there are internal (endogenously determined) sources of economic system fluctuations, as well as external (exogenously determined) ones. In models of ES they can be marked by the use of some endogenous variables interrelated with others (for internal sources) or by the use of given exogenous variables (for external sources). One may postulate an AR model for each exogenous variable and treat the noise of AR as source of fluctuations. Another possibility is to postulate that the noises are the errors that forecasting units make in their forecasting of the exogenous variables. To do it we use simulation processes.
The experiments were carried out on the models of exchange rate, a real U.S.A. rate of interest's yearly model estimated for the period 1965-1991 (see § 2 for the models description and § 3 for the analysis of results).
In § 4 we present results of sensitivity analysis that suggest appropriate respecification of empirical models.

Structural Change of Macro Allocation

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Macro allocation of GDP and imports for exports, consumption and investments is analyzed. We modified and used linear expenditure system. Different parameters of GDP allocation and imports allocation are assumed.
The system is applied for a group of debt countries. Changes of macro allocation parameters are a function of foreign debt.
Usually structural change is treated as some function of time. From economic point of view an approach presented in a paper explaining economic factors influencing structural change is more interesting.
We study the following topics:
1. foreign debt influence on increase of exports share,
2. links of exports share increase with fall of consumption or investment shares.
Estimation results show change of macro allocation (mainly increase of exports share and decrease of consumption share) from beginning of 1970:s.

135

Industrial Forecasting

Chair: *Benito E. Flores*

    Texam A&M University, College of Business, Business Analysis Department, College Station, TX 77843, USA

Reliability Stress-Strength Models for Time Series Data with Applications in Clinical Trials and Industry

Debashis Kushary, Pandu Kulkarni

    University of South Alabama, Dept. of Mathematics and Statistics, FCS 3, Mobile, Alabama 36688-0002, USA

Reliability stress-strength models have been in the literature for quite some time. However, a study of such models for the time series data has not been considered. In this paper, we present an alternative method of estimating the reliability when the stress and the strength are correlated and compare it with the usual methods of estimation. Further, we develop reliability stress-strength models for the time series data in general and study the methods for specific models. Some applications in clinical trials and industry are considered.

Long Term Trend Forecasting of Processed Raw Materials

Fritz Feichtinger

    International Research Circle - Production Dynamics, P.O. Box 3857, 1900 Vanderbiilpark, South Africa

Two conflicting views dominate the perception of man's long term future. The "catastrophists" believe the earth's virgin resources will soon be exhausted and that this will lead to a collapse of society. The "cornucopians" argue that most of the essential raw materials are infinite.

The paper addresses an engineering approach for describing and forecasting long term trends pertaining to the production and use of processed raw materials. The forecasting is based on the postulate that the industrial conversion of a virgin resource to a processed raw material progresses according to a Sigmoid curve. A resource circulation model has been established, to verify the resource conversion postulate. The first three derivatives of the resource conversion path are used in a growth model, to calculate the output rate, acceleration and driving force of a processed raw material. To compute the various parameters a non-linear optimisation model is applied.

Long-term trends have been calculated for various processed raw materials, such as steel, aluminium and platinum.

Forecasting Accuracy in an Industrial Setting

Benito E. Flores

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Arturo Macias

    University of the Americas, College of Business, Puebla, Mexico

Sales forecast in an industrial setting may have outside influences that are not part of the values of the time series data. The many well known parameters such as forecast horizon length, aggregated versus non aggregated values, etc. have an impact on the accuracy of the sales forecast. In this analysis, data gathered from the Textile Industry in Mexico and other countries is analyzed. The results found are mixed, indicating some traditional results and some unexpected finds.

What Should Forecasters Know?

Chair: *Herman O. Stekler*
Industrial College of the Armed Forces, National Defense University, Fort Leslie J. McNair, Washington DC 20319, USA

Panel Members:

Robert Fildes
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Stuart Bretschneider
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Interest has been expressed in a certification program for forecasters. In such a program it would be necessary to determine the criteria for certification. This panel will examine some of the skills that a forecaster should possess. These include awareness of techniques, contextual knowledge, organizational awareness, evaluation procedures and their uses, and understanding of the forecasting process, for example.

Seasonality

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

Regional Disparities and National Similarities in the Spanish Unemployment. A Case of Seasonal Cointegration?

Carles Murillo, Marc Saez
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There exists an adjustment mechanism that ensures the convergence of the short run productivities towards the long run technical productivities. In fact, there are several trends and shocks representing economical restrictions that allow to obtain an exactly identified VECM, the model that permits the convergence. With quarterly data of the Spanish labour market since 1975, we'll estimate a VECM, deriving common trends and 'common' seasonals. The objective is to investigate the variables that explain the dynamic behaviour of the Spanish unemployment. In particular we'll try to find those long and short run rigidities that impede the complete integration of the Spanish labour market.

A Model Based Seasonal Adjustment Method Using the Beveridge-Nelson Decomposition

Michael Beckmann
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Jörg Breitung
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In this paper we suggest a variant of the Beveridge-Nelson (BN) decomposition for seasonal time series. Assuming that the seasonal pattern is associated with poles in the spectral density at seasonal frequencies it is straight-forward to decompose the series into a number of nonstationary components which are integrated at different frequencies. We suggest a simple two-stage least-squares procedure to determine the decomposition empirically. In a number of examples the new seasonal adjustment technique is investigated from a practical point of view. We find that the BN type of decomposition performs similar to the CENSUS X-11 method and the Basic Structural Model advocated by Harvey and Todd (1983). The main advantage is, however, that the BN approach builds on the wide class of ARIMA models while alternative methods either fail to have a clearly specified stochastic model or employ rather restrictive specifications.

A Periodic ARFIMA(0, D_s, 0) Model for Quarterly UK Inflation

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

This paper proposes and estimates an extension of the standard ARFIMA(0,d,0) model which allows the differencing parameter d to vary with the season s. This PARFIMA(0,d_s,0) model fits well to quarterly United Kingdom inflation data, 1955.1-1988.4. Its forecasts outperform a rival periodic AR model, although there are virtually no differences with those of a nonperiodic ARFIMA model. The estimated d_s values indicate that the first and second quarter display nonstationary behaviour since the relevant d_s values significantly exceed 0.5, while the third and fourth quarter, having d_s values significantly less than 0.5, display characteristics corresponding to a long-memory stationary process. A nonperiodic ARFIMA model yields inconclusive results.

Non-Stationarity and Long Run Forecastability

Organizer and Chair: *Katarina Juselius*
    University of Copenhagen, Institute of Economics, Studiestræde 6, DK-1455 Copenhagen K, Denmark

Predictable and Unpredictable Components of the Long-run Growth in Nominal Prices

Katarina Juselius
    University of Copenhagen, Institute of Economics, Studiestræde 6, DK-1455 Copenhagen K, Denmark

This paper investigates the second order properties of nominal prices within an I(2) VAR model based on CPI prices, interest rates and exchange rates for Denmark and Germany. The paper focuses on the long-run trend in Danish prices and demonstrates that it is possible to decompose the trend into its predictable and unpredictable components using the vector moving average representation of the original cointegrated VAR-model. A graphical analysis of the deterministic and stochastic components of the long-run trend in Danish prices is used to illustrate the potential usefulness of this procedure.

The Predictive Power of the Money Market Term Structure

Tom Engsted
    The Aarhus School of Business, Fuglesangs allé 4, DK-8210 Aarhus V, Denmark

The term structure of interest rates is analyzed using weekly data from the Danish money market. First, integration and cointegration analyses reveal that interest rates are individually integrated of order one, and cointegrated so that the term structure is driven by one common stochastic trend, which is in accordance with the expectations hypothesis. Second, using the methods from Campbell & Shiller (1991), it turns out that yield spreads are much more powerful predictors of future interest rates in periods with relative volatile interest rates than in periods with relative smooth interest rates. However, also in the latter case do spreads significantly predict future short rate changes. This implies, among other things, that the slope of the term structure may be used by the monetary authorities as a useful indicator of the tightness of monetary policy.

Simultaneous Estimation of Aggregate Labour Market Relationships

Henrik Hansen, Karsten Albæk
    University of Copenhagen, Institute of Economics, Studiestræde 6, DK-1455 Copenhagen K, Denmark

In this paper we analyze quarterly data for unemployment, vacancies, and hirings in Denmark, covering the period 1974-1988. Using multivariate cointegration analysis we find two stationary relations in the data. One relation is between unemployment and vacancies, the so called Beveridge Curve. The other describes hiring as a constant returns Cobb-Douglas function in unemployment and vacancies. In a structural description of the dynamics of the system we find that permanent chocks are related to the changes in the vacancies, which makes the vacancies the stochastic trend in the system. Our results indicate that the vacancies are weakly exogenous with respect to the parameters in the two remaining equations the unemployment and the hirings. Finally, the dynamics of the system are investigated using impulse-response analysis in the structural model. We find the dynamics in the U-V-plane to be counter clockwise as expected from theory.

Issues in Financial Forecasting II

Chair: *Elias C. Grivoyannis*

Seton Hall University, W.P. Stillman School of Business, South Orange, N.J. 07079-2692, USA

Constructing Index Arbitrage Portfolios over Long and Short Horizons: A New Approach

Godfrey Cadogan

University of Michigan, Industrial and Operations Engineering/Financial Engineering, Ann Arbor, Michigan 48105, USA

This paper proposes an econometric theory for arbitrage pricing by imposing portfolio generating restrictions in a model with dynamic specification. A three stage procedure robust to nonstationarity in prices is proposed for estimating the portfolio weights. Stage one provides unrestricted estimates for ancillary parameters from a maximum likelihood approach and stage two provides restricted parameter estimates conditioned on portfolio design. In stage three a consistent estimator of the portfolio weights is obtained from utilizing the restricted ancillary parameters in stage two and the unrestricted analog parameters in stage one. The proposed model identifies long run market equilibrium paths and temporal disequilibrium adjustments that reflect arbitrage opportunities from mispriced assets. Asymptotic results from an invariance proposition and martingale central limit theorem are used to provide confidence ellipsoids for 'no arbitrage' bounds.

A Fundamental Approach for Forecasting Interest Rates with an Application to the Deutsche Mark Yield Curve

Christian L. Dunis

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Macroeconomic policy co-ordination has often tumbled in recent years on divergent monetary policies between countries and, even more so, divergent interest rate trends.

In this paper, we derive a forecasting methodology that discriminates between the impact of domestic and foreign factors on interest rates, while at the same time distinguishing between the long and the short end of the yield curve.

For short-term interest rates, we show that when futures implied rates are not available for a long enough period, the "equilibrium rate" can be used successfully in an attempt to model the domestic determinants of these rates (the "equilibrium rate" is defined as the sum of the average real rate estimated over the long-term, plus the inflation rate).

But foreign factors are important too: we show that, because of potential currency substitution, foreign interest rates and the perceived exchange rate risk play also an important part in determining the level of the short-term rate.

For long-term interest rates, we show that the combination of the traditional expectations theory with the theory of distributed lags can, under some not too restrictive assumptions, lead to the presentation of a rather simple autoregressive model.

Finally, we present an empirical application of our methodology to the DEM yield curve, adopting the two-stage error correction technique and estimating our model on monthly data from September 1985 to September 1993.

Our practical results, both in and out-of-sample, are more than satisfactory and they should go a long way towards vindicating our approach and extending its application to interest rates on other currencies.

Theory-Dominated Versus Data-Driven Specifications in Forecasting the Demand for Real Money Balances

Elias C. Grivoyannis

Seton Hall University, W.P. Stillman School of Business, South Orange, N.J. 07079-2692, USA

Theory-dominated demand-for-money specifications have been characterized by a low information content since the early 1970s. Data-driven specifications reveal that the lagged real balances can alone explain up to 99

percent of the variations in the demand for real M1. Time-series analysis could become, in such an eventuality, more appropriate than behavioral equations in describing a series-generation process and in facilitating better forecasting.

This paper investigates the descriptive and forecasting properties of theory-dominated and data-driven specifications of the demand for real transaction balances (real M1) using quarterly data for the U.S. and Japan since 1960.

Scenario Analysis and Strategic Planning

Organizer and Chair: *Bartolomeo Sapio*
Fondazione Ugo Bordoni, Via Baldassarre Castiglione, 59, 00142 Roma, Italy

A Metaproject Scenario to Forecast the Evolution Towards Future Telecommunications Networks

Enrico Nicolò
Fondazione Ugo Bordoni, Via Baldassarre Castiglione, 59, 00142 Roma, Italy
Francesco Villani

Metaproject Analysis is a scenario method for mid and long-term strategic preplanning. It allows evolution towards preestablished goals to be modeled and simulated through stochastic "metaproject networks" made up of macroactivities pertaining to different cooperating agents. This paper summarizes some aspects of Metaproject Analysis and presents a scenario that models a possible evolution of public telecommunications networks towards Broadband - Integrated Services Digital Network (B-ISDN). Model building and analysis are performed using SLAM II (Simulation Language for Alternative Modeling II). Statistics such as mean value of metaproject completion-time for B-ISDN implementation are computed and critical macroactivities are detected.

Weighted Impact Structured Evaluation (WISE) of an Evolutionary Scenario Towards Broadband Integrated Telecommunications Networks

Enrico Nicolò, Bartolomeo Sapio
Fondazione Ugo Bordoni, Via Baldassarre Castiglione, 59, 00142 Roma, Italy
Francesco Villani

The new method (WISE) is a structural-analysis tool used to simplify an economic context and to incorporate quantitative techniques into strategic planning, pointing out the structure of the quantifiable and qualitative relations among the variables in a scenario. This paper deals with an application of the WISE-method to the evaluation of factors influencing the implementation of new broadband telecommunications systems. Technological, environmental, market and regulatory factors are singled out and the impacts they exert upon each other are estimated. Results lead to a classification of factors according to their driver power and dependence, showing a ranking of their relative importance.

Linking Scenario Analysis, Visioning and Strategic Initiatives: Organizational Strategy Making in Turbulent Environments

Manolete V. Gonzalez
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Organizations can address the conflict between the reality that its strategic direction is the product of decisions that are local and often short-term in orientation, and the need to adopt a long-term perspective by integrating three processes: scenario analysis, organizational visioning, and managing strategic initiatives. Organizational strategy evolves as a concatenation of many decisions that result from an organization's (sub)processes, which in turn respond to complex environments. These organizational processes can be managed more effectively by the proposed linkage; the value of scenario analysis, visioning, and strategic initiatives as tools to focus organizational attention is discussed.

Scenarios in Strategic Management: Theoretical Framework and Practice in European Companies and Nationalities

Tarja Meristö

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The purpose of this study is to describe why the companies need multiple scenario approach in strategic management, which background it has in futures studies, what it is all about and how it can be combined to the managerial work both conceptually and in practice. The basic questions are: what are possible worlds and which kind of trends and events can influence the future? Who we are and where could we be as a person or as an organization or a nation, or even as a continent? Where do we decide to go and whose role and responsibility it is? How can we do all this in practice? Case study concerning Finnish Society and Finland's future options from the viewpoint of Finnish industry is discussed in the paper. The methodology of PESTE analysis and action scenario approach is developed and used in these applications.

Statistical Properties of Forecasting Methods

Organizer and Chair: *Mituaki Huzii*
Tokyo Institute of Technology, Dept. of Information Sciences, O-okayama, Meguro, Tokyo 152, Japan

Some Statistical Properties of a Forecasting Method for a Seasonal Time Series

Mituaki Huzii
Tokyo Institute of Technology, Dept. of Information Sciences, O-okayama, Meguro, Tokyo 152, Japan

For forecasting the future value of a seasonal time series, many methods have been proposed by many authors. Those include methods constructed by fitting a periodic mean function and by fitting an autoregressive integrated moving average model.

In this paper, we mainly discuss statistical properties of the predictor which is constructed as the sum of an estimator of the periodic mean function and a predictor of the residual. We show these properties for the cases when the residuals are stationary and, also, non-stationary. We compare the prediction error of this predictor with the prediction errors of other predictors.

Some Statistical Properties of Forecasting Methods by Misspecified Model Fittings

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Mituaki Huzii
Tokyo Institute of Technology, Dept. of Information Sciences, O-okayama, Meguro, Tokyo 152, Japan

If a time series satisfies a finite dimensional model exactly and we fit the model to the time series, we know that we can obtain efficient results in analysis of the time series by the model fitting. If, however, the time series does not satisfy the model, how are the results of the analysis by this model fitting? We clarify some properties of conditional quasi-likelihood equations and their solutions. We show some results of the effects on the forecasting errors under misspecified ARMA model fittings.

Model Selection for Multistep Forecasting

R J Bhansali
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An established approach for multistep forecasting of a time series is to select and fit an initial model for the observed time series and then to use this model iteratively for generating forecasts at higher lead times by replacing the unknown intermediate future values by their previously obtained forecasts. If the initial selected model coincides with that generating the time series then this 'plug-in' method is well-known to be optimal because the multistep prediction constants are estimated by maximum likelihood and there is no model selection 'bias' due to using an incorrect model. In practice, however, the model generating an observed time series is rarely known a priori, and, a selected model, at best, captures only certain aspects of the overall stochastic structure of the time series. In this situation, the plug-in method is still optimal in a somewhat restricted sense for one-step prediction. For prediction more than one step ahead, however, even this restricted optimality property does not hold and the possibility of improving the multistep forecasts in a linear least-squares by adopting a different approach does exist. Recently, there has been much interest in a 'direct' method for multistep prediction in which a new time series model is selected and fitted for each forecast lead time. An asymptotic optimality result for this direct method is described and discussed. Examples illustrating empirical applications of this method are also given.

144

Some Statistical Properties of the Holt-Winters Seasonal Forecasting Method

Chunhang Chen
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There are many empirical evidences that the Holt-Winters seasonal forecasting method performs well for many time series in practical fields, though statistical properties of this method have not been clarified. In this paper we consider whether or not the forecasts by this method are reasonable for a wide class of time series from some statistical viewpoints. For that purpose, we show theoretically asymptotic forecast errors of the Holt-Winters method for some time series when the sample size tends to infinity and comparisons of forecast errors between this method and some other commonly used methods for various time series in the small sample case by Monte Carlo studies.

Judgemental Forecasting IV

Chair: *William Remus*
University of Hawaii, 2404 Maile Way, Honolulu, HI 96822, USA

Asymmetric Action Intervals: Applications of Prospect Theory to Judgemental Forecast Intervals

Thomas Yokum
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Terence A. Shimp
The University of South Carolina, College of Business Administration, Columbia, SC 29203, USA

Action intervals are judgmental confidence intervals based on the necessity of managerial actions to changes in the patterns of trended time series data. Prospect theory is used as a theoretical structure to explain the development of action intervals. Prospect theory explains action intervals as "framed" positive or negative deviations from a reference point (i.e. point forecast). These deviations may be asymmetric and serve as warning signals for managerial action. An experiment is used to illustrate the links between action intervals and prospect theory, manipulations of trended data, and traditional symmetric statistical confidence intervals.

Will Reliable Information Improve the Judgemental Forecasting Process

Marcus O'Connor
University of New South Wales, School of Information Systems, Kensington 2033, New South Wales, Australia
Ken Griggs, William Remus
University of Hawaii, 2404 Maile Way, Honolulu, HI 96822, USA

This study investigates people's ability to use information when forecasting time series. Previous studies of time series forecasting have emphasized the importance of additional information in improving the accuracy of the final forecasts (Edmundson et al, 1988). In this study, the subjects were presented with three types of information about the future direction of the time series - perfect, imperfect and no information. Results indicate that the more accurate the information provided, the more improved the quality of the forecasts. However, the subjects were not able to fully use the information and, thus, underperformed simple statistical forecasting models.

Judgemental Forecasting for National Strategy: Output Determination in the Bahamas and Barbados

R. DeLisle Worrell
Central Bank of Barbados, Spry Street, Bridgetown, Barbados

The increasing competitiveness of the world economy makes more difficult the task of national economic strategists - especially in small open economies.

The Bahamas and Barbados, tourism-oriented economies in the Caribbean with populations of similar size, have both embarked on strategies for economic diversification. The paper attempts to quantify their strategies.

The forecast begins with a set of historical national accounts which show how the national product has grown in the recent past, what contribution has been made by each sector and the factors that have determined growth in each sector. Projecting these growth rates into the future gives a baseline scenario for economic change when there is no improvement in strategy. Informed judgement helps to eliminate the effects of special circumstances in past performance and to identify underlying forces. This analysis allows for the identification of effects of competitiveness, market imperfections, limited market access, factors affecting transport costs and availability, etc.

146

Forecasting in Formerly Planned Economies

Organizer and Chair: *Seppo Pitkänen*
    Lappeenranta University of Technology, P.O. Box 20, 53851 Lappeenranta, Finland

Development Scenarios in Formerly Socialist Countries

Alari Purju
    The Estonian Institute of Future Studies, Lai 34, EE-00100 Tallinn, Estonia

Development scenarios differ from other forecasting methods in that they allow analysis of relationships between rather disparate factors. The relationships may be of a hypothetical character and can be hard to prove, or even to check. They could also be between quantitative data and qualitative features.

Here we try to describe the future economic environment in Estonia for a potential investor. The scenarios forecast the influence of the relationships between the four factors: macroeconomic stabilization, privatization, direct foreign investment and the relation to CIS.

Only half of the time will be used for this prepared presentation. All participants are encouraged to participate in the subsequent general discussion.

Telecommunications Forecasting II

Chair: *Peter Hackl*
  Wirtschaftsuniversität Wien, Augasse 2-6, A-1090 Wien, Austria

Forecasting the Development of the Market for Business Telephones

Nigel Meade
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Towhidul Islam
  Imperial College, The Management School, 53 Princes Gate, Exhibition Road, London SW7 2PG, UK

The problem of producing medium to short term forecasts of the market for business telephone is examined. This market is particularly sensitive to the state of business confidence and the feasibilities of incorporating explanatory economic variables into the growth curve forecasting model are investigated. Three different types are compared; growth curves with a fixed saturation level, a multivariate linear model and growth curves with saturation levels determined by explanatory variables. Issues examined are model selection, forecasts of explanatory variables, comparisons of forecasting performance using actual and forecasts of explanatory variables.

The International Diffusion of Mobile Telecommunications: An Analogical Forecasting Approach

Paul Bottomley
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Robert Fildes
  University of Lancaster, Dept. of Management Science, Lancaster LA1 4YX, UK

The proliferation of new telecommunications technologies has created a competitive environment unparalleled in previous decades. The prospects for parameterising diffusion models using coefficients from analogous products appears to offer a promising solution to forecasting the adoption of these new products with limited or no data. Whilst previous research has concentrated on consumer goods, this paper investigates the applicability approach in the context of the European mobile telecommunications markets. The paper explores the use of country specific parameters and possible country segmentation schemes and the incorporation of updating to reflect entry time differences as the technologies were rolled out internationally.

Near-Real-Time Monitoring of Call Record Statistics in AT&T Switched Network, Using the CDRM System

Dvora Tzvieli
  AT&T Bell Labs, Rm 1L-220, 101 Crawfords Corner Road, Holmdel, NJ 07733, USA

CDRM (Call Detail Recording Monitor) is a system able to detect in near-real-time variations in recording data that may indicate failures in message recording in the AT&T switched network. Its algorithms allow hourly and daily monitoring of hundreds of data streams, covering a variety of switches, services, switch generics, and measurement statistics.
  Seasonal univariate Box-Jenkins models forecast expected values and provide alarm thresholds. Additional fully-automated mechanisms select model forms, remove data anomalies, fit and diagnose models, ensure stability, treat outliers and holidays, and detect and treat step changes in a switch. They also identify traffic pattern changes and refit models to accommodate them, while maintaining continuity of monitoring, and provide default models for complete coverage.
  CDRM monitoring algorithms are efficient, flexible, robust, fully automated, provide very accurate forecasts, and have excellent alarm quality.

Index

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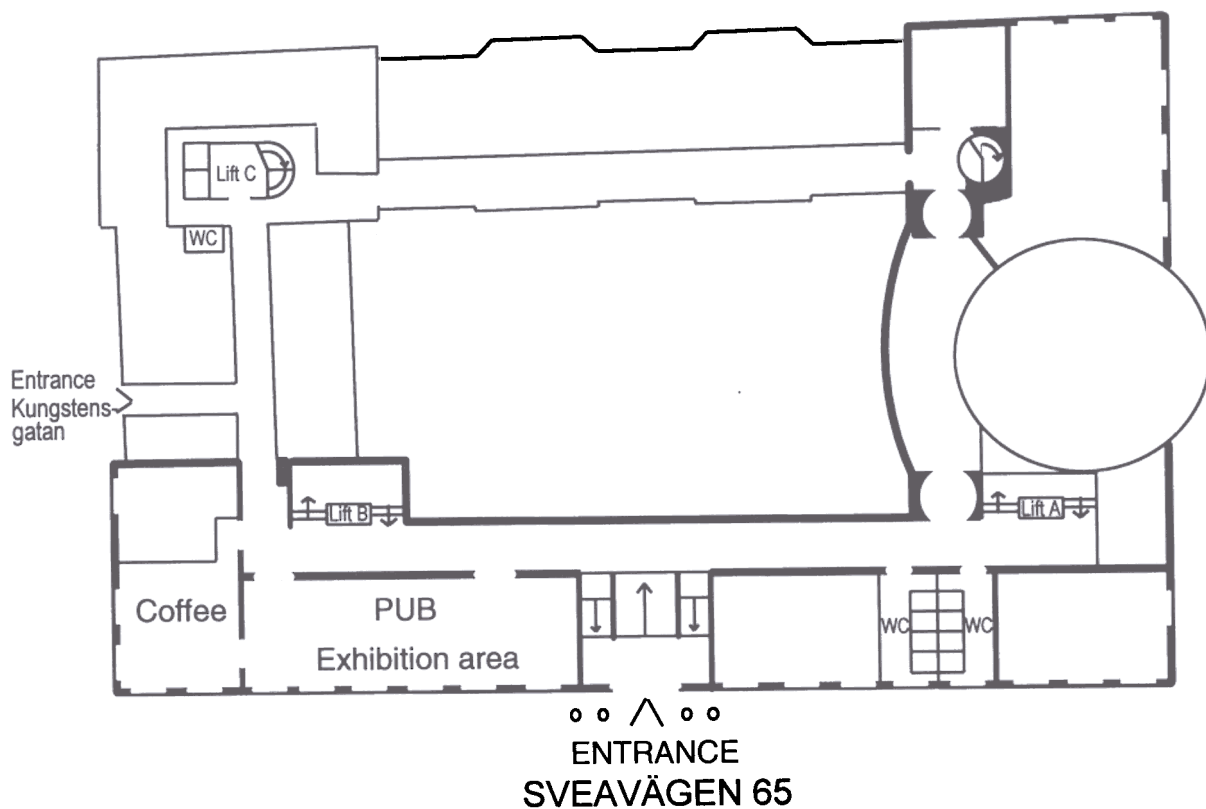
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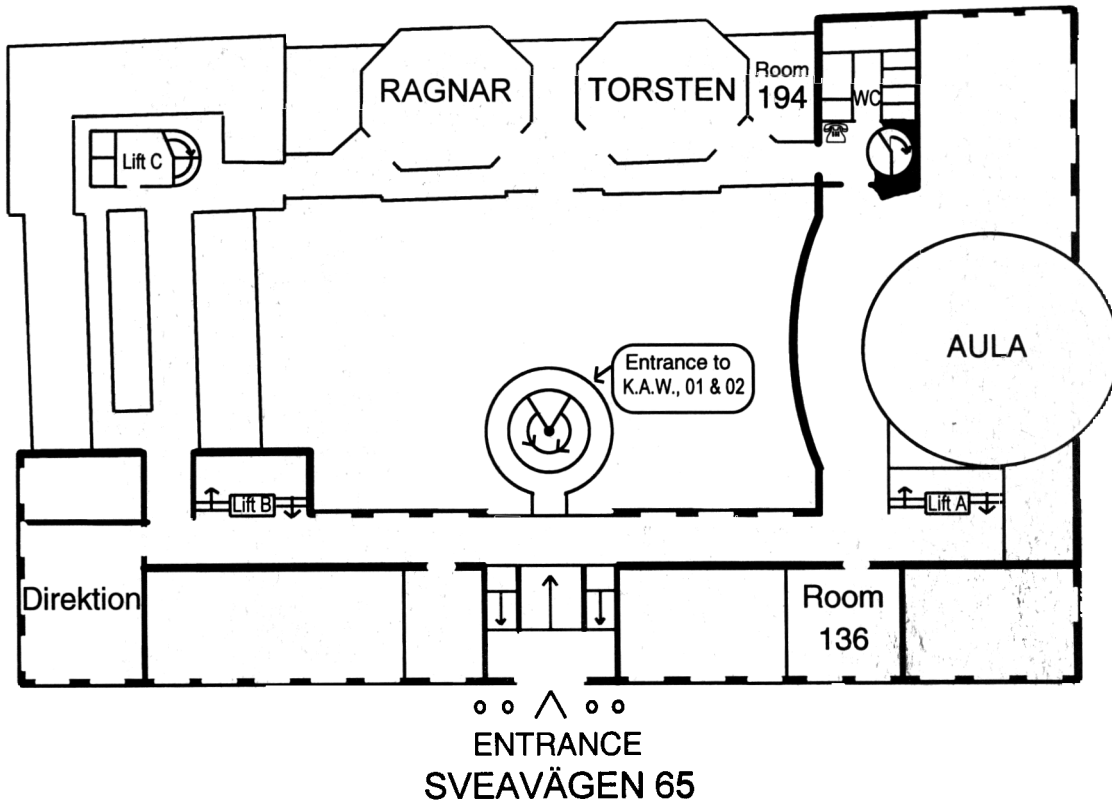
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WC

Room 343

Room 342

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