
24th International Symposium on Forecasting



Sydney, Australia

4–7 July 2004

Programme and abstracts
24th International Symposium on Forecasting (ISF2004)
4-7 July 2004
Sydney, Australia.

Printed in Australia.

Contents

Welcome from ISF2004 Chair	4
Welcome from IIF President	5
Sponsors	6
Organizing committee	7
Programme committee	8
General information	9
Social/partners programme	11
Exhibitors	13
Meetings	14
Keynote and featured speakers	15
Practitioner forum	16
List of sessions by topic area	17
Room locations	20
Timetable	21
Abstracts	26
Guidelines for chairs of sessions	174
Guidelines for speakers	175
Guidelines for posters	178
International Institute of Forecasters	179
Membership application for IIF	180
International Journal of Forecasting	181
Index of topics	182
Index of people	184

Welcome from ISF2004 Chair

It is indeed a pleasure to welcome ISF2004 to Sydney. This is the first time the International Symposium on Forecasting has been held in Australia and we are thrilled that so many have been willing to face the long distance travel to come here.

Because of our concern that distance would be a big barrier, our forecasting proved poor: we established too low a break-even number at 175 participants. Now, as I write this text, the number of registrants is 270 with more in the pipeline, over 250 contributed papers and with roughly two thirds of the delegates from overseas. We are delighted at the excellent response to the conference. Doubtless some of the credit for this must go to my colleagues on the Organising Committee who had the wonderful foresight to invite Clive Granger as a keynote speaker before his talent was recognised by the Nobel Prize Committee. Congratulations Clive from all of us on your many years of research excellence now honoured by the Nobel Prize.

Australians are perhaps notorious for balancing work and fun. We have endeavoured to develop a programme which reflects these two objectives. The formal programme is quite demanding: starting at 8.30 am and continuing until 5.30pm. Social events are planned for Sunday, Monday and Tuesday evenings.

I would like to pay special tribute to the hard work of Rob Hyndman and Ralph Snyder who as Programme Co-Chairs actively solicited papers, managed the reviewing process and put together the Programme. The large number of invited and contributed papers is testimony to their success. The Organising Committee has worked hard and harmoniously and without their efforts this conference would not be where it is today.

All of us on the ISF2004 Organising Committee wish you a very happy conference and stay in Sydney.



Michael Lawrence
Chair of ISF2004

Welcome from IIF President

It is a pleasure and an honour, for the first time as President of IIF, to wish you all welcome to our 24th International Symposium on Forecasting, ISF.

Becoming the president of the IIF this year means taking over a flourishing organisation. Being the President is also a great challenge. I'll try my best to live up to the high standards of IIF. There is still much to be done in the field of forecasting. We need more reliable results on how to improve forecasts, especially economic predictions. The quality of the data we use as the basis of forecasts has to improve. We must make good forecasting practices better known both in companies and in the public sphere.

Research in forecasting should reach the highest scientific standards. At the same time forecasting is not just an academic pursuit; it is everyday business, and the two have to be closely related for the benefit of both. This ISF is a great occasion for making friends across borders, be they professional or national.

Our flagship, the *International Journal of Forecasting*, competes very well in its market segment. Last year we started a new type of forecasting meeting: small-scale workshops on a special theme. Thanks to Antonio García-Ferrer for organising an excellent workshop in Madrid! The most recent issue of our newsletter, the *Oracle*, arrived by e-mail in May.

Our main endeavour, the ISFs, are becoming better every year. The arrangements get smoother and the scientific program holds higher quality, as does the entertainment. I think that all those who were in Mérida last year agree with me that the symposium was marvellous. We are grateful to Víctor Guerrero and his team for the great effort they put in to make the event such a success.

This is the first time we meet in Australia. Sydney is a beautiful place, and again we can be sure to experience a wonderful time together. My thanks to Michael Lawrence and his Organising Committee who have put everything perfectly in place; now it's our turn to make this symposium an unforgettable event!



Lars-Erik Öller
President of IIF

Sponsors



UNSW



The
University
of Sydney



MONASH University



Australian
Bureau of
Statistics

Deloitte.



ELSEVIER

Check out

www.elsevierbusinessandmanagement.com
the information resource for researchers and
professionals in the business and manage-
ment community.



SAS provides software solutions for
organisations across the commer-
cial, financial services, academia
and government sectors, enabling
them to make better and more in-
formed business decisions.

www.sas.com.

Organizing committee



Ron Bewley
Commonwealth Bank of Australia



Rob Hyndman
Monash University
Programme Co-Chair



Masaki Katsuura
Meijo University, Japan



Michael Lawrence
University of New South Wales
Conference Chair



Allan Layton
Queensland University of Technology



Marcus O'Connor
University of Sydney



Ralph Snyder
Monash University
Programme Co-Chair



Maxwell Stevenson
University of Sydney
Exhibits

Conference Secretariat: **Elizabeth Greig**

Programme committee

Programme Co-Chairs

Rob Hyndman, Monash University, Australia

Ralph Snyder, Monash University, Australia

Invited session organizers

- Heather Booth, Australian National University, Australia
- Lynda E Chambers, Bureau of Meteorology, Australia
- Yue Fang, University of Oregon, USA
- Jiti Gao, University of Western Australia, Australia
- Richard Gerlach, University of Newcastle, Australia
- Irene Gijbels, Université Catholique de Louvain, Belgium
- Wilpen L Gorr, Carnegie Mellon University, USA
- Kesten C Green, Victoria University of Wellington, New Zealand and Monash University, Australia
- Mohsen Hamoudia, France Telecom, France
- Andrew C Harvey, Cambridge University, UK
- Nigel Harvey, University College London, UK
- Richard B Lawton, University of West of England, UK
- Allan P Layton, Queensland University of Technology, Australia
- Hans Levenbach, Delphus Inc., USA
- Wai-keung Li, University of Hong Kong, Hong Kong
- Gary Madden, Curtin University of Technology, Australia
- J Keith Ord, Georgetown University, USA
- Heping Pan, University of Ballarat, Australia
- Mathew Parackal, University of Otago, New Zealand
- Larry Pohlman, PanAgora Asset Management, USA
- Jerry Shan, Hewlett-Packard Company, USA
- Brian Sloboda, US Department of Transportation, USA
- Michael S Smith, University of Sydney, Australia
- Len Tashman, Institute of Forecasting Education, USA
- James W Taylor, Oxford University, UK
- Timo Teräsvirta, Stockholm School of Economics, Sweden
- Rodney Wolff, Queensland University of Technology, Australia
- Peg Young, US Department of Transportation, USA
- Xichuan (Mark) Zhang, Australian Bureau of Statistics, Australia

General information

Emergencies

Ambulance, Fire, Police	000
Dental emergencies	9211 2224
Poisons information	13 1126
Pharmacy Guild (24 hrs)	9966 8377
Life Line	13 1114
The Rocks Police Station	8220 6399

Safety Hints

- Caution crossing the road as Australians drive on the left hand side. Look right and left then right again.
- Pedestrian Crossing — do not assume that traffic will stop automatically. Wait until cars have stopped before stepping onto the crossing.
- Swim at patrolled beaches between the flags.

Credit Cards

American Express	1300 132 639
Mastercard	1800 120 113
Visa	1800 450 346
Diners Club	1300 350 060

Directory Assistance

Local & national	1223
Overseas	1225
Wake-up & reminder	12454

Medical Hospitals

Sydney Hospital	9382 7111
<i>(8 Macquarie St, Sydney)</i>	
Sydney Eye Hospital	9382 7111
<i>(8 Macquarie St, Sydney)</i>	
St Vincent's Hospital	8382 1111
<i>(Victoria St, Darlinghurst)</i>	

Postal Information

GPO Martin Place

Trading Hours: 8.30am–5.30pm Monday – Friday and 10.00am–2.00pm Saturday

Banking Hours

9.30am – 4.00pm Monday – Friday

Reception Desk

Registration will take place in the foyer of Shangri-La Hotel, 2.00–6.00pm on Sunday 4th July.

On Monday 5th, Tuesday 6th and Wednesday 7th the Reception Desk will be found in the Ballroom Foyer. It will open at 7.30am.

In an emergency you can also contact the Conference Organiser, Libby Greig, on 0418 19 4554.

Internet access information can be obtained at the Reception Desk

The Captain Cook Dinner Cruise can be booked at the Reception Desk.

Tours can be booked on Sunday 4th July 2004 at the Tours desk located in the Registration Area.

Badges: Delegates are asked to wear their badges at all times for all symposium events.

Internet facilities

Guests staying at the Shangri-La Hotel, Sydney can make use of wireless internet access provided by inter-touch in the hotel's public areas including the Horizon Club Lounge, Lobby Lounge, Brasserie Restaurant and throughout all conference and meeting rooms.

To use the service, first obtain an access card from the hotel's Reception Desk or Business Centre on Level 2. Then simply switch on your wireless internet-enabled laptop computer or personal digital assistant and open your Internet browser. You will be immediately presented with a welcome screen; simply key in the user name and password contained on the access card.

Customer support is available 24 hours, 7 days a week.

Costs: 30 minute card \$15; 2 hour card \$25; 12 hours \$40.

All accommodation rooms also have high speed inter-touch connection outlets. Costs: \$26 for 24 hours

Convenience Store

A convenience store is situated in Harrington Street close to the Shangri-La Hotel with email access at the special rate of \$8 per hour for ISF2004 delegates.

Security

Please do not leave your laptop or other valuable materials unattended within the hotel.

Social/Partners programme

Sunday 4 July

6.00pm– **Welcome Reception**
7.30pm Grand Ballroom, Shangri-La Hotel

Monday 5 July

7.00am ***Tours to:**
Blue Mountains (departs from Shangri-La Hotel)
(All day tour with lunch included)

7.30am ***Tours to:**
Hunter Valley
Sydney's Waterways and Animals
Canberra
(All day with lunch included)

6.00pm– **Evening Reception** (Grand Banking Chamber, Commonwealth
8.00pm Bank of Australia, cnr Martin Place and Elizabeth St)
The Banking Chamber is about 15 minutes walk from the Shangri-La Hotel. There is a map of the area provided in your conference material. Walking instructions: turn left on leaving the hotel into Essex Street and proceed to George Street. Turn right and follow to Martin Place. Turn left into Martin Place and walk three short blocks to the Bank which is on the corner of Martin Place and Elizabeth St, with the entrance around the corner in Elizabeth Street.

Tuesday 6 July

7.15am– ***Prayer Breakfast** "All the promises of God". Speaker: The Most
8.15am Rev Peter Jensen, D. Phil (Oxford), Archbishop of the Anglican Church, Diocese of Sydney.
Bradfield Lounge, Shangri-La Hotel

9.30am ***Walking Tours:**
The Sydney Opera House
The Rocks
(Departs from Shangri-La Hotel. Half day with morning tea/coffee)

7.15pm ***ISF2004 Captain Cook Dinner Cruise**
Cruise the spectacular Sydney harbour at night on the luxury cruiser MV John Cadman. Meet at Jetty No 6, Circular Quay, at 7.15pm for a prompt departure at 7.30pm.

*Please book on the web registration form or at the registration desk.

Sydney Suggestions

- **Walk to the Botanic Gardens.** Walkway stairs opposite the Shangri-La Hotel.
- **Art Gallery of New South Wales**
 - Yiribana Aboriginal and Torres Strait Gallery. Free guided tours each morning at 11.00am except Monday. Art Gallery Road, the Domain, Sydney. Admission free.
- **MCA** (Museum of Contemporary Art), George Street, The Rocks. Admission free.
 - Events during ISF2004 include the 14th Biennale of Sydney. Featuring 51 artists from 32 countries, the Biennale of Sydney is Australia's largest festival of contemporary art
- **The Sydney Opera House.**
 - Catch world class performances from 3–7 July. Operas include "Norma" by Bellini and "The Mikado" by Gilbert and Sullivan.
 - See Australia's leading indigenous dance company. The Bangarra Dance Company presents a new work "Clan" in the Drama Theatre of The Opera House
 - The Sydney Symphony Orchestra presents "Symphonic Czech Scenes" in the Concert Hall.
 - Book early and check ticket costs and performance dates on www.sydneyoperahouse.com.au.
- For a great theatre visit **The Sydney Theatre company** at Hickson Road, The Rocks
- **Climb the Harbour Bridge** with BridgeClimb, situated at the end of Cumberland Street along from the Shangri-la Hotel. Booking essential. www.bridgeclimb.com.au

If there is anything that you particularly want to see or do please contact the registration desk for further information.

Exhibitors



www.elsevier.com



www.blackwellpublishing.com



www.abs.gov.au



www.isf2005.org



www.forecastpro.com



www.sas.com



www.timberlake.co.uk



www.hearne.com.au

Meetings

Directors Meeting

Saturday 3 July 2004
11.30am – 3.30pm
Quay 414, Shangri-La Hotel

Directors Meeting

Sunday 4 July 2004
1.30pm – 3.30pm
Quay 414, Shangri-La Hotel

IJF Associate Editors Meeting

Sunday 4 July 2004
3.30pm – 5.00pm
Cambridge IV, Shangri-La Hotel

IJF Associate Editors Dinner

Monday 5 July 2004
7.45pm
Waterfront Restaurant, The Rocks.
27 Circular Quay West, (walk past the MCA and the Sydney Cove Overseas Terminal) on the waterfront. Taxi access by Hickson Road, The Rocks.

IIF Members Meeting

Monday 5 July 2004
5.00pm – 5.30pm
Grand Ballroom II, Shangri-La Hotel

Future Organisers Meeting

Wednesday 7 July 2004
Breakfast meeting
7.15am – 8.15am
Bradfield Lounge, Shangri-La Hotel

Keynote speakers



Professor Stephen J Brown

Doubling the risk of financial forecasting

Monday 8.45am–10.00am

Page 27



Professor Clive WJ Granger

Some aspects of the future of forecasting

Tuesday 8.30am–9.45am

Page 87



Professor Warwick J McKibbin

Climate change scenarios: projecting the future

Wednesday 8.40am–10.00am

Page 151

Featured speakers



Professor Derek W Bunn

Modelling and forecasting electricity prices

Monday 10.10am–11.15am

Page 28



Professor Andrew C Harvey

Forecasting with unobserved components time series models

Tuesday 1.45pm–2.50pm

Page 118



Dr Martin Parkinson

Intergenerational challenges facing Australia and the world

Tuesday 4.45pm–5.50pm

Page 145



Professor Nigel Harvey

Judgment in forecasting

Wednesday 11.40am–12.45pm

Page 164

Practitioner Forum

The International Symposiums on Forecasting provide a unique opportunity for practitioners and academics to get together to discuss forecasting issues. We have identified sessions in the programme that we think would be of specific interest to practitioners and these make up the Practitioner Forum. Naturally, academics and practitioners are encouraged to attend any session they find interesting, whether or not it is identified as part of the Practitioner Forum. We hope that this symposium will provide many valuable interactions of mutual benefit to both practitioners and academics.

This year the Practitioner Forum includes two special streams:

Energy Monday is a day of energy with Professor Derek W Bunn (Director of the Energy Market Group, London Business School, UK) speaking on “Modelling and Forecasting Electricity Prices”. Derek is sponsored by Deloitte. Other energy sessions on Monday will look at forecasting electricity load, electricity markets and weather derivatives.

Software The software stream will take place on Tuesday with Professor Len Tashman (Director, Institute of Forecasting Education, USA) leading two invited panels on the state-of-the-art and the future of forecasting software. Len is sponsored by SAS Institute. Other software sessions on Tuesday cover demand planning, a markup language for forecasting, issues associated with forecasting weekly and daily data, automatic forecasting, and more.

There are many more sessions in the Practitioner Forum including:

- How to integrate forecasts into business planning processes
- Telecommunications
- Judgment in forecasting
- Forecasting for a supply chain
- Forecasting with interventions

Practitioner Forum sessions are marked with an asterisk (*) in the timetable.

List of sessions by topic area

The **topic index** on page 182 can also be used to locate papers in your areas of interest.
Practitioner Forum sessions are marked with an asterisk (*).

Keynote talks

- | | | |
|-----|--|--------------------------|
| *K1 | Stephen J Brown:
<i>Doubling the risk of financial forecasting</i> | Monday 8.45am–10.00am |
| *K2 | Clive WJ Granger:
<i>Some aspects of the future of forecasting</i> | Tuesday 8.30am–9.45am |
| *K3 | Warwick J McKibbin:
<i>Climate change scenarios: projecting the future</i> | Wednesday 8.40am–10.00am |

Climate and Environment

- | | | |
|----|---|-------------------------|
| C1 | Invited: Climate forecasting in Australia | Tuesday 11.25am–12.45pm |
| C2 | Contributed: Climate and Environment | Tuesday 1.45pm–2.50pm |

Demography

- | | | |
|----|-------------------------|---------------------------|
| D1 | Invited: Demography | Monday 10.10am–11.15am |
| D2 | Invited: Demography | Monday 11.40am–12.45pm |
| D3 | Contributed: Demography | Monday 1.45pm–2.50pm |
| D4 | Invited: Demography | Tuesday 3.00pm–4.20pm |
| D5 | Contributed: Demography | Wednesday 10.10am–11.15am |

Economics

- | | | |
|----|---|---------------------------|
| E1 | Contributed: Economic forecast evaluation | Monday 11.40am–12.45pm |
| E2 | Contributed: Leading indicators | Monday 1.45pm–2.50pm |
| E3 | Invited: Forecasting business cycles | Monday 3.00pm–4.05pm |
| E4 | Contributed: Cycles & turning points | Tuesday 9.55am–11.00am |
| E5 | Contributed: Inflation | Tuesday 11.25am–12.45pm |
| E6 | Contributed: VAR models | Tuesday 3.00pm–4.20pm |
| E7 | Featured speaker – Martin Parkinson:
<i>Intergenerational challenges facing Australia and the world</i> | Tuesday 4.45pm–5.50pm |
| E8 | Contributed: Applications | Wednesday 10.10am–11.15am |
| E9 | Contributed: Labour market | Wednesday 11.40am–12.45pm |

Energy

- | | | |
|------|--|------------------------|
| *EN1 | Featured speaker – Derek W Bunn:
<i>Modelling and forecasting electricity prices</i> | Monday 10.10am–11.15am |
| *EN2 | Contributed: Electricity prices | Monday 11.40am–12.45pm |
| *EN3 | Tutorial: Weather Derivatives: What are they, where are they traded and how are they priced? | Monday 1.45pm–2.50pm |

- *EN4 Contributed: Electricity load Monday 3.00pm–4.05pm
 EN5 Contributed: Electricity Tuesday 9.55am–11.00am

Finance

- F1 Contributed: Finance Monday 11.40am–12.45pm
 F2 Contributed: Finance Monday 3.00pm–4.05pm
 F3 Contributed: Financial forecast evaluation Tuesday 9.55am–11.00am
 F4 Invited: Financial market prediction Tuesday 1.45pm–2.50pm
 F5 Invited: Financial modelling, forecasting, and applications Tuesday 3.00pm–4.20pm
 F6 Contributed: GARCH models Tuesday 4.45pm–5.50pm
 F7 Invited: Bayesian methods in finance Wednesday 10.10am–11.15am
 F8 Invited: Finance Wednesday 11.40am–12.45pm

Judgment

- J1 Contributed: Judgmental and scenario forecasting Monday 1.45pm–2.50pm
 J2 Contributed: Judgmental and scenario forecasting Monday 3.00pm–4.05pm
 J3 Invited: Judgmental forecasting Tuesday 11.25am–12.45pm
 J4 Invited: Judgmental forecasting & the Juster Scale Tuesday 1.45pm–2.50pm
 J5 Invited: Judgmental forecasting & the Juster Scale Wednesday 10.10am–11.15am
 *J6 **Featured speaker – Nigel Harvey:** Wednesday 11.40am–12.45pm
Judgment in forecasting

Forecasting methods

- M1 Contributed: Seasonality Monday 11.40am–12.45pm
 M2 Invited: Combining forecasts Monday 1.45pm–2.50pm
 M3 Contributed: Forecasting methods Monday 1.45pm–2.50pm
 *M4 Tutorial: How to effectively integrate forecasts into business planning processes Monday 3.00pm–4.05pm
 M5 Contributed: Neural nets Monday 3.00pm–4.05pm
 M6 Invited: Bayesian forecast averaging Tuesday 9.55am–11.00am
 *M7 Invited: Forecasting sales with interventions Tuesday 9.55am–11.00am
 *M8 Contributed: Supply chain and intermittent demand Tuesday 11.25am–12.45pm
 M9 Invited: Prediction intervals Tuesday 1.45pm–2.50pm
 *M10 Tutorial: Pragmatic approaches to forecasting weekly and daily data using time series models Tuesday 3.00pm–4.20pm
 *M11 Panel: Do forecasting competitions miss the (turning) point? Wednesday 10.10am–11.15am
 M12 Invited: Improving official statistics using forecast techniques Wednesday 11.40am–12.45pm

Nonparametric and high-dimensional methods

- N1 Invited: Dynamical systems in high dimensions Tuesday 9.55am–11.00am
 N2 Invited: Dynamical systems in high dimensions Tuesday 11.25am–12.45pm

- N3 Invited: Non-parametric forecasting Tuesday 3.00pm–4.20pm
 N4 Invited: Semi- and non-parametric methods of forecasting Wednesday 10.10am–11.15am

Posters

- *P1 Posters: Monday 4.10pm–4.50pm

Software

- *S1 Panel: Software showcase Tuesday 9.55am–11.00am
 *S2 Panel: Business forecasting software: progress and promise Tuesday 11.25am–12.45pm
 *S3 Contributed: Software Tuesday 1.45pm–2.50pm
 *S4 Invited: Automatic model selection Tuesday 4.45pm–5.50pm

Statistical models

- SM1 Invited: State space models Monday 10.10am–11.15am
 SM2 Invited: Nonlinear time series models Monday 11.40am–12.45pm
 SM3 Contributed: State space models Monday 1.45pm–2.50pm
 SM4 Invited: Nonlinear time series models Monday 1.45pm–2.50pm
 SM5 Invited: Count time series Monday 3.00pm–4.05pm
 SM6 Contributed: Nonlinear time series models Tuesday 11.25am–12.45pm
 SM7 **Featured speaker – Andrew C Harvey:**
Forecasting with unobserved components time series models Tuesday 1.45pm–2.50pm
 SM8 Contributed: Time series analysis Tuesday 3.00pm–4.20pm
 SM9 Contributed: Long memory approaches Tuesday 4.45pm–5.50pm
 SM10 Invited: Exponential smoothing Wednesday 10.10am–11.15am
 SM11 Invited: Exponential smoothing Wednesday 11.40am–12.45pm
 SM12 Contributed: Time series analysis Wednesday 11.40am–12.45pm

Telecommunications and technology

- *T1 Invited: Telecom business forecasting Monday 10.10am–11.15am
 T2 Contributed: Technology and diffusion models Monday 11.40am–12.45pm
 *T3 Invited: Telecommunications Tuesday 9.55am–11.00am
 T4 Invited: Telecom consumer demand studies Tuesday 1.45pm–2.50pm
 T5 Invited: Modelling ICT and traffic forecast methodology Tuesday 3.00pm–4.20pm
 T6 Contributed: Technology Tuesday 4.45pm–5.50pm
 *T7 Contributed: Telecommunications Wednesday 11.40am–12.45pm

Other applications

- A1 Invited: Conflict forecasting – terrorism Monday 10.10am–11.15am
 A2 Contributed: Tourism and transportation Monday 10.10am–11.15am
 A3 Invited: Conflict forecasting – warfare Monday 11.40am–12.45pm
 A4 Invited: Crime Monday 3.00pm–4.05pm

A5	Contributed: Applications	Tuesday 11.25am–12.45pm
A6	Invited: Transportation	Tuesday 3.00pm–4.20pm
A7	Contributed: Sales	Tuesday 4.45pm–5.50pm
A8	Contributed: Applications	Wednesday 10.10am–11.15am

Room locations

The following rooms in the Shangri La Hotel will be used for conference sessions and meetings.

Level B Grand Ballrooms I & II

Level 1 Harlequin Room
Bradfield Lounge

Level 3 Essex I
Essex II
Cambridge I
Cambridge II
Cambridge III
Cambridge IV

Level 4 Quay 414

Timetable

The **topic index** on page 182 can also be used to locate papers in your areas of interest.
 Practitioner Forum sessions are marked with an asterisk (*).
 Room locations are given on the previous page.

Sunday 4 July

Sunday 1.30pm–3.30pm

Directors meeting (Quay 414)

Sunday 3.30pm–5.00pm

IJF Associate Editors meeting (Cambridge IV)

Sunday 6.00pm–7.30pm

Welcome Reception (Grand Ballroom II)

Monday 5 July

Monday 8.30am–8.45am

Conference Opening (Grand Ballroom II)

Monday 8.45am–10.00am

*K1 **Keynote speaker – Stephen J Brown:** (Grand Ballroom II) . 27
Doubling the risk of financial forecasting

Monday 10.10am–11.15am

*EN1 **Featured speaker – Derek W Bunn:** (Grand Ballroom II) . 28
Modelling and forecasting electricity prices

A1 Invited: Conflict forecasting – terrorism (Essex I) 29

A2 Contributed: Tourism and transportation (Essex II) 30

D1 Invited: Demography (Cambridge II) 32

SM1 Invited: State space models (Cambridge III) 33

*T1 Invited: Telecom business forecasting (Bradfield Lounge) 35

Monday 11.15am–11.40am

Morning tea (Grand Ballroom I)

Monday 11.40am–12.45pm

A3 Invited: Conflict forecasting – warfare (Essex I) 37

D2 Invited: Demography (Cambridge II) 39

E1 Contributed: Economic forecast evaluation (Essex II) 41

*EN2 Contributed: Electricity prices (Grand Ballroom II) 43

F1 Contributed: Finance (Harlequin Room) 45

M1 Contributed: Seasonality (Cambridge IV) 47

SM2	Invited: Nonlinear time series models	(Cambridge III) . . .	49
T2	Contributed: Technology and diffusion models	(Bradfield Lounge) . .	51

Monday 12.45pm–1.45pm

Lunch (Grand Ballroom I)

Monday 1.45pm–2.50pm

D3	Contributed: Demography	(Cambridge II)	53
E2	Contributed: Leading indicators	(Bradfield Lounge) . .	55
*EN3	Tutorial: Weather Derivatives: What are they, where are they traded and how are they priced?	(Grand Ballroom II) .	57
J1	Contributed: Judgmental and scenario forecasting	(Cambridge IV)	58
M2	Invited: Combining forecasts	(Harlequin Room) . .	60
M3	Contributed: Forecasting methods	(Essex I)	62
SM3	Contributed: State space models	(Essex II)	64
SM4	Invited: Nonlinear time series models	(Cambridge III)	66

Monday 3.00pm–4.05pm

A4	Invited: Crime	(Essex II)	68
E3	Invited: Forecasting business cycles	(Cambridge III)	70
*EN4	Contributed: Electricity load	(Bradfield Lounge) . .	72
F2	Contributed: Finance	(Harlequin Room) . .	74
J2	Contributed: Judgmental and scenario forecasting	(Cambridge IV)	76
*M4	Tutorial: How to effectively integrate forecasts into business planning processes	(Grand Ballroom II) .	78
M5	Contributed: Neural nets	(Essex I)	79
SM5	Invited: Count time series	(Cambridge II)	81

Monday 4.10pm–4.50pm

*P	Posters (<i>drinks provided</i>)	(Grand Ballroom I) . .	83
----	------------------------------------	------------------------	----

Monday 5.00pm–5.30pm

IIF members meeting (Grand Ballroom II)

Monday 6.00pm–8.00pm

Conference reception

Grand Banking Chamber, Commonwealth Bank of Australia.

Instructions on how to get there are on page 11.

Monday 7.45pm

IJF Associate Editors Dinner

Waterfront Restaurant, The Rocks.

Instructions on how to get there are on page 14.

Tuesday 6 July

Tuesday 7.15am–8.15am*Prayer breakfast*

(Bradfield Lounge)

Tuesday 8.30am–9.45am

*K2 **Keynote speaker – Clive WJ Granger:**
Some aspects of the future of forecasting

(Grand Ballroom II) . . . 87

Tuesday 9.55am–11.00am

E4	Contributed: Cycles & turning points	(Essex II)	88
EN5	Contributed: Electricity	(Cambridge IV)	90
F3	Contributed: Financial forecast evaluation	(Harlequin Room)	92
M6	Invited: Bayesian forecast averaging	(Cambridge III)	94
N1	Invited: Dynamical systems in high dimensions	(Essex I)	96
*S1	Panel: Software showcase	(Grand Ballroom II)	97
*M7	Invited: Forecasting sales with interventions	(Cambridge II)	98
*T3	Invited: Telecommunications	(Bradfield Lounge)	99

Tuesday 11.00am–11.25am*Morning tea*

(Grand Ballroom I)

Tuesday 11.25am–12.45pm

A5	Contributed: Applications	(Cambridge IV)	101
C1	Invited: Climate forecasting in Australia	(Cambridge III)	104
E5	Contributed: Inflation	(Harlequin Room)	106
J3	Invited: Judgmental forecasting	(Bradfield Lounge)	109
*M8	Contributed: Supply chain and intermittent demand	(Essex II)	111
N2	Invited: Dynamical systems in high dimensions	(Essex I)	113
*S2	Panel: Business forecasting software: progress and promise	(Grand Ballroom II)	115
SM6	Contributed: Nonlinear time series models	(Cambridge II)	116

Tuesday 12.45pm–1.45pm*Lunch*

(Grand Ballroom I)

Tuesday 1.45pm–2.50pm

SM7	Featured speaker – Andrew C Harvey: <i>Forecasting with unobserved components time series models</i>	(Grand Ballroom II)	118
C2	Contributed: Climate and Environment	(Essex I)	119
F4	Invited: Financial market prediction	(Cambridge III)	121
J4	Invited: Judgmental forecasting & the Juster Scale	(Essex II)	123
M9	Invited: Prediction intervals	(Cambridge II)	125
*S3	Contributed: Software	(Harlequin Room)	127
T4	Invited: Telecom consumer demand studies	(Bradfield Lounge)	129

Tuesday 3.00pm–4.20pm

A6	Invited: Transportation	(Cambridge III)	. . . . .	131
D4	Invited: Demography	(Cambridge II)	. . . . .	133
E6	Contributed: VAR models	(Essex I)	. . . . .	134
F5	Invited: Financial modelling, forecasting, and applications	(Harlequin Room)	. . . . .	136
*M10	Tutorial: Pragmatic approaches to forecasting weekly and daily data using time series models	(Grand Ballroom II)	. . . . .	138
N3	Invited: Non-parametric forecasting	(Essex II)	. . . . .	139
SM8	Contributed: Time series analysis	(Cambridge IV)	. . . . .	141
T5	Invited: Modelling ICT and traffic forecast methodology	(Bradfield Lounge)	. . . . .	143

Tuesday 4.20pm–4.45pm

Afternoon tea (Grand Ballroom I)

Tuesday 4.45pm–5.50pm

E7	Featured speaker – Martin Parkinson: <i>Intergenerational challenges facing Australia and the world</i>	(Grand Ballroom II)	. . . . .	145
A7	Contributed: Sales	(Essex I)	. . . . .	146
F6	Contributed: GARCH models	(Harlequin Room)	. . . . .	147
*S4	Invited: Automatic model selection	(Essex II)	. . . . .	148
SM9	Contributed: Long memory approaches	(Cambridge III)	. . . . .	149
T6	Contributed: Technology	(Bradfield Lounge)	. . . . .	150

Tuesday 7.15pm–

Captain Cook Dinner cruise
on the luxury cruiser the MV John Cadman.
Meet at Jetty No 6, Circular Quay, at 7.15pm for a prompt departure at 7.30pm.

Wednesday 7 July

Wednesday 7.15am–8.15am

Future Organizers Meeting (Bradfield Lounge)

Wednesday 8.40am–10.00am

*K3 **Keynote speaker – Warwick J McKibbin:** (Grand Ballroom II) . 151
Climate change scenarios: projecting the future

Wednesday 10.10am–11.15am

A8 Contributed: Applications (Essex I) 152
 D5 Contributed: Demography (Cambridge II) 154
 E8 Contributed: Applications (Cambridge IV) 155
 *M11 Panel: Do forecasting competitions miss the (turning) (Grand Ballroom II) . 157
 point?
 F7 Invited: Bayesian methods in finance (Bradfield Lounge) . . 158
 J5 Invited: Judgmental forecasting & the Juster Scale (Harlequin Room) . . 159
 N4 Invited: Semi- and non-parametric methods of forecasting (Cambridge III) 161
 SM10 Invited: Exponential smoothing (Essex II) 162

Wednesday 11.15am–11.40am

Morning tea (Grand Ballroom I)

Wednesday 11.40am–12.45pm

*J6 **Featured speaker – Nigel Harvey:** (Grand Ballroom II) . 164
Judgment in forecasting
 E9 Contributed: Labour market (Cambridge II) 165
 F8 Invited: Finance (Harlequin Room) . . 167
 M12 Invited: Improving official statistics using forecast tech- (Essex I) 169
 niques
 SM11 Invited: Exponential smoothing (Cambridge III) 170
 SM12 Contributed: Time series analysis (Essex II) 171
 *T7 Contributed: Telecommunications (Bradfield Lounge) . . 173

Wednesday 12.45pm–1.45pm

Lunch (Grand Ballroom I)

ABSTRACTS

K1

Plenary session

Monday 8.45am–10.00am

Room: Grand Ballroom II

Chair: Michael Lawrence, University of New South Wales, Australia**Doubling the risk of financial forecasting**

Stephen J Brown

Leonard N Stern School of Business, New York University, New York, USA

Much of the discussion of the National Australia Bank doubling affair, at least as it filters through to New York, centres on management failures. How could the NAB have allowed trading losses to build up to \$340 million? What are we to make of reports that compliant management allowed the traders involved to trade over their authorised limits for months? In recent APRA and PriceWaterhouseCooper's reports, much of the blame is placed on inadequate risk management procedures and practices at the bank. Yet, the situation is similar in some ways to the disaster at Long Term Capital Management, which employed some of the most sophisticated quantitative risk management tools. I will propose that ex post conditioning bias, one of the perils of financial forecasting, renders these tools ineffective precisely when they are most needed. The challenge is to develop a new generation of risk management procedures that can provide an early warning signal of disasters before they occur.

Email: sbrown@stern.nyu.edu



Stephen J Brown is the David S. Loeb Professor of Finance at the Stern School of Business, New York University. He is well known for his perceptive insights into the operation of finance markets and for his contribution to the profession through editorships of leading finance journals and as an office holder of major finance associations in the USA. His stature in the profession is reflected by the fact that he has served on the nominating committee for the Nobel Prize in Economic Sciences. He is currently retained as an advisor to SG Yamaichi Asset Management on investment issues both in Japan and the United States, and has served as an expert witness for the US Department of Justice.

EN1

Featured talk

Monday 10.10am–11.15am

Room: Grand Ballroom II

Chair: Robert Fildes, Lancaster University, UK**Modelling and forecasting electricity prices**

Derek W Bunn

London Business School, UK

The new competitive markets for electricity have made a dramatic impact on energy business risk and commodity trading. The stochastic properties of power prices are now becoming well recognised as spiky and mean-reverting with extraordinary volatilities. Almost all electricity markets are economically imperfect and financially inefficient, so that behavioural properties (technical, strategic and learning) are key to understanding price formation. Conventional models from financial econometrics, therefore, are generally unsatisfactory in capturing the characteristics of spot prices. Structurally rich, regime-switching formulations can, however, provide a good basis for adaptive models and forecasts. This presentation reviews the current state of theory and practice in modelling electricity prices, with reference to both forecasting and market surveillance.

Email: dbunn@london.edu

Derek W Bunn is Professor and Chairman of the Decision Sciences subject area and Director of the Energy Markets Group at the London Business School. He is internationally renowned for his work in energy forecasting and economics, having consulted for many global energy companies and having been an adviser to a number of European government agencies. He has also been active on the editorial boards of a number of leading international journals in forecasting, management science and energy economics.

This session is sponsored by Deloitte.

A1

Invited session: Conflict forecasting – terrorism

Monday 10.10am–11.15am

Room: Essex I

Chair: Kesten C Green, Victoria University of Wellington, New Zealand
Monash University, Australia**How to use experts to forecast in the war on terrorism**

J Scott Armstrong

The Wharton School, University of Pennsylvania, USA

Kesten C Green

Victoria Management School, Victoria University of Wellington, New Zealand

Business & Economic Forecasting Unit, Monash University, Australia

In 2003, the Pentagon proposed the use of a market on terrorism as a way to assess dangers. While it was politically unpopular, one might ask whether it was a good idea. In many situations, combining the predictions of large groups of unbiased people can provide accurate forecasts. As we will show, given the conditions involved in terrorism forecasting, markets are unlikely to increase accuracy substantially. They might also have negative consequences for behavior. We examine alternative approaches to using experts to forecast acts of terrorism including the Delphi technique and structured analogies. Information on these approaches to forecasting conflicts with terrorist organizations are available at conflictforecasting.com.

Email: armstrong@wharton.upenn.edu**Simulated interaction: An approach to terrorism forecasting**

Kesten C Green

Victoria Management School, Victoria University of Wellington, New Zealand

Business & Economic Forecasting Unit, Monash University, Australia

J Scott Armstrong

The Wharton School, University of Pennsylvania, USA

Important decisions in the war on terrorism are based on predictions of the decisions that allies, adversaries, and terrorist leaders will make. Decision makers typically resort to unaided judgment, but other approaches such as game theory and acting out the interactions between the parties (a procedure we call simulated interactions) have been proposed. Forecasts from simulated interactions using novice role players have been found to be more accurate than forecasts from both experts using their unaided judgment and game theorists. We review the evidence on these forecasting methods for conflicts and make suggestions on how simulated interaction might be used to improve forecasting in the war on terrorism. In particular, we suggest that simulated interaction would be useful for assessing alternative strategies and tactics. For example, the reactions of Iraqi groups to different constitutions, or the reactions of hijackers to different types of armed response. A description of the simulated interaction method is available at conflictforecasting.com.

Email: kesten@paradise.net.nzWeb: www.conflictforecasting.com

A2

Contributed session: Tourism and transportation

Monday 10.10am–11.15am

Room: Essex II

Chair: Brian W Sloboda, US Department of Transportation, USA**Modelling and predicting UK road accident casualties**

Robert Raeside, Phil Darby

Centre for Mathematics and Statistics, Napier University, Scotland

Road traffic accident data are recorded at the scene of an accident on the STATS 19 form. These records are available for the period 1992 to 2002 and have been analysed using both conventional statistical approaches and data mining techniques and causal models have been constructed of involvement in fatal, serious and slight accidents. From these models predictions have been constructed to 2010 and show that accident trends will meet UK government accident reduction targets. However, these can be re-cast to allow for the ageing population and it becomes apparent that fatalities will rise as a consequence of the increased proportion of road users and pedestrians who are frail. The paper ends with consideration of the impact of age regarding exposure to accidents.

Email: r.raeside@napier.ac.uk

Forecasting road crashes: a comparison of state space models

Phillip G Gould

Accident Research Centre, Monash University, Australia

Frits Bijleveld, Jacques Commandeur

SWOV Institute for Road Traffic Research

This paper compares the forecasting power of four different state-space models applied to Victorian road crash data. The four models, while all structural, make different assumptions regarding how crash rates evolve over time. The structures also use different measures of road safety, such as accidents per licensed driver or deaths per kilometer driven. The first three models are state-space adaptations of widely-used methods for forecasting and explaining crashes. The advantages of using a state-space framework for estimation of these models is also discussed. A generalised Basic Evaluation Model (BEM) is developed, which nests the other models and allows for a more flexible, application-driven analysis of the data. The models are assessed on the basis of forecasting accuracy over a two-year period of monthly data.

Email: Phillip.Gould@general.monash.edu.au

Vehicle flow simulation at an unsignalized saturated intersections using time series and neural networks

Luiz P Calôba, Victor Dweck

Electrical Engineering Department, COPPE, Federal University of Rio de Janeiro, Brazil

Nelson Maculan

Systems Engineering Departmentt, COPPE, Federal University of Rio de Janeiro, Brazil

Traffic models predict traffic flow from past flow information. Most available methods for modelling unsignalized intersections use gap-acceptance models and adjustable variables to approximate them to reality. Besides the need of human control to adjust the model, those methods are useful only for unsaturated traffic. Traffic flow at saturated intersections depends a lot on drivers' behavior. The purpose of this work is to address the human nature of the problem using a neural network, so that the model can be self-adjustable for different intersections and/or different cultures. We expect that the ANN may be able to learn from experience, that is from drivers' behavior. The data we used to train and to validate the model were obtained from a saturated intersection at Rio de Janeiro, Brazil. The traffic was composed mainly of cars and buses, but also included small trucks. Traffic lights located away from the intersection introduced periodic components in the traffic flow series, which were modeled using conventional time series techniques. Then, a two-layer ANN was used to simulate the residual traffic flow. Results showed that the ANN improves the time-series-only model. The complete model produces reasonable estimates of traffic flow without the need of human control.

Email: caloba@ufrj.br

The integration US transportation satellite accounts into the Bureau of Transportation Statistics Economic Analysis modelling System (BTEAMS)

Brian W Sloboda, David Chien

US Department of Transportation, Bureau of Transportation Statistics, USA

The Transportation Satellite Accounts (TSAs) will be used primarily as a source of data for analysis of transportation-related issues and will be a major driver in the Bureau of Transportation Statistics Economic Analysis modelling System (BTEAMS), a forecasting model analyzing the effects of various policies on transportation. The primary purpose of the TSAs is to produce more comprehensive economic measures of all transportation activities, both in terms of their contribution to the economy and their use of inputs from other industries in the economy. More specifically, the current US Input-Output Accounts do not show the complete contribution of private transportation to the national economy. As a remedy, the TSAs represent an extension of the US Input-Output Accounts to show the contribution of private waterborne transportation and other private modes to the national economy. The TSA's will cover both for-hire and in-house (private) transportation activities. For-hire activity is already identified as transportation within the US Input-Output Accounts; however, neither in-house transportation conducted by businesses with their own resources for their own use. From this present analysis, the development of the TSAs will enable analysts to determine the total contribution of private transportation to the total contribution to the national economy, and the analysis will also discuss how the TSAs will be incorporated into the BTEAMS modelling system.

Email: brian.sloboda@bts.gov

D1

Invited session: Demography

Monday 10.10am–11.15am

Room: Cambridge II

Chair: Heather Booth, Australian National University, Australia**Post-processing of stochastic population forecasts**

Juha M Alho

Department of Statistics, University of Joensuu, Finland

Due to the complexity of parameter specification we must limit the selection of alternative models in any program producing stochastic forecasts. The restrictions on generality can be alleviated by post-processing. We discuss two techniques developed for use in a forecast of the population of eighteen EU/EEA countries. The starting point is that single country forecasts have been produced by a program PEP.

To produce a forecast for the total EU/EEA population, we must take into account the cross-correlations of the vital processes. Empirical studies suggest that errors in mortality, fertility and migration forecasts are positively correlated. The structure of PEP allows the relevant correlations to be incorporated in the input phase for migration. For fertility and mortality, a general strategy has been developed to order the simulation output to produce certain hierarchical correlation structures for such measures as life expectancy and general fertility rate.

PEP is also restricted in terms of the shape of the predictive distribution that it assumes for the future vital rates. Techniques of rejection sampling can be used to produce subsets of the simulation counts that correspond to alternative distributional shapes.

Email: juha.alho@joensuu.fi

Comparing forecasting performance of stochastic fertility forecasts: Does tempo adjustment lead to improved forecasts?

José Antonio Ortega

Department of Economics, Universidad de Salamanca, Spain

Stochastic fertility forecasts is a field in development. Different modelling strategies have been proposed. Most of the stochastic forecasts rely on pure period measures (Lee, Keilman, Lutz), another on tempo-adjusted rates (Kohler and Ortega), another on cohort measures (Lestheaghe). There have been no attempts trying to compare the forecasting performance of different approaches. This presentation applies variations of the three techniques to the same data set (US data) in order to elucidate if the increased complexity of the cohort and tempo-adjusted procedures lead to better forecasting performance. Performance is evaluated at the age-specific, the period and the cohort level.

Email: jaortega@usal.es

SM1

Invited session: State space models

Monday 10.10am–11.15am

Room: Cambridge III

Chair: Andrew C Harvey, Cambridge University, UK**Forecasting general insurance liabilities**

Piet De Jong

Department of Actuarial Studies, Macquarie University, Australia

The forecasting of general insurance liabilities using runoff triangle data is discussed and considered. Techniques are based on state space methods which facilitate the calculation of forecast distributions. Models are readily estimated and permit the consideration of correlation within and between triangles. These correlations are critical to proper reserving. Models are assessed using diagnostics. Examples illustrate procedures. Calculations are implemented in Excel linked to specialized algorithms.

Email: piet.dejong@mq.edu.auWeb: www.actuary.mq.edu.au/research_papers/index.shtml**A constrained state-space approach to the prediction of comparable real income across countries**

Alicia N Rambaldi, DSP Rao

School of Economics, University of Queensland, Australia

Howard E Doran

School of Economics, University of New England, Australia

Studies on growth performance of countries and catch-up and convergence require and make extensive use of internationally comparable data on real gross domestic product (GDP) expressed in a common currency. The International Comparisons Program (ICP), a project supported by the World Bank (WB), and a host of other international bodies, developed purchasing power parities (PPPs) as the most robust and appropriate converter for accurately reflecting differences in the levels of prices of goods and services in different countries. The coverage of the ICP, however, has been limited to a few benchmark years and countries, roughly every five years since 1970. The Penn World Tables (PWT) and Tables available from the WB, are obtained by extrapolating the latest available ICP benchmark results to cover in excess of 150 countries from 1950. The extrapolation disregards earlier benchmark comparisons. This paper shows how a constrained state-space formulation of the problem can be used to generate internationally comparable GDP consistent with all the available ICP results. We treat the ICP data set as an unbalanced panel, present a suitable econometric model for GDP extrapolations, and re-formulate it in a constrained state-space form to complete the panel.

Email: a.rambaldi@uq.edu.auWeb: <http://www.uq.edu.au/~uqaramba>

The effect of seasonal adjustment on forecasting accuracy

Liam J A Lenten, Imad A Moosa

Department of Economics and Finance, La Trobe University, Australia

This paper investigates the effect of seasonal adjustment on the forecasting power of structural time series models. This is an important issue, which is relevant to two controversial issues that often arise in applied econometrics and time series analysis: (i) whether or not seasonal adjustment contaminates the dynamics of the underlying model, and (ii) the appropriateness of using standard seasonal adjustment procedures as opposed to model-based seasonal adjustment.

The empirical work is based on 14 quarterly Australian time series (both macro and sectoral). Models are estimated for the seasonally unadjusted and seasonally adjusted time series, and out-of-sample forecasts are generated from both models. The seasonally adjusted forecasts are subsequently deseasonalised to facilitate comparison. Having done that, the AGS test is performed to find out if there is a statistically significant difference between the root mean square errors of the two models. If the model that is estimated from the seasonally unadjusted data is a more powerful forecasting tool than the other model, we conclude that seasonal adjustment is detrimental to the forecasting accuracy of time series models.

Email: l.lenten@latrobe.edu.au

T1

Invited session: Telecom business forecasting

Monday 10.10am–11.15am

Room: Bradfield Lounge

Chair: Gary Madden, Curtin University of Technology, Australia**Forecasting for emerging telecommunications markets**

John J Street

Communications Research Unit, Department of Communications, Information Technology & the Arts, Australia

This paper will discuss the forecasting of supply and demand for emerging telecommunications technologies by advisers to Government, the difficulties of getting it right, and the possible consequences of getting it wrong. The focus of the paper will be on emerging technologies such as broadband and cellular mobile, and on information and communication technologies such as the Internet and video on demand. It will contain a discussion of which forecasting techniques appear to be feasible, which have actually been used in projects aimed to advise the Australian Government (for instance, the Communications Futures Project and the National Bandwidth Inquiry), and which forecasts have subsequently proved right or wrong. The paper will conclude with some thoughts on how we can make forecasting more useful for the purposes of advising Government on expected future developments in telecommunications and other emerging technology markets.

Email: john.street@dcita.gov.au

Forecasting for the business

Penny Blankfield

Forecasting and Business Planning, Telstra, Australia

Telstra is Australia's leading telecommunications and information services company. The company offers a full range of services and competes in all telecommunications markets throughout Australia, providing more than 10.3 million Australian fixed line and more than 6.5 million mobile services. For the financial year ended June 2003, Telstra achieved more than A\$20bn of Sales Revenue. This revenue flows from more than 200 products across a number of customer segments. To support company wide planning, forecasts of product revenue and physical measures are required for each product, bundle and customer segment. This paper will explore many of the issues encountered in forecasting for the business. Products span the full spectrum of the product life cycle. Forecasting techniques employed range from qualitative/expert opinion to time series and regression, with collaborative forecasting a key requirement. Forecasts are subject to regular review and update. Comparative forecasts of the markets in which Telstra operates are required to benchmark the company's current and planned performance. Key to the business is the comparison of actual to forecast performance and an understanding of the reasons for any over or under achievement. These and other aspects of forecasting will be presented.

Email: Penelope.A.Blankfield@team.telstra.com

Telecom forecasting in an era of competition and regulation

Aniruddha Banerjee

NERA Economic Consultants, USA

This paper focuses on the practices and problems of forecasting that are peculiar to a telecommunications industry in transition. As regulated monopoly telecommunications systems yield to hybrid competitive-regulated market structures, the role of forecasting is both more important and controversial. Forecasts of both more or less aggregate series (e.g., industry-wide demand or diffusion of specific new services) are routinely placed at the service of complicated public policy formulations and courts and arbitration panels. This paper examines two areas of concern: (1) how naïve and judgmental forecasts are often the basis for important public policy decisions on the design of incentive regulation plans, the operation of universal service funds, and the resolution of commercial disputes; and (2) how advances in forecasting methods introduced through cointegration, long memory, and ARCH models, as well as structural models that capture policy interventions, can better serve public policy and litigation needs in telecommunications. The overriding question is: how much improvement in telecommunications forecasting practices is worth pursuing, and what are the consequences of not doing so? This paper attempts to address that question.

Email: andy.banerjee@nera.com

A3

Invited session: Conflict forecasting – warfare

Monday 11.40am–12.45pm

Room: Essex I

Chair: Kesten C Green, Victoria University of Wellington, New Zealand
Monash University, Australia**Course of action analysis interactive role-play war-game**

Donald E Brown, Kent M Miller

Department of Systems and Information Engineering, University of Virginia, USA

Although widely used in business, the legal profession, and the military, studies demonstrating the predictive value of interactive role-playing in conflict forecasting are both sparse and suspect. More recent studies have explored the comparative accuracy of role-playing in forecasting a single decision or outcome. We hypothesize that using simulated interactions to forecast the ostensible set of plausible decisions and/or outcomes is of greater utility to decision-makers in conflict environments than a single decision and/or outcome forecast. The US Military employs an interactive war-game to forecast the success or failure of a prospective battle plan when played against a single enemy course of action. A deficiency in the current doctrine is the inability to account for the uncertainty in the threat reactions. Our methodology remedies this shortcoming by allowing simultaneous play of multiple enemy courses of action. We believe the resulting risk assessment will facilitate the identification and development of more robust courses of action. (We define robustness as a quality, which describes how well a course of action is expected to perform, taking into account the ostensible set of possible adversary reactions.) We present our findings from experiments conducted within the US Military.

Email: brown@virginia.edu

An oracle of battle: forecasting results of joint military operations

Jonathan E Czarnecki

Naval War College of the United States, USA

War, campaigns, operations and combat appear to be chaotic in their application of violence. However, within that chaos, there are common processes and behaviors that seem to transcend history and culture in the conduct of such chaos. Are there common elements or variables critical to all joint military operations? If there are common elements, can one begin to develop a theory that describes and explains this class of societal behavior? Finally, can one use such a theory to forecast the success or failure of joint operations, and thus obtain insights into forecasting the future results of the war in which such operations occur?

This paper argues that there are common variables critical to joint military operations. It develops a theory that can concisely explain and describe these operations through four independent variables. These variables are: training; integrated combat fires; decision space; and information processing. Using selected historical data from the post-1975 United States experience with joint military operations and applying psychometric judgmental scaling methods, the paper tests the theory's ability to explain the results of past joint military operations. It concludes that the theory has merit, and recommends further refinement through the continuation of research and production of forecasts.

Email: jczarne@nps.navy.mil

Comparing conflict prediction: economic motive vs non-linear framework

Prasad S Bhattacharya, Dimitrios D Thomakos

Department of Economics, Florida International University, Miami, USA

The empirical literature on domestic conflict shows an inverted U-shaped relationship between democracy, development and onset of civil war. Our study examines this aspect to predict conflict intensity for seventeen Latin American countries using two different modelling perspectives.

First, we build an economic model using explanatory variables from existing theoretical work. The conflict intensity is then analyzed from this model using ordinal regression and multinomial logit techniques. Using data from International Peace Research Institute, World Bank and Statistical Abstracts of Latin America, we find that overdependence on agricultural exports, along with lack of public and private investment in an economy characterized by poor socio-political performance, could lead to higher intensity of conflict.

Second, we explore how our results change and possibly improve, by using a variety of potentially more powerful models. We examine whether an Artificial Neural Networks framework, Cox's Proportional Hazard model and a Markov Switching model can improve the accuracy of classification prediction for the intensity of conflict. Our results indicate that, for predictive purposes, there may be advantages for prediction in combining prior knowledge in the form of explanatory economic variables with a non-linear classification model, rather than relying exclusively on the performance of the traditional ordinal regression approach.

Email: prasad.bhattacharya@fiu.edu

D2

Invited session: Demography

Monday 11.40am–12.45pm

Room: Cambridge II

Chair: Juha M Alho, University of Joensuu, Finland**Demographic entropy in mortality forecasts of the oldest-old: Differentials by race and sex for the US**

Lawrence R Carter

Department of Sociology, University of Oregon, USA

The Lee-Carter method is used to examine differentials in observed and forecasted age-sex-race-specific mortality among the oldest-old in the United States, 1900 to 2065. For each race/sex (white males, white females, nonwhite males, and nonwhite females) category, this method is fitted to age-specific death rates, 1933 to 1996, using singular value decomposition to derive a single time varying index of mortality, k_t . Box-Jenkins techniques are used to estimate and forecast k_t , which is used to generate life expectancies from 1996 to 2065. Of interest is the dynamics of life table entropy, H , in forecasts of mortality among this fastest growing segment of the US population. Attention is paid to measurements of excess mortality, δ , implied in race and sex ratios of life expectancy. Results show white female, white male, nonwhite female, and nonwhite male e85+s in 2065 to be 10.1, 8.5, 7.8, and 6.9 respectively. H shows near linear decline for all groups over the forecast period, almost parallel within races, but with greater slopes for whites. The sex ratios diverge by race for both sexes with excesses for nonwhites. The sex ratios diverge for whites, but converge for nonwhites. Parity is not likely for any of these pairs in the 21st century.

Email: lcarter@oregon.uoregon.edu**Probabilistic mortality forecasts with both short- and long-run uncertainty**

Sergei J Scherbov

Vienna Institute of Demography, Austrian Academy of Sciences, Austria

Warren C Sanderson

Department of Economics, Stony Brook University, USA

This paper presents a new approach to making probabilistic mortality forecasts to the year 2100. The approach incorporates: (1) recent findings about the trend in best-practice life expectancy, (2) time series methods, and (3) expert opinion. These three are brought together within a framework that distinguishes between short-run and long-run uncertainty. The new approach is applied to projections for Germany, Japan and the United States. Probabilistic results for population sizes, age structures and dependency rates are presented and compared with other forecasts. We conclude with remarks about the importance of the new approach for analyzing the viability of pay-as-you-go pension systems.

Email: sergei.scherbov@oeaw.ac.at

United Nations long-range population projections: assumptions, methods and challenges

Thomas Buettner, Pablo Lattes

UN Population Division, Department of Economic and Social Affairs, USA

The United Nations Population Division has recently produced a set of long-range population projections that comprised all countries of the world, covering the period from 2000 to 2300. Assumptions made and results obtained from the projection exercise are described. The paper then deals with methodological issues relevant to the practical implementation of long-range projections. It is argued that long-range projections are an important tool for the modeller to verify a given methodology and ensure its robustness and validity. The paper discusses in greater detail the methodological challenges of and the approaches used for these projections. Exploring possible population trends over very long time periods made it necessary to implement methodology that produces robust and plausible projections of all the demographic components. While formulation of fertility scenarios was straightforward, creation of mortality trajectories was challenging. Existing models did not allow for extension of survival to extremely high ages, did not sufficiently control for plausible sex-differential in life expectancy over the long run, and could not ensure consistency in ultimate levels of mortality between countries. The projections ultimately employed the Lee-Carter model with suitable adjustments for some of the difficulties. The adjustments implemented and other solutions are critically examined and discussed.

Email: buettner@un.org

E1

Contributed session: Economic forecast evaluation

Monday 11.40am–12.45pm

Room: Essex II

Chair: Herman O Stekler, George Washington University, USA**Forecast encompassing tests and probability forecasts**

David I Harvey

School of Economics, University of Nottingham, UK

Michael P Clements

Department of Economics, University of Warwick, UK

Competing forecasts are frequently evaluated by assessing whether a linear combination of the predictions yields more accurate forecasts than either of the single forecasts alone, or, alternatively, whether one forecast encompasses the other. A number of procedures exist for testing the null of forecast encompassing among rival point forecasts. In this paper, we extend such analysis to probability event forecasts, where the predictions assign a probability to an event occurring, and so are defined on the open interval $(0,1)$. We consider three well known approaches for testing encompassing among point forecasts, and assess their validity for probability forecasts. We find that one commonly used approach is not valid in general. We examine the asymptotic distributions of the test statistics for probability forecasts, and investigate the tests finite sample size and power properties by way of Monte Carlo simulation.

Email: dave.harvey@nottingham.ac.uk

Immigrant remittance flows and the economy of Ghana: A non-linear analysis

Adusei Jumah

Department of Economics and Finance, Institute for Advanced Studies, Austria

Robert M Kunst

Department of Economics, University of Vienna, Austria

Several recent studies have examined the relationship between remittances and national economies. Some have argued that since remittances take place under asymmetric information and economic uncertainty, implying the existence of a significant moral hazard problem, remittances have a negative impact on economic growth. Others have also observed that recipients utilize remittances to increase consumption rather than to invest in businesses or other productive assets, suggesting that remittances are not benefiting the recipient economies.

The current study extends the discussion by relating remittances to macroeconomic sub-aggregates by means of recent developments in time series analysis. While former studies have been based on linear models, we consider the possibility that the asymmetric attributes of remittances and growth trends in macroeconomic sub-aggregates imply non-linear dynamic features. Consequently, their interdependence should lend itself to modelling via non-linear error correction functions. We evaluate the merits of the suggested models by means of several forecasting experiments.

Email: jumah@ihs.ac.at

How quickly do forecasters incorporate news? Evidence from cross-country surveys

Gultekin Isiklar, Kajal Lahiri

Department of Economics, University at Albany, State University of New York, USA

Prakash Loungani

International Monetary Fund, USA

We provide evidence on the efficiency of real GDP forecasts by testing if forecast revisions are uncorrelated. As the forecast data used are multidimensional — 18 countries, 24 forecast horizons and 12 target years — the panel estimation has to take into account the complex structure of the variance-covariance matrix due to, among other things, the propagation of shocks among countries. We reject the hypothesis of efficiency in almost all cases: forecast revisions tend to be serially correlated. We then develop measures of the degree of inefficiency in forecasts for the G-7 countries by estimating a VAR model on forecast revisions. We find that the degree of inefficiency tends to be smaller for the US and Japanese forecasts than in the forecasts of European countries. The quality of forecasts of many of these countries can be significantly improved if forecasters pay more attention to news originating from abroad.

Email: isiklaG@assembly.state.ny.us

Evaluating one-time long run economic forecasts

Herman O Stekler, Rupin Thomas

Department of Economics, George Washington University, USA

Most evaluations of economic forecasts are based on a time series consisting of a large number of observations. It is then possible to calculate various error measures such as MSE, MAPE, etc. With only one observation it is not possible to evaluate the forecast in this manner. The error of the forecast can be compared with that of a benchmark, but statistical testing is not possible.

The problem is more severe if the forecast involves long-run projections. In this case, the magnitude of the error may not be as important as correctly predicting structural change. Statistical measures for evaluating structural change include dissimilarity indexes and the information content of the forecast. These concepts are applied to the projections that BLS made in 1989 relating to labor market conditions that were expected to prevail in 2000.

Email: hstekler@gwu.edu

EN2

Contributed session: Electricity prices

Monday 11.40am–12.45pm

Room: Grand Ballroom II

Chair: Maxwell J Stevenson, University of Sydney, Australia**Nonlinear dynamic models for predicting electricity prices**

David Velásquez, Isaac Dyner

Escuela de Ingeniería de Sistemas, Universidad Nacional de Colombia, Colombia

Reinaldo Castro Souza

Department of Electrical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

The electricity price series in world spot markets, besides being very short, present changing characteristics and nonlinearities. Commonly used models in statistical modelling and artificial intelligence don't fulfill these requirements simultaneously. A new nonlinear dynamic model is presented. It's based on structural dynamic models, which contribute their adaptation capacity to the changes in the series dynamics; and on nonparametric regression models, that allow modelling of static nonlinear relationships. In the general case, it can be interpreted as a structural dynamic model that allows included variables with static or dynamic nonlinear influence. Under some simplifications, it may be interpreted as a multilayer perceptron with weights from hidden layer to output layer changing in dynamic form, and adapting to new characteristics of the time series. It may also be interpreted as an ANFIS model, where the linear equation coefficients of consequents change with the new observations. An application to modelling Brazilian electricity spot prices is presented.

Email: jdvelasq@unalmed.edu.co**Modelling electricity price surges**

Vlad Pavlov, Stan Hurn

School of Economics & Finance, Queensland University of Technology, Australia

This paper investigates the features of average daily Queensland half-hourly or pool prices for the period from December 8, 1998 to January 29, 2003. During periods of market stress, electricity prices can rise dramatically. These stressed market situations are associated with either unusually high demand or, more often, unexpected shortfalls in supply that can be caused, for example, by generator failures. Price spikes are of extreme importance to electricity retailers who, because of retail price regulation, can not pass them on to final customers and end up bearing the price risk. This paper uses a two state regime switching model to study the price adjustments around price spikes. An important innovation in the econometrics is the use of the generalised beta distribution to capture the skewness of the error term in the high price state. The main conclusion is that, by allowing for time-varying transition probabilities and incorporating information about seasonal and non-regular demand patterns and meteorological variables, the model can predict high price episodes surprisingly well.

Email: v.pavlov@qut.edu.au

Forecasting the spot price for temperature related weather derivatives

Maxwell J Stevenson, Teddy Oetomo

School of Business, University of Sydney, Australia

Jan G De Gooijer

Faculty of Economics and Econometrics, University of Amsterdam, Netherlands

Growth of the market for weather derivative contracts has been rapid. Deregulation of energy markets and the effect that weather has on the revenue of electricity generators and retailers, along with the growing need of other industries to hedge against extreme weather, has contributed to this growth. The most frequently traded weather derivative contract is temperature related. Clearly, temperature is a non-tradeable underlying asset and, as such, there is an absence of a universally accepted pricing model. The spot price level for a future month is represented by the monthly accumulated Heating Degree Day (HDD) or Cooling Degree Day (CDD) Index over the days in that month. What is of paramount importance is the derivation of accurate forecasts of these metrics that control for possible seasonal effects.

In this paper we forecast the monthly accumulated HDD and CDD indices for ten US cities that account for the bulk of weather derivative trading on the Chicago Mercantile Exchange. The forecasts from a linear, seasonal autoregressive (SEAAR) model are compared with those from a SEASETAR model that models seasonal self-exciting threshold autoregressive (SETAR) nonlinearity. By recalling that an estimate of the spot price is the accumulated HDD or CDD index for a month of days but some months ahead, we evaluate the out-of-sample forecasting performance of the nonlinear model against the linear alternative on an n month-ahead basis. Further, these forecasts are compared to those from existing models based on stochastic simulation and an alternative seasonal time series approach.

Email: m.stevenson@econ.usyd.edu.au

F1

Contributed session: Finance

Monday 11.40am–12.45pm

Room: Harlequin Room

Chair: Leighton Vaughan Williams, The Nottingham Trust University**The predictive value of quarterly interim financial reports relative to analysts aggregate earnings forecast errors and forecast dispersion**

Yaw M Mensah

Department of Accounting & Info Systems, Rutgers Business School, Rutgers University, USA

Xiaofei Song

Department of Accounting, Sobey Faculty of Commerce, St. Mary's University, Halifax, Canada

This study examines empirically the predictive value of interim earnings reports for reducing analysts' aggregate annual earnings forecast errors and forecast dispersion. Previous studies have demonstrated that interim quarterly reports help financial analysts to reduce their absolute forecasting errors with respect to total annual earnings and future quarterly earnings. This study extends these findings to potential reductions in aggregate forecast errors and forecast dispersion.

In general, we find evidence that the releases of interim reports are associated with reductions in these two measures of aggregate analyst forecast performance. More importantly, we find that the reductions in analysts' aggregate forecast errors and forecast dispersion are not uniform across the pre-disclosure information environment. Instead, the predictive value of interim quarterly reports is inversely related to the pre-disclosure information environment. That is, the poorer the information environment (i.e., highest annual earnings forecast errors and greatest degree of dispersion), the greater the reduction in analysts' annual earnings absolute forecast error and forecast dispersion.

Email: mensah@business.rutgers.edu

Technical analysis and the identification of chaos in stock prices and exchange rates

Rajaratnam Premachandran, Rae Weston

Macquarie Graduate School of Management, Macquarie University, Australia

We test a multiple linear detrend method on stock price data for leading USA and Australian stocks and exchange rate data for \$C and \$A against the \$US. The case for detrending is to reduce the impact of noise which is a major hazard in chaotic analysis due to the sensitivity of chaos to initial conditions. The insight this explores is that non-stationarity is not a necessary condition for chaos. We then explore the chaotic structure of the un-detrended and detrended series.

For the stock price series using daily close prices from January 1984 to May 1999 we find for both leading USA and Australian stocks that the multiple linear detrend method is a successful data filtering process.

With respect to exchange rates we use undetrended and multiple linear-detrended time series for the period 1973–2003 for the \$C/\$US and 1985–2003 for the \$A/\$US. Here the multiple linear detrends do not assist in the data filtering process for these exchange rate time series.

The implications of our results are that forecasting is possible from multiple linear detrended stock price series but not from filtered exchange rate series.

Email: prem@dodo.com.au

Forecasting outcomes in index markets: Can traders beat the book?

Leighton Vaughan Williams

Division of Economics, The Nottingham Trent University, UK

David Paton

Department of Economics, Nottingham University Business School, UK

In this paper, we examine a relatively novel form of trading that mirrors (and indeed overlaps with) practices in conventional financial markets. In this form of trading, a number of market-makers each quote a bid-ask spread about the result of some future event, and traders are invited to buy (sell) at the top (bottom) end of the quoted spreads. These spreads may or may not coincide or overlap. We hypothesize that the existence of an outlying spread may provide uninformed traders with forecasting information that can be used to develop improved trading strategies. Using data from a popular market in the United Kingdom we find that, in the presence of a number of price-setters, the price obtained at the market mid-point does indeed provide a better forecast of asset values than the price implied in the outlying spread. We further show that this information can be used to develop trading strategies that lead to returns that are consistently positive and superior to those from noise trading and, in some cases, significantly so.

Email: leighton.vaughan-williams@ntu.ac.uk

M1

Contributed session: Seasonality

Monday 11.40am–12.45pm

Room: Cambridge IV

Chair: Alex W Stuckey, Australian Bureau of Statistics, Australia**Group seasonal indices methods vs individual seasonal indices method**

Huijing Chen, John E Boylan

Buckinghamshire Business School, Buckinghamshire Chilterns University College, UK

Traditionally seasonality is estimated from the individual series. However, for a product family or a certain stock keeping unit (SKU) stored at different locations, estimating seasonality from the group may produce better estimates and improve forecasting accuracy. We compare the traditional individual seasonal indices method and the group seasonal indices methods theoretically for both additive and multiplicative seasonality. Factors are identified to establish the conditions under which one method is better than the other. These factors are: underlying mean, variance of demand, correlation between demand, group size, data history, and seasonal length. Rules are established to decide which method to use. Simulation results on large groups will be presented and discussed to (a) validate theory, (b) quantify the gain of using the rules, and (c) test the sensitivity of the factors in affecting the rules. A brief discussion on empirical analysis will follow.

Email: fchen01@bcuc.ac.uk

Forecasting products with similar seasonal patterns by aggregation

Pim Ouwehand, Karel van Donselaar, Ton de Kok

Department of Technology Management, Eindhoven University of Technology, The Netherlands

In this study we try to improve individual item forecasts by simultaneously forecasting a group of products that exhibit similar demand patterns. The method is an adaptation of the Holt-Winters procedure where seasonal indices are found at an aggregate level instead of at the item level. The idea is that if we are able to construct product families, consisting of individual products with similar seasonal patterns, we may find the seasonal indices at the product family level and use these when we make forecasts at the individual product level. Based on the idea that in general the demand at an aggregate level is relatively less erratic compared with demand at the item level, separating the seasonal pattern from the randomness will then be easier. Empirical results for three Dutch wholesalers show significant improvement potential of the product-aggregation method over classical methods. In this paper, we investigate the impact of several parameters on the performance of the product-aggregation method.

Email: p.ouwehand@tm.tue.nl

Signal extraction: A frequency-based approach with improved noise reduction

Marc Wildi

Institute for Data Analysis and Process Design, Zurich University of Applied Sciences Winterthur, Switzerland

Bernd Schips

KOF, GESS, ETH-Zentrum Zürich, Switzerland

Trend extraction, or equivalently elimination of seasonal and noise components in economic time series, is an important task in the production of statistical data. The commonly used methods (TRAMO/SEATS, X-12) have some stability problems at the boundary. A solution for these stability problems involves frequency-based asymmetric filters. The disadvantage of this approach is the time consuming filter design for each individual time series. Therefore we propose a frequency-based approach relying on a preliminary classification of time series with respect to their spectral properties. The procedure has been applied to 41 time series (business survey data) resulting in five distinct "clusters". For each cluster a single boundary filter is computed in the frequency domain. For each of the 41 time series the resulting signal estimates are then compared to corresponding optimal trend estimates from TRAMO/SEATS. Besides being very fast, the proposed frequency based approach is more accurate and more flexible, since it allows a control of the phase (time delay) of the boundary filter. This possibility combined with an improved elimination of high frequency noise components favours an earlier detection of turning points.

Email: wia@zhwin.ch

Aggregation of seasonally adjusted estimates by a post-adjustment

Alex W Stuckey, Xichuan (Mark) Zhang, Craig H McLaren

Methodology Division, Australian Bureau of Statistics, Australia

Many seasonally adjusted estimates are published at both component and aggregate levels. Seasonal adjustment using a multiplicative X-11 method does not preserve additivity across component series and a post-adjustment is necessary to restore additivity to the system of series. We will present various solutions to this problem and detail conditions under which each method is preferred. The methodology will be illustrated by an application to a system of economic time series.

Email: alex.stuckey@abs.gov.au

SM2

Invited session: Nonlinear time series models

Monday 11.40am–12.45pm

Room: Cambridge III

Chair: Wai-keung Li, University of Hong Kong, China**Bayesian Gaussian mixture autoregressive model**

Mike KP So, John W Lau

Hong Kong University of Science and Technology, China

A Gaussian mixture autoregressive model for nonlinear time series is studied from a Bayesian viewpoint. The conditional distribution of the time series is written as a flexible mixture of Gaussian densities. Unknown parameters of this model include a mixing distribution which has a Dirichlet process prior. The posterior distribution of autoregressive and scale parameters, and the orders of the AR processes are expressed as finite sums over partitions of the time series data. A weighted Chinese restaurant process which clusters the data and an imputation based on the sequential imputations are developed to evaluate posterior distributions. Numerical results from simulated and real data are presented to illustrate the methodology.

Email: immkpso@ust.hk

Self-weighted LSE and MLE for ARMA-GARCH models

Shiqing Ling

Hong Kong University of Science and Technology, China

How to do inferences for the ARMA-GARCH model is a standing open problem when its 4th-order moment is infinite. A solution for this is given in this paper. For the finite variance case, we propose a self-weighted least squares estimator (LSE) for the ARMA part and then use the residuals to obtain the global maximum likelihood estimator (MLE) for the GARCH part. Both estimators are shown to be consistent and asymptotically normal. Using them as the initial estimators, we show that the local MLE for ARMA-GARCH is asymptotically normal. For the infinite variance case, a self-weighted LSE and a self-weighted MLE are proposed for ARMA and ARMA-GARCH, respectively, such that the estimated parameters are consistent and asymptotically normal. Based on the self-weighted MLE, the Wald test statistic is constructed for linear restrictions on the parameters and it is shown that the test has non-trivial local powers.

Email: maling@ust.hk

Forecasting US inflation with linear, nonlinear, and structural change models

Dick van Dijk

Econometric Institute, Erasmus University Rotterdam, Netherlands

Forecasting inflation remains an intriguing research topic among academics and practitioners alike. Recent studies by Stock and Watson (1999 *JME*, 2003 *JEL*) have documented the limited usefulness and instability of Phillips curve type models using unemployment or other macroeconomic and financial variables for the purpose of forecasting inflation. However, this conclusion is built upon the assumption of a linear relationship between inflation and the relevant predictor variable(s). In this paper, we relax this assumption and consider the forecasting performance of threshold models, Markov switching models, and linear models with structural breaks in terms of point, interval, and density forecasts for US inflation over the period 1976–2002. The results of point forecast evaluation tests confirm the established notion in the forecasting literature on the favourable performance of the linear model. However, we also find evidence that point forecasts from Markov switching models and threshold models are more accurate during extended sub-periods closely related to business cycle recessions. In addition, the non-linear models frequently render more accurate interval and density forecasts. This supports the idea that non-linear models may outperform linear competitors only for certain specific observations and in terms of describing the uncertainty around future realizations of a time series.

Email: djvandijk@few.eur.nl

T2

Contributed session: Technology and diffusion models

Monday 11.40am–12.45pm

Room: Bradfield Lounge

Chair: Towhidul Islam, University of Guelph, Canada**Forecasting the evolution of demand for the large sized television of next generation using conjoint and diffusion models**Chul-Yong Lee, Jong-Su Lee, Young-Sang Cho, Jung-Dong Lee
Techno-Economics and Policy Program, Seoul National University, Korea

The Bass diffusion model has some problems which don't forecast the demand of prelaunch product and don't reflect consumer heterogeneity and competition among products. In this paper, we introduce a new method to solve these problems. This new model is composed of four steps as follows. First, we estimate the utility function of customers to investigate the preference for the attributes of products by conjoint analysis. Second, we estimate the dynamic price function of each product competing against each other in the market to capture the change of technology and market environment. Third, combining the utility function and the price function, we transform the static utility function into a dynamic utility function. Finally, we forecast the sales of each product using market share estimated from the dynamic utility function and the overall sales for each period estimated from the Bass diffusion model.

We apply this model to the large sized TV market (CRT TV, Projection TV, LCD TV, PDP TV) of Korea, and investigate the consumer choice and the diffusion pattern. The results show that consumers are sensitive to the resolution and the price of TV. So Projection TV will have a large market share due to low price in the short run. But LCD TV will have the largest market share due to the high resolution and steep price falling after LCD TV over 50 inch is launched. Results show that consumers will prefer the 40 inch TV to the 50–60 inch TV due to suitability for households.

Email: poad98@snu.ac.kr

A hybrid approach to estimate the parameters of the diffusion modelFu-kwun Wang
Industrial Engineering and Management, National Taipei University of Technology, Taiwan

The Bass diffusion model has been successfully applied to describe the empirical adoption curve for many new products and technological innovations. In order to improve the parameter estimates, a hybrid approach, which combines nonlinear least squares and a genetic algorithm, is proposed. This approach can produce more accuracy of the parameter estimation for the Bass diffusion model. The new automobile sales data during 1987 to 2001 in the Taiwan market is used to demonstrate the application of the proposed method. The results show that the Bass model using a hybrid approach outperforms the time series model in terms of forecasting accuracy.

Email: fukwun@ntut.edu.tw

Modelling the duration time between key events in innovation diffusion

Towhidul Islam

Department of Marketing and Consumer Studies, University of Guelph, Canada

Nigel Meade

Tanaka Business School, Imperial College London, UK

The diffusion of a new product grows in a sequence of stages. The key events are typically: product concept; invention; market introduction; sales take off; the launch of the next generation of technology; sales take off of the second generation. The analysis explores the inter-relationship between the inter-event duration times. We examine the feasibility of predicting the duration of the interval to the next event. We shall use multivariate copulas and different hazard models to analyze two generations of mobile phone adoption data from about 50 countries.

Email: islam@uoguelph.ca

D3

Contributed session: Demography

Monday 1.45pm–2.50pm

Room: Cambridge II

Chair: Tom G Wilson, University of Queensland, Australia**Migration in the context of stochastic population projections: An application to Swedish data**

Michael Hartmann

Demographic Unit, Statistics Sweden, Sweden

This paper deals with migration in the perspective of making stochastic population forecasts or projections. Swedish time series on migration are used to illustrate that in, out and net-migration comply with the first-order autoregressive process (abbreviated the AR(1)-process), including the random walk. These illustrations are based on studies of first-order differences, residuals and spectra for the time series. Out-migration is for the period 1851–2002. In- and net-migration is for the period 1875–2002.

Because the migration data can be approximately typed as finite samples from AR(1)-processes, an obvious way of creating pseudo-realizations is to make use of estimated AR(1)-models. Here the notion of pseudo-realization means mimicking, as realistically as possible, the stochastic mechanisms underlying the observed process-segments. It is however also possible to create pseudo-realizations of the observed processes by means of fitting finite Fourier series to the sampled data (harmonic analysis). By randomly varying the phases in the fitted Fourier series, new time series segments of migration are created that have the same mean and variance as the observed segment. Both techniques for randomizing the observed process-segments are discussed and illustrated.

Email: michael.hartmann@scb.se

Multivariate VARS modelling and forecasting of international total fertility rates: Southern Europe 1950–2000

José Antonio Ortega

Department of Economics, Universidad de Salamanca, Spain

Pilar Poncela

Department of Economic Analysis: Quantitative Economy, Universidad Autónoma de Madrid, Spain

In this paper we introduce a new multivariate factor model, the Vector AutoRegressive Slope model, and apply it to obtain joint forecasts of international trends in total fertility rates. The VARS model is an unobserved component model characterized by an eventual forecast function with a time-changing asymptotic value, and exponential decay in the slope. It is particularly well suited for capturing joint fertility trends that are characterized by sudden turning points and common trends. The model is applied to Southern European data for the sample 1950–2000. The forecasting performance is evaluated and compared to alternative univariate and multivariate models.

Email: jaortega@usal.es

Subnational probabilistic population forecasts for Australia

Tom G Wilson, Martin Bell

Queensland Centre for Population Research, School of Geography, Planning and Architecture, The University of Queensland, Australia

The variability of demographic trends at the subnational scale, particularly internal and international migration, renders subnational population forecasting more difficult than at the national scale. Probabilistic population forecasting models have the potential to overcome many of the problems of deterministic variant projections, but these models have so far been limited to national forecasts. This paper presents probabilistic population forecasts for the states and territories of Australia using a multiregional framework. The forecasts quantify to what extent greater uncertainty exists about the demographic future at the subnational compared to the national scale.

Email: tom.wilson@uq.edu.au

E2

Contributed session: Leading indicators

Monday 1.45pm–2.50pm

Room: Bradfield Lounge

Chair: Anirvan Banerji, Economic Cycle Research Institute, USA**Business cycles forecasting with leading economic indicators and stock selection in the G7 countries**

John B Guerard

International University of Monaco, USA

The purpose of this study is to integrate the forecasting of the composite index of leading economic indicators (LEI) with industry rotation and stock selection in the G7 countries during the 1995–2003 period. A quantitative stock selection model is used to rank securities within the countries and is statistically significant at identifying under-valued securities. We use the forecasts of the G7 country LEI to alter a traditional market-capitalization derived portfolio. Additionally, we explore the implications of using a quantitative stock selection model to generate sector exposures.

Email: JGuer43756@aol.com

Composite leading indicators of inflation in New Zealand

Michael A Graff

Economics, Reserve Bank of New Zealand, New Zealand

Inflation forecasts are crucial for projections of real economic activity. Moreover, they are a cornerstone of central bank monetary policy formulation. Most central banks rely on a variety of methods to drive inflation forecasts, where structural macro models and semi-structural approaches are supplemented by indicator based models. Since the latter are empiricist rather than guided by rigorous theory, there is a bias to prefer the former approach. Based on data from New Zealand, however, this paper demonstrates that indicator based inflation forecasts may be more informative than the preferred structural approach. Specifically, based on ex-post data, an algorithm is developed to combine information from a set of potential indicators into principal components. These combined indicators of inflation are Pareto-optimal in the sense that no other combination from the set of indicators produces forecasts of inflation that a) are equally precise but have a longer lead, or b) have the same lead and better precision. The indicators thus derived have leads of up to six quarters and are Pareto-superior to the most popular structural measure of inflationary pressure, the output gap. This holds ex-post as well as in simulated real time. Out-of-sample forecasts confirm that these findings are not spurious.

Email: graffM@rbnz.govt.nz

Combining leading indicators and flash estimates

Lars-Erik Öller

Statistics Sweden, Economic Statistics, Sweden

Tom Persson

Mathematical Statistics, Stockholm University, Sweden

A flash estimator uses monthly production data to obtain early estimates of quarterly manufacturing. This is combined with leading indicators, both monthly and quarterly. The leading information is extracted from the Business Tendency Survey using a Kalman filter. The result is called a Leading Flash Estimator (LFE). Preliminary results indicate that LFE is more timely than a conventional flash and more accurate than a leading indicator.

Email: Lars-Erik.Oller@SCB.SE

A leading index of US manufacturing jobs

Anirvan Banerji

Economic Cycle Research Institute, USA

Philip A Klein

Department of Economics, Pennsylvania State University, USA

The composite leading index approach was developed to predict cycles in aggregate economic activity, i.e., business cycles, but can be used to predict cycles in aspects or sectors of the economy. Given the rapid disappearance of US manufacturing jobs during the current business cycle recovery, the development of a Leading Index of Manufacturing Employment (LIME) is especially timely. The approach is appropriate, since manufacturing employment is highly cyclical.

The half-century historical record shows that the LIME anticipates peaks and troughs in manufacturing employment, while the LIME growth rate has a good record of anticipating cyclical turns in manufacturing job growth. While the lead may be longer than usual, this remains true even in the current cycle, which has seen a structural shift involving a massive loss of industrial jobs. This underscores Granger and Newbold's admonition that a leading index is intended to forecast the timing of turning points and not the size of the forthcoming downswing or upswing. Sure enough, the magnitude of the job loss defies historical experience, and could not have been predicted by the long-term relationship between the LIME and manufacturing employment. This is a sign of a change in economic structure, not in the LIME's usefulness.

Email: anirvan@businesscycle.com

EN3

Tutorial

Monday 1.45pm–2.50pm

Room: Grand Ballroom II

Weather Derivatives: What are they, where are they traded and how are they priced?

Maxwell J Stevenson

School of Business, University of Sydney, Australia

In this session I will briefly review six different temperature forecasting models proposed by the prior literature for pricing weather derivatives. Simulation of these models is used to estimate daily temperature and, as a consequence, the metrics used for pricing temperature derivatives. The models that rely on an Autoregressive Moving Average (ARMA) process exhibit a better goodness-of-fit than those that are established under Monte Carlo simulations. However, the superiority of ARMA-type models is not reflected over the forecast horizon. Over that period, the models which rely on Monte Carlo simulations exhibit a tendency to over-forecast the monthly-accumulated Heating Degree Day (AccHDD) index and to under-forecast the monthly-accumulated Cooling Degree Day (AccCDD) index. Alternatively, models established under the ARMA approach both under-forecast and over-forecast the monthly accumulated indices. All models consistently over-forecast the average daily temperature. The most appropriate pricing model varies between cities and months. Finally, the models examined in this study generate a more accurate AccHDD futures price than the price traded on the market. However, the ability of these models to estimate the AccCDD futures price is significantly poorer than that of the market.

Max Stevenson is a Senior Lecturer in Finance within the School of Business at The University of Sydney. He holds Masters Degrees in mathematical statistics and econometrics and a PhD in mathematical economics from the University of New South Wales. Max's research interests and publications are drawn from broad areas of corporate finance, financial econometrics, forecasting and risk management. Recent research and publication have included his work on the reliability of temperature-based weather derivative pricing models and their use as a risk management tool within the electricity industry.

Email: M.Stevenson@econ.usyd.edu.au

J1

Contributed session: Judgmental and scenario forecasting

Monday 1.45pm–2.50pm

Room: Cambridge IV

Chair: Roy Batchelor, Cass Business School, UK**Stigma induced property value diminutia from nuclear waste transportation**

Paul Washeba

Finance, Avnet, USA

Sheila Conway

Urban Environmental Research LLC, USA

Irene Navis

Clark County Department of Comprehensive Planning Nuclear Waste Division, Nevada, USA

Stigma resulting from an amplified perception of risk has been associated with all aspects of nuclear power plant siting and operations and stigma has been associated with a decline in property values. The United States Department of Energy (USDOE) will soon embark on a massive program to transport High-Level Nuclear Waste (HLNW) from civilian nuclear power plants and the nation's weapons complex to a repository at Yucca Mountain, Nevada. The HLNW will travel through Clark County, Nevada.

This paper examines the extent of property value diminution that may occur in Clark County, Nevada, as a result of this program. Several methodologies have been developed for estimating property value diminution. These methodologies focus on measuring either comparable current sales or the statistical change in a large number of past transactions. Since a massive shipment campaign of HLNW has never occurred there is neither comparable current sales nor past transactions that can be used for comparison. In order to evaluate the range of potential property value diminutia that may result from the transportation of HLNW and SNF, a survey of real estate appraisers and lenders was combined with an analogous case study, and a survey of Clark County, Nevada, residents.

Email: paul.washeba@avnet.com

Demand forecasting of alternative-fuel vehicle using conjoint analysis and multi-product diffusion model

Young-Sang Cho, Jong-Su Lee, Jung-Dong Lee

Techno-Economics & Policy Program, Seoul National University, Korea

The Korean government is deregulating the sale of diesel vehicles, raising many questions about environmental impacts, energy supply and demand, and tax on new vehicles. Because the Korean government should follow world environmental protection law, policy makers need to control the demand of diesel vehicles to meet the situation properly. To control demand of diesel vehicles, the Korean government is considering the change of the fuel price, vehicle tax, obligatory equipment of DPF (Diesel Particulate Filter) system, and so on. In this research, we investigate the consumer choice on the selection of a vehicle using conjoint analysis, and analyze the characteristics of consumers. Finally we forecast the market share of alternative-fuel vehicle under the various policies of government. The results of this research will provide important information to policy makers of government in making fuel pricing and taxing policy.

Email: 95cys@hanmail.net

The effects of learning in interactive monetary policy committees

Jan Marc Berk, Beata Bierut

Monetary and Economic Policy Department, De Nederlandsche Bank, The Netherlands

Monetary policy decisions are usually taken by a group of individuals instead of 'the' central bank. We show that this has important consequences for the quality of interest rates decisions, especially since group decision-making involves interaction. The theoretical results from the voting literature show that interaction is detrimental to the quality of group decision-making. We reconcile these results with intuition and statements of policy-makers suggesting that exchange of information implicit in interaction is beneficial for the decision-making process. Our results show that if interaction involves learning, it improves the quality of monetary policy. Furthermore, we show that the inefficiencies induced by heterogeneous skills of committee members are to a large extent reduced by allowing for interaction. We conclude by investigating the consequences of interaction and learning for the optimal committee size.

Email: j.m.berk@dnb.nl

Judgmental bootstrapping of technical traders in the bond market

Roy Batchelor, Tai Yeong Kwan

Faculty of Finance, Cass Business School, City of London, UK

Meta-analysis shows that in many domains the decisions of experts are inferior to the decisions of statistical models of experts. The aim of this paper is to test this proposition in the financial markets, where genuine expertise is hard to find and the drivers of success hard to determine. We exploit a unique database containing the recommended trading positions of technical analysts following the German bond market in the years 2000–2001, and questionnaires revealing the technical indicators they used. The analysts have only average directional forecasting ability, but make consistent profits through superior market timing. However, ordered response models describing their positions, and driven by a subset of their technical indicators, make even more profits, with no increase in risk. Interestingly, the models that perform best on statistical criteria are not necessarily the most profitable in- or out-of-sample, and parsimonious and quasi-linear models are preferred over more complex models, including a single-layer neural network.

Email: r.a.batchelor@city.ac.uk

Web: <http://www.staff.city.ac.uk/r.a.batchelor>

M2

Invited session: Combining forecasts

Monday 1.45pm–2.50pm

Room: Harlequin Room

Chair: Yue Fang, University of Oregon, USA**Pooling of forecasts**

David F Hendry

Department of Economics, Oxford University, UK

Michael P Clements

Department of Economics, Warwick University, UK

We consider forecasting using a combination, when no model coincides with a non-constant data generation process (DGP). Practical experience suggests that combining forecasts adds value, and can even dominate the best individual device. We show why this can occur when forecasting models are differentially mis-specified, and is likely to occur when the DGP is subject to location shifts. Moreover, averaging may then dominate over estimated weights in the combination. Finally, it cannot be proved that only non-encompassed devices should be retained in the combination. Empirical and Monte Carlo illustrations confirm the analysis.

Email: david.hendry@nuffield.ox.ac.uk

Effects of judges' forecasting on their later combination of forecasts for the same outcomes

Clare Harries, Nigel Harvey

Department of Psychology, University College London, UK

In a first experiment, judges' ability to combine forecasts that they received from more knowledgeable advisors was impaired when they previously made their own forecasts for the same outcomes. It appears that they implicitly include their own forecasts among those they combine. In a second experiment, we demonstrate that people combining forecasts put more weight on forecasts that are their own (whether or not they are labelled as such) or are labelled as their own (when they are not) than on equivalent forecasts that are neither their own nor labelled as such. We argue that the cognitive mechanisms responsible for these effects are better characterized as a type of conservatism rather than as an example of anchoring. This suggests people responsible for integrating forecasts from more knowledgeable advisors should not explicitly include their own forecasts among those that they combine and should consider avoiding making their own forecasts altogether.

Email: clare.harries@ucl.ac.uk

Time series forecasting of short-term US energy consumption

Yue Fang

Charles H. Lundquist College of Business, University of Oregon, USA;

School of Finance and Applied Statistics, Australian National University, Australia

Many time series analysis methods can be used to forecast energy consumption. These methods differ in model structure, estimation method, and data used. This paper investigates two interrelated problems for forecasting short-term total energy consumption: (i) We study whether it is preferable to forecast the contemporaneously disaggregated series (i.e., series of four end-use sectors: commercial, industrial, residential and transportation) and aggregate the forecasts, rather than forecast the contemporaneously aggregated series directly; (ii) We examine whether considerable gain in forecast efficiency can be obtained for forecasts of future temporal aggregates (say, quarterly total energy consumption) when using models based on temporally disaggregated data (say, monthly consumption series) for which forecasts are updated as soon as the new information becomes available.

Noting that the forecasts for total energy consumption from different models are often not perfectly correlated with each other and it is very rare for any individual forecast to systematically dominate the others, we apply forecast encompassing tests to evaluate information relevant to forecasting total energy consumption in each of the forecasts, and examine whether, and how, competing forecasts may be fruitfully combined to produce a composite forecast which is superior to the individual forecast.

Email: yfang@lcbmail.uoregon.edu

M3

Contributed session: Forecasting methods

Monday 1.45pm–2.50pm

Room: Essex I

Chair: Konstantinos Nikolopoulos, Lancaster University, UK**Why the securities industry relies so much upon moving average models**

Sufi M Nazem

College of Business Administration, University of Nebraska at Omaha, USA

Forecasting activity in the securities industry has grown substantially over recent years, and the professionals in this industry rely heavily on moving average type models. For example, the 90-day moving average is widely published and used by investment professionals. Most professionals in this industry are interested in the short term movement of financial markets, and more specifically the short term movement of security prices. Our research is aimed at establishing empirical evidence, if any, to justify the industry's apparent reliance on moving average models. We have selected a sample of over 100 equities from the list of Fortune 500 companies for further study. Monthly closing price of these company stocks provided the raw time series data for further analysis. Models are developed for each time series data using several popular forecasting methods such as classical decomposition, exponential smoothing techniques, and ARIMA models using Box-Jenkins approach.

This paper will report the relative performance of various forecasting methods. By examining the relative performance of these models we expect to draw conclusions about the use of moving average models in the securities industry.

Email: sufi_nazem@unomaha.edu**Forecasting new brand performance: traditional and non-traditional models**

Michelle K Tustin, Erica Riebe, John G Dawes

Marketing Science Centre, School of Marketing, University of South Australia, Australia

Forecasting the growth of new brands remains one of the most difficult and challenging tasks facing practitioner and marketing modellers today.

Historically, forecasting models such as Fourn-Woodlock, Eskin, TRACKER and ASSESSOR, which were developed to predict future sales of new brands, have at their core the trial-repeat purchase phenomena that implies that a new brands repeat buying rate grows slowly over time. These models, of which there are many, decompose data into trial and repeat parts to produce formal sales or market share predictions for new brands.

However, importance has been placed on finding the context in which the models fit best, and evaluating the measures and techniques inherent in the models, rather than determining generalisable findings about new brand performance. This paper discusses the benefits of an alternative model, the Dirichlet model, which has also been used to examine new brand performance.

Examination of new brand performance utilising the Dirichlet model has established an empirically based finding of near-instant loyalty for new brands. This finding implies that the traditional and commercial trial-repeat forecasting models are inappropriate for several reasons. These reasons will be discussed, along with preliminary empirical results that highlight potential indicators of new brand performance.

Email: Michelle.Tustin@MarketingScienceCentre.com

Generalising the theta model

Konstantinos Nikolopoulos

Management Science, Lancaster University Management School, UK

Vassilis Assimakopoulos

School of Electrical and Computer Engineering, National Technical University of Athens, Greece

The theta model is a univariate forecasting method, introduced in the M3-Competition, presenting surprisingly good performance, especially for monthly series and microeconomic data. As a result, the model generated great interest as to what is behind this success. In this study, the originators of the model present a generalization of the model via the adoption of more than two Theta lines in the extrapolation process. The generic model is tested on M3 and non-M3 data series.

Email: k.nikolopoulos@lancaster.ac.uk

SM3

Contributed session: State space models

Monday 1.45pm–2.50pm

Room: Essex II

Chair: Ashton J de Silva, Monash University, Australia**Identifying pattern change in univariate time series with multi-model forecasting methodology**

Xiaoqiang Gao

Information Management and Information Systems, College of Economics and Business Administration,
Chongqing University, Chongqing, China

Time series forecasting is carried out under the assumption that historical patterns of time series will persist in the future and can be identified by analyzing data. Most attention has been paid to how to identify accurately the historical pattern in a time series. In this paper, pattern change in a time series is investigated by using a multi-model forecasting approach. A set of models composed of exponential smoothing and moving average with different orders were used to explore the effect on one-period ahead forecasting and other statistics at forecasting time. Simulated and real-life series were used for identification purposes. The derivative time series, based on the statistics of maximum or minimum of forecasting error, variance over the forecasting models, and so on, were obtained for each original time series. More information about the original time series is revealed in the derivative time series and some changes in the pattern of time series are also identified.

Email: xqgao@cqu.edu.cn

Does the parameter space affect forecast performance for exponential smoothing state space models?

Muhammad Akram, Rob J Hyndman

Business & Economic Forecasting Unit, Monash University, Australia

We discuss various possible parameter spaces for single source of error state space models that underly exponential smoothing methods. We compare these parameter spaces by applying them when forecasting the data from the M1 and M3 competitions. In this paper we consider three possible parameter spaces: (1) the admissible (invertible) space; (2) the usual (0,1) space; and (3) the intersection of the previous two. We will also consider the empirical impact of distant past values on forecasts obtained under the various parameter spaces.

Email: Muhammad.Akram@BusEco.monash.edu.au

Single source of error state space approach to Beveridge Nelson decomposition

Chin Nam Low, Ralph D Snyder

Business & Economic Forecasting Unit, Monash University, Australia

Heather M Anderson

School of Economics, Australia National University, Australia

The use of the Beveridge Nelson decomposition in macroeconomic analysis involves the truncation and estimation of infinite weighted sums of random variables, whereas the single source of error (SSE) state space approach provides a simple and effective framework that leads to exactly the same decomposition. Thus, although the (SSE) approach was originally developed as a forecasting tool, it can also be used as a macroeconomic tool, providing a straightforward decomposition of the series into trend and cyclical components, and simplifying the calculation of the relative importance of permanent and temporary shocks.

Email: chinlow@buseco.monash.edu.au

Vector exponential smoothing: an introduction

Ashton J de Silva, Rob J Hyndman, Ralph D Snyder

Business & Economic Forecasting Unit, Monash University, Australia

The objective of this research is to consider a multivariate extension to the Univariate Exponential Smoothing (UES) methodology. The multivariate extension is denoted in state space form characterised by a single source of error per series. In general the forecasts generated from the Vector Exponential Smoothing (VES) methodology are expected to be at least as good as the nested univariate counterpart. There are three forms of the inter-series dependencies captured in the VES specification, two of which are captured by coefficient matrices. The final form of inter-series dependency is captured in the multivariate normal distribution of errors.

Email: ashton.desilva@buseco.monash.edu.au

SM4

Invited session: Nonlinear time series models

Monday 1.45pm–2.50pm

Room: Cambridge III

Chair: Timo Teräsvirta, Stockholm School of Economics, Sweden**Investigating business cycle asymmetry in US state-level output using a multi-level panel smooth transition autoregressive model**

Dick van Dijk, Dennis Fok, Philip Hans Franses

Econometric Institute, Erasmus University Rotterdam, Netherlands

Business cycle nonlinearity in macroeconomic variables such as output and unemployment has been well-documented. In this paper, we consider a multi-level smooth transition model for a panel of time series variables to examine the presence of common non-linear features across monthly US state-level output series. The model is positioned in between a fully pooled model, which imposes such common features, and a fully heterogeneous model, which might render estimation problems for some of the panel members. To keep the model tractable, we employ a second-stage model, which links the parameters in the transition functions with observable explanatory variables. We discuss representation, estimation by concentrated simulated maximum likelihood and inference. The empirical analysis reveals that there is a high degree of synchronicity in cyclical movements across states, but also that there are subtle differences in leads and lags for nation-wide business cycle recessions and expansions. Comparing the out-of-sample forecast performance of the multi-level with standard univariate linear and nonlinear models confirms its potential.

Email: djvandijk@few.eur.nl

Tree-structured smooth transition autoregressive models

Álvaro Veiga

Department of Electrical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

Joel Rosa

Department of Statistics, Federal University of Paran, Brazil

Marcelo C Medeiros

Department of Economics, Pontifical Catholic University of Rio de Janeiro, Brazil

STAR models are linear models with coefficients determined by the position of the vector of explanatory variables in the transition space. They are not always easy to interpret but there are a number of statistical inferential tools available to specify, test and provide diagnostic checking. CART refers to tree-based classification and prediction methods. One of the main features of CART is its interpretability, which can be read as a logical sentence concerning the explanatory variables. Comparing with the STAR formulation, CART is a multiple regime model with only a constant term with transition space partitioned according to a binary tree. However, due to the abrupt transition provided by CART algorithm, statistical tests and specification procedures are hard to derive.

This work proposes a new variation of the STAR model where the transition space is partitioned according to smooth transition binary tree that implicitly defines a smooth partition of the transition space. The motivation for this is twofold. First, smooth transition models can be specified through statistical procedures. Second, the final tree can be easily interpreted and, like in CART, can be read as logical sentences on the explanatory variables. We called the model TS-STARX (Tree-Structure Smooth Transition Autoregression with eXternal Variables).

Email: alvf@ele.puc-rio.br

Smooth transition autoregressions, neural networks, and linear models in forecasting macroeconomic time series: A re-examination

Timo Teräsvirta

Department of Economic Statistics, Stockholm School of Economics, Sweden

Dick van Dijk

Econometric Institute, Erasmus University Rotterdam, The Netherlands

Marcelo C Medeiros

Department of Economics, Pontifical Catholic University of Rio de Janeiro, Brazil

In this paper we consider the question whether univariate nonlinear models provide better forecasts for macroeconomic time series than linear autoregressive models. The data set consists of seven monthly seasonally adjusted macroeconomic time series for each of the G7 economies for the years 1960–1999. Both point and interval forecasts are considered. Two types of nonlinear models are considered: a tightly parameterized model, which is a smooth transition autoregressive model (STAR), and a loosely parameterized model, which is a single-hidden layer feedforward artificial neural network model. The forecasts are recursive: a single model is used for all forecast horizons, 1, 3, 6 and 12 months ahead. Every model is re-estimated after adding an observation and respecified once every 12 months. An important issue investigated in the paper is whether careful modelling helps when it comes to forecasting. Whether combining forecasts leads to increased accuracy is investigated as well. The results show that, on average, the STAR models yield more accurate point forecasts than its competitors. The neural network models do not have a clear edge over the linear autoregressive model, and in some cases the performance of neural network models is clearly inferior compared to the performance of the other models. Reasons for this outcome are discussed. Another conclusion is that careful modelling does increase forecast accuracy compared to the alternative in which the parameterization of the nonlinear model is fixed in advance. Combinations of forecasts are occasionally more accurate than the individual forecasts that have been combined, but the main advantage of combining forecasts appears to be that the frequency of rather bad forecasts is substantially reduced.

Email: Timo.Terasvirta@hhs.se

A4

Invited session: Crime

Monday 3.00pm–4.05pm

Room: Essex II

Chair: Wilpen L Gorr, Carnegie Mellon University, USA**Choice models for forecasting terrorist events in urban environments**

Donald E Brown, Jason Dalton, Hoyle Heidi

Department of Systems & Information Engineering, University of Virginia, USA

Terrorist events, such as suicide bombings, are frightening, destructive, and rare. The nature of suicide bombings makes effective defensive measures difficult, with the result that these measures typically impose greater restrictions on the larger population. Forecasting the locations of terrorist events can enable more directed defensive efforts. While a number of forecasting methods might be used for this problem, very few are capable of dealing explicitly with the inherent conflict that motivates the terrorist. This paper describes an approach to terrorist incident forecasting that uses discrete choice models to predict the behavior of the terrorist. This work builds on our previous work in forecasting criminal behavior using spatial choice models. We give an example of the use of this approach and an evaluation of its performance using data from suicide bombings in Israel.

Email: brown@virginia.edu

Forecasting geo-temporal crime levels

Hasan Al-Madfai

School of Technology, University of Glamorgan, UK

Jonathan Corcoran, Andrew Ware

School of Computing, University of Glamorgan, UK

This presentation will detail a forecasting framework for short-term, tactical deployment of police resources in which the objective is the identification of areas where the levels of crime are high enough to enable accurate predictive models to be produced. The presentation will compare and contrast the use of artificial neural networks and traditional statistical forecasting methods that both utilise geographical clusters of crime data to facilitate predictive modelling. The data used in this study are three types of police incidents (violence against the person, criminal damage and disorder), spanning two years in an urban area measuring approximately 242.7km². Included in the database of crime incidents are a number of variables relating to time, day, month, and location (represented as geographical co-ordinates). The presentation will conclude by presenting an analysis of the results obtained together with a comparison of the usability and intuitiveness of the models constructed.

Email: hmadfai@glam.ac.uk

Short-term crime forecasting: results based on large data collections

Wilpen L Gorr, Jacqueline Cohen

Heinz School of Public Policy, Carnegie Mellon University, USA

Over the past several years, our research group has built very likely the largest and most comprehensive laboratory for testing crime forecasting models. We have assembled and processed over six million police reports from two medium-sized, US cities. We have 12 years' data for each crime type aggregated by month for several sub-city geographies including grid cells, census tracts, and police administrative areas. As a baseline, we ran several simple univariate forecast models through these data. The conclusion is that we can break police precincts up into two or three subsections for forecasting and obtain adequate one-month-ahead accuracy for high volume crimes. Best is simple exponential smoothing with multiplicative seasonality estimated from pooled, city-wide data. We also have two multivariate models that can improve on forecast accuracy. One model interacts multiplicative seasonal dummies with socio-economic and land use variables in order to model seasonality by neighborhood type. This model often yields improvements over the best univariate model. The second multivariate model uses lesser crimes, lagged in time and space, as leading indicators of serious crimes. Early results on this model suggest that it is best when there are very large changes forecasted.

Email: gorr@cmu.edu

E3

Invited session: Forecasting business cycles

Monday 3.00pm–4.05pm

Room: Cambridge III

Chair: Allan P Layton, Queensland University of Technology, Australia**Nonlinear autoregressive leading indicator models of output in G7 countries**

Heather M Anderson, Farshid Vahid

School of Economics, Australian National University, Australia

George Athanasopoulos

Department of Econometrics and Business Statistics, Monash University, Australia

This paper studies linear and nonlinear autoregressive leading indicator models of business cycles in G7 countries. The models use the spread between short-term and long-term interest rates as leading indicators for GDP, and their success in capturing business cycles is gauged by non-parametric shape tests, and their ability to predict the probability of recession. We find that bivariate nonlinear models of output and the interest rate spread can successfully capture the shape of the business cycle in cases where linear models fail. Also, our nonlinear leading indicator models for USA, Canada and the UK outperform other models of GDP with respect to predicting the probability of recession.

Email: heather.anderson@anu.edu.au

Measuring the response of macroeconomic uncertainty to shocks

Kalvinder Shields, Nilss Olekalns, Ólan T Henry

Department of Economics, The University of Melbourne, Australia

Chris Brooks

ISMA Centre, The University of Reading, UK

Recent research documents the importance of uncertainty in determining macroeconomic outcomes, but little is known about the transmission of uncertainty across such outcomes. This paper examines the response of uncertainty about inflation and output growth to shocks documenting statistically significant size and sign bias and spillover effects. Uncertainty about inflation is a determinant of output uncertainty, whilst higher growth volatility tends to raise inflation volatility. Both inflation and growth volatility respond asymmetrically to positive and negative shocks. Negative growth and inflation shocks lead to higher and more persistent uncertainty than shocks of equal magnitude but opposite sign.

Email: k.shields@unimelb.edu.au

A further look at the issue of duration dependence in US business cycle phases

Allan P Layton

School of Economics and Finance, Queensland University of Technology, Australia

Daniel R Smith

Faculty of Business Administration, Simon Fraser University, Canada

Durland and McCurdy (1994) investigated the issue of duration dependence in US business cycle phases using a Markov regime switching approach introduced by Hamilton (1989) and extended to the case of variable transition parameters by Filardo (1994). In their model, duration alone was used as a putative explainer of the transition probabilities. Bodman (1998) applied the same type of model to Australian data. Both Durland & McCurdy and Bodman found that recessions were duration dependent whilst expansions were not. In this paper, we explicitly incorporate the widely-accepted US business cycle phase change dates as determined by the NBER, and use a state-dependent multinomial logit (and Probit) modelling framework incorporating both duration and movements in two leading indexes — one designed to have a short lead (SLI) and the other designed to have a longer lead (LLI) — as putative explainers. We find that doing so suggests that current duration is not only a significant determinant of transition out of recessions, but that there is evidence that it is also weakly significant in the case of expansions. Furthermore, we find that SLI has more informational content for the termination of recessions whilst LLI has more for expansions.

Email: a.layton@qut.edu.au

EN4

Contributed session: Electricity load

Monday 3.00pm–4.05pm

Room: Bradfield Lounge

Chair: Leonard A Smith, London School of Economics, UK**A two-stage dynamic learning algorithm for very short-term load forecasting**Frank A Monforte, Christine Fordham, Stuart J McMenamin
Itron, Inc., USA

Since the early 1990s, significant work has been focused on short-term electricity load forecasting. From this body of work, neural networks and regression techniques have become the tools of choice. Most of the short-term load forecasting models are used to forecast hourly loads, and less attention has been placed on very short-term forecast horizons of five-minutes ahead. Traditionally, these forecast horizons have been handled using Kalman filters and other time series techniques. Under FERC's direction, market operators are finding that they need to extend the five-minute forecasts out to ten days ahead to support system and market operations. For longer horizons, autoregressive techniques fail to account for important changes in loads due to weather and calendar conditions. This suggests casting the five-minute ahead forecasting problem in a neural network or regression framework. This paper presents a framework that provides ten-day ahead load forecasts at the five-minute level and leverages the hourly modelling concepts implemented over the past decade. The framework blends neural network models at the 15-minute level with regression models at the five-minute level. The framework also introduces two sets of dynamic learning weights that correct for both within-day and prior-day forecast errors.

Email: frank.monforte@itron.com

Short term load forecasting: a new approach by decision tree

Reinaldo Castro Souza

Department of Electrical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

Ana Paula Sobral

Department of Statistics, Federal University of Juiz de Fora (UFJF), Brazil

The importance of load forecasting for the short term has been steadily growing over the past few years. Load forecasts are the basis for forecasting energy prices, and the privatisation and increased competitiveness in the Brazilian electricity sector, have turned price forecasting into an extremely important task.

As a consequence of structural changes in the electricity sector, the variability and the non-stationarity of the electrical loads have tended to increase, because of the dynamics of the energy prices. Due to these structural changes, new forecasting methods are needed to meet the new scenarios.

The tools that are available for load forecasting in the international market require a large amount of online information, especially information about weather data. Since this information is not yet readily available in Brazil, this work proposes a short-term load forecaster that takes into consideration the restrictions in the acquisition of temperature data.

A short-term (one-day ahead) forecaster of hourly loads is proposed that combines load data and weather data (temperature), by means of decision tree models. Decision trees were chosen because those models, despite being easy to interpret, have been very rarely used for load forecasting.

Email: reinaldo@ele.puc-rio.br

A comparison of univariate time series methods for predicting electricity demand up to a day ahead

Lilian M de Menezes

Cass Business School, City University, UK

James W Taylor

Saïd Business School, Oxford University, UK

Patrick E McSharry

Department of Engineering, Oxford University, UK

This empirical paper compares the accuracy of six univariate methods for short-term electricity demand forecasting for lead times up to a day ahead. These methods include naïve benchmarks, ARIMA, neural network, the recently proposed double seasonal exponential smoothing method, and a decomposition approach based on principal component analysis. Two 30-week time series are used to evaluate forecast accuracy: hourly demand for Rio de Janeiro and half-hourly demand for England and Wales. The results for the exponential smoothing method were particularly good, leading us to conclude that simpler and more robust methods, which require little domain knowledge, can outperform more complex alternatives.

Email: l.demenezes@city.ac.uk

End-to-end probability forecasts for the energy sector from operational ensemble weather forecasts

Leonard A Smith

Centre for Analysis of Time Series, London School of Economics, UK

Modern operational weather forecast centres often employ ensemble prediction systems: a Monte Carlo approach to uncertainty in the current state of the atmosphere which provides a small sample (of order 32) of simulations in a high dimensional model space (of order 10 million) from each forecast centre. Two distinct methods of translating this small set of trajectories of weather models into probabilistic forecasts of interest to the energy sector are illustrated; one treats the various simulations as scenarios, while the second attempts to construct a product space including all the forecasts and corresponding past verification targets. Proof of value studies for a wind farm production forecasting and temperature related demand forecasting are discussed, each based on real observations and operational forecasts and evaluated in terms of economic value (income).

Email: lenny@maths.ox.ac.uk

F2

Contributed session: Finance

Monday 3.00pm–4.05pm

Room: Harlequin Room

Chair: Paula Hill, University of Leeds, UK**A behavioural finance model of an investor**

Michel Fuksa

Department of Theology, Saint Paul University, Canada

Standard finance theory proclaiming absolute investor rationality has been replaced recently by the new mantra of behavioural finance, which relaxes the very strict assumptions of the original theory. The new approach maintains that investors treat information according to Bayes' law, but do so imperfectly. A weakness of the behavioural finance framework is the lack of an empirical model for explaining financial asset prices.

A model, inspired by behavioural finance, is introduced, in which investor behaviour is likened to the operation of a filter in statistics or engineering. It is shown that there exist parallels between psychological evidence on investor behaviour, and the behaviour of statistical filters. An analysis is performed to demonstrate the similarities, and, in particular, the Kalman filter is used to illustrate this point.

An empirical model of an investor, based on the Kalman filter, is constructed, and is used in an attempt to predict the behaviour of stock returns.

Email: mfuksa@business.carleton.ca**Equity price reversals and duration dependence**

Juan Yao, Graham Partington, Maxwell J Stevenson

Finance Discipline, University of Sydney, Australia

A growing body of work in behavioural finance proposes that the stock market under- and overreacts based on investors psychological biases. The overreaction and correction of the market gives stock prices the appearance of fluctuating around their fair values. Investor behaviour, overreaction and underreaction may cause duration dependence and price bubbles. In this paper, we propose a non-parametric approach to estimate the transition probabilities of equity price reversals and the duration dependence of stock market prices. Furthermore, the out-of-sample tests will examine whether any evidence of duration dependence can be used to forecast the timing of price-reversals.

We adopt the Cox's proportional hazard model to estimate the probability that a price run will end. Our main interest is to test whether the probabilities of stock price reversals depend on the length of the run and to estimate the probability and timing of a state change. We seek evidence of duration dependence in the dynamics of stock market prices. Evidence of duration dependence and its effect on price bubbles provides important insights into the efficiency of the Australian stock market and the predictability of stock market returns.

Email: j.yao@econ.usyd.edu.au

The interdependence in international stock markets

Gultekin Isiklar

Department of Economics, University at Albany, State University of New York, USA

This paper studies the international transmission of shocks among stock markets using a structural vector autoregression (SVAR). For systems that include variables that may be efficient in some form of the efficient market hypothesis (EMH), i.e., systems with variables that respond to news quickly, identification of SVAR via Choleski decomposition is not applicable. So for identification of the SVAR, we explore the use of eclectic restrictions on the dynamics of the system. Using Monte Carlo simulations we show that this new identification methodology provides a much better fit of the impulse responses for the systems that include efficient market variables. We use this new approach to identify a SVAR model on daily rates of return from leading stock markets. We compare our results with the orthogonalized and generalized impulse responses and illustrate that identification methodology may have significant effects on the results.

Email: isiklag@assembly.state.ny.us

Forecasting the performance of initial public offerings in the long run

Paula Hill

Leeds University Business School, University of Leeds, UK

Gulnur Muradoglu

Cass Business School, City University, UK

An initial public offering (IPO), or stock market flotation, is the first time a company lists its shares on a stock market. A number of studies find evidence of long run IPO underperformance. However, this underperformance is sensitive to the model of expected returns employed, and tests of IPO underperformance suffer from the problem of jointly testing the adequacy of the model selected for risk adjustment. Improvements in methodology, most specifically to allow for the risk premium associated with company size and/or book to market values, and to allow average returns to be calculated over calendar time rather than event time, have led more recent studies to find less evidence of IPO long run underperformance. Nonetheless, the problem of selecting an adequate model for risk adjustment continues to afflict most studies of IPO returns over the longer term.

This paper employs a range of within sample variables to determine both risk adjusted and non-adjusted returns for a sample of 500 UK IPOs for up to a five year period post issue. The practical use to which the findings may be applied are twofold. Firstly this will provide information to investors in IPOs to enable them to distinguish between longer term winners and losers. Secondly, the findings might throw some light on the characteristics of IPO stocks which cause their underperformance, and hence assist in the development of a model which adjusts adequately for the risk of IPO stocks.

Email: ph@lubs.leeds.ac.uk

J2

Contributed session: Judgmental and scenario forecasting

Monday 3.00pm–4.05pm

Room: Cambridge IV

Chair: Dilek Önköl, Bilkent University, Turkey**Systems view to strategic decision making and forecasting**

Rajat Dhawan

Business Information Systems, University of Sydney, Australia

The paper is centred on the fact that the quality of information used by decision makers and forecasters is often not appropriate; which affects the quality of the decision and accuracy of a forecast. Furthermore, the organisational environment of forecasting and decision making is complex (involving causal loops, time delays and non-linearity) and the human mind alone is unable to process all the available information. This lack of relevant information while making a decision/forecast leads to poor understanding of the problem and ends up solving its symptoms rather than the problem itself.

System Dynamics is one such technique which aims at modelling a complex problem and improving the judgmental forecasting process. It takes into consideration the relationship of the apparent problem with other organisational factors and aims at tracing the root of the problem. The paper eventually illustrates how System Dynamics could prove useful in making policies and strategies that affect decisions and forecasts.

Email: r.dhawan@econ.usyd.edu.au

Long-term forecasts of income: a causal model

Dennis Ahlburg

Carlson School of Management, University of Minnesota, USA

J Scott Armstrong

The Wharton School, University of Pennsylvania, PA

Given the complexity of the problem of forecasting income growth by country, we propose the use of a "growth policy index". We used a Delphi study to summarize expert opinion on the policy variables that affect long-term income growth. The expert opinions were compared with findings from empirical studies. The index was then composed of variables on which there was substantial agreement among experts, and also between experts and empirical studies. We then tested the growth policy index on a sample of countries to examine the extent to which relative growth rates could be predicted.

Email: dahlburg@csom.umn.edu

Ongoing investigation into the utility of uncertainty information in forecasting and decision making

Michael D Nelson, Michael Lawrence

School of Information Systems, Technology & Management, University of New South Wales, Australia

Marcus O'Connor

School of Business, University of Sydney, Australia

This study provides an update on an investigation into the utility of objective Uncertainty Information (UI). UI, such as confidence intervals or confidence levels, indicates the level of uncertainty associated with a forecast. Forecasts in business are often not accompanied by UI, and are generally not required to, perhaps because past research into UI utility has been inconclusive. Yet people are poor judges of uncertainty, so the provision of objective UI should improve decision-making. Using a capital budgeting style decision task, where UI had diagnostic and decision-making value, this study investigated the overall impact of providing UI in the form of a 75% confidence level. UI improved both overall decision performance and the calibration of decision confidence. These results occurred regardless of whether the 75% confidence level was provided with or without a forecast. However, modifying the level of task uncertainty did affect UI utility and decision performance, but this was dependent upon whether the 75% confidence level was accompanied by a forecast. These results are discussed, and ideas for further study are indicated.

Email: michael_nelson@hotmail.com

Effects of source-framing on judgmental adjustment of forecasts

Dilek Önkal

Faculty of Business Administration, Bilkent University, Turkey

Paul Goodwin

The Management School, University of Bath, UK

Mary E Thomson

Department of Psychology, Glasgow Caledonian University, UK

Andrew C Pollock

School of Computing and Mathematical Sciences, Glasgow Caledonian University, UK

This research examines judgmental adjustments of external predictions when the presented forecasts are framed as originating from statistical techniques versus experts. Point forecasts, 70% prediction intervals and 95% prediction intervals are used as the three predictive formats. Employing real stock-price data, the experimental task involves eliciting initial forecasts, presenting external forecasts using source-framing, and requesting adjusted forecasts. In the first experiment, groups are presented with one external forecast (framed as either coming from a statistical forecasting technique or a financial expert). In the second experiment, groups are presented with two external forecasts (which are framed as coming from two statistical forecasting techniques, two financial experts, or one statistical forecasting technique and one expert). We discuss the implications of our findings for forecasting support systems.

Email: onkal@bilkent.edu.tr

M4

Tutorial

Monday 3.00pm–4.05pm

Room: Grand Ballroom II

How to effectively integrate forecasts into business planning processes

Joseph K McConnell

McConnell Chase Software Works, USA

The player who consistently sees ahead and gets to the right place at the right time to make a play has great anticipation — and smarts. Smarts separates the better performers from those with just as much physical ability and natural talent, and thus is a significant competitive advantage. In business, the ability to see ahead comes from forecasting, and is based on both statistical extrapolation and human intuition. For an enterprise, the ability to act on its forward vision depends, however, on how well the forecasting function is integrated into the rest of the company. This tutorial will cover the integration of forecasting into a comprehensive planning process encompassing forecasting, demand planning, sales and operations planning, plus strategic, financial, and inventory supply planning.

Joseph K McConnell is President and Chief Architect of McConnell Chase Software Works. Founded in 1985, McConnell Chase is a leading edge supplier of comprehensive business forecasting solutions with diverse customers such as Hewlett Packard, Kennametal, Ultratech Stepper, and Symantec International.

Email: jkm@mcconnellchase.com

M5

Contributed session: Neural nets

Monday 3.00pm–4.05pm

Room: Essex I

Chair: Bruce Curry, Cardiff University, UK**Asymmetric objective functions for artificial neural network applications in business forecasting**

Sven FS Crone

Department of Management Science, Lancaster University Management School, UK

Artificial neural networks in time series prediction generally minimize a symmetric statistical error, such as the sum of squared errors, to obtain predictors. However, applications in business elucidate that real forecasting problems contain asymmetric errors and non-quadratic errors. Consequently, a variety of loss functions have been discussed for parameter estimation and evaluation in business forecasting. In inventory management the costs arising from over- versus under-prediction are dissimilar for errors of identical magnitude, requiring an ex-post correction of the predictor through safety stocks. To reflect this, an asymmetric cost function is developed and employed as the objective function for neural network training, deriving superior forecasts and a cost efficient stock-level directly from the network output. Some experimental results are computed using a multilayer perceptron modelled for nonlinear autoregression and trained with different objective functions, evaluating the performance in competition to standard statistical forecasting methods on different ARIMA time series data. The results demonstrate the benefits of incorporating the appropriate loss function in the estimation process.

Email: crone@bis-lab.de

Forecasting seasonal time-series using artificial neural networks

Rohit Dhawan

Business Information Systems, University of Sydney, Australia

Previous research has shown that, under most circumstances, neural networks are inept at forecasting time series with a seasonality component. Should data always be de-seasonalised first? If neural networks are capable of modelling hidden relationships within data, why are they not able to recognise seasonality? Can the neural network architecture be changed to enable it to incorporate seasonality? Or can the time-series be decomposed and then fed to the neural network for it to model the affect of seasonality?

This paper attempts to answer these questions, to seek an understanding of the relationship of seasonal time-series and artificial neural networks. If neural networks could be successfully implemented to forecast seasonal time-series, it would save the forecaster time ,and would also eventually result in more efficient forecasts.

Email: ro.ind@yahoo.com

Identification of nonlinear principal component neural networks

Brigitta S Voss

Novartis, Switzerland

Claus Weihs

Department of Statistics, University of Dortmund, Germany

In applied statistics it is common practice to sample a multitude of the most correlated variables to predict one or several dependent variables. An approach to the multicollinearity of the observed variables is to extract a few latent variables containing most of the information of the observed variables, and use them as new predictor variables.

A powerful statistical technique for defining latent variables is principal component analysis. But the assumption of a linear relationship among the observed variables limits its usefulness for many practical applications.

A popular method of estimating nonlinear principal components is based on five-layer feed-forward neural networks (NLPCA), which have been applied widely. For prediction, the method is limited, since the estimated parameters of neural networks are not unique. We will therefore address the important question of parameter identifiability for the NLPCA neural network. The central result, a condition under which a weakened identifiability holds, will be presented. We will show that, with this condition, the asymptotic covariance matrix of the parameters' estimates can be calculated. For example, this allows the calculation of prediction intervals.

Email: Brigitta.Voss@gmx.de

Identification issues in neural networks

Bruce Curry, Peter H Morgan

Cardiff Business School, Cardiff University, UK

At ISF2003 the Chebyshev polynomials were introduced as a method of analysing the somewhat difficult functional form represented by feedforward neural networks; one of the themes examined was parameter identification and redundancy. For the current presentation, new results have been derived and the theme of identification is explored by a second method. This involves using a Taylor series approximation for the network function and thereby solving, with suitable constraints, a set of nonlinear equations involving the network weights. The method has been used by the authors to demonstrate that a network can simulate a linear function, thus removing the need for forcible inclusion of a linear component. It has now been employed to show the existence of quite simple interdependencies between network weights. Combining the results from both methods leads to the conclusion that the network equation contains naturally occurring interdependencies between parameters, in addition to those considered by previous authors. There are consequences for significance testing and also for the training process itself. For the latter, weight interdependencies cause the RMS surface to be locally almost flat, thus potentially trapping the search algorithm; the problem is especially important for gradient-based algorithms.

Email: curry@cardiff.ac.uk

SM5

Invited session: Count time series

Monday 3.00pm–4.05pm

Room: Cambridge II

Chair: Rob J Hyndman, Monash University, Australia**Integer-valued exponential smoothing models for count time series**

Lydia Shenstone, Rob J Hyndman

Business & Economic Forecasting Unit, Monash University, Australia

This paper introduces and evaluates new discrete forecasting models, namely the Integer-valued Exponential Smoothing (INES) models, which have properties analogous to those of exponential smoothing. The INES models provide an alternative approach for intermittent demand forecasting (IDF). Some of the theoretical properties of the INES models are explored and discussed. An empirical comparison of the INES models to other existing IDF models (e.g., Croston's model) is performed based on real datasets with intermittent patterns.

Email: Lydia.Shenstone@buseco.monash.edu.au

Models and methods for estimating and forecasting count time series

William TM Dunsmuir

School of Mathematics, University of New South Wales, Australia

This paper will review methods for modelling and forecasting time series of counts with particular emphasis on two classes of state space models for which the observations follow a member of the exponential family. The focus is on assessing the impact of time dependent covariates on the observed counts when serial dependence exists. In observation driven models, the state equation incorporates past observed values suitably normalized. The talk will discuss choice of normalization and the impact this can have on ergodicity of the resulting time series in the Poisson and binomial cases. Observation driven models are straightforward to estimate and forecast. In parameter driven models the state equation incorporates serial dependence through a latent stationary autocorrelated, usually Gaussian, time series. These models are appealing from an interpretive perspective, and limit theory for estimation is relatively straightforward. However, maximum likelihood or Bayesian estimation, as well as generation of forecasts, are computationally challenging. Simulation based methods for computing the likelihood and forecasting will be described briefly and a useful, quick to compute, approximate likelihood method will be discussed. Illustrations of the models and methods will be drawn from trade-by-trade price movements, hospital admissions and public policy intervention assessment.

Email: W.Dunsmuir@unsw.edu.au

Testing for correlation in non-Gaussian data

Brendan McCabe

School of Management, University of Liverpool, UK

Gael Martin

Department of Econometrics and Business Statistics, Monash University, Australia

Keith Freeland

Department of Statistics and Actuarial Science, University of Waterloo, Canada

This paper provides a general methodology for testing for correlation in count, duration and other non-Gaussian data. Should the test reject, a model may be constructed to provide forecasts. A latent factor approach is adopted, whereby a dynamic model is postulated for a continuous latent variable, and the correlation transferred to the non-Gaussian, possibly discrete, observations. The transmission of the correlation from the latent to the observed variables is discussed, as is the question of testing for correlation of various types. Tests for short memory, long memory and unit root correlation, which are applicable under broad distributional assumptions, are derived. Under certain conditions, the short memory and long memory statistics that are derived are invariant to the form adopted for the conditional distribution, within the exponential class. Furthermore, the statistics in these cases are equivalent to tests previously derived under the assumption that the data in question are both Gaussian and directly correlated with the assumed correlation structure. As such, the results in the paper provide justification for the use of already existing test procedures in much broader distributional settings than had previously been considered. In the case of the unit root test, the statistic derived, under the specific assumption of conditional lognormality, is equivalent to that which would be derived had the data been transformed to normality and a direct unit root test applied. Monte Carlo experiments are used to gauge the finite sample size and power properties of the tests, and empirical illustrations conducted using Australian intraday stock market data.

Email: Brendan.McCabe@liv.ac.uk

P

Poster session

Monday 4.10pm–4.50pm

Room: Grand Ballroom I

Using loglinear models to describe, analyze and forecast fertility

Pedro C Alvarez, Cristina Rueda, Pilar Rodríguez
Department of Statistics, University of Valladolid, Spain

In this paper we propose to use loglinear models to describe, analyze and forecast fertility patterns. We define a multivariate dynamic non-Gaussian model: a loglinear model for a fixed time point. We wish to emphasize several advantages of the proposed model. First, the presented method can be used to formulate a discrete model both for childbearing intensities or fertility rates. Second, for each fixed time point, the model is fitted using standard software and maximum likelihood methods which gives estimators of the parameters and standard errors and provides with other conventional tools to analyse the model. Third, the interpretation of the parameter series permit explanations of the changes in the level and timing of fertility and also to forecast fertility measures using different scenarios. In a first step we analyse the series using standard Box-Jenkins methodology but the state-space formulation of the models allows a unified analysis that will be consider in the future. Finally, to illustrate our method, we use data from Spain and Sweden.

Email: pedroc@eio.uva.es

Bridge models to forecast G7 economic activity

Roberto Golinelli
Department of Economics, University of Bologna, Italy
Giuseppe Parigi
Research Department, Bank of Italy, Italy

Quantitative information on the current state of the economy is crucial to economic policy-making and to early understanding of the economic situation, but the quarterly national account data for GDP are delayed in their release.

The aim of the paper is to examine the forecast ability of bridge models (BM) for GDP growth in the G7 countries. BM bridge the gap between the information content of timely updated indicators and the delayed (but more complete) national accounts. In doing so, we run alternative one and two-step forecasting experiments to assess BM performance in situations as close as possible to the actual forecasting activity.

Two issues are dealt with in this paper: a) the assessment of the forecasting performance of our BM against some benchmark models; and b) the choice of the more appropriate aggregation level to be adopted in the forecasting procedure. BM are estimated for GDP both for single countries (USA, Japan, Germany, France, UK, Italy, and Canada), and area-wide (G7, European Union, and Euro area).

National BM forecasting ability is always superior to that of benchmark models, provided that at least some indicators are available over the forecasting horizon. Area-wide GDPs are more precisely predicted by aggregating national forecasts.

Email: golinell@spbo.unibo.it

Process adjustment via restricted forecasts with transfer function models

Victor M Guerrero

Research Coordination, INEGI, and Department of Statistics, ITAM, Mexico

Edilberto Ruiz

Department of Mathematics, Universidad Nacional de Colombia, Colombia

In this work we study the process adjustment problem from a restricted forecasting point of view. Some common discrete feedback control schemes are considered explicitly within the context of transfer function models.

We consider a bivariate system with one input and one output. Then, by imposing restrictions on the future values of the output variable we obtain restricted forecasts of the input variable which coincide with the adjustment rules produced by optimal feedback control schemes.

Some simulated and real examples are presented to shed some light on how the method works in practice.

Email: guerrero@itam.mx

Spatial analysis and forecast on labor demand and supply in China

Tianli He

Department of Economics, Shandong Institute of Business and Technology, China

Lihua Zhao

School of Marketing, University of New South Wales, Australia

China is undergoing rapid economic development, and experiencing increased urbanisation and conflict between over-supply of unskilled labor and demand of skilled labor force. An accurate prediction of labor demand and supply is beneficial to both decision-making at the local level and policy making at the national level. Complexity and difficulty exist regarding the forecasting of labor force because there are many variables and uncertainties that may have significant impact, and also because essential historical data and research regarding internal migration of population is in most cases inadequate. We have developed a multiple-level forecasting model, with a focus on the impacts of technologies and industry structure. Essentially, the location of a region plays an important role in determining the industry structure, and the labor demand and supply of a region may be improved due to the economic development and industry structure of neighboring regions. This paper outlines the framework of this forecasting model and details the empirical study based on the county-level datasets in Shandong Province, including spatial analysis and forecasts. It provides the most likely trend of labour demand and supply in the specified areas and how the trend may be controlled by industry structure and policies.

Email: lihua.zhao@unsw.edu.au; hetianli@ccec.edu.cn

Forecasting payroll costs for the department of social security

Harry Kogetsidis

Business School, Intercollege, Cyprus

The Department of Social Security awards pay increases to all staff on the basis of annual performance markings. These are translated into cash amounts according to complex progression rules, which specify the increment that an employee receives, depending on his or her position on the salary scale. The aim of this paper is to discuss how a forecasting model based on regression analysis was developed for the Department of Social Security in order to complement their existing payroll modelling system. The new forecasting model was tested and found to be robust to changes in the forecast complements, the spine flow propensities, and the initial average salaries, all of which were used as inputs to the Departments payroll modelling system.

Email: kogetsidis.h@intercollege.ac.cy

Integrating GIS and data mining for area market demand forecasting

Hongwei Lu, Lihua Zhao

School of Marketing, University of New South Wales, Australia

Accurate area market demand forecasting can help marketers to develop their sales territories and retail centres with optimized planning, and allocate their marketing resources effectively. However, the research in this field has long been restricted by data scarcity and algorithm inferiority, which currently are being overcome by well developed census data in digital format, and good progress made with data mining models. Aided by data mining and Geographical Information System (GIS) technologies, this research focuses on the area market demand forecasting by exploring geo-demographic (census) data and historical sales data. The analysis methods such as genetic algorithms and decision trees are employed to develop the area market demand forecasting models. GIS provides a visualisation and spatial analysis tool for market demand forecasting at different levels of regions, such as postcode area, local government area, sales catchment area, etc. It also provides database functions for managing area related spatial data. A case of automobile market demand forecasting for a car dealer in Sydney demonstrates the methodology and framework developed in this research, and the cross-validating is applied to verify the quality and efficiency of the prediction results.

We acknowledge financial support from an ARC Linkage Grant (LP0348935) and data from Mapdata Interface International Pty Ltd.

Email: z2226784@student.unsw.edu.au

Forecasting of temperature with applications

Luciana Magnano, John Boland

Centre of Industrial and Applied Mathematics, University of South Australia, Australia

The purpose of this study is to introduce a model to describe and forecast daily average temperature. It is developed using Fourier transformations to describe seasonality and autoregressive terms to explain the deseasonalized noise behaviour. The model developed is more parsimonious than others found in the literature showing the same forecasting performance. Additionally, both the deterministic and stochastic terms have a physical explanation for their inclusion in the model. In the first case, two cycles are used to describe the seasonality; one to explain the summer/winter temperature behaviour and the other, less strong, that describes the spring/autumn one. Since the error term still shows a seasonal pattern, each value is divided by the standard deviation of the average temperature, corresponding to each day of the year, calculated again using the Fourier transformation. Finally, the deseasonalized error term is explained by an autoregressive model of order three which relates today's temperature with the temperature of the previous three days. The ability to forecast weather variables can be useful for weather derivatives analysis as well as in the Electricity Market. In the last case, also hourly forecasts are useful. Some results will be presented on that basis.

Email: Luciana.Magnano@postgrads.unisa.edu.au

Multi-seasonal ARIMA models in electrical load forecasting

Joanicjusz Nazarko

Faculty of Management, Bialystok Technical University, Poland

The paper presents the methodology of constructing multi-seasonal ARIMA models and their application in electrical load forecasting. One of the commonly used approaches proposed by Box and Jenkins is generalised by applying it to a wider class of ARIMA models with many seasonal components.

Each stage of the model construction has been described and discussed. As an example, the data on the load of a medium voltage line has been used. The proposed approach broadens the current forecasting methodology used in power engineering and contributes to the better understanding of the mechanisms shaping the demand for electrical power. The assessment of the quality of the obtained forecast indicate a high efficiency of multi-seasonal ARIMA models in the electrical load forecasting.

Email: jnazarko@pb.bialystok.pl

Forecasting of ENSO Niño 3.4 anomaly based on a nonlinear method

Dadang Subarna

Climate Modeling Division, Lapan, Indonesia

In this paper, a nonlinear method is used to give 12 months of forecasts of the sea surface temperature (SST) anomaly for the Niño 3.4 region (120°–170°W, 5°N–5°S) based on observations from January 1950 through December 2003. SST anomaly predictions are given for the monthly SST Niño 3.4 anomaly. Optimal parameters of the nonlinear method were 14 months lag time and 9 embedding dimensions. The result of model validation was a correlation coefficient of 0.91. The model predicts that the SST Niño 3.4 anomalies for the 12 months of 2004 will range between 0.05°C and 0.24°C, which is within the thresholds of -0.65 (minimum) and 0.75 (maximum) for La Niña or El Niño onset according to IRI (International Research Institute for climate prediction).

Email: dangsub@yahoo.com

Product demand forecasting with a novel Fuzzy Cerebellar Model Articulation Controller (FCMAC)

Raveen L Tilani

School of Computer Engineering, Nanyang Technological University, Singapore

Daming Shi

Division of Computer Science, Nanyang Technological University, Singapore

Xiang Li, Atul Harkisanka

Product Design & Development, Singapore Institute of Manufacturing Technology, Singapore

Forecasting product demand has always been a crucial challenge to managers as they play a critical role in making many business critical decisions such as production and inventory planning. These decisions are instrumental in meeting customer demand and ensuring the survival of the organisation.

This paper introduces a novel Fuzzy-Cerebellar-Model-Articulation-Controller (FCMAC) neural network for forecasting and investigates its performance in comparison to established techniques such as the Single Exponential Smoothing, Holt's Linear Trend, Holt-Winters' Additive and Multiplicative methods and the Box-Jenkins ARIMA model. Experimental results from the M3 Competition data revealed that the FCMAC model yielded lower errors for certain data sets. The conditions under which the FCMAC model emerged superior are discussed.

Email: raveen@pmail.ntu.edu.sg

Forecasting in XL Miner

Elzbieta K Trybus

Systems and Operations Management Department, California State University, USA

Ginter Trybus

Computer Science Department, California State University, USA

Although the field of data mining is in a continual state of change, a few basic approaches have remained constant. These are classification, estimation, and predictive models. However, unlike a classification or estimation model, where the current behavior is analyzed, the purpose of a predictive model is to determine future outcome. In this paper we will discuss XL Miner package in terms of the utilization of predictive models and their predictive accuracy. Both categories of attributes, numerical and categorical, are considered.

Email: elzbieta.trybus@csun.edu

K2

Plenary session

Tuesday 8.30am–9.45am

Room: Grand Ballroom II

Chair: Allan P Layton, Queensland University of Technology, Australia**Some aspects of the future of forecasting**

Clive WJ Granger

Department of Economics, University of California at San Diego, USA

Most of the forecastable important topics of the future in forecasting are already starting. A list would include:

- 1 Long-run economic macro forecasting, up to five, ten, or even twenty years ahead. Is this possible? How well do currently available methods perform, particularly concerning confidence intervals?
- 2 Forecasting breaks. Are any types of breaks forecastable? The answers seems to be a qualified yes, only a few weeks ahead for financial crisis. Can new methods develop?
- 3 Predictive Distributions. How do we form and evaluate forecasts from them; use of quantiles; combinations.
- 4 Can we use decision theory to derive economic-based criteria for the evaluation of forecasts?

Email: cgranger@ucsd.edu

Clive Granger is Professor Emeritus in the Economics Department, University of California at San Diego (UCSD). He shares the 2003 Nobel Prize in Economics with Robert Engle. His work has been principally concerned with econometric forecasting, and he received his Nobel Prize “for methods of analyzing economic time series with common trends (cointegration)”. Apart from his work in cointegration, he is also well known for development of the concept of “Granger causality”.

Clive Granger was born in Swansea, Wales, and educated at the University of Nottingham where he was a undergraduate and postgraduate student, then an academic, becoming a full professor before leaving for UCSD in 1974. He is author of 250 academic papers and 12 books, and he has been one of the most influential scholars in time series econometrics over the last 40 years.

E4

Contributed session: Cycles & turning points

Tuesday 9.55am–11.00am

Room: Essex II

Chair: Don Harding, University of Melbourne, Australia**The relationship between traffic accidents and real economic activity: Common cycles, aggregation and forecasting**

Antonio Garcia-Ferrer, Arancha de Juan, Pilar Poncela

Department of Economic Analysis: Quantitative Economy, Universidad Autónoma de Madrid, Spain, Spain

This paper analyses the aggregate relationships between traffic accidents and real economic activity in Spain during the last thirty years. Our general approach is based on two basic assumptions: 1) the number of accidents depends on the use of cars and other exogenous variables, and 2) the level of economic activity affects variation in the stock of cars, as well as degree of utilisation. The proposed turning point characterisation for monthly seasonal data allows us to check whether economic and road accident cycles coincide, and to date the beginning and end of their respective cycles. Empirical results from this section are important in establishing posterior causal models, and whether or not economic activity and road accidents have a common component in the long run, and a varying lead-lag relationship, depending on the cycles. Finally, the predictive performance of several modelling alternatives (using different information sets) is assessed. Attention is focussed on disaggregated data, and whether or not disaggregation pays off in terms of forecasting.

Email: antonio.garcia@uam.esWeb: <http://www.uam.es/departamentos/economicas/econcuam/default.html>**Value of transportation indicators in business cycle research**

Kajal Lahiri, Vince Yao

Department of Economics, State University of New York at Albany, USA

Transportation plays a central role in facilitating economic activities across sectors and between regions, and information from this sector is essential to the business cycle study. Scope of transportation we consider covers transportation services, equipment and infrastructure. Transportation-related indicators, including the new transportation services index (TSI), production of transportation equipment and spending on infrastructure, are sorted into leading, coincident and lagging group of economy-wide business cycles using various criteria.

Email: klahiri@albany.edu

Business cycle asymmetries in univariate macroeconomic forecasting

José Ramon Cancelo

Department of Applied Economics II, Universidade da Coruña, Spain

We investigate empirically whether allowing for business cycle asymmetries improves univariate forecasts of macroeconomic data. Our aim is to set up nonlinear time series models for a variety of macroeconomic aggregates and a set of countries, and to assess under which circumstances they predict better than linear autoregressions. We consider smooth transition autoregressions to capture nonlinear behavior related to cyclical asymmetries. Two classes of switch between regimes are considered: endogenous determination of regimes, following standard practice in the literature, and exogenous transition so the switch between regimes is a function of a more direct indicator of the business cycle. Our forecasting exercise focuses on five major macroeconomic aggregates (GDP, private consumption, investment, imports and unemployment rate) for the G7 countries, so we have 35 case studies to gather information from. The working sample to build the models is 1970:1 to 1998:4, and they are used to forecast the period 1999:1 to 2003:2 with forecasting horizons ranging from one quarter to one year. To compare nonlinear forecasts with predictions derived from linear autoregressions we carry out explicit tests of the hypothesis of equal accuracy, and pay special attention to specific forecasts around turning points.

Email: jramon@udc.es

Using turning point information to study economic dynamics

Don Harding

Department of Economics, The University of Melbourne, Australia

Procedures are developed to compute the proportion of turning points located in the sample path of time series data. It is shown that the proportion of turning points can be directly related to the data generating process. Methods for estimating model parameters are developed using counts of turning points. It is shown that the proposed method has the advantages of tractability and robustness. The latter feature arises as it does not require that any of the moments of the series $Y(t)$ exist.

Tests of model specification are developed using these counts of turning points. These tests are applied to several models, one including the issue of whether GDP is better modelled as trend stationary or difference stationary.

Monte Carlo results are presented for both the estimation and testing procedures.

Email: d.harding@unimelb.edu.au

EN5

Contributed session: Electricity

Tuesday 9.55am–11.00am

Room: Cambridge IV

Chair: Reinaldo Castro Souza, Pontifical Catholic University of Rio de Janeiro, Brazil**Investigating the price determination process in the England and Wales electricity market 1994–2001**

Marilyn Amobi, Erik R Larsen, Lilian M de Menezes
Cass Business School, City University, UK

In this preliminary study, we address the price determination process of electricity in England and Wales during the pool regime, which ceased to exist in 2001. Half-hourly pool data bundles from January 1, 1994 to March 31, 2001 on capacity and price are used to examine the market outcome under the pool regime. The time series patterns are analyzed and give us insights into possible pricing strategies that may have been used.

Email: m.amobi@city.ac.uk

Statistical modelling of Brazilian electricity spot prices using ANFIS

David Velásquez, Isaac Dyner
School of Systems Engineering, Universidad Nacional de Colombia, Colombia

Reinaldo Castro Souza
Department of Electrical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

In this article, we examine how the specification of ANFIS for financial modelling must be guided for a statistical strategy. At first, we show how ANFIS must be interpreted as a nonlinear autoregressive model for time series; later, we analyze a nonlinear time series strategy for initial ANFIS specification. Finally, Brazilian electricity spot price forecasting case is presented as application example. As a result of this study, it is suggested that this modified strategy should become an integral part of modelling of time series using ANFIS.

Email: jdvelasq@unalmed.edu.co

The hierarchical profiling approach to STLF of multi-year daily electricity demand in South Wales

Hasan Al-Madfai

Division of Mathematics and Statistics, University of Glamorgan, UK

Jamal Ameen

School of Care Sciences, University of Glamorgan, UK

Alan Ryley

School of Technology, University of Glamorgan, UK

Short term load forecasting (STLF) has been subject to several time series based studies, most of which utilise a form of transfer function models to represent the data. The use of weather variables as inputs to these models is derived from the effect of the weather on consumer behaviour, which influences electricity demand. Other factors that influence the consumers' behaviour exist—religious events and holiday seasons, for example. These factors contribute to the non-stationary component of the process, as do multiple periodicities and repeated aperiodic disturbances. Such processes may not be made stationary by conventional techniques.

A univariate time series analysis was undertaken of the daily electricity demand in South Wales from January 1993 to October 2000. Hierarchical profiles were used to model the time windows of specific events. This is based on a decomposition of the data into two main components, deterministic and stochastic. The deterministic component is used to model time windows, thus creating a hierarchical structure of profiles, each modelling a separate component of the series. The remaining stochastic component is then modelled using an ARIMA model, and the overall model is formed by combining the two components.

The proposed modelling technique provides a better understanding of the observed process and can be used in bulk forecasting of special periods such as the Christmas holidays.

Email: jrmameen@glam.ac.uk

The Variability Decomposition (VD) approach to transfer function modelling: application in multi-year STLF

Hasan Al-Madfai

Division of Mathematics and Statistics, University of Glamorgan, UK

Jamal Ameen

School of Care Sciences, University of Glamorgan

Alan Ryley

School of Technology, University of Glamorgan

Transfer function time series models aim primarily to build a structure through which a set of inputs explains the variability in a set of outputs. This structure is often extended to utilise historic observations of the output series in the model. This, however, is often done after the relationships between the inputs and the outputs have been identified.

In this paper, the Variability Decomposition (VD) approach is developed. VD makes the distinction between Inherent and External variability at the model identification stage. As analytical and empirical verifications of VD are encouraging, a VD based transfer function model is introduced. The VD model is identical in shape to existing transfer function models, but its parameters are more pertinent, providing added insights into the underlying dynamics of the processes in question.

The VD transfer function model was used in Short Term Load Forecasting (STLF) of the daily electricity demand in South Wales, as a function of weather. Multi-year average daily electricity demand and temperature data, from 1/1/1993 to 31/10/2000, were used in the analysis. The VD model is compared to two existing approaches, and results show that it is superior in one-step-ahead forecasts, and in the logical interpretations of its parameters.

Email: hmadfai@glam.ac.uk

F3

Contributed session: Financial forecast evaluation

Tuesday 9.55am–11.00am

Room: Harlequin Room

Chair: Ilias Tsiakas, University of Warwick, UK**Forecasting accuracy of banking economic reports**

Giampaolo Gabbi

Banking and Insurance Department, SDA Bocconi, Milan, Italy

The research is aimed at verifying the reliability of real forecasts periodically published by international financial intermediaries. During the last few years we have recorded a sensible increase of analysis and research papers to support investment decision centres, both for real and financial economics. First, our research will show an analysis of the database provided by 13 banks and economic forecasting centres; then, we find out some of the methodologies committed to performance measurement. The following sections are dedicated to the application of the error methodology to a group of countries. The main purpose is to explain the errors, and defining and estimating the factors which should affect the forecasting performance. The research suggests the application of a volatility-adjusted error measure (VAEM) as the ratio between the Theil index and the volatility of min and max forecasts. This is useful to assess the accuracy of real financial forecasts usually generated by analysts working in banking firms.

Email: giampaolo.gabbi@sdabocconi.it

A smooth test for density forecast evaluation

Aurobindo Ghosh

School of Economics and Social Sciences, Singapore Management University, Singapore

Anil Bera

Department of Economics, University of Illinois at Urbana-Champaign, USA

Recently, financial econometricians have shifted their attention from point and interval forecasts to density forecasts in order to address the huge loss of information that results from depicting portfolio risk by a measure of dispersion alone. In this paper we propose an analytical test for density forecast evaluation, using the Smooth Test procedure for both independent and serially dependent data. Apart from indicating the acceptance or rejection of the hypothesized model, this approach provides specific sources (such as the mean, variance, skewness and kurtosis of the distribution or types of dependence) of departure, thereby helping in deciding possible modifications of the assumed forecast model.

We also address the issue of where to split the sample into in-sample (estimation sample) and out-of-sample (testing sample) observations in order to evaluate the goodness-of-fit of the forecasting model both analytically, as well as through simulation exercises. Monte Carlo studies reveal that the proposed test has good size and power properties. We also investigate applications to value-weighted S&P 500 returns that indicate that introduction of a conditional heteroscedasticity model significantly improves the model over one with constant conditional variance.

Email: aurobindo@smu.edu.sg

Analysis of the predictive ability of information accumulated over nights, weekends and holidays

Ilias Tsiakas

Warwick Business School, University of Warwick, UK

Recent empirical evidence shows that the weekend and holiday calendar effects are much stronger and are statistically significant in daily volatility as opposed to daily expected returns. This paper seeks an explanation for this empirical finding by undertaking a comprehensive investigation of the predictive ability of information accumulated over nights, weekends and holidays for a series of global indices. We study this form of seasonal heteroscedasticity by employing a stochastic volatility model where the conditional daily volatility measured in calendar time from open-to-close of the market depends on lagged close-to-open returns. We conduct a series of empirical tests and conclude that the information accumulated over weekends and especially holidays is a predictor of subsequent daily volatility.

The SV parameters are estimated by implementing a Bayesian MCMC algorithm, which is adjusted for sampling the seasonal volatility level effects. We compute in-sample and out-of-sample density forecasts for assessing the adequacy of the conditional distribution. We also use Bayes factors as a likelihood-based framework for evaluating the SV specifications. Bayes factors account for both estimation and model risk. We conclude by computing volatility forecasts relevant for risk management.

Email: ilias.tsiakas@wbs.ac.uk

M6

Invited session: Bayesian forecast averaging

Tuesday 9.55am–11.00am

Room: Cambridge III

Chair: Michael S Smith, University of Sydney, Australia**Forecasting combination and model averaging using predictive measures**

Sune Karlsson, Jana Eklund

Department of Economic Statistics, Stockholm School of Economics, Sweden

The basic approach to forecast combination based on in-sample measures of fit is extended by forming the weights for forecast combination based on predictive measures. In particular predictive likelihood, which fits into the Bayesian model averaging (BMA) framework, is considered.

In order to evaluate each model a hold out sample of ℓ observations is needed in order to calculate the predictive measure. The number of observations available for estimation is thus reduced from T to $T - \ell$. There is a trade-off involved in the choice of ℓ . The predictive measure becomes less erratic as ℓ increases which should improve the performance of the procedure. Estimation, on the other hand, is performed without taking the most recent observations into account, which might have a detrimental effect.

The use of the predictive likelihood is proposed in the context of forecasting Swedish CPI. The performance of forecast combination procedures is compared with forecasts based on standard BMA and other procedures intended for situations with a large number of potential predictors. The size of the hold out sample is a key parameter and the effect of its choice on forecast performance will be evaluated.

Email: sune.karlsson@hhs.se**Bayes model averaging of cyclical decompositions in economic time series**

Herman K van Dijk, Richard Kleijn

Erasmus University Rotterdam, The Netherlands

A flexible decomposition of a time series into stochastic cycles under possible non-stationarity is specified, providing both a useful data analysis tool and a very wide model class. A Bayes procedure using Markov Chain Monte Carlo (MCMC) is introduced with a model averaging approach which explicitly deals with the uncertainty on the appropriate number of cycles. The convergence of the MCMC method is substantially accelerated through a convenient reparametrization based on a hierarchical structure of variances in a state space model. The model and corresponding inferential procedure are applied to simulated data and to economic time series like industrial production, unemployment and real exchange rates. We derive the implied posterior distributions of model parameters and some relevant functions thereof, shedding light on a wide range of key features of each economic time series.

Email: hkvandijk@few.eur.nlWeb: <http://www.few.eur.nl/few/research/pubs/ei/2003/reports.htm>

Bayesian modelling and forecasting of intra-day electricity load

Michael S Smith, Remy Cottet

Econometrics and Business Statistics, University of Sydney, Australia

With the advent of wholesale electricity markets there has been renewed focus on intra-day electricity load forecasting. This paper employs a multi-equation regression model with a diagonal first order stationary vector autoregression (VAR) for modelling and forecasting intra-day electricity load. Bayesian model averaging is undertaken on both the correlation structure of the disturbances to the VAR and the regressors for the mean. The full spectrum of finite sample inference is obtained using a Bayesian Markov chain Monte Carlo sampling scheme. This includes the predictive distribution of load and the distribution of the time and level of daily peak load, something that is difficult to obtain with other methods of inference. The method is applied to of half-hourly total system load in New South Wales, Australia. Short-term forecasts from simple models highlight the gains that can be made if accurate temperature predictions are exploited. Bayesian predictive means for half-hourly load compare favourably with point forecasts obtained using iterated generalized least squares estimation of the same models.

Email: mikes@econ.usyd.edu.au

N1

Invited session: Dynamical systems in high dimensions

Tuesday 9.55am–11.00am

Room: Essex I

Chair: Rodney Wolff, Queensland University of Technology, Australia**Approximating volatilities by asymmetric power GARCH functions**

Qiwei Yao, Jeremy Penzer, Mingjin Wang

Department of Statistics, London School of Economics, UK

To overcome some shortcomings of GARCH modelling, we propose to approximate volatilities by functions of the asymmetric power GARCH form. The statistical inference for such an approximation and the associated theory have been established. We also report some numerical illustration.

Email: q.yao@lse.ac.uk

Nonparametric and semiparametric time series forecasting

Jiti Gao

Department of Mathematics and Statistics, University of Western Australia, Australia

This paper seeks to address some very important issues in using nonlinear and nonstationary time series with structural breaks and changing trends for various forecasting purposes. In theory, the paper develops a unified structure to deal with both nonlinear threshold and change-point problems. In methodology, the paper proposes some general model determination and specification techniques that are suited to nonlinear time series data that may be stochastically nonstationary. In practice, the proposed specification techniques are applicable in forecasting time series data with nonlinearity and nonstationarity. Specifically, the paper discusses an application in forecasting monthly electricity sales based on the monthly price of electricity, individual income, and average daily temperature. The paper also considers an application in forecasting mean temperature series based on a sequence of explanatory variables and a changing trend function.

Email: jiti@maths.uwa.edu.au

Towards achievable forecast goals given imperfect models: Accepting inadequacy, abandoning probability, assessing “fair odds”

Leonard A Smith

Centre for Analysis of Time Series, London School of Economics, UK

Observational uncertainty introduces the requirement for probabilistic forecasting of deterministic systems even when a perfect model is in hand. This mind set has dominated operational weather forecasting for the last ten years, and Popper's notion of an accountable model has been generalised to cope with chaos. Model inadequacy introduces the requirement for stochastic modelling even when the underlying system is deterministic, and in doing so removes all hope of accountable probability forecasts. These facts are illustrated in three distinct forecasting scenarios: that of (a) recurrent systems, where the duration of the observations is long compared to the recurrence time in the (model) state space, (b) weather-like systems, where the system is not recurrent but many forecasts are made and evaluated under the same model, and (c) climate-like systems, where by construction all testing must be done in-sample and the time-scale of the forecast far exceeds the lifetime of a given model. Operational models are used to illustrate the weather (ECMWF and NOGAPS) and climate (HCM3 a la climateprediction.net) scenarios, and potentially viable alternatives to the traditional definitions of “fair odds” and “noise” are discussed.

Email: lenny@maths.ox.ac.uk

S1

Panel discussion

Tuesday 9.55am–11.00am

Room: Grand Ballroom II

Chair: Len Tashman, Institute of Forecasting Education, USA**Software showcase****Panelists:**

Michael J Leonard

SAS, SAS Institute, USA

Eric Stellwagen

Forecast Pro, Business Forecasting Systems, USA

Joseph K McConnell

Forecasting for Demand, McConnell Chase Software Works, USA

David F Hendry

OxMetrics, Timberlake Consultants, UK

Simone Grose

PhiCast, Monash University, Australia

In this session, forecasting software exhibitors will demonstrate the features and performance of their software programs. This will be an excellent opportunity to learn about new software capabilities, and to compare the opportunities offered in the different packages.

M7

Invited session: Forecasting sales with interventions

Tuesday 9.55am–11.00am

Room: Cambridge II

Chair: Hans Levenbach, Delphus Inc., USA**Determining the impact of innovations on sales data**

Edward Melnick, Aaron Tenenbein

Department of Statistics, New York University, USA

Hans Levenbach

Delphus, Inc., USA

The determination of the effectiveness of a company's policy innovations on sales data requires comparisons with sales data from a control group. In the absence of a balanced control, forecasts are used to remove market confounding influences in the data. A unique characteristic in the 5-year bi-weekly recorded sales data was a peak that grew linearly from September to the end of December, and then dropped abruptly. This pattern implied that the underlying process was not time reversible and, therefore, a linear forecasting model should not be used. The Holt-Winters smoothing algorithm with multiplicative seasonality fit the data well.

Email: emelnick@stern.nyu.edu

The analysis of company sales data

Konstantinos Nikolopoulos, Robert Fildes

Department of Management Science, Lancaster University Management School, UK

Paul Goodwin

The Management School, University of Bath, UK

In company sales forecasting, data series are often affected by special events, such as promotions, as well as more consistent influences that result in stable patterns in the data. This presentation examines data collected from a number of companies, comparing the final forecast produced by the company forecasters with automatic forecasting methods and more structured approaches that include both the subjective interventions of the forecaster and any related data. The benefits of intervention are evaluated and the rationality of the company forecasters, as well as their comparative forecasting accuracy, are assessed.

Email: k.nikolopoulos@lancaster.ac.uk

Base sales volume forecast: an optimal filter approach

Yikang Li

i2 Technologies, USA

Base sales volume plays a critical role in promotion evaluation and promotion forecast. The conventional way to estimate base volume is IRI's PROMOTER approach. It is a decision support system that estimates an item's normal sales volume in the absence of promotions, after trend, business cycle, seasonal and exception effects are accommodated.

This paper proposes an optimal low-pass approach to estimate the base sales volume. While working in the time domain, the approach offers interpretations of the components in the frequency domain. The bandwidth selection of the filter is based on the performance of promotion lift regression. The results from this study show that higher forecasting accuracy of promotion volume works well for data with a short life span.

Email: Yikang_Li@i2.com

T3

Invited session: Telecommunications

Tuesday 9.55am–11.00am

Room: Bradfield Lounge

Chair: Mohsen Hamoudia, France Telecom, France**Broadband technology forecasting**

Kjell Stordahl

Telenor Networks, Telenor, Norway

During the last few years a significant broadband demand has been generated in Western Europe. The most relevant broadband technologies are: DSL, HFC (Cable modem), FTTH (Fibre to the home), FTTB (Fibre to the building), FWA (Fixed wireless broadband access), WLAN, multiple ISDN lines, digital terrestrial TV network with IP (DTT-IP) and also satellite solutions. The incumbent operators have started to roll out ADSL. The second step is to use enhanced technologies like ADSL2+ and VDSL.

Diffusion models are used to forecast the total broadband penetration. The paper divides the total broadband forecasts into forecasts for each main broadband technology. The separate technology forecasts are based on the evolution so far, the market share, and economic evaluation of the technology by use of techno-economic assessments. The techno-economic calculations show the ability of the various broadband technologies in different types of areas. The results are used to predict market share for the broadband technologies in different area types. Substitution effects between the main broadband technologies are built into the overall forecasting model.

Email: kjell.stordahl@telenor.com**Models for forecasting cost evolution of components and technologies**

Borgar T Olsen

Telenor R&D, Telenor, Norway

Kjell Stordahl

Telenor Networks, Telenor, Norway

Learning curves are used to predict cost decrease per produced unit as a function of production volume. The reasons for cost reductions are: better control of the production process, new production methods, new technology, redesign of the product, standardization and automatization. Wright and Crawford developed the learning curve model for aircraft production. The model is a simple exponential function where the decrease of production cost is a function of number of produced units, the initial production costs and the learning curve coefficient. This paper shows an extension of the learning curve model. To be able to use the cost prediction model in economic calculations, it is important to forecast the cost evolution as a function of time, not as a function of produced units. The extended learning curve model, developed by Olsen and Stordahl in 1993 within the European program RACE 2087/TITAN, is a combination of the learning curve model and a diffusion model. The paper shows how the model has been used to evaluate and forecast the costs of the different telecommunications network technologies with different maturity and market potential, and how the results are fed back into forecast models of market share of the technologies.

Email: borgar-torre.olsen@telenor.com

Modelling and forecasting the growth of the multimedia mobile services

Mohsen Hamoudia

Corporate Solutions, France Telecom, France

The speed and extent of the success of new mobile terminals and the new services currently being distributed will still largely condition the ability of the telecommunications services sector worldwide, and particularly in Europe, to remain a growth market. The real start of Multimedia Mobile Services in Europe in 2002 had a high and significant impact on the global demand for the Mobile Sector.

Multimedia Mobile Services include many services such as SMS (Short Messaging Service) and MMS (Multimedia Messaging Service), community services (chat, forum, dating), SMS games, votes and TV games, handset personalisation, M-Services (banking, booking, ticketing), video (downloads, streaming) and other new services. However, MMS and SMS will still remain the main drivers of Multimedia Mobile markets (more than 60% in 2007).

The aim of this paper is to develop forecasting approaches for European SMS and MMS services based on diffusion models (multi-country pooling) and to test the multi-generation (multi-country models) approach developed successfully for some other new products and services.

Email: mohsen.hamoudia@francetelecom.com

A5

Contributed session: Applications

Tuesday 11.25am–12.45pm

Room: Cambridge IV

Chair: Walter MJ van Waterschoot, University of Antwerp, Belgium**Application of time series analysis in public health**

Akbar A Zaidi

Centers for Disease Control and Prevention, Division of STD Prevention, Health and Human Services, USA

Gonorrhoea is a social disease transmitted through sexual contacts between infected and uninfected individuals. This disease is one of the major public health problems throughout the world. In this paper, we build time series (Box and Jenkins) models to understand the dynamic relationship between male and female gonorrhoea morbidity. To build these models we used the number of gonorrhoea cases among men and women reported each quarter in the United States from 1975 to 2002. First, we identified consistent patterns embedded in these series, then we built univariate models relating the present observation as a function of the past data. We also studied cross-correlations to identify the relationship between the two series and build transfer function models. Both male and female quarterly gonorrhoea morbidity are highly seasonal with a seasonality of four quarters. In the univariate models, cases reported during current quarter is a function of the previous quarter's observation and the observation four quarters earlier. Transfer function models show that there is an instantaneous effect of the change in one series on the other. These models can be tested and used in modelling other health outcomes of public health importance.

Email: azaidi@cdc.gov

Modelling pest incidence — nonparametric approach

Pradip Kumar Sahu, Satyabrata Pal

Department of Agricultural Statistics, Bidhan Chandra Krishi Viswavidyalaya, India

This paper exposes the superiority of nonparametric modelling in comparison to parametric modelling, to model pest incidence over the year based on weekly incidence data on brinjal crop. The fluctuations and characteristics in temporal real life data are often represented better with nonparametric models. Ten data sets on pest/insect infestations have been considered, each data set being the year-long weekly records of incidences of one of the ten pests on brinjal crop. Recorded data were obtained over two successive years, and it was observed that seasonal incidences follow almost identical patterns. Such models help to produce forecasts on the magnitude of incidences at different time-points in the year, so as to provide advisory services against possible pest attack to the farmers. The parametric models considered include polynomial, logarithmic, inverse, exponential, logistic, a special class of temporal models, etc.; and the nonparametric models include spline and loess. In each of the above ten data sets, the performance of the nonparametric models is found to be superior to the parametric models.

Email: satbrpal@vsnl.net

Forecasting the filing of patents

Nigel Meade

Tanaka Business School, Imperial College London, UK

Peter Hingley

European Patent Office, Germany

This work is concerned with methods for forecasting the filing of patents and was carried out in conjunction with the European Patent Office. The issues addressed were: the effect of aggregation by bloc or by industry on the accuracy of the forecast of total EPO filings; the effect of aggregation over time (from monthly to annual data). Two approaches were used: the ARIMA framework and the dynamic linear model in both univariate and multivariate modes. The filings data were subdivided by EPC Countries, Blocs (EPC, Japan, USA and the Rest of the World) and Fields of Technology (Industries). It was found that: (a) there were some benefits to be gained by aggregating forecasts over the main blocs of the EPO; (b) no significant benefits were found from aggregating over industries; and (c) monthly data did tend to provide greater accuracy in annual forecasts. The best modelling approaches were the dynamic linear model with monthly data, and the ARIMA with annual data. The most effective combination was the dynamic linear model with monthly data in a mixture of univariate and multivariate modes. The recommended forecasting approach provides a benchmark against which other forecasts drawing on different data sources can be compared.

Email: n.meade@imperial.ac.uk

Forecasting a tennis match at the Australian Open

Tristan Barnett, Stephen R Clarke, Alan Brown

Swinburne University, Australia

In this paper, a method is proposed to forecast the winner of a tennis match, not only at the beginning of the match, but also during the match. Previous match statistics, as published on the web by the ATP, are combined to predict the statistics to be obtained when two given players meet, and illustrates the use of a Markov Chain model to predict the outcomes of tennis matches played at the Australian Open. Exponential smoothing is used after each round for updating the parameters of the model. By applying Bayesian methods the model can be used for a match in progress. Using the Australian Open point-by-point data, we demonstrate how a match can be forecasted in real time. Suggestions to improve the predictions are discussed.

Email: tbarnett@swin.edu.au

A qualitative research contribution to quantitative forecasting of therapeutic drug prescription behaviour

Walter MJ van Waterschoot, Katia Campo, Odette De Staebel
Department of Marketing, University of Antwerp, Belgium

Els Gijsbrechts
Department of Marketing, University of Tilburg, The Netherlands

Most studies rely on large scale surveys among physicians to describe and forecast therapeutic drug prescription. Those studies examine the impact of marketing mix instruments like advertising, detailing and pricing on the basis of factual data, collected by specialized syndicated sources. For aggregated marketing mix models it may not be possible, however, to correctly identify the underlying causes of persistence in choices. Recorded data on past prescription outcomes may not be sufficiently informative, and may need to be supplemented with additional sources of information. First, prescription takes place in a complex environment possibly involving multiple stake holders. Second, the decision process may be partly habitual; based on heuristics rather than structured analysis of all relevant information, and partly based on non-medical motives (e.g., gifts). From a substantive viewpoint, the present paper sheds more light on the prescription process of physicians, e.g., by challenging the traditional assumption that prescription decisions would be based (solely) on compensatory decision rules. From a methodological viewpoint, a qualitative approach is presented to collecting and using prescription information. Even when of limited isolated use, this approach may significantly contribute to the relevance of (interpreting) traditional forecasting, e.g., by identifying heterogeneity between physicians and prescription contexts or by identifying specific dynamic effects.

Email: walter.vanwaterschoot@ua.ac.be

C1

Invited session: Climate forecasting in Australia

Tuesday 11.25am–12.45pm

Room: Cambridge III

Chair: Lynda E Chambers, Bureau of Meteorology, Australia**The development of climate forecasting in Australia**

Lynda E Chambers

Bureau of Meteorology Research Centre, Bureau of Meteorology, Australia

Australia is a large island continent with a diverse range of climate zones. These vary from tropical regions in the north, through the arid expanses of the interior, to temperate regions in the south. Seasonal fluctuations can be great, with temperatures ranging from above 50 degrees Celsius to well below zero. Rainfall amounts can vary markedly from year to year and from season to season, and occasional tropical cyclones can bring abundant rainfall to tropical coastal regions and, sometimes, further inland.

Long before Europeans arrived in Australia, Aboriginal people made general climate predictions based upon observations of plants and animals. Early work by meteorologists in Australia concentrated on descriptions of average climate, with little emphasis on the possibility of climate prediction. During the last 30 years, however, advances in climate forecasting have been dramatic. Much of the improvement can be linked to greater understanding of the climate systems, particularly the influence of ENSO, and advances in technology, for example, faster and cheaper computing and communications.

This paper traces the development of climate forecasting in Australia, and the problems associated with presenting fairly complex forecasts to members of the public in formats that they can use.

Email: L.Chambers@bom.gov.au

The practice of climate forecasting at the Bureau of Meteorology's National Climate Centre

David A Jones, Phillip A Reid

National Climate Centre, Bureau of Meteorology, Australia

The Bureau of Meteorology has been producing seasonal climate forecasts since 1989, although since then there have been many improvements in the methodology. These forecasts are based on a statistical relationship between historic surface observation records and sea surface temperatures, and are presented as probabilistic distributions. As a matter of routine, all forecasts since mid-1998 are verified.

Associated with the seasonal climate forecasts are outlooks of the El Niño Southern Oscillation (ENSO) state (warm, cool or neutral). Ocean and atmosphere conditions, as well as output from dynamic climate models, are examined to determine the prospective future state of ENSO. At this stage forecasts of the ENSO state tend to be subjective, although based on scientific objective analysis.

This paper presents the current operational process associated with producing, disseminating and verifying seasonal climate forecasts within the National Climate Centre. It also briefly mentions prospective future developments associated with dynamic forecasting systems.

Email: d.jones@bom.gov.au

Climate risk in the livestock industry of southern Australia: A progress report on the linking and validation of operational climate forecasting systems to rainfall and potential pasture growth depiction tools

Gregory P Laughlin, Simon Knapp, Simon Barry
Bureau of Rural Sciences, Australia

This paper describes early progress on a R&D program being undertaken for Meat and Livestock Australia. It describes software and statistical infrastructure which will present users with depictions of current and historical seasonal rainfall and indices of potential pasture growth; current depictions will be updated weekly for many sites in southern Australia. The paper also describes a methodology whereby current depictions are extended into the future using several operational climate forecasting systems as well as their statistical validation.

Email: gregory.laughlin@brs.gov.au

POAMA: Bureau of Meteorology operational coupled model seasonal forecast system

Oscar Alves
Bureau of Meteorology Research Centre, Bureau of Meteorology, Australia

POAMA (Predictive Ocean Atmosphere Model for Australia) is a state-of-the-art coupled ocean/atmosphere model seasonal forecast system developed jointly by the Bureau of Meteorology Research Centre (BMRC) and CSIRO Marine Research. It is based on the latest version of BMRC's unified climate/NWP atmosphere model (BAM) and the Australian Community Ocean Model (ACOM2). The POAMA system uses a sophisticated ocean data assimilation system that incorporates the latest oceanic observations into the initialisation procedure for the model forecasts. It is also one of the few models that uses real atmospheric data, taken from the Bureau's operational weather forecast system.

The POAMA system has been run in real-time by the operational section of the Bureau of Meteorology since 1st October 2002. The initial focus of POAMA is the prediction of El Niño. POAMA was the first coupled model, back in November 2002, to forecast that the 2002 El Niño would rapidly decay at the beginning of 2003.

The operational system and latest results will be described. Results show that the skill of POAMA forecasts is at least as good as the best international models. Also discussed is the model's unique ability to simulate and predict intra-seasonal variability, such as the Madden-Julian Oscillation (MJO).

Email: o.alves@bom.gov.au

E5

Contributed session: Inflation

Tuesday 11.25am–12.45pm

Room: Harlequin Room

Chair: Kenneth F Wallis, University of Warwick, UK**Determinants of multi-period inflation uncertainty using panel data on density forecasts**

Kajal Lahiri, Fusang Liu

Department of Economics, State University of New York at Albany, USA

This paper examines the determinants of inflation forecast uncertainty. We show that previous studies based on aggregate data are biased due to the heterogeneity of forecasts. Instead, we estimate a dynamic heterogeneous panel data model. We find that although past inflation forecast uncertainties are important determinants of the current inflation forecast uncertainty, they are not as important as previously thought. In addition, in the context of multi-period forecasts with varying forecast horizons, there is no strong link between past squared forecast errors and the current inflation forecast uncertainty, as often assumed in the ARCH literature. In this context, forecasters pay more attention to the most recent news about inflation than the out-of-date past squared forecast errors. We propose a way to estimate the uncertainty on news from the Survey of Professional Forecasters (SPF), and show that it is an important determinant of the current inflation forecast uncertainty. Our results also support Friedman's (1977) conjecture that higher inflation rate leads to higher inflation forecast uncertainty.

Email: klahiri@albany.edu**The long term interest rate and underreaction to unexpected inflation**

Kasimir Kaliva, Lasse Koskinen

Insurance Supervisory Authority, Finland

A starting point of our study is that the long term interest rate depends on inflation expectations. We assume that inflation expectations of market participants are approximately a long run weighted average of past inflation rates. Several psychological studies claim that people suffer from so called self-attribution bias. They overweigh information that confirms their existing beliefs and underweigh information that does not. In the case of the long term interest rate, self-attribution bias means that people underreact to unexpected inflation. In this paper we introduce a statistical model for that kind of behaviour. Findings of this paper imply that people underreact to unexpected inflation in the case where the difference between the interest rate and inflation is lower than average.

Email: kasimir.kaliva@vakuutusvalvonta.fi

Inside and outside bounds: threshold estimates of the Phillips curve

Michelle L Barnes, Giovanni P Olivei

Research Department, Federal Reserve Bank of Boston, USA

There have been several instances over the past 40 years when large movements in the unemployment rate have elicited little response in the inflation rate. Such instances, while casting doubt on the trade-off implied by the linear Phillips curve, are also associated with large inflation forecasting errors. In principle, these movements are consistent with a Phillips curve relationship; they just require the curve to shift in the same direction as the unemployment rate. Econometric representations of the Phillips relationship usually incorporate factors that can cause the Phillips curve to shift over time. However, the literature has not yet provided a test of whether such factors are sufficient to explain the episodes of horizontal movement. In this paper, the authors test the explanatory power of a double threshold specification of the Phillips relationship against a simple linear specification, and compare dynamic and static out-of-sample forecasts of inflation across linear and double threshold specifications of the Phillips curve. The authors find that traditional shifters in the relationships are insufficient for characterizing the periods of horizontal movement, and that a double threshold specification makes significant improvements in the static and dynamic out of sample inflation forecasting performance of the Phillips curve.

Email: michelle.barnes@bos.frb.org

The real-time forecasting performance of Phillips curves

Tim F Robinson, Andrew G Stone, Marileze van Zyl

Economic Research Department, Reserve Bank of Australia, Australia

Analysts typically use a variety of techniques to forecast inflation. These include both bottom-up approaches, for near-term forecasting, as well as econometric methods. One econometric approach to inflation forecasting is the use of Phillips curves based on estimates of the output gap. This paper suggests, however, that the real-time capacity of such Phillips curves to forecast inflation is limited, relative to simple benchmarks such as an autoregressive model or a random walk assumption. It appears that the lack of precision with which output-gap-based Phillips curves can be estimated in real time, limits their usefulness for forecasting inflation in isolation.

Phillips curve-based forecasts may, however, perform a little better than autoregressive model-based ones in predicting whether inflation will increase or decrease from its current level. Moreover, combining Phillips curve-based forecasts with those from alternative approaches does seem to offer some scope for improving the real-time forecast accuracy of the latter. These observations suggest that, in spite of their disappointing performance in forecasting inflation in isolation, output-gap-based Phillips curves may continue to be useful in real time — as a tool for conditioning gap estimates within a multivariate filtering framework, and as a possible complement to other inflation forecasting approaches.

Email: robinsont@rba.gov.au

Web: <http://www.rba.gov.au/PublicationsAndResearch/RDP/RDP2003-12.html>

An assessment of Bank of England and National Institute inflation forecast uncertainties

Kenneth F Wallis

Department of Economics, University of Warwick, UK

This paper evaluates the density forecasts of inflation published by the Bank of England and the National Institute of Economic and Social Research. It extends the analysis of the Bank of England's fan charts in an earlier article by considering data up to 2003, quarter 4, and by correcting some technical details in the light of information published on the Bank's website in Summer 2003. National Institute forecasts are also considered, although there are fewer comparable observations. Both groups' central point forecasts are found to be unbiased, but their density forecasts substantially overstated forecast uncertainty.

Email: K.F.Wallis@warwick.ac.uk

Web: <http://www.warwick.ac.uk/go/kfwallis>

J3

Invited session: Judgmental forecasting

Tuesday 11.25am–12.45pm

Room: Bradfield Lounge

Chair: Nigel Harvey, University College London, UK**Do forecasts expressed as prediction intervals improve decision-making?**

Paul Goodwin

The Management School, University of Bath, UK

Dilek Önkal

Faculty of Business Administration, Bilkent University, Turkey

Mary E Thomson

Department of Psychology, Glasgow Caledonian University, UK

A number of studies have shown that providing point forecasts to decision-makers can lead to improved decisions. However, point forecasts do not convey information about the level of uncertainty that is associated with forecasts. In theory, the provision of prediction intervals, in addition to point forecasts, should therefore lead to further enhancements in decision accuracy. Indeed, a recent study by Önkal and Bolger indicated that decision-makers perceive prediction intervals to be more useful than point forecasts. An experiment was carried out to find out whether prediction intervals do lead to more accurate decisions. Subjects were asked to decide on the levels of production of a series of products in order to meet the following week's demand. Either underproduction cost twice as much per unit as overproduction or vice versa. The subjects were supplied with a graph of the demand for each product in the previous 20 weeks, together with either a point forecast, a 50% prediction interval or a 95% prediction interval for the following week's demand. This paper will report on the results of the experiment and suggest areas where further research is needed.

Email: mnspeg@management.bath.ac.uk

Learning to predict the weather: re-examining insight and performance in multiple-cue judgment

Ben R Newell

School of Psychology, University of New South Wales, Australia

David A Lagnado, David R Shanks

Department of Psychology, University College London, UK

In multiple-cue judgment tasks, people acquire information about imperfect indicators on a trial-by-trial basis, and combine these to predict a criterion variable. Previous research suggests that 1) people can perform well on such tasks but often appear to lack insight into their own judgment process, and 2) that people solve the tasks by using a variety of simple strategies. However, such conclusions are often drawn on the basis of coarse-grained analyses of learning behaviour and insensitive measures of insight. We present two experiments that re-assessed insight and learning using more fine-grained measures. A rolling regression technique, in which regressions are fit to each individual trial-by-trial, demonstrated that participants revealed judgment weights corresponded to the environment weights, and that the apparent adoption of simple strategies was an emergent property of a more general ability to track statistical features in the environment. Trial-by-trial assessments of insight revealed highly accurate knowledge of both cue use (knowledge of judgment process) and cue importance (knowledge of task structure). Together, the findings suggest that insight accompanies multiple cue learning and that a regression model is sufficient to describe the dynamics of learning.

Email: ben.newell@unsw.edu.au

Forecasting affect: Why can't people judge how they'll feel?

Peter Ayton, Naila Naseem, Alice Pott
Department of Psychology, City University, UK

A growing body of literature suggests that people are not good judges of the effects of future events on their own (or others') feelings of well-being. Several authors report that people are too extreme in their forecasts of the intensity and duration of their own happiness or unhappiness following emotionally significant incidents. These findings are a puzzle: given that life is a series of emotional ups and downs, why haven't people learned about their relatively ephemeral reactions to good and bad news? For learning to occur, people must determine and recall relevant past experiences comparable with future ones, and recall the time course of their emotions. Individuals who have experienced a series of highly similar emotional events should be more able to use these past experiences to predict similar future ones. Our study of the forecasts of football fans and repeatedly failing driving test candidates found little evidence for learning. Focusing on aspects affected by the event and neglecting unaffected aspects—the focusing illusion—may explain poor predictions. We tested this by helping forecasters to contemplate detailed low-level construals of the future life of lottery winners and HIV patients. This defocusing exercise greatly improved extreme predictions.

Email: P.Ayton@city.ac.uk

Judgmental time series forecasting: The impact of the mood of the forecaster

Marcus O'Connor
School of Business, University of Sydney, Australia
Joa Sang Lim
Sangmyung University, South Korea

A person's emotional state potentially plays an important role in decision-making. This study investigated the impact of emotion within a well-specified decision-making domain (judgmental time series forecasting) and examined its interaction with factors known to influence forecasting judgments. Forty students were tested in a 2 (emotion) \times 2 (display) \times 2 (seasonality) \times 4 (trials) factorial design. A change in emotional valence was induced by differential feedback concerning task performance in a pre-test and by the provision or withholding of rewards. Two different types of time series (seasonal or non-seasonal) were presented in different formats (graphical or tabular) in order to determine if mood interacted with these factors. The results showed that seasonality of the data had an effect (more errors made with seasonal data) and presentation format had an effect, but only for the seasonal data (tabular produced less errors than graphical presentations only with the seasonal data). The effect of emotion was only shown in terms of an interaction with presentation format for the seasonal data.

Email: m.oconnor@econ.usyd.edu.au

M8

Contributed session: Supply chain and intermittent demand

Tuesday 11.25am–12.45pm

Room: Essex II

Chair: Paul J Fields, Brigham Young University, USA**Accuracy measures and stock control performance**

Aris A Syntetos

School of Management, University of Salford, UK

John E Boylan

Buckinghamshire Business School, Buckinghamshire Chilterns University College, UK

The selection of accuracy measures (error statistics) is an important and often difficult exercise that ensures the objective evaluation of the forecasting performance of a given estimator and/or allows accuracy comparison results to be generated for more than one method. The majority of studies on accuracy measures conducted so far, focus on ensuring the objectivity of the results with respect to the forecast accuracy only. In a forecasting for stock control context, though, improved forecast accuracy is not as important as improved stock control performance. This may be particularly true in an intermittent demand context, where the relationship between forecast errors and deviations between target and achieved Customer Service Levels is not easy to specify. Similar difficulties arise where the stock control system is driven by minimisation of a cost function. Little work has been done (and few suggestions for further work have been made) regarding the linkage of the accuracy measures and the empirical utility (stock control performance) of forecasting methods. In this paper, some results are presented, based on an extended simulation experiment and on an empirical analysis of a large set of series, to examine the interaction between accuracy and utility for stock control.

Email: a.syntetos@salford.ac.uk

A multivariate approach to forecasting lumpy, intermittent demand for inventory and merchandising applications

Hans Levenbach

Delphus, Inc, USA

Bill Sichel

Revlon, Inc., USA

Most approaches to forecasting intermittent demand have their origin in Croston's method. Aside from its theoretical drawbacks, Croston's method is designed to handle one series at a time. In many situations, groups of items are known to possess similar behavior (e.g., ABC groupings of inventory stock, store-level product assortments, etc.). For intermittent demand series, there is a scarcity of demand volume for analysis by conventional time series methods. In this talk, we discuss a multivariate approach to modelling lumpy, intermittent demand patterns. Some empirical analysis with industrial data has provided some encouraging signs of the usefulness of our approach. A prototype-forecasting tool has been created to test the approach with other large volume datasets.

Email: hlevenbach@delphus.com

Forecasting thirst principles

Kevin V Albertson

Manchester Metropolitan University, UK

Jon Aylen

University of Manchester Institute of Science & Technology, UK

A major UK brewer faces a complicated demand from retail sales for a popular product; inter- and intra-week, monthly and yearly seasonality are observed. The large shifts in demand are accentuated by the irrational restocking behaviour of the wholesale purchaser, one of the UK's leading supermarket chains. Overshooting and undershooting in restocking orders, in combination with the underlying seasonal shifts have led to the demand series being labelled "unforecastable".

In this study we consider modelling the supermarket decision rules along with underlying demand. Using EPOS data we show that it is possible to provide useful forecasting insights.

Email: k.albertson@mmu.ac.uk

Using multi-stage forecasting in the newsboy problem

Paul J Fields

Department of Statistics, Brigham Young University, USA

The classic newsboy problem addresses the problem of determining the optimum order quantity for a perishable item. An accurate forecast of demand is essential to achieve an optimum trade-off between the costs of ordering too many or too few items. However, the forecasting errors from statistical methods are often too large for the forecasts to be economically practical. If the production cycle is shorter than the lifetime of the product, then the demand period can be divided into multiple stages and an updated forecast of demand and a revised order quantity determined for each stage. We refer to this problem, the Newsboy Problem with Replenishment, as the Muffin Man Problem. We show that the optimum solution to this problem is not simply a series of single-stage solutions. The summation of the multi-stage order quantities will be either greater or less than the summation of single-stage order quantities, depending on the relative cost of errors. Comparing the analytical results with empirical results using demand data from a muffin bakery, we show that the reductions in forecasting errors can provide forecasts with nearly crystal-ball accuracy.

Email: pjfields@stat.byu.edu

N2

Invited session: Dynamical systems in high dimensions

Tuesday 11.25am–12.45pm

Room: Essex I

Chair: Qiwei Yao, London School of Economics, UK**Effect of noise filtering on predictions for financial data: on the routes of chaos and long memory processes**

Dominique Guegan

Department of Economy and Business, Ecole Normale Supérieure de Cachan, France

The detection of chaotic behaviors in stock markets is usually complicated by large noise perturbation inherent in the underlying system. It is well known that predictions from pure deterministic chaotic systems can be accurate in the short or long term. Thus, it will be important to be able to reconstruct, in a robust way, the attractor in which evolves the data, if this attractor exists. Thus, very precise predictions can be obtained.

In chaotic theory, the deconvolution methods have been largely studied and there exist different approaches which are competitive and complementary. In this talk, we review these methods and consider also the wavelet approach, which has not been investigated a lot for filtering chaotic systems, and apply them on different data sets.

Very often, using a chaotic approach implies short term predictions, but long term predictions can be also considered when long memory behavior is detected. We will discuss also the possibility of different long memory behavior inside chaotic systems, and their utility in terms of predictions.

Email: guegan@ecogest.ens-cachan.fr

Non-Gaussian long memory processes: construction and forecasting

Jerome J Collet

School of Economics and Finance, Queensland University of Technology, Australia

Dominique Guegan

Department of Economy and Business, Ecole Normale Supérieure de Cachan, France

Forecasting real data is a natural problem that we encounter in a lot of fields. Most methods of forecasting are developed in a Gaussian framework. In practice, time series are often non-Gaussian.

In this talk, we are interested in the case of forecasting non-Gaussian time series with long memory models. For that, we consider k -factor Gegenbauer processes which are a generalisation of FARIMA processes. It is important to note that long memory behaviour has been exhibited in dynamical systems, including chaotic systems.

First, we present a method which permits us to simulate non-Gaussian long memory k -factor Gegenbauer processes. Next, we use this method to make forecasts with these models. Finally, we illustrate our method with two data sets. With these examples, we show how our method improves the efficiency of forecasting long memory processes with non-Gaussian distributions.

Email: j.collet@qut.edu.au

Forecasting chaos: some approaches to exact inference for Lyapunov exponents

Rodney Wolff

School of Economics and Finance, Queensland University of Technology, Australia

The Lyapunov exponent of a one-dimensional iterative map can be considered to represent the average exponential rate of divergence (in the short term) for trajectories with nearby initial conditions, where the average is taken across the attractor of the dynamical system generated by the map. In this sense, the Lyapunov exponent indicates the degree of accuracy to which short-term forecasts of a dynamical system can be made. Values of Lyapunov exponents can also be used to diagnose the presence of chaos.

Several authors have demonstrated asymptotic methods for estimating the Lyapunov exponent(s). However, these raise some important questions over inference, in that results do not generally indicate how quickly normality is achieved. Some recent work shows that asymmetry may be a feature of the distribution of some estimators.

We consider improving the approximation of the distribution of Lyapunov exponents using some standard asymptotic expansion methods. An interesting feature of this approach is that cumulants in the expansion may be functionally related to each other, in a similar manner to the use of moment closure in solving epidemic models. We also investigate non-parametric estimators of Lyapunov exponents. Comparisons with existing estimators, and implications for forecasting, will be given.

Email: r.wolff@qut.edu.au

S2

Panel discussion

Tuesday 11.25am–12.45pm

Room: Grand Ballroom II

Chair: Len Tashman, Institute of Forecasting Education, USA**Business forecasting software: progress and promise****Panelists:**

Michael J Leonard

SAS, SAS Institute, USA

Eric Stellwagen

Forecast Pro, Business Forecasting Systems, USA

Joseph K McConnell

Forecasting for Demand, McConnell Chase Software Works, USA

Ana Timberlake

OxMetrics, Timberlake Consultants, UK

We now have a generation of experience with dedicated business forecasting software. From awkward mainframe modules in the 1970s, through the quirky DOS-based initiatives for the PC in the 1980s, and the emergence of powerful processors and the Windows operating systems in the 1990s, to the automation and integration of forecasting within supply chain systems, we appear to have come a long way. In this session, a panel of software developers will evaluate the progress made in forecasting software, and look ahead at what developments the next 5 years will bring. Issues to be addressed:

- 1 What have been the truly important advances in forecasting software design and capability? Has business forecasting performance improved because of these advances? How do you know?
- 2 Where has the developmental emphasis been — on methodology, on presentation/display, on integration with business planning, or elsewhere?
- 3 On what bases do software developers compete? What motivates a new version of an existing package?
- 4 Can a business rely on a single software product to deal with its forecasting needs or does it need to maintain a library of products?
- 5 Can one effectively compare the forecasting accuracy of different software products? If so, how? In this pursuit was the M3 Competition informative in clarifying and distinguishing the performance of different software programs?
- 6 Before committing to new forecasting software, what steps should a business take to properly compare different software products? Can it trust the developer's self-description? Is there a need for a middleman to do this on a firm's behalf?
- 7 In a chapter in the *Principles of Forecasting Handbook*, Tashman and Hoover developed a rating scale for software products and used it to compare more than a dozen programs. From a developer's viewpoint, is this a useful tool? How about from a potential customer's viewpoint?
- 8 What do we see as the major weaknesses of the current products? How will these be addressed in the near future?
- 9 When we look at your forecasting software in the year 2010, what is the most substantive capability it will offer that it does not presently provide?

This session is sponsored by SAS, providing a new generation of business intelligence software and services that create true enterprise intelligence. SAS provides software solutions for organisations across the commercial, financial services, academia and government sectors enabling them to make better and more informed business decisions.

SM6

Contributed session: Nonlinear time series models

Tuesday 11.25am–12.45pm

Room: Cambridge II

Chair: Luiz Felipe Amaral, Pontifical Catholic University, Brazil**A closer look at the LSTAR(1) estimation**

Álvaro Veiga

Department of Electrical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

Joel Rosa

Department of Statistics, Federal University of Paran, Brazil

Marcelo C Medeiros

Department of Economics, Pontifical Catholic University of Rio de Janeiro, Brazil

The use of nonlinear models has grown in regression and time series analysis. Despite the computational advances that made it possible to find more applications to these models, some theoretical aspects have not yet been satisfactorily investigated. The objective of this work is to present some aspects of estimation in the LSTAR(1) model, a particular case of the STAR (Smooth Transition AutoRegressive) models proposed in Granger & Teräsvirta (1993). The difficulty in identifying this model in some regions of the parameter space brings serious problems to traditional estimation methods such as nonlinear least squares and maximum likelihood, if a probability distribution is to be assumed. A Monte Carlo experiment that simulates LSTAR(1) processes with highly smooth transitions and few points in the regimes makes it possible to estimate the bias and error variance for the parameters, and to compare them to more favorable situations. The results are summarized in tables and graphics that help to quantify the uncertainty associated with few observations of a regime.

Email: alvf@ele.puc-rio.br**Nonlinear dynamics and forecasts of the real exchange rate**

SangKuck S Chung

School of Economics and International Trade, Inje University, Korea

The purpose of the paper is to contribute to the debate on the relevance of nonlinear modelling and forecasts in the deviation from PPP. To that end, the paper considers the Exponential Smooth Transition Autoregressive (ESTAR) model and provides out-of-sample forecasts of the German Mark, French Franc, Italian Lira, UK Pound, Japanese Yen, Canadian Dollar, and Swiss Franc. When formally tested for forecast accuracy, the results reveal that the ESTAR out-of-sample predictors statistically outperform the linear AR, random walk, and fractionally integrated autoregressive models at standard significant levels. The hypothesis of equal forecasting accuracy between ESTAR models and the other linear models is formally rejected based on the test of Diebold and Mariano (1995). This paper offers further evidence of the ability to forecast exchange rates using nonlinear methods. Hence, we conclude that linear models are not always optimal for forecasting exchange rate.

Email: tradcsk@inje.ac.kr

A powerful test for conditional heteroscedasticity for financial time series with highly persistent volatilities

Esther Ruiz Ortega

Department of Statistics, Universidad Carlos III de Madrid, Spain

Julio Rodriguez

Department of Statistics, Universidad Politecnica de Madrid, Spain

High frequency time series of returns are characterized by evolving conditional variances and, consequently, absolute returns are autocorrelated. However, several tests for homoscedasticity, based on testing whether these autocorrelations are zero, have rather low power. The low power could be attributed to negative biases of the sample autocorrelations and/or to the very small magnitude of the population autocorrelations. However, these tests cannot distinguish between the correlogram of an uncorrelated variable that has all the autocorrelation coefficients small and randomly distributed around zero and the correlogram of a variable that has relatively small autocorrelations with a distinct pattern. In this paper, we propose a new statistic to test for conditional homoscedasticity that considers the information about possible patterns in successive correlations. We derive its asymptotic distribution and show that it is an adequate approximation to its finite sample distribution. Furthermore, we show that, in the context of SV models, it has larger power than the McLeod-Li, Harvey-Streibel and Pea-Rodriguez tests if the volatility is highly persistent. The results are illustrated with the empirical analysis of several series of exchange rate returns.

Email: ortega@est-econ.uc3m.es

Model selection in STAR models

Luiz Felipe Amaral, Reinaldo Castro Souza

Department of Electrical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

This paper considers information criteria as model evaluation tools for nonlinear smooth transition autoregressive models (STAR). It is well known that criteria such as BIC and HQ for autoregressive models are weakly consistent and, for some special cases, strongly consistent for the true order. From the forecasting perspective, it is also known that AIC and FPE are the best choices for selecting orders that are not necessarily correct but that give the lowest one-step-ahead prediction errors. We analyze theoretical expressions for these criteria when choosing the order for the true data generating process assuming it is a STAR model. Note that these expressions are not necessarily equivalent to those rigorously derived from the STAR assumptions. The same exercise is presented for GIC and ICOMP. Monte Carlo evidence, for small and large sample situations, suggest that those criteria, somewhat ad hoc when used in STAR model selection, are not consistent estimators for the true data generating process order.

Email: lfelipe@ele.puc-rio.br

SM7

Featured talk

Tuesday 1.45pm–2.50pm

Room: Grand Ballroom II

Chair: Ralph D Snyder, Monash University, Australia**Forecasting with unobserved components time series models**

Andrew C Harvey

Faculty of Economics, Cambridge University, UK

Structural time series models are formulated in terms of components such as trends, seasonals and cycles, that have a direct interpretation. As well as providing a framework for time series decomposition by signal extraction, they can be used for forecasting and for 'nowcasting'. The structural interpretation allows extensions to classes of models that are able to deal with various issues in multivariate series and to cope with non-Gaussian observations and nonlinear models. The statistical treatment is by the state space form and hence data irregularities such as missing observations are easily handled. Continuous time models offer further flexibility in that they can handle irregular spacing. The paper compares the forecasting performance of structural time series models with ARIMA and autoregressive models. Results are presented showing how observations in linear state space models are implicitly weighted in making forecasts and hence how autoregressive and vector error correction representations can be obtained. The use of an auxiliary series in forecasting and nowcasting is discussed. A final section compares stochastic volatility models with GARCH.

Email: ach34@econ.cam.ac.uk



Andrew Harvey is Professor of Econometrics in the Faculty of Economics at the University of Cambridge. Prior to 1996, he held a chair at the London School of Economics. He is a Fellow of the Econometric Society and the British Academy. He has published nearly 100 articles on econometrics and time series analysis. His three books include a 1989 monograph on *Forecasting, Structural Time Series Models and the Kalman Filter*. He was also instrumental in developing the STAMP package for structural time series analysis.

C2

Contributed session: Climate and Environment

Tuesday 1.45pm–2.50pm

Room: Essex I

Chair: Lynda E Chambers, Bureau of Meteorology, Australia**The past, present and future of droughts in central North America: How bad is bad?**

Gemai Chen

Department of Mathematics and Statistics, University of Calgary, Canada

Peter Leavitt

Department of Biology, University of Regina, Canada

Drought-related losses in western Canada exceeded 1.8 billion Canadian dollars in 1988 alone, while continuing uncertainty in drought prediction contributes to crop insurance payouts of over \$175 million per year. This talk describes the efforts to reduce high economic and social costs of droughts by improving mechanisms to predict the frequency, intensity and duration of major droughts in central North America.

Reliable drought records in central North America exist for only under 100 years or so. A biological approach has been taken to obtain drought-related climatic indicators for the past 2000 years. By analyzing these indicators, we are able to provide a description of the past drought history in central North America, and to forecast the probabilities of future droughts that are as bad as, or worse than, the drought in 1988.

Email: gchen@math.ucalgary.ca

Modelling and forecasting of the air pollution emitted from mobile sources in an urban tunnel

Reginaldo Rosa Cotto de Paula

CEFET-ES and Pontifical Catholic University of Rio de Janeiro, Brazil

Luiz Felipe Amaral, Reinaldo Castro Souza

Department of Electrical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

Marcos Sebastião de Paula Gomes

Department of Mechanical Engineering, Pontifical Catholic University of Rio de Janeiro, Brazil

Air pollution from vehicle emissions is considered a serious problem in urban areas, especially in closed environments, such as a tunnel. A major concern with these sites is the elevated levels of human exposure to air pollutants when driving through them. These emissions are characterized by a significant influence of carbon monoxide (CO), which is formed as a by-product of the incomplete combustion of the carbonaceous fuel. CO is an important contaminant of the atmosphere requiring control and prevention measures for guaranteeing adequate protection of the public health. This work presents a time series model for the description of the hourly average concentration of the CO in an urban tunnel (Rebouas tunnel located in the metropolitan region of Rio de Janeiro, Brazil). The aim is to provide an estimate and forecast for the daily maximum CO concentration the tunnel, to assess how people are exposed to it. The results from model forecasting were compared with time series of the CO concentration obtained from measurements taken at different location in the Rebouas tunnel during November 2002. The results show that the time series model can be used to improve the determination of the CO concentration in the tunnel under realistic driving conditions.

Email: rcotto@mec.puc-rio.br

Operational consensus forecasts (OCF)

Chermelle B Engel, Frank Woodcock, Beth Ebert

Bureau of Meteorology Research Centre, Bureau of Meteorology, Australia

The Bureau employs a range of schemes to provide objective weather guidance to operational forecasters. The schemes include direct model output (DMO) from local and overseas numerical weather (NWP) models, and a model output statistics scheme (MOS) that is based on linear regression relations between past NWP model output and its corresponding weather. Downscaling techniques used for DMO forecasts result in systematic location dependent biases. The derivation of MOS predictive equations requires two to four years of stable development data, with upgrades to the underlying model introducing biases to generated forecasts.

Operational Consensus Forecasts (OCF) is a newly developed automated operational forecasting system that adapts to underlying numerical model upgrades within 30 days. It employs a range of routinely available DMO and MOS guidance that are combined after bias-correction using a mean absolute error (MAE) weighted average algorithm. Currently in operational use for predictions of daily forecast values such as maximum and minimum air temperature, verification statistics for a 6-month period have shown that the MAE of OCF forecasts are significantly lower than that of contributing MOS and DMO forecasts.

The extension of this system to hourly predictions of weather parameters has also shown promising results.

Email: c.engel@bom.gov.au

Weather prediction model output post-processing by neural networks

Emil Pelikan, Krystof Eben, Jiri Vondracek, Pavel Juras

Institute of Computer Science, Prague, Czech Republic

Weather prediction plays a very important role in many application areas. For power distribution companies, high-quality weather forecasts in specific localities (e.g., in large cities) are crucial for their decision, planning and control processes. Even a small improvement in forecasting error can bring significant economic savings. In our contribution we discuss a method of improving the quality of temperature forecasts produced by a numerical weather prediction model with respect to the needs of the energy sector. For this purpose we used the outputs from the mesoscale and microscale numerical weather prediction model MM5. The hourly model outputs (model temperatures, solar radiations, water vapour concentrations, wind speed, wind direction, etc.) were generated covering the period from September 2001 to November 2002 (13 months). The model outputs were postprocessed by multilayered neural networks (MLPs) using the temperatures measured in several large cities in the Czech Republic. The final models were tested using the data sets that were excluded from the training process.

Email: emil@cs.cas.cz

F4

Invited session: Financial market prediction

Tuesday 1.45pm–2.50pm

Room: Cambridge III

Chair: Heping Pan, University of Ballarat, Australia**A swingtum theory of intelligent finance integrating technical, quantitative and fundamental analysis of the financial markets**

Heping Pan

School of Information Technology and Mathematical Sciences, University of Ballarat, Australia

We see the necessity and tendency of unifying three distinct disciplines (technical, fundamental and quantitative analysis of the financial markets) into a general science of finance, which we call intelligent finance. The fundamental belief underlying this unification is that market dynamics are driven by three intertwining forces: business dynamics, investor mass psychology and news events. While the mathematics of finance may be developed for some aspects of business dynamics and mass psychology, the rest cannot be captured with mathematical models. Each of the three disciplines alone exploits only about 1/3 of the total information, and still we have to leave about 1/5 to random walk. Intelligent finance as a science is a structured collection of dynamic patterns in a multidimensional space of price-time. For successful investing and trading, the ultimate solution should be a comprehensive intelligent system operating continuously in real-time in world financial markets. Intelligent finance should include five major components: financial market prediction, technical trading strategies, fundamental investing methodologies, quantitative portfolio management, and complete trading systems. This paper examines problems and possible approaches for these components from the perspective of market swings and momentums in the price-time space (thus swingtum).

Email: h.pan@ballarat.edu.auWeb: <http://uob-community.ballarat.edu.au/~hpan/papers/IntelligentFinance1.pdf>**An ensemble of overfitting neural networks for generating probability distribution of predictions**

John Yearwood, Heping Pan, Ranadir Ghosh

School of Information Technology and Mathematical Sciences, University of Ballarat, Australia

Overfitting of a neural network being trained with a given data set has been considered an undesirable defect. However, we turn the overfitting problem to a significant advantage by forming an ensemble of many overfitted neural networks that are trained by different training data and test data randomly selected from the same original data set. The number of neural networks trained can be large (say hundreds). The ensemble of this large number of overtrained neural networks has two unique properties: (1) it provides multiple, possibly a complete sphere of, perspectives on the same problem, where each overfitted neural network provides a particular perspective over the data set; (2) it provides a probability distribution of predictions, which is made up of the outputs of all of the individual neural networks in the ensemble, for any given input pattern. Two possible approaches for forming the ensemble are considered: random sampling of training data and clustering of the original data. While a neural network with good generalization properties may be useful in general, the probability distribution of predictions produced by the ensemble of neural networks provides more useful information in many applications, in particular in trading financial markets.

Email: j.yearwood@ballarat.edu.auWeb: <http://uob-community.ballarat.edu.au/~hpan/papers/EnsembleNN1.pdf>

Forecasting with multiple variables using association rules

Andrew Stranieri, Marcello Bertoli

School of Information Technology and Mathematical Sciences, University of Ballarat, Australia

Forecasting in complex fields such as financial markets or national economies is made difficult by the impact of numerous variables with unknown inter-dependencies. A forecasting approach is presented that produces forecasts on a variable based on past values for that variable and other, possibly inter-dependent, variables. The approach is based on the intuition that the next value in a series depends on the last value and the last two values and the last three values and so on. Furthermore, the next value depends also on past values on other variables. No assumptions about the form of functions underpinning a dataset are made. Rather, evidence for each possible next value is collected by combining confidence values of numerous association rules. The approach has been evaluated by forecasting values in a hypothetical dataset and by forecasting the direction of the Australian stock market index with favorable results.

Email: a.stranieri@ballarat.edu.au

J4

Invited session: Judgmental forecasting & the Juster Scale

Tuesday 1.45pm–2.50pm

Room: Essex II

Chair: Mathew Parackal, University of Otago, New Zealand**The Juster purchase probability scale: developments and issues**

Mike Brennan

Department of Marketing, Massey University, New Zealand

The Juster Scale is a purchase probability scale that was originally developed to predict the actual purchase rate in a population from a sample of consumers from that population. A variant of the scale has been developed for use in telephone interviews, as well as face-to-face and self-completion surveys, and procedures have been developed so the scale can be used to estimate purchase quantities as well as purchase rates. The scale has also been used in a variety of applications, such as to predict voting behaviour, to test advertising copy, and to construct demand curves, as well as to estimate demand. More recently, the scale has been used to examine individual rather than aggregate purchase behaviour. The purpose of this paper is to provide an overview of these developments, and examine some of the issues that need to be investigated and resolved.

Email: m.brennan@massey.ac.nz

Using the Juster scale to construct demand curves

Mike Brennan

Department of Marketing, Massey University, New Zealand

Estimating demand is an important concern of marketers, and business managers in general, because such estimates are an integral requirement for both strategic and tactical planning decisions. One approach that has shown promising results involves the use of the Juster Purchase Probability Scale, an 11-point scale that has verbal (e.g., almost sure), numerical (e.g., 9) and probability (e.g., 9 in 10) descriptors. This scale has been shown to consistently outperform other types of scale, and appears suitable for a range of applications, such as estimating purchase rates, purchase levels, relative market share, assessing advertising copy effectiveness, predicting voting behaviour, and constructing demand curves. However, while the number of applications of the scale is expanding, relatively little replication research has been undertaken to examine boundary conditions and confirm reported findings, and in some cases the findings are conflicting. For example, there have been conflicting reports of item order effects in studies employing the Juster Scale to estimate demand curves. Clearly, an item-order effect would have important implications for the way in which the scale should be used. This paper reports on research that investigated this item order effect, and comments on implications for using the Juster Scale to construct demand curves.

Email: m.brennan@massey.ac.nz

Using the Juster scale to set price for a new environment-friendly consumer product

John G Dawes, Erica Riebe, Michelle K Tustin

Marketing Science Centre, University of South Australia, Australia

An important task for planning new products is to estimate likely demand. There are a plethora of texts and papers that address how to forecast sales for new products. We focus on one method, consumer surveys, and one tool, the well known Juster scale. Our contribution is to integrate the Juster method of information acquisition with two important issues in consumer behaviour: the notion of consumer reference prices; and the well accepted asymmetry between consumer gains (from lower than expected prices) and losses (from higher than expected prices) derived from Prospect Theory.

Specifically, we address the managerial problem of ascertaining the appropriate price for a new product, in this case an environment-friendly shopping bag. We survey consumers to obtain self-reported reference prices for such a product and their likelihood of purchase. We then determine the change in likelihood from departures from this reference point, by manipulating the selling price to be 10% above, and then 10% below this reference point. We use a modern CATI (computer aided telephone interviewing) program to automatically calculate the departures from the self reported consumer reference price during the survey.

Email: john.dawes@marketingsciencecentre.com

M9

Invited session: Prediction intervals

Tuesday 1.45pm–2.50pm

Room: Cambridge II

Chair: James W Taylor, Oxford University, UK**Importance of choice of error structure and model misspecification on the accuracy of prediction intervals from Holt-Winters models**

Geoffrey Allen, Bernard J Morzuch

Department of Resource Economics, University of Massachusetts-Amherst, USA

We investigate the performance of different assumptions about error structure in the Holt-Winters model as described in a state-space framework by Koehler et al. (*International Journal of Forecasting* 17(2001): 269–296) and investigated further by Hyndman et al. (*International Journal of Forecasting* 18(2002): 439–454). Although optimal values of the smoothing parameters depend on whether forecast errors are assumed constant, vary with level, or season, or both, and whether model disturbances are additive or multiplicative, we restrict ourselves to the standard algorithm for multiplicative Holt-Winters. The assumptions on error structure give rise to four different cases with four different error-distribution formulas. Using the 756 quarterly and 1428 monthly series from the M3 competition, we produce 1–8 or 1–18 steps-ahead forecasts, respectively, and determine the prediction-interval performance (or calibration) of each error-distribution formula. We also compare calibration when the estimated model for a series passes misspecification tests and when it does not.

Email: allen@resecon.umass.edu

Using prediction intervals to describe probabilistic forecasts of nonlinear systems

Patrick E McSharry

Department of Engineering Science, University of Oxford, UK

Nonlinear time series models are capable of simulating a rich variety of outcomes. The ability of these models to forecast extreme events requires an accurate description of the tails of the probabilistic forecast distribution. This is often complicated by the existence of asymmetric distributions, which in some cases may be multi-modal. Prediction intervals provide a straightforward means of quantifying the chance of such extreme events occurring. The pros and cons of using prediction intervals for nonlinear systems are investigated. In particular, the ability of prediction intervals to compensate for both observational and dynamical uncertainty, resulting from inadequate models, is discussed and illustrated with examples from both simple low-dimensional systems and real time series.

Email: patrick@mcsharry.net

Web: <http://www.mcsharry.net/papers/isf2004.shtml>

Generating volatility forecasts from value at risk estimates

James W Taylor

Saïd Business School, University of Oxford, UK

Statistical volatility models rely on the assumption that the shape of the conditional distribution is fixed over time and that it is only the volatility that varies. The recently proposed conditional autoregressive value at risk (CAViaR) models require no such assumption, and allow quantiles to be modelled directly in an autoregressive framework. Although useful for risk management, CAViaR models do not provide volatility forecasts, which are needed for several other important applications, such as option pricing and portfolio management. It has been found that, for a variety of probability distributions, there is a surprising constancy of the ratio of the standard deviation to the interval between symmetric quantiles in the tails of the distribution, such as the 0.025 and 0.975 quantiles. This result has been used in decision and risk analysis to provide an approximation of the standard deviation in terms of quantile estimates provided by experts. Drawing on the same result, we construct financial volatility forecasts as simple functions of the interval between CAViaR forecasts of symmetric quantiles. Forecast comparison, using five stock indices, shows that the method is able to outperform GARCH models and moving average methods.

Email: james.taylor@sbs.ox.ac.uk

S3

Contributed session: Software

Tuesday 1.45pm–2.50pm

Room: Harlequin Room

Chair: Michael J Leonard, SAS Institute, USA**Categorical time series data preparation and analysis using SAS**

Brenda Wolfe

SAS Institute, Inc., USA

Observed time-stamped data associated with a single individual or with an organization are often categorical in nature. This categorical data may be related to commercial, social, criminal, medical, political, and other activities or conditions. This categorical data along with any related numeric predictor variables (inputs) can be analyzed with respect to time to better understand the underlying dynamic data generating process. In order to analyze time-stamped categorical data, which may or may not be recorded on fixed-time intervals, it is convenient to prepare the data in various time series formats. Recording the counts of each categorical value for each time period can form categorical vector count (binary) series. Recording a single categorical value for each time period by accumulating several categorical values into one can form categorical time series. Following data preparation, vector count (binary) series and count distribution techniques can be used to analyze and visualize the resultant categorical vector count (binary) series. Sequence and similarity techniques can be used to analyze and visualize the resultant categorical time series. These analyses can help in the development of statistical models that can help make better categorical predictions and understand the influence of the (tentative) predictor variables. This paper surveys and illustrates the identification step in an analysis process similar to Box-Jenkins Analysis: identify, estimate, check, and forecast. These analyses and visualizations are useful for categorical time series analysis, modelling, forecasting, and data (text) mining. This paper demonstrates these techniques using SAS/BASE, SAS/ETS, SAS/STAT, Enterprise Miner, and SAS High-Performance Forecasting Software.

Email: Brenda.Wolfe@sas.com**A system framework for demand planning applications**

Hans Levenbach

Delphus, Inc, USA

Many software systems that support the periodic sales and inventory forecasting cycles in a corporation often lack a number of components that are best suited for time series-oriented forecasting applications. The spreadsheet paradigm of the flat file, for instance, often leads to very large files that have a way of degrading performance and data integrity when large numbers of items (tens of thousands) are to be forecasted. In this talk we describe a relational database framework that captures the essential ingredients of the product, customer, price, and time components for large-scale, collaborative time series forecasting applications faced by manufacturers, distribution and retail organizations in their monthly or weekly sales and operations process.

Email: hlevenbach@delphus.com

Predictive modelling markup language for time series models

Michael J Leonard

SAS Institute, Inc., USA

Using the eXtensible Markup Language (XML), data miners have created a Predictive modelling Markup Language (PMML) that allows the results of data mining processes provided by data mining software vendors to be represented in a standard format. Based on this PMML standard, other software vendors can develop software that uses these standardized results to generate predictions in their own software. To date, this standard has focused on predictive models and less focus has been given to time series analysis, modelling, and forecasting. Extending PMML to include time series models would allow forecasting processes to be standardized in time series forecasting software. This standardization should improve the diffusion of forecasting principles through software. This paper demonstrates a variant of the PMML standard for time series models that is used in SAS High-Performance Forecasting Software.

Email: Michael.Leonard@sas.com

T4

Invited session: Telecom consumer demand studies

Tuesday 1.45pm–2.50pm

Room: Bradfield Lounge

Chair: Gary Madden, Curtin University of Technology, Australia**A longitudinal approach to forecasting consumer segment adoption patterns in the household Information and Communication Technology (ICT) market**Alastair W Robertson, Robert Fildes
Management Science, Lancaster University, UK

The success of broadband in the UK hides a great deal as to the dynamics of the adoption process itself. Most of the early adopters are known to be switchers from the dial-up market and, if this pattern remains, a slower adoption pattern later is inevitable as the number of dial-up users declines. Using longitudinal data collected during April 2003 and April 2004 respectively, two distinct logit models are used to estimate market effects for these distinct time periods. Changing market effects are discussed via the comparison of market elasticities and odds ratios. The adoption effects discussed are user demographics, such as household disposable income, the presence of children in the household and household technology acceptance level. On the product attribute level, the effects of product pricing on ICT adoption are discussed. Overall, this paper finds that technology acceptance plays the strongest role in the market for ICTs, and that price elasticities vary systematically by this factor across consumer segments. Over time however, the effect of technology decreases but price becomes more pronounced as later adopters become more price sensitive to the broadband product. This information is then used to forecast broadband adoption for each distinct consumer segment.

Email: a.w.robertson@lancaster.ac.uk

Modelling consumer behaviour in telecommunications markets: opportunities for grid computingAshley D Lloyd
Curtin Business School, Curtin University of Technology, Australia

Convergence in telecommunications and computing technologies increases the scope and scale of business interactions carried across the wire, leading to new business opportunities — or as a report to the House Committee on Consolidation in the Telecommunications Industry put it: lower prices, higher quality, better service, greater choice, and increased innovation.

The Grid represents another phase in this convergence. Like the Internet it offers to increase the scope and scale of interactions but, critically, also delivers the computing power required to manage some of the complexity that attends the above benefits within global (telecommunications) markets, such as reducing product lifecycles and increasing churn.

This paper reports a project funded by the UK Economic and Social Research Council that has established a Grid portal in Western Australia providing a link to the computing facilities at the Edinburgh Parallel Computing Centre, home of the UK National eScience Centre and lead partner in HPCx, one of the world's most powerful Grid computers. Through collaboration with a Telco, we demonstrate the use of the Grid as a trusted means of bringing together the data, the technical skills, the market knowledge, and the computing power required to model and predict consumer behaviour within telecommunications markets.

Email: ashley@curtin.edu.au

Estimating the demand for VoIP services

P N Rappoport

Department of Economics, Temple University, USA

Lester D Taylor

Department of Economics, University of Arizona, USA

Don Kridel

Department of Economics, University of Missouri at St. Louis, USA

James Alleman

College of Engineering and Applied Science, University of Colorado, USA

The potential impact of Voice over Internet Protocol (VoIP) services on traditional telephony is the focus of much speculation and judgmental forecasting. The provision of VoIP services by large cable systems is seen as a direct threat to incumbent local exchange providers. The recent announcements that AT&T and Qwest will be offering VoIP services attests to the heightened level of interest in VoIP.

There are few, if any, background empirical models of the demand for these services. In this paper, a model of the potential demand for VoIP services is approached in terms of a sequential decision framework in which a household's first decision is associated with acquisition of high-speed Internet access and then a second decision is made with respect to the adoption of VoIP services. The decisions are treated as sequential rather than joint because high-speed access, while necessary for VoIP, may be demanded by a household for reasons other than VoIP. A sequential logit model is estimated using information obtained from a large omnibus survey of US households. Data on a household's choice of Internet access, their willingness to pay for high-speed access and their total spending for local and long-distance calling are available in the survey, as is information on typical household socio-economic demographics such as age, education, and income.

Alternative forecast scenarios of VoIP services are derived conditional on both expected broadband penetration rates and expected price of VoIP services relative to household spending on local and long distance services.

Email: prapp4@comcast.net

A6

Invited session: Transportation

Tuesday 3.00pm–4.20pm

Room: Cambridge III

Chair: Peg Young, US Department of Transportation, USA**Forecasts of air traffic and movements in the hubs of Northern Europe: a comparative study**Miriam E Scaglione, Andrew Mungall
Ecole hôtelière de Lausanne, Switzerland

During the past 15 years, a hub development strategy has been widely adopted by airports all over the world. Some authors claim, however, that hub airports are vulnerable to airline restructurings. Hubs which rely on substantial amounts of connecting traffic are especially vulnerable, as potential schedule adjustments may reduce revenues, result in greater operational costs passed on to the airlines, and limit financial flexibility.

The aim of this paper is to study the long-term evolution of the seven main airports in northern and central Europe: Heathrow and Gatwick (London), Orly and Charles de Gaulle (Paris), Schipol (Amsterdam), Frankfurt and Zurich. The analyses are based on Structural Time Series models applied to air traffic data (movements and passengers).

The effects on the general dynamic of the system, as well as on the particular dynamics of each hub, and of particular events such as alliances between airlines or bankruptcy, as in the case of Swissair, are shown.

Email: miriam.scaglione@ehl.ch

An analysis of gender differences in vehicles miles travelled using forecasting methodsBrian W Sloboda
US Department of Transportation, Bureau of Transportation Statistics, USAWenxiong Yao
Department of Economics, State University of New York at Albany, USA

There have been substantial differences between the travel patterns of men and women, even in the case of commuting to work. Typically, women make shorter work trips, greater use of public transit, and drive far fewer miles per year than men. These differences in travel are delineated by the separate social responsibilities of men and women. Women in a traditional society were more attached to the home, which resulted in a different travel pattern from men. However, this trend has been changing due to more participation in the labor force of women. As a result, actual vehicle miles traveled (VMT) by women has increased and may surpass the VMT of men in the future.

So far few transportation studies have been oriented to women's travel issues for various reasons. This paper analyzes and forecasts the differences in VMT between men and women using the data from National Household Transportation Survey (NHTS) and other data sources. Additionally, the analysis will provide some insights into the results of the analysis by substantiating the results from the NHTS as prepared by the Bureau of Transportation Statistics (BTS) in the US Department of Transportation.

Email: brian.sloboda@bts.gov

Monitoring modal output measures in the transportation services index

Peg Young

Bureau of Transportation Statistics, US Department of Transportation, USA

J Keith Ord

The McDonough School of Business, Georgetown University, USA

The Transportation Services Index (TSI) is a monthly measure of transportation output that has been recently developed at the Bureau of Transportation Statistics. Ten time series that measure freight or passenger movements are combined to create the TSI, which is also being considered as a possible leading indicator of GDP (Lahiri, Yao, Stekler and Young, 2004). Using STAMP, we first create monthly forecasts of these indicators. Then we compare the new observed values of these measures to the one-step-ahead forecasts in order to provide alerts for those measures that deviated more than expected in a given month. The analysis aims to identify both departures from target levels and changes in the statistical process due to assignable causes. In this way, transportation analysts can be forewarned of changes in the series, which may lead to changes to the overall TSI.

Email: peg.young@bts.gov

D4

Invited session: Demography

Tuesday 3.00pm–4.20pm

Room: Cambridge II

Chair: Len Smith, Australian National University, Australia**Forecasting mortality rates and related actuarial values**

Piet De Jong, Leonie Tickle

Department of Actuarial Studies, Macquarie University, Australia

This article discusses the fitting and use of the Lee-Carter model for mortality forecasting. Shortcomings of the approach are discussed and a more flexible approach is suggested based on standard time series approaches to estimation and forecasting. The approach is applied to Australian mortality data.

Email: piet.dejong@mq.edu.auWeb: www.actuary.mq.edu.au/research_papers/index.shtml**Order selection for functional forecasting**

Md Shahid Ullah, Rob J Hyndman

Business & Economic Forecasting Unit, Monash University, Australia

Functional data arises when each observation in a time series consists of a smooth curve. For example, mortality rates are a smooth function of age and are observed annually. We propose a new method to choose the number of principal components to be used in forecasting functional data. Our method is called FRESS (Forecast Residual Sum of Squares) and it chooses the optimal number of components for forecasting one or more steps ahead. We apply our methodology to French and Australian mortality data and show that it out-performs all existing methods. We also compare the methods on simulated data and find that the FRESS does better than currently available methods.

Email: Shahid.Ullah@BusEco.monash.edu.au**A multi-country comparison of mortality forecasting methods**

Rob J Hyndman

Business & Economic Forecasting Unit, Monash University, Australia

Piet De Jong

Department of Actuarial Studies, Macquarie University, Australia

Heather Booth, Len Smith

Demography & Sociology Program, Australian National University, Australia

We present the results of an evaluation of various mortality forecasting methods applied to ten countries. The methods include a variation of the Lee-Carter method due to Booth, Maindonald and Smith, a new nonparametric method based on a functional data approach due to Hyndman and Ullah, and a state space approach due to De Jong. The methods are applied to each sex and each country using all available data from 1900 to 1985 and comparing the forecasts with actual mortality in the data available from 1986 onwards. Each method will be briefly described, and then the results of the comparison will be presented. We will also discuss the most appropriate measures to be used in a comparison of this type.

Email: Rob.Hyndman@buseco.monash.edu.au

E6

Contributed session: VAR models

Tuesday 3.00pm–4.20pm

Room: Essex I

Chair: George Athanasopoulos, Monash University, Australia**Structural vector autoregression: The case of Thailand**

Athipong Hirunraengchok

Department of Macroeconomics, National Economic and Social Development Board, Thailand

We employ a structural vector autoregression (SVAR) approach in analysing Thailand macroeconomic data. In this SVAR model we study contemporaneous and long run impacts of four key macroeconomic variables (price, interest rate, money supply and real GDP) under a theoretical relationship suggested by Keating (1992). We estimate impulse response functions to show economic impacts in the short- and long-run, and we use this model to generate out-of-sample forecasts and create scenarios by incorporating some exogenous variables in the model such as the Federal Reserve Fund Rate, the world GDP, and the world oil price, each of which has the potential to affect the Thai economy.

Email: athipong@nesdb.go.th, athipongh@yahoo.com

Forecasting the global electronics cycle with leading indicators: A VAR approach

Keen Meng Choy

Department of Economics, National University of Singapore, Singapore, Singapore

Hwee Kwan Chow

School of Economics and Social Sciences, Singapore Management University

Developments in the global electronics industry are typically monitored by tracking indicators that span a whole spectrum of activity in the sector. However, these indicators invariably give mixed signals at each point in time, thereby hampering efforts at prediction. In this paper, we present a unified framework for forecasting the global electronics cycle by constructing a VAR model that reflects the simultaneous interactions between leading indicators representing orders, inventories, production, shipments and prices. The five variables in the model are identified from a longer list of electronics indicators, based on their ability to presage world semiconductor sales in cross-correlation analyses and Granger causality tests. The VAR model is used to characterize the dynamic paths of adjustment of global chip sales in response to shocks in each of the leading variables. These impulse response functions conform to our theoretical priors and confirm the leading status of the selected indicators. The VAR system also facilitates the testing of parameter instability, and allows us to make inferences about changes in leading relationships. Finally, out-of-sample forecasts of global chip sales are generated from the VAR model and compared with forecasts from a model which uses a composite index of the leading indicators. An evaluation of their accuracy suggests that the VAR model's forecasting performance is superior to that of the more parsimonious leading index model.

Email: ecsckm@nus.edu.sg

Are VAR models good enough for forecasting macroeconomic variables?

George Athanasopoulos

Department of Econometrics and Business Statistics, Monash University, Australia

Farshid Vahid

School of Economics, Australian National University, Australia

VAR models are used in practice in preference to VARMA models because of the difficult issues involved in the identification and estimation of VARMA models. This paper examines whether VAR models are good enough for forecasting macroeconomic variables. To answer this question, we first extend the Tiao and Tsay procedure for identification of VARMA models and examine the properties of this identification procedure through simulations. Then we use this procedure to determine VARMA models for macroeconomic sets of variables and compare their forecasting performance against the forecasting performance of VAR models.

Email: George.Athanasopoulos@buseco.monash.edu.au

F5

Invited session: Financial modelling, forecasting, and applications

Tuesday 3.00pm–4.20pm

Room: Harlequin Room

Chair: Jerry Shan, Hewlett-Packard Company, USA**Term structured GARCH modelling**Shuling Chen, William TM Dunsmuir, Ben Goldys
School of Mathematics, University of New South Wales, Australia

The development of economic and statistical models describing the term structure of interest rates has been considered important. Term structure of interest rates is dependent on two variables, the time of evolution and the length of time to maturity (or benchmark, the level of maturity). Univariate GARCH models in each benchmark, with some exogenous innovation variables and residuals having a Student-t distribution, showed that the parameters of the individual GARCH models are functionally dependent on the length of time to maturity (benchmark). The function patterns are plausible with the financial economy. In this paper, a GARCH model is presented, with the new parameters describing the benchmark dependence of the GARCH coefficients in both mean equations and conditional variance equations of the multivariate GARCH ignoring the correlation structure. This model not only reduces the number of parameters to estimate but also provides a consistent prediction of the term structure interest rates in any other benchmarks. We refer this model as a term structured GARCH model (TSGARCH).

Diagnoses of TSGARCH model are considered, comparing with the Pure Diagonal Correlation model, the Constant Conditional Correlation (CCC) model and Dynamic Conditional Correlation (DCC) model in terms of the conditional variance structure.

Email: shuling@maths.unsw.edu.au

Forecasting classical business cycle turning points at the ends of series using Markov switching modelsPeter J Thomson
Statistics Research Associates, New ZealandRobert A Buckle
New Zealand Treasury, New Zealand

The classical definition of turning points is associated with Burns and Mitchell (1946) and the NBER, with an implementation given by the dating algorithm in Bry and Boschan (1971). A simplified version of the Bry and Boschan algorithm modified for quarterly data has been proposed by Harding and Pagan (2002).

This paper uses a hidden Markov switching model to identify potential turning points in the classical business cycle at the ends of quarterly series where the non-parametric Harding and Pagan algorithm is unable to make a classification. The performance of this hybrid procedure is examined using simulated data and quarterly New Zealand aggregate GDP. These results are also benchmarked against those obtained by replacing the HMM model by simpler parametric linear models for the growth rates.

Email: peter@statsresearch.co.nz

Forecasting with dynamic updating by Bayesian modelling

Jerry Shan, Hsiu-Khuern Tang

HP Labs, Hewlett-Packard Company, USA

Suppose we are predicting the total amount of a metric in a period, with the objectives being forecast as accurately as possible and as early as possible. Many profile based prediction methods, which essentially use time or space percentages and the corresponding prediction metrics accumulated percentages, work reasonably well after some initial stabilization period. However, the prediction performance can be quite unsatisfactory at the early stage. One major reason is that there is then usually too much volatility for the derived models of the profile. For instance, in predicting the total amount in a month of a financial metric, an experienced forecaster could quickly note very early on that the month's total definitely won't be able to reach either bounds of the prediction interval derived from the profile based prediction methods. How can we then address the problem?

By properly incorporating information on the totals from historical periods into the modelling with Bayesian inference techniques, we have successfully solved this problem. With the new observations coming up, the Bayesian model can also take care of the dynamic updating automatically. This paper will showcase our methodology through its applications to the revenue prediction work that we have successfully carried out at HP.

Email: jerry.shan@hp.com

M10**Tutorial**

Tuesday 3.00pm–4.20pm

Room: Grand Ballroom II

Pragmatic approaches to forecasting weekly and daily data using time series models

Eric Stellwagen

Business Forecast Systems, USA

Forecasters who work with weekly and daily data sets grapple with a large number of issues that are rarely addressed in the forecasting literature. This tutorial will address issues such as defining the calendar, accommodating week 53, correcting for the number of working days, tracking holidays, forecasting multiple cycles (e.g., day of week and week of year) and converting between different periodicities. It will also explore a technique the presenter refers to as “seasonal simplification”—a variant of exponential smoothing whereby the number of seasonal indices estimated is less than the number of periods in the seasonal cycle.

Numerous real-life examples will be presented to illustrate how the techniques are applied to corporate data.

Eric Stellwagen is the Vice President and co-founder of Business Forecast Systems, Inc. He consults widely in the area of practical business forecasting and spends 20–30 days a year presenting workshops on the subject. He has worked with many leading firms including Coca-Cola, Kraft, Merck, Nabisco, Owens-Corning and Verizon. Mr Stellwagen is also the co-author of the Forecast Pro software product family.

Email: estellwagen@forecastpro.com

N3

Invited session: Non-parametric forecasting

Tuesday 3.00pm–4.20pm

Room: Essex II

Chair: Jiti Gao, University of Western Australia, Australia**Dynamical modelling and forecasting of financial time series**

Vladimir Spokoiny

Weierstrass Institute, Berlin, Germany

Financial time series are often modelled by parametric ARCH or GARCH models under the assumption of stationarity. This approach is not flexible enough to incorporate models with structural breaks and time varying parameters. This paper presents a unified approach for modelling non (local) stationary time series including change point and smooth transition models. The procedure is based on the *adaptive weights* idea from Polzehl and Spokoiny (2000, 2002, 2003). The paper discusses some theoretical properties of the method and illustrates its numerical performance by means of simulated examples and applications to real data.

Email: spokoiny@wias-berlin.de

Non- and semi- parametric forecasting methods, with applications to unemployment rate and GNP data

Lijian Yang

Department of Statistics and Probability, Michigan State University, USA

US Bureau of Labor Statistics, USA

In this paper, we present a variety of forecasting tools including multi-step ahead forecasting via multivariate local polynomial smoothing, one-step ahead forecasting via polynomial spline smoothing of additive autoregression, and one-step ahead marginal integration forecasting of additive coefficient autoregression. Several US unemployment rates and one set of German GNP data will be used to illustrate the use of these methods.

Email: yang@stt.msu.edu

Forecasting rainfall in southwest Western Australia via the generalised boosting MARS model

Yun Li, Edward Campbell

CSIRO Mathematical and Information Sciences, CSIRO, Australia

We analyse the area averaged monthly rainfall in southwest Western Australia (SWWA) bounded by 32°S, 34°S, 116°E and 118°E. This grid square covers most of the agricultural area of SWWA where the percentage decline in May-October rainfall has been the strongest, as measured by 1976–2001 average rainfall compared with the 1925–1975 average. We choose 15 climate variables and their lags (1–6 months) as potential candidates that affect rainfall over SWWA. A model based on the generalized boosting and multivariate adaptive regression splines techniques has been developed to select the important variables, and to model the relationship of rainfall with the selected important climate variables.

In this talk, we first focus on modelling rainfall mechanisms based on raw data and then use the developed model to forecast monthly rainfall. It appears that the rainfall mechanism can be modelled by 4 important climate predictors: Dew point temperature depression (DTD) (30°S, 117.5°E) at the 850 hPa level, Perth Mean Sea Level Pressure (PMSLP), North-South Sea Level Pressure gradient (NSG) and Indian ocean skin temperature at lag 4 months (SKT.4). By examining the estimated predictors pre- and post-1976 we are able to quantify the influence of predictor main effects on the rainfall decline. In particular it appears that SKT.4 post-1976 must be larger than was previously the case to trigger rainfall in the southwest. The contributions to rainfall from higher NSG and lower PMSLP and lower DTD became less post-1976. To build a seasonal forecasting model for rainfall, we search only for relationships using the important lagged (4 months) variables. Results show that there is some predictability for monthly rainfall in SWWA.

This work is supported by the Western Australian Government through the Indian Ocean Climate Initiative.

Email: Yun.Li@csiro.au

Markov predictive densities for time series

Dawit Zerom

Department of Finance & Management Science, University of Alberta, Canada

Sebastiano Manzan

CeNDEF, University of Amsterdam, The Netherlands

In this paper we introduce a new approach to predict the conditional density of a time series. The method is based on the Markov bootstrap that is designed to preserve the dependence structure in the series. The method has the attractive feature, common in nonparametric methods, of capturing a wide spectrum of linear and nonlinear structures. In addition, the bootstrap part of the method allows correct inference at the sample sizes typically available in economics and finance. We evaluate the conditional densities using the approach of Diebold, Gunther and Tsay. We investigate the finite sample properties of the Markov Predictive Densities (MPD) by simulation of linear and nonlinear time series models. We find that the selection of the bandwidth is a crucial element for the success of the method. The MPD perform reasonably well for most models and also for small samples. Finally, we illustrate the method with an empirical application.

Email: dawit@ualberta.ca

SM8

Contributed session: Time series analysis

Tuesday 3.00pm–4.20pm

Room: Cambridge IV

Chair: Carole Toque, Ecole Nationale Supérieure des Télécommunications, France**Modelling, analysis and forecasting the dynamics of input-output phenomena**

Akram M Chaudhry

Management and Marketing, University of Bahrain, Kingdom of Bahrain

For modelling, analysing and forecasting the dynamics of input-output phenomena, a linear dynamic system model is proposed. This model is constructed in the Bayesian spirit, keeping in mind the principle of parsimony. To estimate the demand or delivery parameters, which are housed in the state vector of the model, Kalman filter type equations are used.

For forecasting, a dynamic forecast function is introduced to generate optimum short term forecasts and fairly accurate medium to long term forecasts.

To ensure the optimality of estimates of the parameters and the forecasts, especially in the case of time series polluted with AR type colored noise processes, an identification procedure based on ATS is discussed and a technique to reconstruct the model (if required) is proposed.

Email: drakramm@hotmail.com

The predictability of the Brent Crude Oil price

Ann Zhao, Shen Zhang

Beijing ChaosTech Company, China

In this paper, we discuss the predictability of the Brent Crude Oil price using weekly averages over the five year period from 1994 to 1998. First, the trend of the Brent time series from 12 November 1998 to 12 November 1999 was forecast using classical econometric models; the results show that it is unpredictable. Then, we applied rescaled range analysis and spectral estimation to identify the long-memory structure and long-tendency structure in the Brent time series. The dynamic mechanism driving the capital market was also explored. Finally, we forecast the trend of the Brent time series with dynamic non-linear models. By reconstructing a phase space with lagged explanatory variables and then putting the Brent price time series into the phase space, we obtained a very good model which successfully interpreted the trend of the Brent time series from 19 June 1994 to 27 December 1998, and successfully forecast the trend of the Brent price over the periods of January 1999 to January 2000 and June 2000 to November 2000. The conclusion is that a non-linear dynamic system, such as an international crude oil market, can potentially have a steady order and a predictable window far from equilibrium.

Email: ann_zhao@263.net

Structural identification of time series

Carole Toque, Bernard Burtschy

Ecole Nationale Supérieure des Télécommunications, Paris, France

We propose a method to identify a time series model, combining a structural approach by analysis of oscillators and criteria of information through visualisation by factorial methods (principal component analyses PCA and multiple correspondences MCA). It supplies reference graphic models and pertinent criteria for identification of ARMA processes. The method is applied to simulated AR(1) and MA(1) series.

Based on a simulated temporal matrix, the first PCA produces outstanding quality of process representation, with significant groupings and oppositions preserving some properties of ARMA autocorrelation functions. A second PCA, directly based on the autocorrelation matrix, gives analogous results. Meanwhile, some processes said to be 'weak' are less well represented and characterization is unsatisfactory. The factorial model is now based on the initial temporal matrix.

Description and measure of possible structural change lead us to introduce several oscillators, frequencies and measures of entropy. To increase the discriminative ability between processes, all oscillators are to be used. Therefore, results approximate the temporal factorial model.

To establish non-linearity between the numerous criteria, a MCA with 3 modalities is built over a single oscillator, with higher quality process characterization. The method with factorial analyses and incertitude measures is justified and is extended to all ARMA processes.

Email: carole.toque@educagri.fr

T5

Invited session: Modelling ICT and traffic forecast methodology

Tuesday 3.00pm–4.20pm

Room: Bradfield Lounge

Chair: Gary Madden, Curtin University of Technology, Australia**Special features in forecasting ICT infrastructure investment**

Russel J Cooper

AEGIS, UWS City Research Centre, University of Western Sydney, Australia

Gary Madden

CEEM, Curtin Business School, Curtin University of Technology, Australia

This paper looks at special features of the information and communications technology (ICT) infrastructure investment environment with the aim of enhancing forecasting performance when very short time series are available. The approach emphasises the role of an incumbent ICT carrier as a decision maker in a stochastic intertemporal context. It utilises special features of the ICT environment such as producer and consumer externalities, critical mass effects, the general purpose nature of the technology, and the potential for asymmetries in responses to good and bad news. This allows fine-tuning of forecasting capabilities in a situation where the ability to appeal to past patterns in time series data is limited.

Email: r.cooper@uws.edu.au

Effects of ICT use on the performance of Australian firms: evidence from a business longitudinal data set

Jyothi V Gali, Paul Gretton

Productivity Commission, Australian Government, Australia

An empirical analysis of firm-level data from the Australian Business Longitudinal Survey shows positive and significant links between the introduction of ICT, a general purpose technology, and productivity growth in manufacturing and a range of service industry sectors. This conclusion is not sensitive to changes in model specification or to the adoption of alternative measures of ICT use. Firm characteristics were found to be important in identifying businesses using ICTs while significant interactions were also found between ICT use and complementary organisational characteristics (including skill, improved business practices, and business restructuring) in raising productivity. Transition dynamics and time lags were of importance. After an initial productivity boost associated with the uptake of selected ICTs, productivity effects were estimated to have tapered off over time. Looking forward into a forecasting environment, the study suggests the ultimate productivity effects of a new innovation is an endogenous step up in levels, rather than a permanent increase in the rate of growth.

Email: jgali@pc.gov.au

Web: <http://www.pc.gov.au>

Data characteristics and optimal forecasting model selection

Joachim Tan, Gary Madden

Curtin Business School, Curtin University of Technology, Australia

Robert Fildes

Management Science, Lancaster University, UK

Collopy and Armstrong (1992), Fildes (1992), and Shah (1997) suggest that data characteristics are important for optimal model selection and forecasting. Using telecommunication share price series, this study attempts to forecast these prices through growth, crash and recovery phases. The transition from the growth to bust (January 1993 to March 2000), and from bust to recovery (September 2002 to December 2003), are especially considered. The intention is to identify the best forecast method for each series (identified through standard forecast error measures). A second-stage analysis is then conducted to identify a core set of data characteristics that allow the determination of the best (most appropriate) forecasting method for particular series based on their observed data characteristics. In doing so, a multinomial logit model is used to relate observable data set characteristics to forecast methods. Clearly, an understanding of the relationship between data characteristics and forecast accuracy can potentially assist analysts in selecting the most appropriate forecasting model based on different observed series characteristics.

Email: tanj@cbs.curtin.edu.au

Forecasting international bandwidth capacity using linear and non linear methods

Gary Madden, Joachim Tan

Curtin Business School, Curtin University of Technology, Australia

A neural network (NN) can improve forecasts through pattern recognition of historical data. This paper evaluates the reliability of NN methods, as opposed to simple extrapolation techniques to forecast Internet bandwidth index data. A simple feedforward NN model is selected as a non-linear alternative as it is considered flexible enough to model complex linear or non-linear relationship without any prior assumptions regarding the underlying data generating process. These data are virtually white-noise, and thus provide an unusual challenge to forecasters. Using standard forecast error statistics, the NN provides modestly better forecasts than simple extrapolation methods.

Email: maddeng@cbs.curtin.edu.au

E7

Featured talk

Tuesday 4.45pm–5.50pm

Room: Grand Ballroom II

Chair: Lars-Erik Öller, Statistics Sweden

Intergenerational challenges facing Australia and the world

Martin Parkinson

Executive Director (Macroeconomic Group), Department of the Treasury, Australia

The address will examine a range of intergenerational challenges facing Australia and the world, and discuss how Australia should best respond to these challenges. The Australian Government's Intergenerational Report, released as one of the papers for the 2002–03 Budget, presented projections of labour force participation and fiscal pressure over the next forty years, and highlighted the roles of ageing and rising public health expenditures for these projections.

The address will discuss some of the important messages that arise from the Intergenerational Report, particularly for labour force participation and productivity growth over coming years. Compared with many countries, Australia is well placed to respond to intergenerational pressures, because of the strength of the fiscal position and the targeted nature of Australia's social safety net. Despite being relatively well placed, however, a considered and timely response to the challenges highlighted in the Intergenerational Report will render them much more manageable. The address will discuss some more recent work being done at Treasury on these issues, and on policy approaches to responding to them.

The nature of the intergenerational challenges facing the major economies of the world will also be examined. The coming demographic transitions in these major economies will put them under considerable strain, given their current fiscal positions, and the generosity of their government-guaranteed pension and health-care systems. The address will discuss how these strains might be resolved, and what might be the implications for Australia.

Email: agreig@treasury.gov.au

Martin Parkinson is currently Executive Director (Macroeconomic Group) in the Australian Treasury with responsibility for domestic and international macroeconomic issues. He has previously worked at the International Monetary Fund where he headed a unit dealing with issues related to the reform of the international financial architecture. Prior to joining the IMF, Martin headed Treasury's economic conditions branch, with responsibility for analysing economic developments and preparing the official forecasts for the domestic economy and external accounts. In the early 1990s he served as Senior Adviser to Treasurer Dawkins; he also worked for Treasurers Kerin and Willis. During his Treasury career Martin has worked on taxation reform, structural policy, and labour market and industrial relation policy issues.

A7

Contributed session: Sales

Tuesday 4.45pm–5.50pm

Room: Essex I

Chair: Joy V Joseph, Marketing Management Analytics, USA**Forecasting error measures in multiple product situations (case study of a FMCG organisation)**

Jesus Canduela

Centre for Mathematics and Statistics, Napier University, Scotland

As a result of qualitative research work carried out in a major brewing company, three main issues arose. First, there is a difference in the value of a forecast and the way it is used or abused. Second, a clear indication of the social and political influences on planning and the forecasting process also emerged. Third, although the importance of monitoring forecast accuracy is recognised, no one seems to care about it.

A statistical assessment of forecasting performance has been carried out using historical sales data in order to assess which error measure is most useful to the company. In doing this, period and product variation in forecasting accuracy was assessed and explained. A variety of monitoring techniques are then reviewed and suggestions made for the choice of error measure and monitoring procedure. Recommendations are made as to how to better manage the forecasts, and also, from general observation, how better housekeeping can improve accuracy.

Email: j.canduela@napier.ac.uk

Non-stationarity effects in causal sales forecasting models

Joy V Joseph

Client Service, Marketing Management Analytics, USA

One fundamental assumption of classical econometrics that is gaining a lot of attention in financial and economic models is that of stationarity of variables used to specify a regression model, especially with the academic developments in the area of unit roots and vector cointegration. But marketing data based models have not focused as much attention on this issue. Most marketing data may not exhibit a substantial amount of non-stationarity. This is a minor problem if the causal model is for an explanatory or analytical purpose. But for a forecasting model, it might lead to complications like parameter inconsistency or spurious regressions. This empirical analysis uses the Augmented Dickey-Fuller test to identify non-stationary variables in the sales and marketing data of two products in a CPG brand. The out-of-sample forecast MAPEs from single-equation unconditional causal forecast models of sales volume for the products, with and without the identified non-stationary regressors, are then compared to that from a benchmark univariate model, to gauge the effect of nonstationarity on forecast quality. The models are then re-specified with stationarized transformations of these variables, and compared to the benchmark model to analyze potential improvements in forecast quality.

Email: joy.joseph@mma.com

F6

Contributed session: GARCH models

Tuesday 4.45pm–5.50pm

Room: Harlequin Room

Chair: Daniel R Smith, Simon Fraser University, Canada**News impact in multivariate GARCH models**

Harald Schmidbauer

Department of International Finance, Istanbul Bilgi University, Turkey

The interplay of conditional volatility, conditional correlation, and the time series values themselves is often not easy to understand intuitively. In one-dimensional GARCH models, the news impact function has been found useful to measure the effect of past returns on current volatility, and to discuss the influence of asymmetric volatility specifications. This concept carries over to MGARCH models. We investigate news impact on conditional volatility and conditional correlation in several models, and apply the concept to several stock market indices. It is shown how understanding news impact helps understand the co-movements of return series, and some financial consequences are pointed out.

Email: harald@bilgi.edu.tr**Structural breaks in GARCH models**

Daniel R Smith

Faculty of Business Administration, Simon Fraser University, Canada

The GARCH model is one of the most important and widely applied econometric models in finance and is used extensively in empirical asset pricing and risk management. However, GARCH models are only rarely examined with diagnostic tests and almost never tested for structural breaks. In this paper we propose a new test for model specification which uses GMM and apply the structural break tests of Andrews (1993) and Andrews & Ploberger (1994) to GARCH models fitted to a number of financial time series. We find that many of the estimated GARCH models fail the structural break test while passing diagnostic tests for autocorrelation and heteroscedasticity.

Email: drsmith@sfu.ca

S4

Invited session: Automatic model selection

Tuesday 4.45pm–5.50pm

Room: Essex II

Chair: Brian C Monsell, US Census Bureau**Automatic econometric model selection**

David F Hendry

Oxford University, Economics, UK

Hans-Martin Krolzig

Humboldt University, Economics, Germany

After reviewing the performance across different states of nature of automatic regression-model selection, as embodied in PcGets, we show that model selection can be non-distortionary: approximately unbiased 'selection estimates' are derived, with reported standard errors close to the sampling standard deviations of the estimated DGP parameters. The handling of theory-based restrictions, non-stationarity, and problems posed by collinear data are considered. Finally, we demonstrate how PcGets can handle three 'intractable' problems: more variables than observations in regression analysis, and hence tackle both non-linear models and 'generic' parameter non-constancies; perfectly collinear regressors; and modelling simultaneous equations without having a priori restrictions.

Email: david.hendry@nuffield.oxford.ac.uk

Large scale automatic forecasting with inputs and calendar events

Michael J Leonard

SAS Institute, Inc., USA

Businesses must understand the markets they serve. Businesses must be able to analyze, model, and forecast the demand for their products and services. These products and services may be driven by zero or more of many sales drivers that may include input time series (regressor variables) and calendar events (indicator variables). Business leaders, who may be untrained in statistics, must be able to interpret the results of these analyses and make decisions. When the various products/services, categories, and geographies are considered, the number of time series, sales drivers, models, forecasts, and decisions can be tremendous. It is not uncommon that millions of time series must be modeled and forecast and millions of decisions must be made based on these models and forecasts. Given the scale of the problem, customizing a time series model for each time series may not be feasible. An automated system that selects appropriate models and chooses influential sales drivers is required. The automated system must manage the time series data, time series models, and the calendar events, as well as the results of the forecasting processes in a scalable way. The results of the automated system must allow for scenario analysis (What-If analysis), stochastic optimization, and goal seeking in support of decision-making by business leaders. This paper demonstrates such a scalable, automated system using SAS High-Performance Forecasting software. This software uses a model repository to store and manage statistical models, an event repository to store and manage calendar events, and a score repository to store and manage forecast results in support of decision-making. The software uses a variant of the Predictive modelling Markup Language (PMML) customized for time series models to aid decision-making by business leaders.

Email: Michael.Leonard@sas.com

SM9

Contributed session: Long memory approaches

Tuesday 4.45pm–5.50pm

Room: Cambridge III

Chair: Isabel Casas Villalba, University of Western Australia, Australia**Predicting high frequency Japanese stock market data**

Jun Nagayasu

Institute of Policy and Planning Sciences, University of Tsukuba, Japan

This paper analyzes the dynamics of high frequency Japanese stock data and examines their predictability using the statistical model, ARFIMA-FIGARCH. In contrast to previous literature, we incorporate the model's possible persistence in both the mean and volatility of the stock data. Our findings are as follows. First, evidence is obtained for persistence in both the mean and variance data when very high frequency data are employed. Second, this statistical model is proven to produce out-of-sample forecasts, which are more accurate than those from the unit root model. Third, unlike the interest rate, our explanatory variables, the yield-to-price ratio, has some useful information in predicting stock returns. The insignificance of the interest rate in the variance equation indicates that monetary policy did not affect the level of volatility in the Japanese stock market.

Email: nagayasu@sk.tsukuba.ac.jp

Temporal aggregation of stationary and nonstationary discrete-time processes

Henghsiu Tsai

Institute of Statistical Science, Academia Sinica, Taiwan, ROC

Kung-Sik Chan

Department of Statistics and Actuarial Science, The University of Iowa, USA

We study the autocorrelation structure and the spectral density function of aggregates from a discrete-time process. The underlying discrete-time process is assumed to be a stationary AutoRegressive Fractionally Integrated Moving-Average (ARFIMA) process, after a suitable number of differences if necessary. We derive closed-form expressions for the limiting autocorrelation function and the normalized spectral density of the aggregates, as the extent of aggregation increases to infinity. These results are then used to assess the loss of forecasting efficiency due to aggregation.

Email: htsai@stat.sinica.edu.tw

Parameter estimation of continuous-time financial models with long-range dependence

Isabel Casas Villalba, Jiti Gao

Department of Mathematics and Statistics, University of Western Australia, Australia

This paper describes an estimation procedure which estimates the parameters of a class of continuous-time stochastic models. It is commonly accepted that some financial data exhibit long-range dependence. This behaviour may be fitted to a continuous-time fractional stochastic model. The estimation procedure described within this paper uses a version of the Gauss-Whittle objective function to find the parameter estimators that minimise the contrast between the spectral density and the data periodogram. As a particular case, the fractional stochastic volatility (FSV) model is studied as a benchmark for the estimation of the parameter β displayed in Comte and Renault (1998).

Email: icasas@maths.uwa.edu.au

T6

Contributed session: Technology

Tuesday 4.45pm–5.50pm

Room: Bradfield Lounge

Chair: Lance C Gentry, University of Missouri-Rolla, USA**Speed of technology adoption internationally: A cross-national study of two subsequent technological generations**

Henri Suur-Inkeroinen, Saku Mäkinen

Industrial Management, Tampere University of Technology, Finland

Earlier research has identified market entry timing in the growth phase of a technology adoption as one of the key success factors of company's entry decision. Dynamics of the growth phase is surrounded especially with practical interests since anticipation of dynamics would facilitate much needed operational forecasting at the company level. However, the cross-national dynamics of the growth phase in the technology adoption, especially in the context of subsequent technological generations, largely remains unexplored. This article builds on the existing knowledge base by explicitly considering the dynamics of the growth phase between two subsequent technological generations from the cross-national point of view. First of all, the study reports evidence that the second generation technology adoption overall is faster than the adoption of the first generation. Secondly, the study confirms the existence of the lead-lag effect in a cross-national speed of technology adoption in both generations, i.e., leading countries have slower speed of technology adoption than lagging countries for both technological generations.

Email: henri.suur-inkeroinen@tut.fi**Forecasting consumer adoption of technological innovation: choosing the appropriate diffusion models for new products and services before launch**

Lance C Gentry

School of Management & Information Systems, University of Missouri-Rolla, USA

Roger Calantone, Shaojie Cui

Department of Marketing and Supply Chain Management, Michigan State University, USA

There are many good articles on various forecasting models. There is consensus that no single diffusion model is best for every situation. Experts in the field have asked for studies to provide empirically-based guidelines for recommending when various models should be used. This research investigates multiple diffusion models and provides recommendations for which diffusion models are appropriate for radical and really new products and services before the launch of the innovation.

Email: gentryl@umr.edu

K3

Plenary session

Wednesday 8.40am–10.00am

Room: Grand Ballroom II

Chair: Rob J Hyndman, Monash University, Australia**Climate change scenarios: projecting the future**

Warwick J McKibbin

Centre for Applied Macroeconomic Analysis, Australian National University, Australia

The Lowy Institute for International Policy, Australia

A critical aspect of estimating future temperatures in the climate change debate is the need to project concentrations of greenhouse gases, which depend on current and future emissions of these gases. One of the key inputs into any projection of future carbon emissions is the rate of economic growth, the composition of that growth, and the geographical location. Yet it is extremely difficult to predict the evolution of global economic growth over horizons of up to a century.

This presentation examines the different methodologies for predicting future carbon emissions. Important differences in the approaches are directly related to how recent history is understood by the modelling groups. Energy models, which tend to dominate the long run projections literature surveyed by the Intergovernmental Panel on Climate Change (IPCC), have quite a different perspective on the drivers of carbon emissions than found in economic models. This presentation will give an overview of the various issues that should be considered in forming long run projections of energy use. It presents the approach in the G-Cubed multi-country model, and contrasts this with the energy modelling approach. It will also provide some empirical estimates to contribute to the debate between Ian Castles and David Henderson and the IPCC on the adequacy of current emissions projections.

Email: wmckibbin@msgpl.com.au

Warwick McKibbin is one of Australia's leading economists. He is Professor of International Economics at the ANU; a non-resident Senior Fellow at The Brookings Institute in Washington DC; and a Board Member of the Reserve Bank of Australia. He has been actively engaged in influencing the development of policy on macroeconomics, international trade and finance and the greenhouse problem through his consultancies with Australian and international agencies and governments. His specialisation is multi-country economic modelling.

A8

Contributed session: Applications

Wednesday 10.10am–11.15am

Room: Essex I

Chair: Nigel Meade, Imperial College London, UK**Rating forecasts for television programmes**

Denny H Meyer

Institute of Information and Mathematical Sciences, Massey University – Auckland Campus, New Zealand

There have been several attempts to model television viewing taking into account the competition between networks. This paper adds to this literature by comparing the performance of regression, decision trees and neural networks for the fitting of discrete choice and rating models. These models need to allow for day of the week, time of day, network loyalty, carry-over effects, programme genre and demographic information.

In our case, the purpose of these models is to forecast ratings for a given programme schedule. These forecasts and their standard errors can be used for assessing the performance of programmes, and deciding when unpopular programmes should be discontinued.

It is found that the discrete choice models outperform the rating models in that the standard errors for their forecasts are smaller. However, these models require more calculation than the rating models, and the approximate nature of the standard error estimates casts some doubt on their superiority.

Email: d.h.meyer@massey.ac.nz**Forecasting television viewership using time-series decomposition techniques**

Radu Neagu

Applied Statistics Laboratory, General Electric, USA

We address the problem of forecasting viewership for a television company by using television ratings provided by the Nielsen Media Research. The data we use consists of time series of daily ratings for an arbitrary television company, data as reported by the Nielsen Media Research. The daily ratings are computed from a finer, more detailed dataset (half hour instances of ratings estimates) to represent the average rating estimate for that particular day. The advantages of having such viewership predictions are numerous; for example, they could help in better pricing contracts with advertising companies, and others. We use spectral decomposition techniques to separate, in an additive manner, the various components of the transformed daily ratings time series data, followed by fitting of parametric models to the long-term and seasonal components, and autoregressive models to the short-term component. We then use these parametric models to produce our forecasts. We performed an out-of-sample validation study comparing the forecasts of our decomposition model to the actual values observed in the out-of-sample period as well as to the results of other potential competitors of our method (the seasonal ARIMA method and the Holt-Winters method).

Email: neagu@research.ge.com

An analysis of seasonality of non-OPEC supply

Seyed Mohammadreza Tayyebi Jazayeri, Aziz Yahyai

Petroleum Market Analysis Department, Organization of Petroleum Exporting Countries (OPEC), Austria

The purpose of this study is first to find out whether quarterly averages of non-OPEC supply follow a seasonal pattern. If that is mathematically established, then, second, we estimate the best seasonal factors to decompose the forecast yearly average into quarterly averages. A set of historical data consisting of quarterly supply averages of individual countries, regional subtotals and the aggregate non-OPEC supply for the period 1973–2002, forms the basis of the analysis. The study applies Fourier analysis to quarterly supply series to test for seasonality, and provides estimates of seasonal factors for the years 2000–2002 by applying the so-called X-11 decomposition method to the historical annual averages. The accuracy of the results of the application of X-11 is then tested. It is demonstrated that the combination of the Fourier and X-11 methods provides mostly acceptable and, in some cases such as that of China, impressively accurate forecast quarterly supply averages.

Email: sjazayeri@opec.org

Modelling the evolution of inter-purchase times for consumer packaged products

Nigel Meade

Tanaka Business School, Imperial College London, UK

Towhidul Islam

Department of Consumer Studies, University of Guelph, Canada

A model of the evolution of inter-purchase times for a consumer-packaged product is developed. After the introduction of the product, a consumer waits until the initial purchase, then either waits to repurchase or decides not to repurchase. A consumer who decides to repurchase repeats this decision process. The components of the model are the probability of repurchase and the density function of the time to repurchase at each stage of the purchasing cycle. The issues of interest are: the number of repeat purchases before stability is reached; the strength of the association between successive repurchase times; the effects of household characteristics on inter-purchase times; and the problems in dealing with censored data (as fewer people are left in each repurchase). The model is estimated for two products using Australian panel data. Using the parameter estimates from the fitted model of an individual household's behaviour, the aggregate behaviour of a population of households is simulated to produce a time series of product sales. The effect of model parameters on the properties of the time series is investigated.

Email: n.meade@imperial.ac.uk

D5

Contributed session: Demography

Wednesday 10.10am–11.15am

Room: Cambridge II

Chair: Robert Raeside, Napier University, Scotland**Global projections of household numbers using age determined ratios**

Victor E Jennings, Duncan S Ironmonger

Households Research Unit, The University of Melbourne, Australia

Conrad W Lloyd-Smith

CATT Centre, RMIT University, Australia

Age determined ratios are used to estimate household intensities (household per person) using an additive and a bounded model. Household projections are given to 2050 for the world, and to 2030 for seven fertility transition subgroups (cohorts) of the countries of the world. Based upon United Nations 2000 Revision data, from an estimated 1.5 billion households at 2000, growth to 2030 is projected to be an additional 1.1 billion households, whether population increase is 1.5 billion persons under the United Nations low fertility variant, or 2.7 billion persons under the high fertility variant. At that date, one third of all households are projected to be Chinese or Indian. By 2050 it is projected that there will be 3.4 billion households, with a 95 per cent confidence interval on modelling error of 0.4 billion. This compares with 3.2 billion in the Global Report on Human Settlements 1996. The apparent similarity of total household growth under various scenarios conceals a wide range in the growth of household intensities across fertility transition cohorts. A biennial standardized revision technique is proposed to upgrade models and projections, and reassess error. It is recommended that household projections should be produced coincidentally with population projections.

Email: vjennings@surf.net.auWeb: www.economics.unimelb.edu.au/dept/household/hholdunit.htm**Forecasting the fertility of rural Bangladesh**

Robert Raeside, Kaberi Gayen

Centre for Mathematics and Statistics, Napier University, Scotland

Over the last 20 years the total fertility rate of women in rural Bangladesh has almost halved, to around 3.4 children. Surveys of women have been conducted in six rural villages to ascertain variables that have influenced their decision to adopt family planning. Amongst these, communication variables such as frequency of mass media messages, and interpersonal communication as measured through sociometric approaches, emerge as important. Other important variables include the usual demographic and socio-economic variables. A model has been constructed to predict family planning use. Considered in this paper is the future of these variables and whether or not pressure to adopt family planning will increase. It is shown that the future course of fertility in Bangladesh will very much depend on the economic outlook. If the job market expands then fertility will continue to fall, but if there is no expansion then there could well be a catastrophic rise in fertility.

Email: r.raeside@napier.ac.uk

E8

Contributed session: Applications

Wednesday 10.10am–11.15am

Room: Cambridge IV

Chair: Luis C Nunes, Universidade Nova de Lisboa, Portugal**Predicting Japanese bankruptcies**Abhinanda Sarkar, D Bal, K Das, A Kumar
GE Global Research, GE, IndiaJack Lu
GE Consumer Finance, GE, Japan

The continuing recession in Japan has led to a steady growth in the number of personal bankruptcy filings in that country. In turn, this has altered the credit management landscape. Being able to get some foresight into the both the short-term and the long-term scenario in personal bankruptcies is thus of great benefit to the Japanese consumer finance industry. This work is an effort in that direction based on monthly data for the past decade. Both endogenous variation and exogenous variables are leveraged. After factoring out business cycle trends and monthly effects, unemployment rates are incorporated with suitable lags. A macro relationship between unemployment and bankruptcies is derived based on natural rates. This, together with short-term corrections based on consumer debt levels, leads to a multi-horizon prediction strategy. An operational system is also described wherein forecasts can take into account expert opinion on immediate or long horizon trends. Comparisons are made with vector autoregression methods and their cointegration and causality implications. Results indicate that appropriate seasonality adjustments substantially enhance forecast accuracy and that the improving employment scenario in Japan is brightening the bankruptcy picture. Consequently, there may be less pressure on reserves for consumer lending.

Email: abhinanda.sarkar@geind.ge.com

An approach for timely estimations of the German GDP

Andreas Cors

Department of Macro Analysis and Forecasting, German Institute for Economic Research (DIW Berlin), Germany

Vladimir Kouzin

University of Frankfurt, Germany

Using econometric methods, we show that a system of moving 'nowcasts' for main aggregates of the production side of GDP in Germany proves to be a reliable indicator for current trends in economic performance. The findings of the paper are the result of calculations based exclusively upon national accounts data (SNA 1995). The fact that some monthly components, which are published in advance, are directly linked to GDP aggregates proved to be an advantage: they could therefore serve as reliable signals for nowcasts. The paper compiles groups of components in order to achieve sufficiently relevant signals. When no components could be identified, estimations were based upon autoregressive techniques. The quality of the estimations is compared with the reference figures of the Statistical Office in Germany. It turns out that the forecast outperforms an autoregressive benchmark estimation.

Email: acors@diw.de

Web: www.diw.de

The increasing public expenditure demand: a synthetic model of its determinants. The Spanish case (1968–1995)

Luis A Palma-Martos

Economics, University of Seville, Spain

Manuel Jaén-García

Economics, University of Almería, Spain

Most studies about public expenditure increase confirm that the use of bivariate models give contradictory and non-realistic results. In addition, the analysis of the secular increase of government size has been done without connecting the economic and political perspectives. Therefore, the inferences obtained from those studies are that the government works within a political or economic emptiness. It seems obvious the fact that public expenditure size is determined by a complex group of factors which are part of what could be called prevalent economic and/or political structures. The nonexistence of a theory generally accepted or contrasted leads us to expose a synthetic model which incorporates elements from many theories within a coherent scheme to explain the determinants of the increase of public expenditure from a demand perspective. In order to do this we contrast a public expenditure demand equation, taking as dependent variable the ratio public expenditure/GDP in nominal terms. The independent variables are classified in two groups: economic-structural and political-institutional. A cointegration analysis will lead us to obtain the long-term relations among variables. This will let us establish the determinants of public expenditure from the demand side. In addition, the model lets us predict the evolution of public expenditure from the demand point of view and estimate the percentage of GDP that will be destined to the public sector.

Email: lpalma@us.es

Coincident and leading indicators for the euro area: a frequency band approach

Luis C Nunes

Faculty of Economics, Universidade Nova de Lisboa, Portugal

The aim of this paper is to build monthly coincident and leading composite indicators for the euro area business cycle. In contrast with previous literature, where the variables to be included in the composite indicators are chosen according to their overall co-movement with the business cycle, we resort to frequency domain analysis to achieve additional insight about their relationship. We find that, in general, the lead/lag properties of the variables depend on the cycle's periodicity. Up to now this feature has been disregarded in the construction of the composite indicators. In order to take it into account, we follow a frequency band approach. The resulting indicators are analysed and a comparison with other composite indicators proposed in the literature is made. We find that this approach allows for substantial gains when the focus is on leading indicators and it becomes increasingly more important when the desired time lead increases.

Email: lcnunes@fe.unl.pt

M11

Panel discussion

Wednesday 10.10am–11.15am

Room: Grand Ballroom II

Chair: J Keith Ord, Georgetown University, USA**Do forecasting competitions miss the (turning) point?****Panelists:**

Antonio Garcia-Ferrer

Universidad Autónoma de Madrid, Spain

Michele Hibon

INSEAD, France

J Keith Ord

Georgetown University, USA

Jerry Shan

Hewlett-Packard Company, USA

The criteria used to evaluate performance in forecasting competitions such as M3 are typically error measures based upon point forecasts. Such competitions have usually reached the conclusion that simple methods work at least as well as more sophisticated approaches. The panel will explore the question of whether the criteria used build in a bias that leads to the conclusion. In particular, do the criteria lead us away from methods that pick up longer-term trends, identify turning points, or reflect the impact of policy changes? The panel has been selected to reflect a range of viewpoints on the subject.

F7

Invited session: Bayesian methods in finance

Wednesday 10.10am–11.15am

Room: Bradfield Lounge

Chair: Richard H Gerlach, University of Newcastle, Australia**Bayesian analysis of nonlinear and non-Gaussian state space models via multiple-try sampling methods**

Mike KP So

Department of Information & Systems Management, Hong Kong University of Science and Technology, China

We develop in this paper three multiple-try blocking schemes for Bayesian analysis of nonlinear and non-Gaussian state space models. To reduce the correlations between successive iterates and to avoid getting trapped in a local maximum, we construct Markov chains by drawing state variables in blocks with multiple trial points. The first and second methods adopt autoregressive and independent kernels to produce the trial points, while in the third method, we sample along suitable directions. Using the time series structure of the state space models, the three sampling schemes can be implemented efficiently. In two multimodal examples, the three multiple-try samplers are able to generate desired posterior sample, whereas existing methods fail to do so.

Email: immkps@ust.hk

Assessing and testing for asymmetric behavior in stock returns

Cathy WS Chen

Department of Statistics, Feng Chia University, Taiwan

Mike KP So

Department of Information & Systems Management, Hong Kong University of Science and Technology, China

This paper examines the hypothesis that financial returns exhibit mean and volatility asymmetries. We propose a threshold nonlinearity test for financial time series. Our method adopts the idea of Green (1995), reversible-jump Markov chain Monte Carlo methods, to calculate the posterior probabilities of two competitive models, namely a conventional GARCH model and a double-threshold GARCH model. Posterior evidence favoring the threshold GARCH model indicates threshold nonlinearity, or mean and volatility asymmetries. Simulation experiments demonstrate that our method works very well in distinguishing between the conventional GARCH and the double-threshold GARCH models. In an application to G-7 market indices, clear evidence of threshold nonlinearity is discovered, supporting an uneven mean-reverting pattern and volatility asymmetry.

Email: chenws@fcu.edu.tw

MCMC methods for analysing and comparing volatility models: with application to VaR forecasting

Richard H Gerlach, Jin-Sung Park, Frank Tuyt

University of Newcastle, Australia

This paper employs MCMC methods, via the importance sampling technique to efficiently estimate goodness-of-fit diagnostics and model likelihoods incorporating parameter uncertainty. The methods are applied to analysing and comparing GARCH and SV models with regime switching and leptokurtic error distributions for the S&P500 market index, plus incorporation of parameter and model uncertainty into VaR forecasts.

Email: Richard.Gerlach@newcastle.edu.au

J5

Invited session: Judgmental forecasting & the Juster Scale

Wednesday 10.10am–11.15am

Room: Harlequin Room

Chair: Mathew Parackal, University of Otago, New Zealand**Forecasting mutually exclusive behaviours using the Juster Scale**

Mathew Parackal

Department of Marketing, University of Otago, New Zealand

An application of the Juster Scale that has considerable practical use is in forecasting mutually exclusive behaviours. Researchers have employed this application successfully to forecast election results, switching behaviour between competing products and market shares. The challenging part of this application is in getting respondents to indicate probability scores that are relative to the alternatives. Respondents, in general, tend to give probability scores treating each alternative as being independent. Consequently, the probability scores fail to reflect the behaviour of the sample towards each alternative.

Researchers in the past have used a weighting procedure to fix the above discrepancy. While the weighting procedure allowed the logical interpretation of results, investigation into its accuracy was not satisfactory. Another method used to collect probability data for a set of mutually exclusive behaviour is the constant sum scale. This method forces respondents to give probability scores to alternatives that add up to a constant number (usually 100 or 10). While the two methods have individual merits, no study has actually compared them. In this presentation, first the Juster Scale application will be explained, following which, results of a study that compared the two methods will be discussed.

Email: mparackal@business.otago.ac.nz

A meta analysis of Juster Scale errors: Juster versus intentions

Murray S MacRae

Department of Marketing, Massey University, New Zealand

Researchers have demonstrated the Juster Scale to be better than purchase intention measures in predicting the proportion of a population that will buy. Despite this, the Juster Scale is frequently considered too inaccurate for business needs. This may be because, in the past, only predictions of car purchases have been shown to give managerially acceptable accuracy.

This paper examines Juster Scale prediction accuracy through a meta-analysis of 137 comparisons of Juster estimates and actual buying taken from thirteen studies across consumer durables, fast moving consumer goods and consumer services. The results are clear: the Juster Scale is accurate in predicting purchase proportions. Even in telephone surveys, the Juster Scale's derivative, the Verbal Purchase Probability Scale delivers errors well within managerially acceptable levels.

Email: m.s.macrae@massey.ac.nz

Developing a method of collecting purchase probability data in telephone interviews

Dean L Hini

Colmar Brunton Research Ltd, New Zealand

Mike Brennan

Department of Marketing, Massey University, New Zealand

The Verbal Purchase Probability scale (based on the Juster Scale) is an eleven point purchase probability scale designed for use in telephone interviews.

This research investigated ways to improve the accuracy of predictions obtained using the Verbal Purchase Probability scale. The first method was using respondent recall of previous purchase behaviour prior to asking the probability questions. The second method tested was using a bounded prediction technique (asking predictive questions over two time periods of 8 weeks and 4 weeks). The bounded prediction technique proved to be effective, while asking respondents to recall previous purchasing behaviour was not. However, it was found that accurate recall at the time of making a prediction was a precursor to more accurate purchase level predictions (but not purchase rate predictions).

Further investigation of the prediction errors found that 'non-users' had significantly larger errors in their purchase level predictions than 'users'. This led to a new and improved method of estimating purchase levels by assuming non-users have a zero purchase probability and thus the predicted purchase level is equal to the purchase level of users only.

Email: dean.hini@cbrwn.co.nz

N4

Invited session: Semi- and non-parametric methods of forecasting

Wednesday 10.10am–11.15am

Room: Cambridge III

Chair: Irene Gijbels, Université Catholique de Louvain, Belgium**Multivariate conditional quantile prediction**

Jan G De Gooijer

Department of Quantitative Economics, University of Amsterdam, Netherlands

We introduce a nonparametric quantile predictor for multivariate time series via generalizing the well-known univariate conditional quantile into a multivariate setting for dependent data. Applying the multivariate predictor to predicting tail conditional quantiles from foreign exchange daily returns, it is observed that the accuracy of extreme tail quantile predictions can be greatly improved by incorporating interdependence between the returns in a bivariate framework. As a special application of the multivariate quantile predictor, we also introduce a so-called joint-horizon quantile predictor that is used to produce multi-step quantile predictions in one go from univariate time series realizations. A simulation example is discussed to illustrate the relevance of the joint-horizon approach.

Email: j.g.degooijer@uva.nl

Forecasting locally stationary time series

Sebastien Van Bellegem

Institut de statistique, Université catholique de Louvain, Belgium

When an observed time series is covariance stationary, a forecasting procedure is usually constructed using the invariance of its covariance structure (as for computing the Yule-Walker equations, for instance). However, most of the time series observed in the applied sciences are likely to be nonstationary, meaning that the covariance structure of the process can change over time. This phenomena has been confirmed by statistical tests in many fields, such as in finance, biology or meteorology, to name but a few. The question arises as to how to forecast such processes for which the covariance structure is no longer assumed to be constant.

In this talk, we review some recent approaches that we have proposed to address this problem. Using the concept of local stationarity, we show how it is possible to define time series whose variance, covariance or spectral density can change over time. These time-varying quantities are estimated nonparametrically, and then exploited in order to construct a forecasting procedure and forecasting intervals. We study the performance of our approach on real data examples, and provide a comparison with standard stationary forecasters.

Email: vanbellegem@stat.ucl.ac.be

Measuring long-term nonlinear effects

Yingcun Xia

Statistics and Applied Probability, National University of Singapore, Singapore

In epidemiology, long-term effects such as air pollution on human health and vaccination on immunity, have been well demonstrated. However, there has been no method until now to measure the effects quantitatively. In this paper, we propose a statistical method to measure the effects based on semiparametric time series models. An efficient estimation method is developed. The effect of air pollution on respiratory and circulatory diseases in Hong Kong, and the decay function through time of immunity following influenza infection in France, are analyzed.

Email: staxyc@stat.nus.edu.sg

SM10

Invited session: Exponential smoothing

Wednesday 10.10am–11.15am

Room: Essex II

Chair: Richard B Lawton, University of West of England, UK**Method selection for exponential smoothing using information criteria**

Richard B Lawton

Faculty of Computing, Engineering & Mathematical Sciences, University of West of England, UK

A variety of method selection techniques have been recommended for selecting suitable exponential smoothing techniques for a set of data. These include the use of either the Akaike Information Criterion (AIC) or the Bayesian Information Criterion (BIC).

This paper uses a data mining technique to examine how best to use the information that the information criteria require, to see if they are employing it as efficiently as they might, and to assess which of the two is best suited to the task.

In the paper the selection techniques are trying to identify the correct method from a choice of simple exponential smoothing, Holt's method and the damped Holt's method. Seasonal series are not considered. The research involves generating series for which the optimal choice of method is known, and then seeing how well the selection techniques do at correctly determining the optimal method to use for the data.

The paper shows that neither the AIC nor the BIC are using the information on which they are based as efficiently as they could. It goes on to examine why this is the case.

Email: Richard.Lawton@uwe.ac.uk

Constrained optimisation of Holt's linear and damped Holt's forecasting methods

John E Boylan

Buckinghamshire Business School, Buckinghamshire Chilterns University College, UK

Natasha Atanackov

Faculty of Forestry, Belgrade University, Serbia and Monte Negro

An approach to trend forecasting, called constrained optimisation, will be introduced in this paper. By examining the optimality of two trended forecasting methods, Holt's linear and damped Holt's, for the Linear Growth Model and Damped Trend Model respectively, constrained sets of smoothing parameters may be obtained to minimise Mean Square Error. Previous research by Harrison identified the constrained set for the Linear Growth Model. In this paper, the constrained set is identified for the Damped Trend Model. It is expected that the forecasting performance of the relevant methods will be improved when their constrained versions are used, instead of their unconstrained equivalents.

The influence of the constrained set of the smoothing parameters on the forecasting performance of Holt's linear and damped Holt's methods has been tested by a simulation experiment with theoretically generated data. The results have shown that improved forecast accuracy may be obtained for all forecasting horizons tested (up to six-steps ahead). The validity of these findings has been also tested on empirical data sets including non-seasonal M3-competition data and data from a software company. The empirical analysis confirmed the improvement in forecast accuracy of the above methods when the constrained sets of parameters were employed.

Email: john.boylan@bcuc.ac.uk

Exponentially weighted quantile regression

James W Taylor

Saïd Business School, University of Oxford, UK

Exponentially weighted least squares regression, with a constant term and no regressors, is equivalent to simple exponential smoothing of the level of a series. If a time variable is included as a regressor, the regression is equivalent to Brown's double exponential smoothing. The robustness and accuracy of exponential smoothing for point forecasting motivates the development of the approach for density and interval forecasting. Just as least squares regression can be used to estimate parameters in a model for the mean, quantile regression enables parameter estimation in a model for a quantile. In this paper, we introduce exponentially weighted quantile regression. With a constant term and no regressors, the regression can be viewed as simple exponential smoothing of the cumulative distribution function. We consider the inclusion of a time variable, as in Brown's method, and also seasonal terms. We illustrate the use of the approach for density and interval forecasting for inventory control data and for financial returns.

Email: james.taylor@sbs.ox.ac.uk

J6

Featured talk

Wednesday 11.40am–12.45pm

Room: Grand Ballroom II

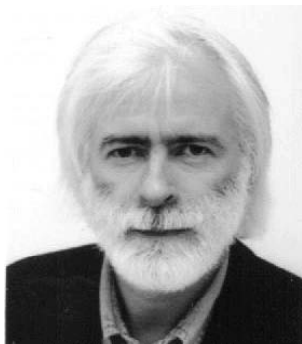
Chair: Marcus O'Connor, University of Sydney, Australia**Judgment in forecasting**

Nigel Harvey

University College London, UK

Judgment enters into forecasting in many ways. It influences development of formal models, choice of forecasting methods, how forecasts are combined, and how they are assessed. It is often the primary way in which forecasts are produced, combined, or adjusted. What is known about judgment in these types of task? Is it good? Does it show systematic biases? What factors influence it? Can it be improved? How does it work? These are among the questions that I shall address.

Email: n.harvey@ucl.ac.uk



Nigel Harvey is Professor of Judgment and Decision Research at University College London. He is President of the European Association for Decision Making, Associate Editor of *Thinking and Reasoning* and the *International Journal of Forecasting*, and serves on the editorial board of the *Journal of Behavioral Decision Making*. His research on judgmental forecasting and judgmental combination of forecasts has focused on the nature of the cognitive processes underlying performance of these tasks, and on the circumstances in which these processes produce various types of forecast error.

E9

Contributed session: Labour market

Wednesday 11.40am–12.45pm

Room: Cambridge II

Chair: Hasan Al-Madfai, University of Glamorgan, UK**Predicting early exits from royal naval services**

Shabbar Jaffry, Yaseen Ghulam

Department of Economics, University of Portsmouth Business School, UK

A number of factors place constraints on the management of Naval manpower, which are mainly attributed to its hierarchal administrative structure. This structure is very different from most other organisations. The main differences are: the single point of entry at the lowest cadre, the long lead time for training, the skill specialisation and the job for life, if wanted. To maintain the right skill mix, manpower retention has recently become one of major management goals.

In this paper we test how the internal job related factors, external labour market conditions, and fluctuations in the macro economy affect the premature voluntary exits of Officers and Ratings. This paper reports predictions of premature (voluntary) employment exits, with the use of a unique Naval administrative longitudinal data set. A group as well as individual level predictions of early exits, using econometric techniques of duration analyses and logistic regression are compared. This paper is one of the first attempts to thoroughly investigate early exits, and provides relevant insights and predictions of early exits for the manpower retention policy in the Royal Navy.

Email: shabbar.jaffry@port.ac.uk

Modelling the unemployment rate of two urban aggregates in Argentina (1974–2002)

María T Blaconá, Javier Bussi, Nora I Ventroni

School of Statistics, National University of Rosario, Argentina

The unemployment rate in Argentina has shown a slow increasing trend in the last 30 years but it is in the decade of 1990 that presents a steep rise reaching a historic maximum with rates around 20%. In this work the series of unemployment rates of two Argentine urban aggregates, Rosario and Buenos Aires in the period 1974–2002 (biannual observations) are studied. The approach of this analysis focuses on three aspects: (i) detection of changes in structure; (ii) determination of the most relevant characteristics of the series; and (iii) utilization of the concept of cointegration and error correction models in order to determine the behavior of the series in the long run. In both urban aggregates outliers and changes in level are determined using structural state-space models. This information is taken into account in the determination of unit roots. A cointegration relation with stochastic common trend and non-zero mean is obtained considering changes in level. In the ECVAR model, the estimation of the adjustment parameter for Rosario is significant but it is not so for Buenos Aires.

Email: mblacona@agatha.unr.edu.ar

Forecasting unemployment

Hasan Al-Madfai

Division of Mathematics and Statistics, University of Glamorgan, UK

Ray Thomas

Faculty of Social Sciences, Open University, UK

Campion Fellow, Royal Statistical Society, UK

The conventional unemployment rate, a measure of stock, is a lagged indicator of trends in the labour market. But the stock of unemployment can be seen as a set of transition matrices covering a range of duration groups. Population at risk (PAR) unemployment rates measure flows between, or from, unemployment duration groups, use a period of time as a denominator, and provide a tool for analysis of these transition matrices. The total stock of unemployment at the end of any period is the outcome of the number of entrants in earlier periods 'inherited' through a range of duration groups, and the 'external' conditions of the labour market encountered by the group. PAR rates indicate labour market response to unemployment, but suffer from strong seasonal variation. A variable decomposition (VD) approach that takes account of inheritance between successive duration groups is used to further the understanding of the cross duration group dynamics and for seasonal adjustment. A forecasting framework is developed that relates the number of entrants and the numbers in the range of duration groups to the total stock of unemployment.

Email: hmadfai@glam.ac.uk

F8

Invited session: Finance

Wednesday 11.40am–12.45pm

Room: Harlequin Room

Chair: Larry Pohlman, PanAgora Asset Management, USA**Directional forecasts of daily commodity futures prices using the Cusum method**

Debashis Guha

Big Sky Capital, LLC, USA

The problem of forecasting the direction of daily commodity futures prices is formulated as the problem of detecting changes in the mean of a stochastic process. It is known that the Cusum method enjoys certain optimality properties for this problem, and has been widely used as a successful online change detection method in practical applications.

In this study the Cusum method is applied to the daily price history of 19 exchange traded commodity futures contracts: corn, wheat, soybeans, soybean oil, crude oil, heating oil, unleaded gasoline, natural gas, EUR, JPY, GBP and CHF, S&P 500, long bonds, 10-Year Notes, Eurodollars, gold, silver, and copper. The success of the forecasts is judged using both the Pesaran-Timmemann test applied to the directional returns, and a simple Wald test applied to the return series.

The directional forecasts are significantly successful, according to the Pesaran-Timmerman test, for 18 out of the 19 contracts tested, failing only for copper. The success of the results from the Wald test is only slightly less impressive, being highly significant for wheat, corn, soybean oil, natural gas, EUR, JPY, CHF and silver, and significant at a lower level for heating oil, bonds and gold.

Email: dguha@bigskycap.com**The value line Dow Jones model: does it have predictive content?**

Thomas B Fomby, Limin Lin

Department of Economics, Southern Methodist University, USA

At the end of every year the Value Line (VL) Corporation publishes its forecasts of the Dow Jones Index and its probable ranges for the coming three years using a three variable multiple regression model. The regression model explains the current year's percentage change in the index as a function of the current year's percentage in earnings produced by the Dow Jones companies, the current year's percentage change in the dividends paid by the companies, and the current year's percentage change in the yields paid on AAA corporate bonds. The model is a static time series model. Therefore, forecasts of the Dow Jones Index rely on forecasts of the independent variables. Obviously the forecast accuracy of the model will depend on the accuracy of the forecasts of the independent variables. This study examines the ex ante forecasting accuracy of the VL Dow Jones model using some out-of-sample forecasting experiments. The forecasting accuracy of the VL Dow Jones model is compared with a benchmark Box-Jenkins model and with several combination methods. The usefulness of the leading indicators in forecasting at different horizons is further examined.

Email: tfomby@mail.smu.edu

Mining for money

Larry Pohlman

PanAgora Asset Management, Boston, USA

Anthony Waclawski

SAS Institute, Inc., USA

Researchers have found that fundamental economic factors can be used to forecast security returns. However, what factors to include, and how to model the relationship, remain open questions. Financial economists have carefully selected and tested a small set of variables suggested by economic theory. At the other extreme, Morillo and Pohlman (2002) forecasted equity market returns by applying the dynamic factor model of Stock and Watson (1998) to a large set of macroeconomic variables. In this article we apply the latest data mining techniques to forecasting equity market returns. The results are economically significant.

Email: lpohlman@panagora.com

M12

Invited session: Improving official statistics using forecast techniques

Wednesday 11.40am–12.45pm

Room: Essex I

Chair: Xichuan (Mark) Zhang, Australian Bureau of Statistics, Australia**Further developments in X-12-SEATS**

Brian C Monsell

Statistical Research Division, US Census Bureau, USA

In collaboration with the current developers of the SEATS seasonal adjustment program, an experimental version of X-12-ARIMA that produces model based seasonal adjustments from SEATS has recently been made available to users. This program allows users of seasonally adjusted series to generate X-11 and SEATS seasonal adjustments using the same interface, and compare these seasonal adjustments using a common set of diagnostics. This session will demonstrate how SEATS adjustments are integrated into the X-12-ARIMA procedure, give examples of new modelling options such as seasonal outliers and pulse regressors, and discuss further directions for this work.

Email: brian.c.monsell@census.gov**Forecasting to improve official statistics**

Richard Penny

Analytical Support Division, Statistics New Zealand, New Zealand

National Statistical Offices (NSO), such as Statistics New Zealand, supply a vast range of economic and social time series. NSOs are constantly attempting to improve the timeliness, quality, and range of these times series. Also NSOs must be aware of respondent burden and work within resource constraints. Auxiliary time series can be used to increase the frequency of the available series. Indicator time series will be available at a high frequency (e.g., monthly), but do not directly measure the series of interest. The series of interest, or benchmark series, can only be measured at a lower frequency (e.g., quarterly). Questions as to the stability of the model are of importance, as recent indicator series will be available before the benchmark. Work in this area is also applicable to the question of the number of time series used to create and index series such Quarterly Gross Domestic Product.

Email: richard.penny@stats.govt.nz**Improving official statistics using forecast techniques**

Xichuan (Mark) Zhang, Craig H McLaren

Time Series Analysis, Australian Bureau of Statistics, Australia

Official statistics focus on the accuracy of seasonally adjusted and trend estimates of a time series at the current end. Efforts have been made to reduce the revisions of the estimates once future data is available. Many approaches often use implied static projection methods to derive the current estimates without using unknown future data.

We argue in favour of using proper time series modelling techniques, because they take the characteristics of the time series into account, and often provide a more accurate forecast into future than static projections do. The improvement for the seasonally adjusted and trend estimates at the current end will be illustrated by applications of univariate and multivariate (cointegration) forecast techniques to real economic time series.

Email: mark.zhang@abs.gov.au

SM11

Invited session: Exponential smoothing

Wednesday 11.40am–12.45pm

Room: Cambridge III

Chair: Richard B Lawton, University of West of England, UK**A pedant's approach to exponential smoothing**

Ralph D Snyder

Business & Economic Forecasting Unit, Monash University, Australia

An approach to exponential smoothing that relies on linear single source of error state space models is outlined. A method for obtaining maximum likelihood estimates of the associated smoothing parameters is presented. Modifications to the standard stability conditions on the smoothing parameters are proposed.

Email: ralph.snyder@buseco.monash.edu.auWeb: <http://www.buseco.monash.edu.au/depts/ebs/pubs/wpapers/2004/>**Forecasting time series with multiple seasonal patterns**

Anne B Koehler

Department of Decision Sciences and Management Information Systems, Miami University, USA

J Keith Ord

McDonough School of Business, Georgetown University, USA

Rob J Hyndman, Ralph D Snyder, Phillip G Gould

Business & Economic Forecasting Unit, Monash University, Australia

The use of exponential smoothing methods and models for forecasting time series with multiple seasonal patterns is investigated. An example of such a time series would be hourly data with one pattern that repeats every day and a second pattern that repeats every week. Another example would be daily data with one pattern repeating every week and a second pattern repeating every year. The single source of error state space model for the additive Holt-Winters method is extended to models for data with more than one seasonal pattern. The implementation of the new models for forecasting is illustrated with real time series.

Email: koehleab@muohio.edu**Intermittent demand forecasting: modelling as a Poisson process**

John E Boylan

Buckinghamshire Business School, Buckinghamshire Chilterns University College, UK

Roy Johnston, George C Karakostas, Estelle A Shale

Business School, Warwick University, UK

It is known that forecasting of intermittent demand may suffer from an order-point bias, whereby the estimate of mean demand is inflated just after a demand occurs, if standard averaging or exponential smoothing methods are used. Forecasting may also suffer from an inversion bias, whereby the estimate of mean demand is inflated (since the expected value of a reciprocal is not the same as the reciprocal of an expected value) if Croston's method is used. In work presented at a previous conference, approximate correction factors for Bernoulli processes have been discussed. In this paper, correction factors for Poisson and Erlang processes are presented. Although the factors are not exact, extended simulation experiments have shown that the approximations are generally very good.

The paper proceeds to examine the sensitivity of the new findings to various deviations from the model assumptions. The effect of the averaging method (unweighted or exponentially weighted) is considered as part of this evaluation. Empirical work on the forecast accuracy implications of correction factors is also summarised, and avenues for further work in this area are discussed.

Email: john.boylan@bcuc.ac.uk

SM12

Contributed session: Time series analysis

Wednesday 11.40am–12.45pm

Room: Essex II

Chair: Stephen J Leybourne, University of Nottingham, UK**Comparison between Akaike's Information Criterion and Akram Test Statistic**

Irfan Ahmed

The University of Lahore, Pakistan

Akram M Chaudhry

Department of Business Administration, The University of Bahrain, Kingdom of Bahrain

The identifiability problem of models is crucial in almost all dynamic systems. Researchers have devised various information tools to help them choose one of several candidate models for analysis and projection of data. For optimal predictions, the model that can predict values of the dependent variable outside the sample is chosen instead of choosing the model best fitting the data. Thus, model selection is not about whether something is true or not, but about whether we have enough information to characterize it properly.

This paper attempts to compare the performance of two approaches, Akaike's Information Criterion (AIC) and Akram Test Statistic (ATS), for the identification of statistical models for analysis and forecasting. The first is parametric in nature while the second is distribution free. The paper shows that ATS performs at least as well as AIC as far as robustness, parsimony and simplicity are concerned, besides numerous other advantages.

Email: irfanstats@yahoo.com**Improving timeliness of industrial short-term statistics using time series analysis**

Frank Aelen

Department of Methods and Informatics, Statistics Netherlands, The Netherlands

National statistical institutes are under growing pressure to improve the timeliness of short-term economic statistics. The aim of this study was to improve the timeliness of the monthly statistics on sales development in the Dutch manufacturing industry. Producing timely statistics implies estimation of indicators in the presence of missing data. Currently, missing data are imputed using, besides already available data for the month in question, known data from only one previous month, whereas we propose to use whole time series for that purpose.

Using the regARIMA time series analysis method, forecasting of the missing values is done on an aggregate level, that is, not for each enterprise separately. In order to improve the forecasts and to make sure that turning points in the business cycle are dealt with properly, a regression variable is used that is based on present and historical data from early responding enterprises, also on an aggregate level.

The relationship between timeliness and accuracy was investigated. It was concluded that with respect to the current method timeliness can be improved from 37 days to 27 days after the end of the month, without sacrificing accuracy. Further improving timeliness is only possible at the cost of reduced accuracy.

Email: faIn@cbs.nlWeb: www.cbs.nl/en/publications/articles/general/discussion-papers/discussion-papers.htm

A note on improving imputations using time series forecasts

Petra Jansson, Maria Kringsman, Lars-Erik Öller
Statistics Sweden, Sweden

The presence of nonresponse is a source of inaccuracy in surveys that is hard to handle and has been a matter of concern for decades. There are several methods for dealing with missing values. Some conventional methods seem to use available information inefficiently. Others are based on expert opinion, lacking both objectivity and transparency. This paper examines the application of forecasts using a simple combination method called the trend method, ARIMA, ARIMA-Regression and Transfer Function models as methods for imputation. Results suggest that a more efficient use of information, both temporal and spatial, pays off for imputations, even in small samples.

Email: petra.jansson@scb.se

Modified tests for a change in persistence

Stephen J Leybourne, David I Harvey
School of Economics, University of Nottingham, UK
Robert Taylor
Department of Economics, University of Birmingham, UK

Being able to correctly characterize an observed time series into its separate difference stationary and trend stationary regimes, should they exist, has important implications for effective model building and forecasting in economics and finance. Existing ratio-based statistics test the null hypothesis that a time series displays constant trend stationarity, $I(0)$, against the alternative of a change in persistence from trend stationarity to difference stationarity, $I(1)$, or vice versa. Here, however, we demonstrate that these tests are unable to adequately discern between a true change in persistence and a constant $I(1)$ process. We propose modified tests which, by design, have the same critical values regardless of whether the process is $I(0)$ or $I(1)$ throughout. Hence, our null hypothesis is that of constant persistence (either constant $I(0)$ or constant $I(1)$). Tests directed against both $I(1)$ to $I(0)$ and $I(0)$ to $I(1)$ persistence changes are provided, together with tests where the direction of change under the alternative is unspecified. Our tests retain the same rates of consistency against persistence change processes as their unmodified counterparts. Simulation evidence suggests that our new procedures work extremely well in practice, with the modified tests correctly being sized in both constant $I(0)$ and constant $I(1)$ environments, and displaying only very modest losses in power, relative to unmodified tests, against persistence change processes.

Email: steve.leybourne@nottingham.ac.uk

T7

Contributed session: Telecommunications

Wednesday 11.40am–12.45pm

Room: Bradfield Lounge

Chair: Stuart I Bretschneider, Syracuse University, USA**Modelling and forecasting multi-generation, multi-country, mobile phone adoption**

Towhidul Islam

Department of Marketing and Consumer Studies, University of Guelph, Canada

Nigel Meade

Tanaka Business School, Imperial College London, UK

A multi-country multi-generation model of mobile phone adoption is presented that simultaneously considers the two current generations of mobiles available. The adoption of the first generation of analog phones has peaked in most countries, but adoptions continue. The second generation of digital mobile phones will attract fresh subscribers in addition to attracting existing analog users. The multi-country approach allows the use of cross-sectional information on the characteristics of the innovation, the country and the context, that will enhance the forecasting in later adopting countries. The forecasts from this overall model are compared with univariate growth curve forecasts, combined forecasts and Holt's linear trend model.

Email: islam@uoguelph.ca

Multiple hierarchies in call minute forecasting

Clive Mason, Neil Fradgley

Analysis & Forecasting, Network Products, BT Retail, UK

Traditional call minutes from fixed line telephones have long been a major source of income for incumbent telephony service providers. Declining market demand, driven primarily by migration to mobile, email and internet based solutions, combined with an increasingly competitive & regulated market place, have driven the demands on call forecasters in BT to new levels of detail. The small team in BT Retail now consider more than 2000 time series on a monthly basis to forecast volume, revenue & gross margins across a range of call products and pricing packages to very demanding timescales. This paper discusses the hierarchical approach which has been developed, and some of the different methodologies adopted at different points of the matrix. The presentation will focus on the practicalities of the process rather than modelling theory.

Email: clive.mason@bt.com

Case study: evaluation of KISDI's judgmental forecast

Stuart I Bretschneider, Dongcul Shim

Center for Technology and Information Policy, Syracuse University, USA

This paper describes the process of forecasting demand for information and telecommunications technology used by the Korean Information Society Development Institute (KISDI). KISDI forecasts over the past 7 years are evaluated and alternative approaches to forecasting are proposed and evaluated. Forecasts are generated for domestic sales as well as imports and exports. Results suggest that while reasonable forecast accuracy is possible from univariate forecasts for domestic demand, imports and exports are more problematic.

Email: sibretsc@maxwell.syr.edu

Guidelines for chairs of sessions

In advance

- Advise presenters and discussants to follow the presentation guidelines.
- Obtain brief biographical information on all participants to use in your introduction.
- Prepare a brief introduction for each presenter. If the presenters have handouts, arrange for someone at the session to help distribute them at the appropriate time.
- Standard equipment will be placed in each room (one overhead projector, one screen and one data projector with cables). **The presenter is responsible for providing their own laptop for their presentation.**
- Allow 20 minutes for invited speakers and 15 minutes for contributed speakers. This will leave at least 5 minutes for discussion at the end of the session.

At ISF04

Before the session begins:

- Be in the room 10 minutes before your session begins.
- Check the condition of your meeting room, especially equipment and how/if the microphone(s) work. If assistance is needed, alert the Reception Desk. Check speakers' names (pronunciation), titles, and affiliations.
- Check the Errata Sheet at the Reception Desk for any last minute changes.

During the session:

- Announce any any changes to the program at the beginning of the session.
- Start on time. Timing and floor discussion are your responsibilities.
- Keep the introductions very brief when changing speakers.
- Insist that all speakers use the microphone if one is provided.
- Make sure that the presenters do not block the view of the screen.
- Hold each speaker to the allotted time.
- Remind speakers about their remaining time. For example, prepare flash cards for 5 minutes and 1 minute remaining. You must have a working watch. Tell each presenter the procedure you will use.
- If a presenter ends early or does not attend, use that extra time for questions and comments from the audience, the panel, or yourself. *Do not start* the next paper early.
- **Note:** You are authorized and instructed to stop the presentation of any speakers who do not adhere to the forecasting subject of their paper. Irrelevant or extraneous comments or handouts having nothing to do with the subject being presented are not permitted.
- Keep the questions brief and relevant for floor discussions. Be assertive in enforcing this. Restate the question to be sure that they are heard by all of the audience.
- End on time. Another session may be using your meeting room. Urge the audience to continue discussion elsewhere.

Guidelines for speakers

- Standard equipment will be placed in each room (one overhead projector, one screen and one data projector with cables). **The presenter is responsible for providing their own laptop for their presentation.**
- Be sure to use handouts or visuals, especially if you have formula, data or graphics.
- Time allocated:
 - Keynote speakers: 1 hour with 15 minutes questions
 - Featured speakers: 55 minutes with 10 minutes questions
 - Invited speakers: 20 minutes
 - Contributed speakers: 15 minutes
- The tips and suggestions below are intended to help you. Please put them to good use. Effective presentations make learning and technical advances more likely. They also enhance the perception of the presenter in the eyes of the professional community. Boring, ineffective presentations are not paid much attention and often are quickly forgotten, especially by planners of future invited sessions.

In advance

Content organization

- Make sure the audience walks away understanding the five things any listener to a presentation really cares about:
 - a. What is the problem and why?
 - b. What has been done about it?
 - c. What is the presenter doing about it?
 - d. What additional value does the presenter's approach provide?
 - e. Where do we go from here?
- Carefully budget your time, especially for short (e.g., 15 minute) presentations.
- Allow time to describe the problem clearly enough for the audience to appreciate the value of your contribution. This usually will take more than 30 seconds.
- Leave enough time to present your own contribution clearly. This almost never requires all of the allotted time.
- Put your material in a context that the audience can relate to. It's a good idea to aim your presentation to an audience of colleagues who are not familiar with your research area. Your objective is to communicate an appreciation of the importance of your work, not just to lay the results out.
- Give references and a way to contact you so those interested in the theoretical details can follow up.

Preparing effective displays

- Keep it simple. The fact that you can include all kinds of cute decorations, artistic effects and logos does not mean that you should. Fancy designs or color shifts can make the important material hard to read. Less is more.
- Use at least a 24-point font so everyone in the room can read your material. Unreadable material is worse than useless — it inspires a negative attitude by the audience to your work and, ultimately, to you. Never use a photocopy of a standard printed page as a display — it is difficult to overstate how annoying this is to an audience.
- Try to limit the material on each slide, keeping the number of words to a minimum. Summarize the main points — don't include every detail of what you plan to say. Keep it simple.
- Limit the tables to six rows/columns for readability. Sacrifice content for legibility —

unreadable content is worse than useless. Many large tables can be displayed more effectively as a graph than as a table.

- Label your graphs clearly with big, readable type.
- Use easily read fonts. In general, standard fonts are easier to read than fancy fonts. Avoid overuse of italics.
- Dark letters on light (or transparent) backgrounds work well for overheads. Light letters (yellow or white) on a dark background (e.g., dark blue) often will be easier to read when the material is displayed using data projectors. Avoid any lettering over the top of graphic images. It can make it impossible to read.
- Use equations sparingly — audience members not working in the research area can find them difficult to follow as part of a rapidly delivered presentation. Avoid derivations and concentrate on presenting what your results mean. The audience will concede the proof and those who really are interested can follow up with you, which they're more likely to do if they understand your results.
- When you do need to use equations, define your notation. An effective way in Powerpoint is to use "callouts".
- Don't fill up the transparency or slide; the peripheral material may not make it onto the display screen, especially the material on the bottom of a portrait-oriented transparency.
- Identify the journal when you give references: Smith, IJF03 clues the reader that the article is in a 2003 issue of the *International Journal of Forecasting*, and is much more useful than just Smith 2003.
- **Always** preview your slides. You will look foolish if symbols and Greek letters that looked OK on your computer don't translate into anything readable on the big screen.
- A common problem with Powerpoint presentations is that fonts are not embedded in the document and so equations lose important symbols. To embed fonts in Powerpoint, go to the Tools menu, select Options, click on "Save" and click "Embed truetype fonts".

Timing your talk

- All speakers find it valuable to practice their delivery before the actual presentation.
- Don't deliver a 30-minute talk in 15 minutes. Nothing irritates an audience more than a rushed presentation. Your objective is to engage the audience and have them understand your message. Don't flood them with more than they can absorb. Think in terms of what it would take if you were giving (or, better, listening to) the last paper in the last contributed paper session of the last day. This means:
 - Presentation time is limited, generally restricting you to only the main points of your paper.
 - Present only as much material as can reasonably fit into the time period allotted. Generally that means one slide or overhead per minute, or less.
 - Talk at a pace that everybody in the audience can understand. Speak slowly, clearly, and loudly, especially if your English is heavily accented.
 - Get colleagues to listen to you, including some who are not too knowledgeable on the topic of your paper; they will be able to point out places where you may not come across clearly.
 - Make such rehearsals as realistic as possible and time them.
 - Refining your timing is one of the most important aspects of your rehearsal.
 - Balance the amount of material you present with a reasonable pace of presentation. If you feel rushed when you practice, then you have too much material. Budget your time to take a minute or two less than your maximum allotment. Again, less is more.

Handouts

- Handouts are recommended. However, you should not merely read the handout to your audience.
- Handouts have an advantage over visual aids in that they are not subject to equipment availability and can be kept by the audience.
- Handouts should include your name and email address for those who want to request the final version of the paper.
- If you run out of handouts, be sure to collect business cards or names and addresses to mail copies later. Alternatively, provide interested people with an email address or web address from which they can obtain a copy of your handout.

At ISF04

- Check the Errata Sheet at the Reception Desk for any last minute changes.
- Talk to your session chair before your session so they are aware of who you are.
- Check the location of your room, so you can arrive on time.
- Arrive at the meeting room 10 minutes before the session begins to take care of last-minute details.
- Be sure that the Session Chair knows you are there.
- Make arrangements with the chair for the distribution of your handouts.
- In larger rooms, put on the microphone and be sure that it works before you begin.

The presentation

- Stay aware of the time for your presentation. The chair is required to stop your presentation at the end of the allotted time, regardless of whether or not you are finished.
- Speak clearly and loud enough to be heard in the back of the meeting room.
- Remember that many points sound differently when presented orally than when the reader can go back and forth over the printed words and symbols.
- Speak from notes — do not read verbatim the written version of your paper.
- Be sure everyone in the room can see your material. With transparencies, this often means that you have to pay attention to the position of the transparency on the projector because only the top half of the screen usually can be seen from the back of the room. Make sure you do not block the screen. Move around if you must so that everyone has a chance to see everything. Handouts are a big help.
- Never apologize for your displays. More to the point, make apologies unnecessary by doing the material properly in the first place (see the recommendations above). Do not say, “I know you can’t see this, but . . .” The reaction of many people in the audience will be “why bother showing it, then?” (Or, even worse, “Why didn’t you take the trouble to make them legible?”)
- Don’t apologize for incomplete results. Researchers understand that all research continues. Just present the results and let the audience judge. It is okay to say, “work is on-going”.

When finished

- Thank the audience for their attention
- Gather your materials and move off quickly to allow the next presenter to prepare
- Stay for the entire session, for the courtesy and benefit of your audience and your co-speakers. Afterward, be available for people to ask you questions.

Guidelines for posters

The poster session will be from 4.10pm to 4.50pm on Monday 5 July.

A poster session is a presentation where materials such as maps, photographs, graphs, charts, and/or tables are posted on a display board along with brief textual summaries of their work. Ideally, a well-constructed poster will be self-explanatory. Successful poster presentations are those which achieve both coverage and clarity.

Coverage: Have you provided all the obvious information? Will a casual observer walk away understanding your major findings after a quick perusal of your material? Will a more careful reader learn enough to ask informed questions? In addition to title/author and abstract, most successful posters provide brief statements of introduction, method, subjects, procedure, results, and conclusions. Ask yourself, "What would I need to know if I were viewing this material for the first time?" and then state that information clearly.

Clarity: Is the sequence of information evident? Indicate the ordering of your material with numbers, letters, or arrows when necessary. Is the content being communicated clearly? Keep it simple. Place your major points in the poster and have the non-essential, but interesting, sidelights for informal discussion. Be selective. Your final conclusions or summary should leave observers focused on a concise statement of your most important findings.

Each poster display should include a lettered sign giving the title and the name(s) of the presenter(s). This sign should be 15cm in height with letters at least 5cm high in a bold font. Extensive, imaginative use of captioned illustrations, photographs, graphs, or other types of visually appealing material is an extremely effective mode of communication in a poster presentation.

People attending a poster session are free to move about from poster to poster, which means they do not usually stop to read excessive text. Text should be limited to four or five pages, double-spaced, in a 16–20 point font. This will allow lettering to be read from a couple of metres away. Do not mount materials on heavy board because these may be difficult to position on the poster board. Be sure to provide clear labels for each section of your presentation.

At ISF04

- Check the Errata Sheet at the Reception Desk for any last minute changes.
- Be in the poster display area by 3.30pm to allow plenty of time to set up your presentation.
- After the presentation is concluded, remove your posted materials immediately.
- You will be provided with an 1.8m × 1.2m display board, push pins, and a table.
- Bring other materials that you might need, such as handouts.
- Do **not** write or paint directly on the display board.



international institute of forecasters

An international institute aimed at promoting the discipline of forecasting

Objectives

The International Institute of Forecasters (IIF) is a non-profit organization founded in 1981 with support from INSEAD, the Manchester Business School, IMEDE, Laval University, and the Wharton School. Its objectives are to stimulate the generation, distribution, and use of knowledge on forecasting. The *International Journal of Forecasting* is the official journal of the Institute.

RESEARCH

Develop and unify forecasting as a multidisciplinary field of research drawing on management, behavioral, social, engineering, and other sciences.

PRACTICE

Contribute to the professional development of analysts, managers, and policy makers with responsibilities for making and using forecasts in business and government

THEORY AND PRACTICE

Bridge the gap between theory and practice, with practice helping to set the research agenda and research providing useful results.

INTERNATIONAL SCOPE

Bring decision makers, forecasters, and researchers from all nations together to improve the quality and usefulness of forecasting.

Annual Conference

The IIF has held outstanding International Symposia on Forecasting in cities around the world beginning with Quebec City in 1981 and most recently in Mérida, Dublin, Atlanta, Lisbon, Washington DC, Edinburgh, Barbados, Istanbul, Toronto, Stockholm, Pittsburgh, Wellington and New York. Included in programs are plenary and featured speakers including international forecasting experts, about 250 research presentations in areas such as new product forecasting, multivariate methods, international trade forecasting, judgmental methods, financial forecasting, demographic forecasting, and rule-based methods, plus book and software exhibitors.

Membership

Membership is for individuals only. It is not available for organizations. Dues are US\$80 per year for regular membership, US\$40 for student members. Included are four issues of the *IJF*, price reduction in the Annual Conference registration fee and the IIF Newsletter. To join please complete the application form over the page.



International Institute of Forecasters Membership Application

Please accept me as a member of the IIF for the year commencing July, 2004. (If for a different calendar year, write in the applicable year instead.) Enclosed is my payment of US \$80.00 (regular membership) or US \$40 (student membership). Student members please include verification of your status. A statement on Department letterhead from your advisor or Department Head will suffice. Student membership is for a maximum of four consecutive years.

Kindly use a bank draft, international money order, postal check, or check drawn on a US bank. Please make check payable to IIF. We also accept payments by VISA and MASTERCARD.

Please print or type:

Name:

Affiliation:

Address:

City, State/Province:

Postal Code:..... Country:

Telephone:

Fax:

Email:

Academic or Practitioner? (Circle one)

Particular forecasting interests:

.....

Do you wish your contact information and interests to be added to a list of members accessible to any Internet user? Yes or No (Circle one)

If paying by credit card please complete the following information:

Card: VISA MASTERCARD (Circle one)

Name exactly as on card (if different from above):

Account number: Expiration date:

Billing address (if different from above):

.....

Please send this completed form with payment to:

International Institute of Forecasters
c/o P. Geoffrey Allen
Department of Resource Economics
University of Massachusetts
Amherst, Massachusetts 01003-2040 USA
Fax: 413.545.5853
Email: allen@resecon.umass.edu

Ask your
librarian to
subscribe

International Journal of Forecasting

Published on behalf of the International Institute of Forecasters
by North-Holland, Amsterdam

EDITOR-IN-CHIEF:

Jan G. De Gooijer, Faculty of Economics and Econometrics, University of Amsterdam,
1018WB Amsterdam, the Netherlands. Email: j.g.degooijer@uva.nl

EDITORS:

Michael P. Clements

Department of Economics
University of Warwick
Coventry CV4 7AL
UK
Email: m.p.clements@warwick.ac.uk

Michael Lawrence

School of Information Systems
University of New South Wales
Sydney 2052
Australia
Email: m.lawrence@unsw.edu.au

Bonnie K. Ray

IBM T.J. Watson Research Center
P.O. Box 218
Yorktown Heights, NY 10598
USA
Email: bonnier@us.ibm.com

AIMS	SCOPE
<p>The International Journal of Forecasting (IJF) is the official publication of the <i>International Institute of Forecasters (IIF)</i> and shares its aims and scope. The Journal publishes high quality refereed papers covering all aspects of forecasting. Its objectives are to bridge the gap between theory and practice. The intention is to make forecasting useful for decision and policy makers who need forecasts.</p> <p>The IJF places strong emphasis on empirical studies, evaluation activities, implementation research, and ways of improving the practice of forecasting. It publishes papers, notes, reviews of recent research, book reviews, and software reviews. For empirical studies, the Journal gives preference to papers that compare "multiple hypotheses" (two or more reasonable hypotheses).</p>	<p>Papers published in the IJF encompass the following areas:</p> <ul style="list-style-type: none">• Evaluation of forecasting methods and approaches• Applications in business, government and the military• Implementation research• Judgmental/psychological aspects of forecasting• Impact of uncertainty on decision making• Seasonal adjustments• Marketing forecasting• Time series forecasting• Organizational aspects of forecasting• Financial forecasting• Economic analysis• Production and inventory forecasting• Technological forecasting• Legal and political aspects

Editorial Announcement

Starting January 1, 2005, Rob J. Hyndman begins his term as Editor-in-Chief of the *IJF*. Rob is Professor of Statistics and Director of the Business & Economic Forecasting Unit at Monash University, Australia. He has published widely on forecasting topics, including non-Gaussian and nonparametric forecasting, and exponential smoothing. Rob is the coauthor of the third edition of *Forecasting: methods and applications* (Wiley, 1998). This is the leading textbook in Business Forecasting. Rob has served on the editorial board of the *IJF* since 2002. In addition he has served as Theory and Methods Editor of the *Australian & New Zealand Journal of Statistics* since 2001.

We congratulate Rob on his appointment and, with confidence, we pass the task of editing the journal to such capable hands.

Jan G. De Gooijer

Index of topics

- aggregation, 47, 48, 61, 83, 88, 102, 149
- agriculture, 101, 105
- ARFIMA models, 149
- ARIMA models, 83, 86, 101, 102
- automatic forecasting, 148
- automobiles, 51, 58, 85

- bankruptcies, 155
- Bayesian methods, 49, 93–95, 102, 137, 141, 158
- behavioural finance, 74
- bridge models, 83
- business cycles, 41, 55, 66, 70, 71, 88, 89, 94, 136, 156

- categorical time series, 127
- chaos, 45, 96, 113, 114
- classification and regression trees, 66
- climate, 85, 86, 96, 104, 105, 119, 140, 151
- cointegration, 36, 146, 155, 156, 165, 169
- combining forecasts, 29, 55, 60, 61, 64, 67, 94, 120
- commodity prices, 167
- conflict, 29, 37, 38, 68
- conjoint analysis, 51, 58
- consumables, 112, 146
- continuous time models, 118, 149
- count time series, 81, 82, 111, 127, 171
- Cox's proportional hazard model, 38, 74
- crime, 68, 69
- Croston's method, 111, 171
- cusum method, 167

- data mining, 30, 85, 86, 127, 128, 162, 168
- decision trees, 72, 85, 152
- Delphi method, 29, 76
- demand curves, 123
- demography, 30, 32, 39, 40, 53, 54, 83, 133, 145, 154
- density forecasts, 50, 87, 92, 108, 121, 125, 126, 140, 161, 163
- diffusion models, 51, 52, 58, 99, 100, 150, 173
- disaggregation, 61, 88, 149
- discrete choice models, 68, 152
- duration models, 52

- economics, 31, 33, 34, 38, 41, 42, 48, 50, 55, 56, 59, 65–67, 70, 76, 83, 87–89, 92, 94, 134–136, 139, 145, 151, 155, 156, 166, 169
- electricity, 28, 43, 44, 57, 72, 73, 85, 86, 90, 91, 95, 96
- electronics, 134
- energy, 28, 43, 44, 57, 61, 72, 73, 86, 90, 91, 95, 96
- environment, 119
- error correction models, 41, 118, 165
- exchange rates, 45, 94, 116, 117, 161, 167
- exponential smoothing, 47, 64, 65, 69, 73, 81, 98, 102, 125, 138, 162, 163, 170

- finance, 27, 28, 43–46, 55, 57, 59, 62, 74, 75, 77, 81, 82, 90, 92, 106, 113, 116, 117, 121, 122, 126, 137, 139, 144, 147, 149, 155, 156, 158, 161, 163, 167, 168
- forecast accuracy measures, 111
- forecast evaluation, 41, 42, 45, 59, 87, 92, 106, 108, 146, 157, 173

- GARCH models, 36, 49, 96, 118, 126, 136, 139, 147, 149, 158
- geographical information systems, 85

- ICT, *See* telecommunications
- inflation, 50, 55, 70, 106–108
- insurance, 33
- interest rates, 59, 70, 106, 136
- intermittent demand, 81, 111, 171
- interventions, 98
- inventory control, 78, 79, 111, 127, 163

- judgmental forecasting, 29, 36, 37, 39, 58–60, 76, 77, 98, 103, 106, 109, 110, 123, 124, 159, 160, 164, 173
- Juster scale, 123, 124, 159, 160

- Kalman filter, 30, 55, 74, 141

- labour market, 56, 84, 145, 165, 166
- leading indicators, 55, 56, 69, 70, 88, 132, 134, 156
- long memory time series, 36, 82, 113, 141, 149
- longitudinal data, *See* panel data

- Markov switching models, 38, 50, 136
- missing data, 171, 172
- model selection, 117, 144, 157, 162, 171

- neural networks, 31, 38, 59, 67, 68, 72, 73, 79, 80, 86, 120, 121, 144, 152
- new products, 35, 51, 52, 62, 100, 124, 129, 130, 150, 173
- nonlinear time series models, 41, 43, 49, 50, 66, 67, 70, 89, 90, 96, 113,

- 114, 116, 117, 125, 139–141, 158, 161
- nonparametric methods, 96, 101, 114, 133, 139, 140, 161
- official statistics, 155, 169, 171
- oil prices, 141, 153
- organizational behaviour, 35, 76, 78, 146
- panel data, 33, 42, 66, 106, 129, 143, 153, 165
- patents, 102
- pharmaceuticals, 103
- Phillips curve, 50, 107
- prediction intervals, 77, 109, 125, 126
- principal component analysis, 55, 80, 133, 142
- probability forecasts, 41, 73
- product demand, 51, 85, 86, 98, 99, 112, 127, 134, 146
- property values, 58
- public health, 81, 101, 119, 161
- purchase behaviour, 123, 124, 153, 159, 160
- quantile regression, 163
- quantiles, *See* density forecasts
- risk management, 27
- road crashes, 30, 88
- role playing, 29
- sales, *See* product demand
- seasonal adjustment, 34, 48, 79, 153, 169
- seasonality, 47, 79, 85, 93, 138, 153, 170
- software, 86, 97, 115, 127, 128, 138, 148
- spatial models, 84
- spectral analysis, 48, 149, 152
- sports, 102
- state and local government, 84, 165
- state space models, 30, 33, 34, 55, 64, 65, 83, 94, 102, 118, 131–133, 170
- structural time series models, *See* state space models
- supply chain, 78, 79, 111, 112, 127, 146
- technology, 35, 51, 52, 58, 99, 100, 129, 130, 143, 150, 173
- telecommunications, 35, 36, 52, 99, 100, 129, 130, 143, 144, 173
- television, 51, 152
- terrorism, 29, 68
- time series analysis, 48, 49, 64, 81, 82, 99, 122, 136, 142, 149, 158, 161, 171, 172
- traffic, 30, 31, 88
- transfer function models, 84, 91, 101, 141
- transportation, 30, 31, 58, 88, 119, 131, 132
- unemployment, 56, 139, 165, 166
- unit root tests, 82
- value at risk, 126, 158
- VAR models, 42, 53, 75, 95, 134, 135, 155
- volatility, 70, 93, 96, 117, 118, 126, 147, 149, 158
- wavelets, 113
- weather, 73, 96, 109, 120

Index of people

Page numbers in **bold** indicate a speaker; page numbers in *italics* indicate a session organizer or chair person; other entries are for co-authors.

- Aelen, Frank, **171**
Ahlburg, Dennis, **76**
Ahmed, Irfan, **171**
Akram, Muhammad, **64**
Al-Madfai, Hasan, **68, 91, 165, 166**
Albertson, Kevin V, **112**
Alho, Juha M, **32, 39**
Alleman, James, 130
Allen, Geoffrey, **125**
Alvarez, Pedro C, **83**
Alves, Oscar, **105**
Amaral, Luiz Felipe, *116, 117, 119*
Ameen, Jamal, 91
Amobi, Marilyn, **90**
Anderson, Heather M, 64, **70**
Armstrong, J Scott, 29, **29, 76**
Assimakopoulos, Vassilis, 63
Atanackov, Natasha, 162
Athanasopoulos, George, 70, *134, 135*
Aylen, Jon, 112
Ayton, Peter, **110**
- Bal, D, 155
Banerjee, Aniruddha, **36**
Banerji, Anirvan, 55, **56**
Barnes, Michelle L, **107**
Barnett, Tristan, **102**
Barry, Simon, 105
Batchelor, Roy, 58, **59**
Bell, Martin, 54
Bera, Anil, 92
Berk, Jan Marc, **59**
Bertoli, Marcello, 122
Bhattacharya, Prasad S, **38**
Bierut, Beata, 59
Bijleveld, Frits, 30
Blaconá, María T, **165**
Blankfield, Penny, **35**
Boland, John, 85
Booth, Heather, 32, 133
Boylan, John E, 47, 111, **162, 170**
Brennan, Mike, **123, 160**
Bretschneider, Stuart I, *173, 173*
Brooks, Chris, 70
Brown, Alan, 102
Brown, Donald E, **37, 68**
Brown, Stephen J, **27**
Buckle, Robert A, 136
Buettner, Thomas, **40**
Bunn, Derek W, **28**
- Burtschy, Bernard, 142
Bussi, Javier, 165
- Calôba, Luiz P, **31**
Calantone, Roger, 150
Campbell, Edward, 140
Campo, Katia, 103
Cancelo, José Ramon, **89**
Canduela, Jesus, **146**
Carter, Lawrence R, **39**
Casas Villalba, Isabel, *149, 149*
Chambers, Lynda E, *104, 104, 119*
Chan, Kung-Sik, 149
Chaudhry, Akram M, **141, 171**
Chen, Cathy WS, **158**
Chen, Gemai, **119**
Chen, Huijing, **47**
Chen, Shuling, **136**
Chien, David, 31
Cho, Young-Sang, 51, **58**
Chow, Hwee Kwan, 134
Choy, Keen Meng, **134**
Chung, SangKuck S, **116**
Clarke, Stephen R, 102
Clements, Michael P, 41, 60
Cohen, Jacqueline, 69
Collet, Jerome J, **113**
Commandeur, Jacques, 30
Conway, Sheila, 58
Cooper, Russel J, **143**
Corcoran, Jonathan, 68
Cors, Andreas, **155**
Cottet, Remy, 95
Crone, Sven FS, **79**
Cui, Shaojie, 150
Curry, Bruce, 79, **80**
Czarnecki, Jonathan E, **37**
- Dalton, Jason, 68
Darby, Phil, 30
Das, K, 155
Dawes, John G, 62, **124**
De Gooijer, Jan G, 44, **161**
De Jong, Piet, **33, 133, 133**
de Juan, Arancha, 88
de Kok, Ton, 47
de Menezes, Lilian M, **73, 90**
de Paula, Reginaldo Rosa Cotto, **119**
de Silva, Ashton J, 64, **65**
De Staebel, Odette, 103

- Dhawan, Rajat, **76**
Dhawan, Rohit, **79**
Doran, Howard E, 33
Dunsmuir, William TM, **81**, 136
Dweck, Victor, 31
Dyner, Isaac, 43, 90
- Eben, Krystof, 120
Ebert, Beth, 120
Eklund, Jana, 94
Engel, Chermelle B, **120**
- Fang, Yue, 60, **61**
Fields, Paul J, *111*, **112**
Fildes, Robert, 28, 98, 129, 144
Fok, Dennis, 66
Fomby, Thomas B, **167**
Fordham, Christine, 72
Fradgley, Neil, 173
Franses, Philip Hans, 66
Freeland, Keith, 82
Fuksa, Michel, **74**
- Gabbi, Giampaolo, **92**
Gali, Jyothi V, **143**
Gao, Jiti, **96**, 139, 149
Gao, Xiaoqiang, **64**
Garcia-Ferrer, Antonio, **88**, **157**
Gayen, Kaberi, 154
Gentry, Lance C, *150*, **150**
Gerlach, Richard H, *158*, **158**
Ghosh, Aurobindo, **92**
Ghosh, Ranadir, 121
Ghulam, Yaseen, 165
Gijbels, Irene, *161*
Gijsbrechts, Els, 103
Goldys, Ben, 136
Golinelli, Roberto, **83**
Gomes, Marcos Sebastião de Paula, 119
Goodwin, Paul, 77, 98, **109**
Gorr, Wilpen L, 68, **69**
Gould, Phillip G, **30**, 170
Graff, Michael A, **55**
Granger, Clive WJ, **87**
Green, Kesten C, 29, 29, **29**, 37
Gretton, Paul, 143
Grose, Simone, **97**
Guegan, Dominique, 113, **113**
Guerard, John B, **55**
Guerrero, Victor M, **84**
Guha, Debashis, **167**
- Hamoudia, Mohsen, 99, **100**
Harding, Don, 88, **89**
Harkisanka, Atul, 86
Harries, Clare, **60**
Hartmann, Michael, **53**
- Harvey, Andrew C, 33, **118**
Harvey, David I, **41**, 172
Harvey, Nigel, 60, *109*, **164**
He, Tianli, **84**
Heidi, Hoyle, 68
Hendry, David F, **60**, **97**, **148**
Henry, Ólan T, 70
Hibon, Michele, **157**
Hill, Paula, 74, **75**
Hingley, Peter, 102
Hini, Dean L, **160**
Hirunraengchok, Athipong, **134**
Hurn, Stan, 43
Hyndman, Rob J, 64, 65, 81, *81*, 133, **133**,
151, 170
- Ironmonger, Duncan S, 154
Isiklar, Gultekin, **42**, **75**
Islam, Towhidul, *51*, **52**, 153, **173**
- Jaén-García, Manuel, 156
Jaffry, Shabbar, **165**
Jansson, Petra, **172**
Jennings, Victor E, **154**
Johnston, Roy, 170
Jones, David A, **104**
Joseph, Joy V, *146*, **146**
Jumah, Adusei, **41**
Jurus, Pavel, 120
- Kaliva, Kasimir, **106**
Karakostas, George C, 170
Karlsson, Sune, **94**
Kleijn, Richard, 94
Klein, Philip A, 56
Knapp, Simon, 105
Koehler, Anne B, **170**
Kogetsidis, Harry, **84**
Koskinen, Lasse, 106
Kouzin, Vladimir, 155
Kridel, Don, 130
Krigsman, Maria, 172
Krolzig, Hans-Martin, 148
Kumar, A, 155
Kunst, Robert M, 41
Kwan, Tai Yeong, 59
- Lagnado, David A, 109
Lahiri, Kajal, 42, **88**, **106**
Larsen, Erik R, 90
Lattes, Pablo, 40
Lau, John W, 49
Laughlin, Gregory P, **105**
Lawrence, Michael, 27, 77
Lawton, Richard B, *162*, **162**, *170*
Layton, Allan P, 70, **71**, 87
Leavitt, Peter, 119

- Lee, Chul-Yong, **51**
Lee, Jong-Su, 51, 58
Lee, Jung-Dong, 51, 58
Lenten, Liam J A, **34**
Leonard, Michael J, **97, 115, 127, 128, 148**
Levenbach, Hans, 98, 98, **111, 127**
Leybourne, Stephen J, *171, 172*
Li, Wai-keung, 49
Li, Xiang, 86
Li, Yikang, **98**
Li, Yun, **140**
Lim, Joa Sang, 110
Lin, Limin, 167
Ling, Shiqing, **49**
Liu, Fusang, 106
Lloyd, Ashley D, **129**
Lloyd-Smith, Conrad W, 154
Loungani, Prakash, 42
Low, Chin Nam, **64**
Lu, Hongwei, **85**
Lu, Jack, 155
- MacRae, Murray S, **159**
Maculan, Nelson, 31
Madden, Gary, 35, *129, 143, 143, 144, 144*
Magnano, Luciana, **85**
Mäkinen, Saku, 150
Manzan, Sebastiano, 140
Martin, Gael, 82
Mason, Clive, **173**
McCabe, Brendan, **82**
McConnell, Joseph K, **78, 97, 115**
McKibbin, Warwick J, **151**
McLaren, Craig H, 48, 169
McMenamin, Stuart J, 72
McSharry, Patrick E, 73, **125**
Meade, Nigel, 52, **102, 152, 153, 173**
Medeiros, Marcelo C, 66, 67, 116
Melnick, Edward, **98**
Mensah, Yaw M, **45**
Meyer, Denny H, **152**
Miller, Kent M, 37
Monforte, Frank A, **72**
Monsell, Brian C, *148, 169*
Moosa, Imad A, 34
Morgan, Peter H, 80
Morzuch, Bernard J, 125
Mungall, Andrew, 131
Muradoglu, Gulnur, 75
- Nagayasu, Jun, **149**
Naseem, Naila, 110
Navis, Irene, 58
Nazarko, Joanicjusz, **85**
Nazem, Sufi M, **62**
Neagu, Radu, **152**
Nelson, Michael D, **77**
- Newell, Ben R, **109**
Nikolopoulos, Konstantinos, 62, **63, 98**
Nunes, Luis C, *155, 156*
- O'Connor, Marcus, 77, **110, 164**
Oetomo, Teddy, 44
Olekalns, Nilss, 70
Olivei, Giovanni P, 107
Öller, Lars-Erik, **55, 145, 172**
Olsen, Borgar T, **99**
Önkal, Dilek, 76, **77, 109**
Ord, J Keith, 132, *157, 157, 170*
Ortega, Esther Ruiz, **117**
Ortega, José Antonio, **32, 53**
Ouwehand, Pim, **47**
- Pal, Satyabrata, 101
Palma-Martos, Luis A, **156**
Pan, Heping, 121, *121, 121*
Parackal, Mathew, *123, 159, 159*
Parigi, Giuseppe, 83
Park, Jin-Sung, 158
Parkinson, Martin, **145**
Partington, Graham, 74
Paton, David, 46
Pavlov, Vlad, **43**
Pelikan, Emil, **120**
Penny, Richard, **169**
Penzer, Jeremy, 96
Persson, Tom, 55
Pohlman, Larry, *167, 168*
Pollock, Andrew C, 77
Poncela, Pilar, 53, 88
Pott, Alice, 110
Premachandran, Rajaratnam, **45**
- Raeside, Robert, **30, 154, 154**
Rambaldi, Alicia N, **33**
Rao, DSP, 33
Rappoport, P N, **130**
Reid, Phillip A, 104
Riebe, Erica, 62, 124
Robertson, Alastair W, **129**
Robinson, Tim F, **107**
Rodriguez, Julio, 117
Rodriguez, Pilar, 83
Rosa, Joel, 66, 116
Rueda, Cristina, 83
Ruiz, Edilberto, 84
Ryley, Alan, 91
- Sahu, Pradip Kumar, **101**
Sanderson, Warren C, 39
Sarkar, Abhinanda, **155**
Scaglione, Miriam E, **131**
Scherbov, Sergei J, **39**
Schips, Bernd, 48

- Schmidbauer, Harald, **147**
Shale, Estelle A, 170
Shan, Jerry, *136*, **137**, **157**
Shanks, David R, 109
Shenstone, Lydia, **81**
Shi, Daming, 86
Shields, Kalvinder, **70**
Shim, Dongcul, 173
Sichel, Bill, 111
Sloboda, Brian W, *30*, **31**, **131**
Smith, Daniel R, *71*, *147*, **147**
Smith, Len, 133, *133*
Smith, Leonard A, *72*, **73**, **96**
Smith, Michael S, *94*, **95**
Snyder, Ralph D, *64*, *65*, *118*, 170, **170**
So, Mike KP, **49**, 158, **158**
Sobral, Ana Paula, 72
Song, Xiaofei, 45
Souza, Reinaldo Castro, *43*, **72**, 90, 90,
117, 119
Spokoiny, Vladimir, **139**
Stekler, Herman O, *41*, **42**
Stellwagen, Eric, **97**, **115**, **138**
Stevenson, Maxwell J, *43*, **44**, **57**, 74
Stone, Andrew G, 107
Stordahl, Kjell, 99, **99**
Stranieri, Andrew, **122**
Street, John J, **35**
Stuckey, Alex W, *47*, **48**
Subarna, Dadang, **86**
Suur-Inkeroinen, Henri, **150**
Syntetos, Aris A, **111**
- Tan, Joachim, 144, **144**
Tang, Hsiu-Khuern, 137
Tashman, Len, *97*, *115*
Taylor, James W, *73*, *125*, **126**, **163**
Taylor, Lester D, 130
Taylor, Robert, 172
Tayyebi Jazayeri, Seyed Mohammadreza,
153
Tenenbein, Aaron, 98
Teräsvirta, Timo, *66*, **67**
Thomakos, Dimitrios D, 38
Thomas, Ray, 166
Thomas, Rupin, 42
Thomson, Mary E, 77, 109
Thomson, Peter J, **136**
Tickle, Leonie, 133
Tilani, Raveen L, **86**
Timberlake, Ana, **115**
Toque, Carole, *141*, **142**
Trybus, Elzbieta K, **86**
- Trybus, Ginter, 86
Tsai, Henghsiu, **149**
Tsiakas, Ilias, *92*, **93**
Tustin, Michelle K, **62**, 124
Tuyl, Frank, 158
- Ullah, Md Shahid, **133**
- Vahid, Farshid, 70, 135
Van Bellegem, Sebastien, **161**
van Dijk, Dick, **50**, **66**, 67
van Dijk, Herman K, **94**
van Donselaar, Karel, 47
van Waterschoot, Walter MJ, *101*, **103**
van Zyl, Marileze, 107
Vaughan Williams, Leighton, *45*, **46**
Veiga, Álvaro, **66**, **116**
Velásquez, David, **43**, **90**
Ventroni, Nora I, 165
Vondracek, Jiri, 120
Voss, Brigitta S, **80**
- Waclawski, Anthony, 168
Wallis, Kenneth F, *106*, **108**
Wang, Fu-kwun, **51**
Wang, Mingjin, 96
Ware, Andrew, 68
Washeba, Paul, **58**
Weihs, Claus, 80
Weston, Rae, 45
Wildi, Marc, **48**
Wilson, Tom G, *53*, **54**
Wolfe, Brenda, **127**
Wolff, Rodney, *96*, **114**
Woodcock, Frank, 120
- Xia, Yingcun, **161**
- Yahyai, Aziz, 153
Yang, Lijian, **139**
Yao, Juan, **74**
Yao, Qiwei, **96**, *113*
Yao, Vince, 88
Yao, Wenxiong, 131
Yearwood, John, **121**
Young, Peg, *131*, **132**
- Zaidi, Akbar A, **101**
Zerom, Dawit, **140**
Zhang, Shen, 141
Zhang, Xichuan (Mark), *48*, *169*, **169**
Zhao, Ann, **141**
Zhao, Lihua, 84, 85